Black Swan Economics: The Impact of the Stock Market on the Real Economy

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ABSTRACT

This paper analyzes eight financial market crashes in the U.S. spanning the period from 1920 to 2024. I found that these events negatively impact the economy, employment, and the purchasing power of people. Additionally, I found that financial markets begin to diverge from economic activity, as measured by real GDP and the fixed income market indicators, prior to the crashes. I also observed that professional market participants usually do not anticipate these market events and remain very optimistic about quick market recovery immediately following the crash. Finally, I found that it takes up to three years for employment levels to return to normal, which is significantly longer than it takes consumer prices to recover to pre-crash levels.

Summary

There is a wide body of academic literature studying financial market crashes, also known as Black Swan events. However, most of the research is limited to case studies of individual market crashes or the last thirty years of history. This paper contributes to previous research by providing a comprehensive analysis of eight market crashes spanning almost 100 years. To my knowledge, there has not been previous research investigating the following complex relationship: the impact of the financial market on economic activity and the impact of economic activity on the purchasing power and employment of the general population. To provide this analysis, I built a unique data panel combining multiple sources including Shiller (2016), Federal Reserve Economic data, US Census Bureau archives, and other data described in the Data section.

Campbell and Shiller (1988) studied fluctuations in the stock market and found them not to be driven by expected future cash flow and interest rates. They used U.S. time series 1871-1986 and 1926-1986.[1] In this study, I compiled a comprehensive U.S. time series spanning from 1920 to 2024, including more recent data and various other indices and data.

Wachter (2008) conducted research regarding the influence of the risk of rare disasters on fluctuations in the stock market, explaining high stock volatility. She also found consistencies between the stock market and macroeconomic contractions.[2] I found that rare financial market disasters do negatively impact economic activity measured by real GDP growth rate and unemployment, which confirmed her observations.

Barro and Ursúa (2008) studied macroeconomic crises in isolation, compiling an international time series, starting in 1870, of personal consumer expenditure and GDP in order to identify 95 and 152 crises for each

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[1] Campbell, J. Y., & Shiller, R. J. (1988). The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors. Review of Financial Studies, 1(3), 195–228. https://doi.org/10.1093/rfs/1.3.195

[2] Wachter, J. & National Bureau of Economic Research. (2008). Can Time-Varying risk of rare disasters explain aggregate stock market volatility? In NBER Working Paper Series (No. 14386). https://www.nber.org/system/files/working_papers/w14386/w14386.pdf

respectively.[3] This study focused on how the US stock market events influence the economy and cause these macro-economic crises.

Kilic and Wachter (2015) studied the influence of time-varying risk of economic crises on labor market and stock market volatility and the link between labor and stock market valuations, while remaining consistent with the business cycle.[4] This study confirms that economic crises influence unemployment. Furthermore, I extend their findings by showing that stock market crashes cause economic crises and broadening my analysis beyond 1951.

The rest of the paper is organized as follows. Section 2 reviews the data panel used for the analysis. Section 3 covers a brief history of Black Swan events in financial markets. Section 4 provides the analysis and major results. In Section 5, I summarize the findings and highlight areas for future research.

Data

This paper focuses on major stock market crashes from the early 20th century to the early 21st century. In order to analyze this, I compiled a monthly data panel for the period from January 1920 to May 2024. This panel aggregates US nominal GDP, S&P 500 return, 10-Year Treasury Note Yield, cyclically adjusted price-to-earnings ratio (CAPE), the consumer price index (CPI), unemployment, and market confidence index (MCI) from multiple sources. One of the achievements of this paper is the compilation of a long history of consistent monthly data listed above.

I used the U.S. Bureau of Economic Analysis' quarterly seasonally adjusted annual gross domestic product data for the period from January 1947 to May 2024[5]. This data was retrieved from the Federal Reserve Bank of St. Louis. I then transformed these observations from quarterly to monthly by forward-filling data for two months. I decided not to interpolate data to avoid look ahead bias. For analytical purposes, the total return GDP time series was converted into an annual GDP growth rate. For the period 1920 to 1946, this paper uses annual nominal GDP data from the U.S. Census Bureau "Bicentennial Edition: Historical Statistics of the United States, Colonial Times to 1970"[6], which were entered manually. I assumed that the annual growth rate was a constant within each year during this period.

Furthermore, to isolate the effects of inflation and real economy growth, I computed real GDP growth rate as a difference between monthly nominal GDP growth rate and monthly CPI rate. Altogether, the aggregate data set provides information regarding the fluctuation in annual real GDP growth rate at a monthly frequency from 1920 through 2024.

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[3] Barro, R. J., Ursúa, J. F., & Harvard University. (n.d.). Macroeconomic Crises since 1870. In Brookings Papers on Economic Activity [Journal-article]. https://www.brookings.edu/wp-content/uploads/2008/03/2008a_bpea_barro.pdf
[4] Kilic, M., Wachter, J. A., & National Bureau of Economic Research. (2015). RISK, UNEMPLOYMENT, AND THE STOCK MARKET: a RARE-EVENT-BASED EXPLANATION OF LABOR MARKET VOLATILITY (Working Paper 21575). https://www.nber.org/system/files/working_papers/w21575/w21575.pdf
[5] Gross domestic product. (2024, July 25). https://fred.stlouisfed.org/series/GDP#0
[6] US Census Bureau. (2021, December 16). Bicentennial Edition: Historical Statistics of the United States, Colonial times to 1970. Census.gov. https://www.census.gov/library/publications/1975/compendia/hist_stats_colonial-1970.html
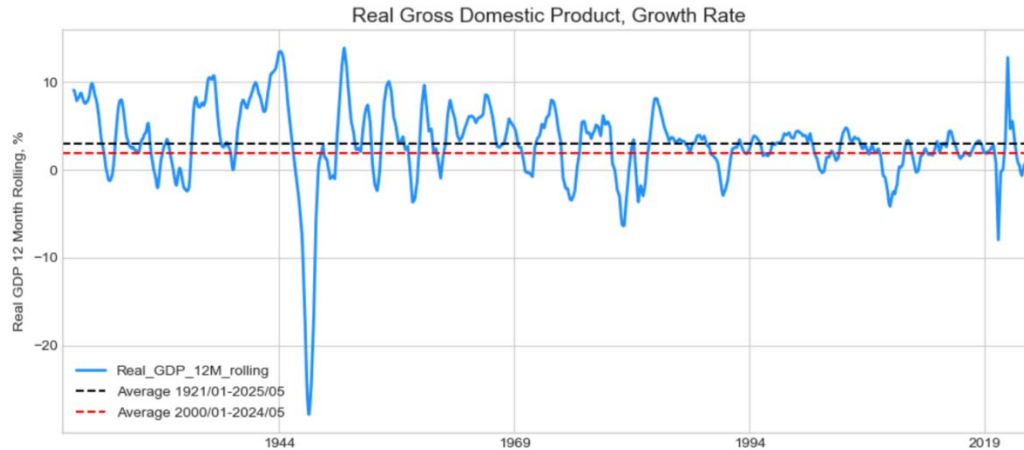
Figure 1. Annual Real GDP for the period from January 1920 to May 2024, Source: Federal Reserve Bank of St. Louis, U.S. Census Bureau.

This paper uses monthly data for S&P 500, CPI, 10-Year Treasury Note Yield, and CAPE, for the period January 1871 through May 2024, from the dataset used by Dr. Robert J. Shiller "Irrational Exuberance" Princeton University Press, 2000, 2005, 2015[7]. This data set, which is continuously being updated to include more recent data, was retrieved from the Yale Department of Economics website. I converted the S&P 500 and CPI time series from total returns into annual returns. The 10-year Treasury Yield provided data on the yield on 10-year treasury notes, which was not transformed in any way. The CAPE metric, introduced by Shiller, is a cyclically adjusted price-to-earnings ratio, which measures stock's price relative to the company's real earnings per share. This was used to evaluate whether the market was overvalued or undervalued before that crash. This time series was also kept in its original form.
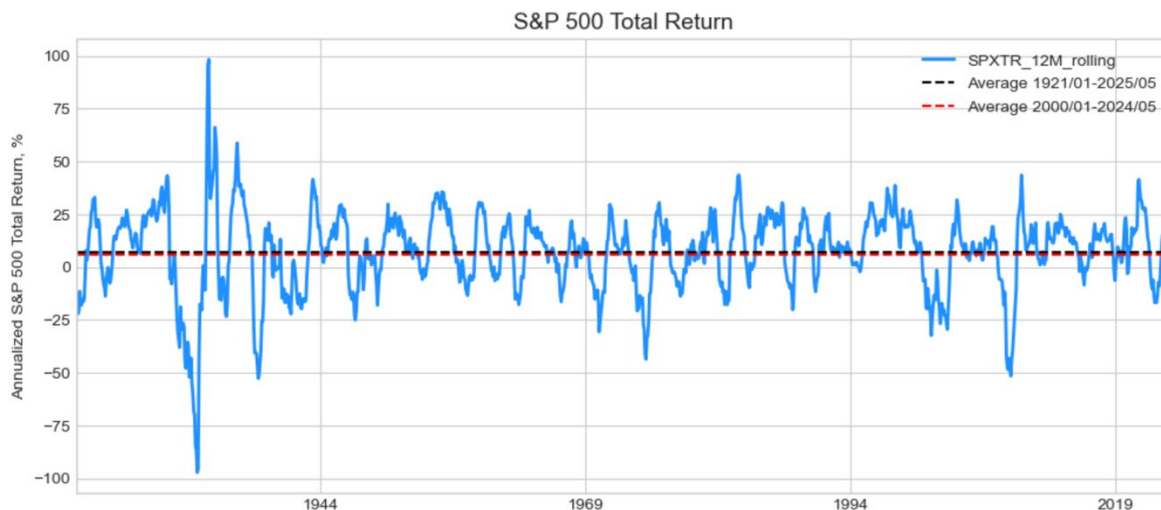

Figure 2. 12-month rolling average of S&P 500 Total Returns for the period from January 1920 to May 2024, Source: Shiller (2016), Yale Department of Economics.

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[7] Shiller, R. J. (2016). Irrational exuberance: Revised and Expanded Third Edition. Princeton University Press.
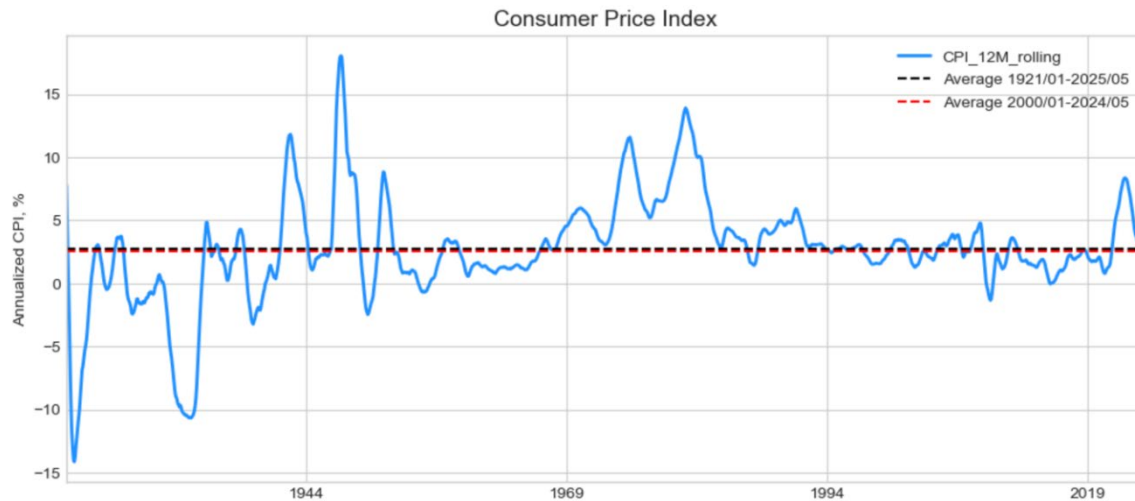
Figure 3. Consumer Price Index for the period from January 1920 to May 2024, Source: Shiller (2016), Yale Department of Economics.

Figure 4. 10-Year Treasury Note Yield for the period from January 1920 to May 2024, Source: Shiller (2016), Yale Department of Economics.
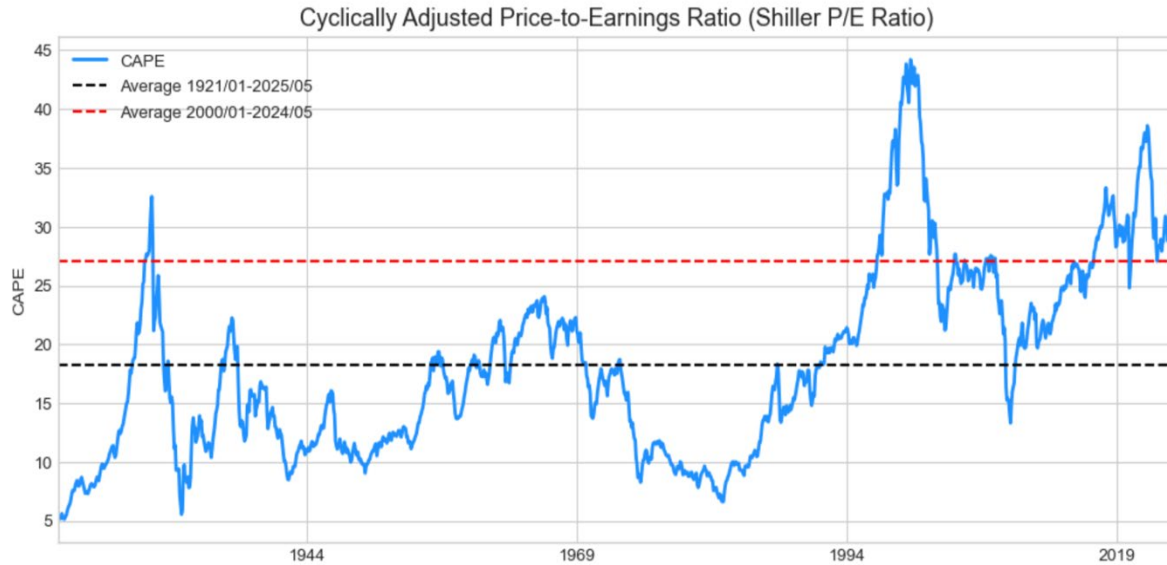
Figure 5. Cyclically Adjusted Price-to-Earnings Ratio for the period from January 1920 to May 2024, Source: Shiller (2016), Yale Department of Economics.

I obtained unemployment data for the period January 1948 to March 2024 from the Federal Reserve Bank of St. Louis, compiled by the U.S. Bureau of Labor Statistics[8]. In order to account for the period 1920 to 1947, this paper uses annual unemployment data from the U.S. Census Bureau "Bicentennial Edition: Historical Statistics of the United States, Colonial Times to 1970". I assumed that unemployment remained stable each month within a given year.
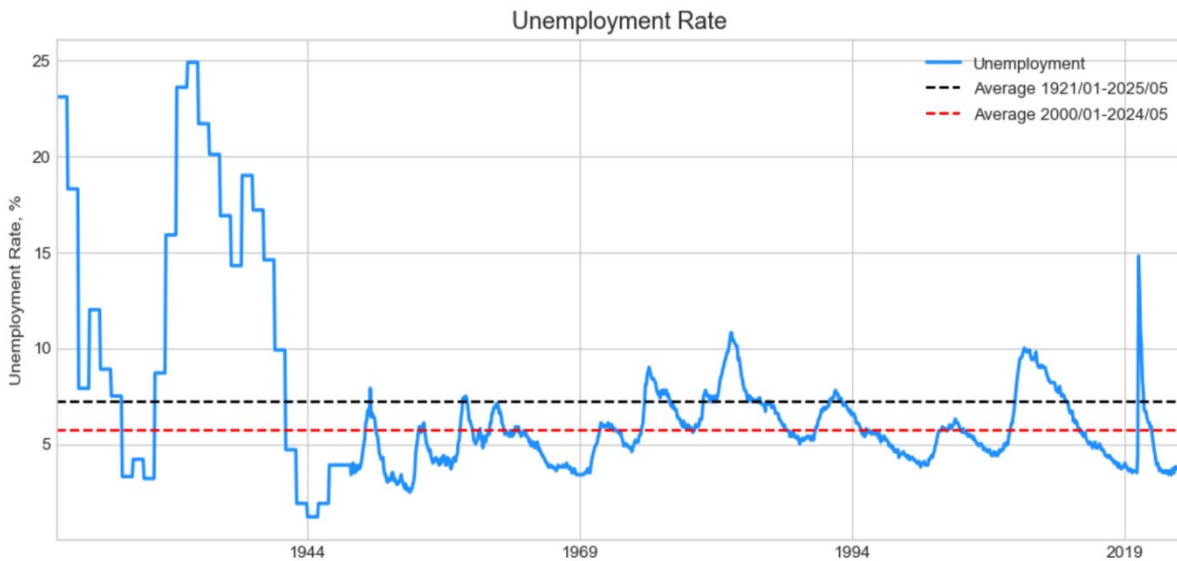

Figure 6. Unemployment Rate for the period from January 1920 to May 2024, Source: Federal Reserve Bank of St. Louis, U.S. Bureau of Labor Statistics.

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[8] Unemployment rate. (2024, August 2). https://fred.stlouisfed.org/series/UNRATE#0

I retrieved U.S. stock market confidence index data from the International Centre for Finance, Yale School of Management[9]. This one-year confidence index is scaled between zero and one hundred. It shows the percent of the institutional investors expecting an increase in the Dow Jones Industrial Average Index in the coming year. This index only starts in October of 1989 and is the only time series in the panel that does not cover the entire period from 1920 to 2024. In order to show the professional investors' confidence for the given time, the index was shifted back by three months.

Figure 7. Stock Market Confidence: Institutional for the period from January 1920 to May 2024, Source: International Centre for Finance, Yale School of Management.

Black Swan Events

A Black Swan event is a very low probability event that has an extremely bad outcome. The term Black Swan was popularized by Nassim Taleb[10]. He described Black Swans as events that are unprecedented at the time, yet seemingly explainable in retrospect.

The first recorded event was Tulip Fever or Tulip Mania in the Dutch Empire in 1637. Although it was not an economic crisis and affected the few enthusiasts of tulip cultivation and production, its name has now become synonymous with Black Swan events due to the legend now surrounding it. In essence, tulips were introduced into Dutch society as a rare and delicate commodity. Prices began to rise as ownership of tulips began to be perceived as a sign of high status, until one tulip bulb was worth ten times the annual wage of a skilled worker[11]. A lag between production and demand was created since tulips took a year to cultivate and additional tulips could not be planted throughout the year to meet demand. Therefore, only an ordinary number of tulips were sold when the price was high. Tulip farmers planted more tulips the following year and entered "futures", contracts to sell a tulip later at a set price, but the market still ended up with a surplus and the bubble burst in 1637. This crisis had minimal impact on the

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[9] United States stock market confidence indices. (n.d.). Yale School of Management. https://som.yale.edu/centers/international-center-for-finance/data/stock-market-confidence-indices/united-states

[10] Taleb, N. N. (2008). The Black Swan: The Impact of the Highly Improbable. Penguin UK.

[11] Wikipedia contributors. (2024b, August 14). Tulip mania. Wikipedia. https://en.wikipedia.org/wiki/Tulip_mania

economy of the Dutch Empire and presented itself as a more social shock than any other. However, this was the first recorded bubble and therefore the ultimate Black Swan despite its minimal economic impact.

Another historic Black Swan is the South Sea Bubble of 1720. The South Sea Company was a joint-stock company that took on Britain's national debt when it bought the right to the Utrecht Treaty[12]. It lent money to those who wished to buy stocks, inflating their value. The stock price crashed in 1720, falling below its original price. Unlike the Tulip Fever, this event did have a major impact on the economy. Investors ranged through all classes, including prominent figures like Jonathan Swift, Sir Isaac Newton, and the reigning king of England. The parliament quickly identified insider trading and bribery as the cause, arrested the individuals responsible, and used the money from their confiscated property to pay back investors[13]. The South Sea Bubble was an unforeseen crisis and a clearcut example of a Black Swan event.

However, in order to clearly understand the impact of Black Swan events on the economy, more recent events had to be studied. Since both Tulip Mania and the South Sea Bubble were so long ago, data for those time periods is both scarce and unreliable. In addition, I restricted this study to the US because of data availability. Therefore, the recorded Black Swan events that will be used as reference points for this study are the Great Depression of 1929, The Kennedy Slide of 1962, Black Monday of 1987, the Dotcom Bubble of 2000, the 9/11 terrorist attack of 2001, the Bear Market Crash of 1998, the Global Financial Crisis of 2008, and the Covid Pandemic of 2020.

Table 1. List of financial market crashes for the period from 1929 to 2020.

Name	Market Crash Month	Bear Market End	Description
The Great Crash	October 1929	1932	Multi-year market crash leading to the Great Depression[14]
The Kennedy Slide	May 1962	June 1962	The market declined from 12/1961-6/1962, with the Flash Crash in 5/1962[15]
Black Monday	October 1987	October 1987	Largest single day stock market crash in history[16]
Bear Market Crash	August 1998	September 1998	Triggered by Russian financial crisis and the collapse of Long-Term Capital Management
Dot-com Bubble	April 2000	October 2002	Crash impacted NASDAQ the most, which lost 75% of its value

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[12] South Sea Bubble. (n.d.). Royal Museums Greenwich. https://www.rmg.co.uk/stories/topics/south-sea-bubble#:~:text=The%20South%20Sea%20Bubble%20was,in%20Central%20and%20Southern%20America.

[13] Marples, A. (2020, September 18). The South Sea Bubble of 1720 - The National Archives blog. The National Archives Blog. https://blog.nationalarchives.gov.uk/the-south-sea-bubble-of-1720/

[14] Richardson, B. G. (n.d.). Stock market crash of 1929. Federal Reserve History. https://www.federalreservehistory.org/essays/stock-market-crash-of-1929

[15] Wikipedia contributors. (2024, February 4). Kennedy Slide of 1962. Wikipedia. https://en.wikipedia.org/wiki/Kennedy_Slide_of_1962

[16] Eckblad, B. D. B. a. M. (n.d.). Stock market crash of 1987. Federal Reserve History. https://www.federalreservehistory.org/essays/stock-market-crash-of-1987

9/11 Terrorist Attack	September 2001	October 2001	Crash impacted both S&P 500 and NASDAQ indices
Global Financial Crisis	September 2008	March 2009	This crash was part of a broader financial crisis
Covid-19 Pandemic	February 2020	March 2020	Caused by the coronavirus pandemic procedures

Analysis

The goal of this research is to analyze the impact of financial market crashes on economic activity and the general population. In order to do this, I conducted this analysis in three steps. First, I confirmed that these Black Swan events, described in section three, were noticeable financial market crashes and were truly unexpected by informed market participants. Second, I determined the spill off from the financial crashes onto the real economy, as measured by real GDP growth rate. Lastly, I looked at the impact of these occurrences on the general population as measured by unemployment rate and CPI rate.

I use the following calculated measures for analysis in this section:

- Historical average value that is used as a baseline to compare metric values during and after financial market crashes.
- Average value during 12 months preceding crashes. This is needed for more precise comparison in cases when structural shifts are present (e.g. CAPE or unemployment rate).
- Observed value during the market crash month.
- Average values during 1-3, 4-6, 7-9, 10-12, 13-24, and 25-36 months following the financial market crashes. These 3-month intervals allow highest accuracy given that many measures are reported at quarterly frequency.

Table 2. Summary of macro-economic measures used for the period from January 1920 to May 2024.

	S&P 500, monthly total return, %	Market Confidence Index, %	CAPE ratio	Annual Real GDP, %	10-Year Treasury Yield, %	Unemployment rate, %	Annual CPI, %
Historical average, excluding crash months	0.69	75.63	18.25	2.98	4.75	7.25	2.72
Average during 12 months prior to crash	1.13	74.39	27.16	2.61	5.14	4.89	2.70
During crash month	-8.91	76.32	26.92	1.22	4.67	4.81	3.07
1-3 months after crash	-1.42	79.06	25.35	-1.51	4.47	6.27	-2.08
4-6 months after crash	0.98	78.77	26.55	6.30	4.34	6.37	2.64
7-9 months after crash	0.75	75.58	26.52	1.37	4.52	6.25	1.30
10-12 months after crash	-0.52	74.10	25.83	1.63	4.54	6.26	2.58
13-24 months after crash	0.42	75.97	25.85	3.14	4.55	6.89	1.65
25-36 months after crash	-0.70	78.96	23.09	1.33	4.55	7.64	1.69

I investigated the market crashes from 1929 through 2020 described in Table 1 by first confirming that they were true outlier events. For that, I used the total return for the S&P 500 index. I found that returns during crash months are -2.18 standard deviations below the mean, which can be classified as a rare event. Next, I compared the measures during market crashes with historical average returns and with average returns during the previous twelve months. The comparison with the historical average is needed to estimate the general scope of the crash and the comparison with the previous twelve months is needed to neutralize potential impact of different regimes that existed over that hundred-year period. Immediately, during the crash the market return was -8.91%, significantly lower than 0.69% during non-crash months and lower than 1.13% during the twelve months preceding the crashes. On average, market returns remained negative three months after the crash, averaging -1.42%. In general, the market during the periods of 3-6 and 6-9 months, the market was recovering and growing at an above average rate.
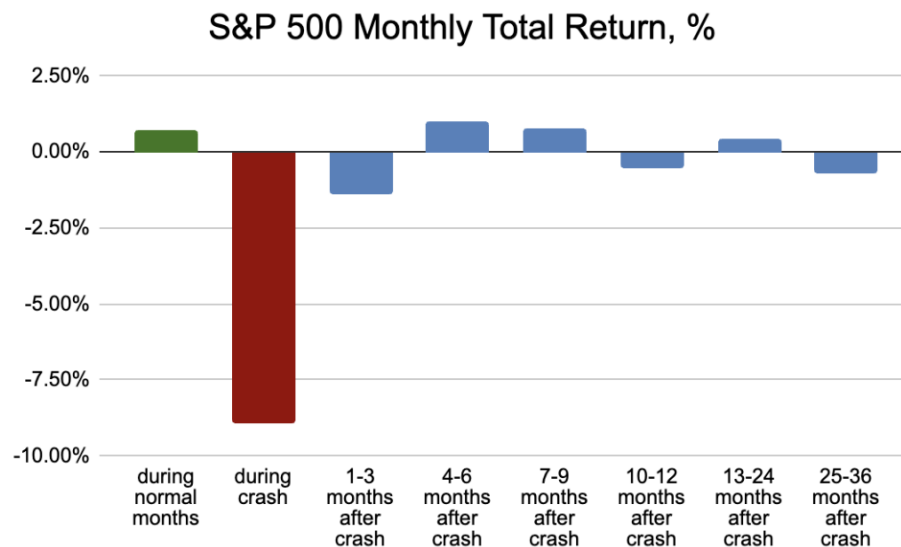

Figure 8. S&P 500 Monthly Total Return, % for the period from January 1921 to May 2024, Source: Shiller (2016), Yale Department of Economics.

I observed that these market crashes were widely not anticipated by institutional investors, professional market participants, as measured by MCI. All predictions are shifted three months back to show a year ahead forecast three months prior to the crash events. Investor confidence was higher during the crash months than during normal months and during the twelve months prior. It is interesting that investor confidence that market returns would be positive was even higher three and six months following the crash, showing that they were optimistic that the market would promptly recover.
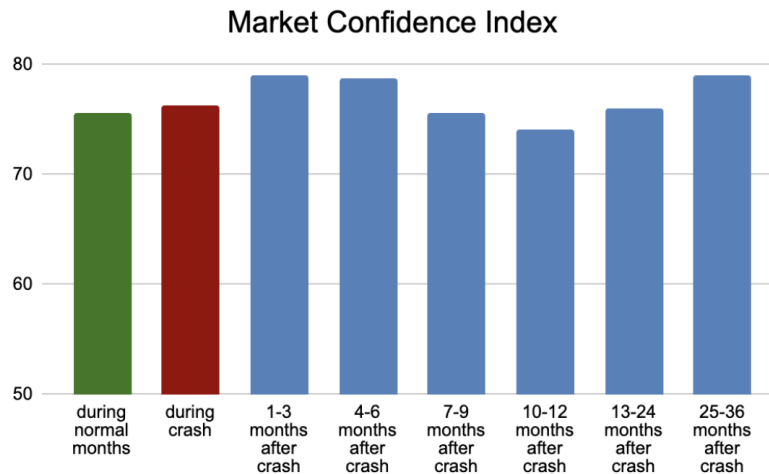
Figure 9. Market Confidence Index for the period from October 1989 to May 2024, Source: The International Centre for Finance, Yale School of Management.

I used CAPE as another indicator of investors' confidence in future market returns. Similarly to MCI, CAPE during crash months (27.0) was higher than historical average (18.3) and slightly lower than twelve months prior to the crash (27.2). This indicates that investors were not anticipating market crashes because they were willing to pay higher multiples. This also can indicate that markets exhibited bubble-like qualities and were overheated.
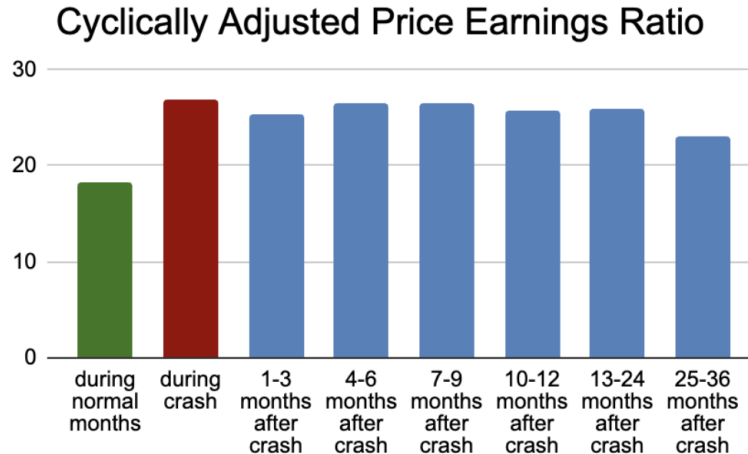

Figure 10. Cyclically Adjusted Price-Earnings Ratio for the period from January 1921 to May 2024, Source: Shiller (2016), Yale Department of Economics.

Next, I investigated the spill off from the financial market crash into broad economic activity, as measured by real GDP. During the crash months the real GDP growth rate was 1.22%, which was lower than the historical average of 2.98% and lower than the average real GDP of 2.61% during the twelve months prior to the crash. This indicates that the economy generally starts to slow down before the crash. This also shows that the economy diverges from the financial market optimism that is displayed above and exhibits bubble-like qualities.
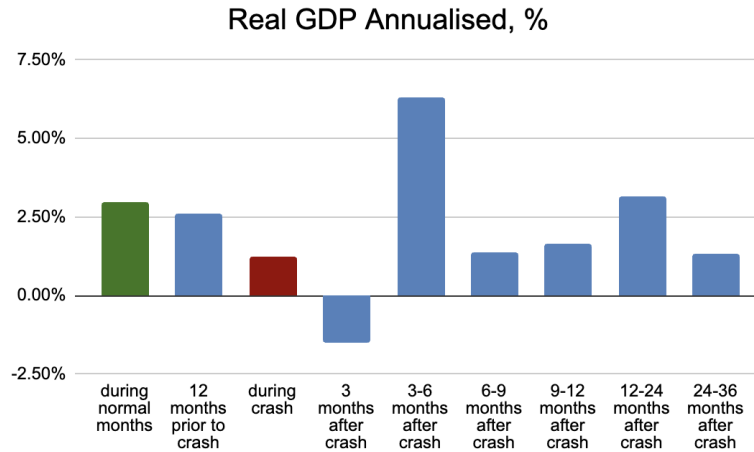
Real GDP Annualised, %

Figure 11. Annualized Real Gross Domestic Product for the period from January 1921 to May 2024, Source: U.S. Bureau of Economic Analysis, Federal Reserve Bank of St. Louis and U.S. Census Bureau "Bicentennial Edition: Historical Statistics of the United States, Colonial Times to 1970".

I used 10-year Treasury bond yield to measure both the Federal Reserve policy and the fixed income market expectations about the path of the economy. I observed this measure reflects a slightly negative view on the economy, as indicated by 4.67% yield during market crash months versus 5.14% yield during the twelve months preceding the market events. The yield continues to stay lower than average up to 36 months after the market events. This indicates that the Federal Reserve pursued financial easing conditions trying to stimulate the economy the period of the years following the financial market crashes.
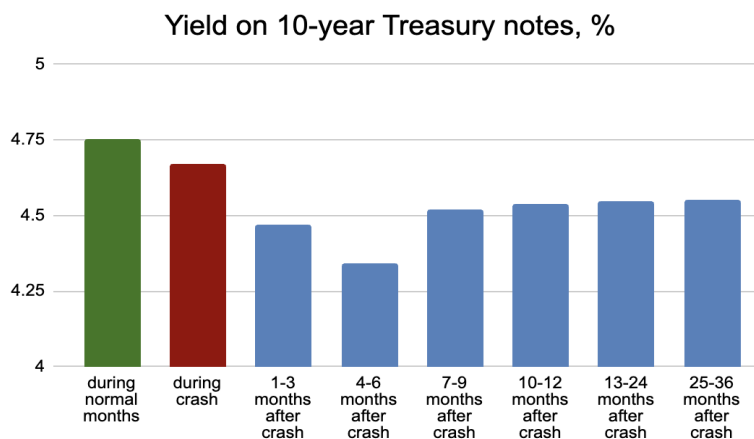
Yield on 10-year Treasury notes, %

Figure 12. 10-Year Treasury Note Yield for the period from from January 1921 to May 2024, Source: Shiller (2016), Yale Department of Economics.

Finally, I observe the negative impact of the financial market crash on the general population, as measured by the unemployment rate. During the market crash unemployment was 4.81%, which is a little lower than 4.89% during the twelve months immediately preceding the crash. This indicates that business owners did not change their hiring patterns and did not anticipate a crash, which is consistent with the investor optimism that was observed above. However, unemployment sharply increased immediately following the financial crash and continued to stay elevated

up to 36 months after the crash. It should be noted that the historical average of 7.25% is not a good comparison in this case because, as was shown in Figure 6, there were structural shifts in the unemployment rate.
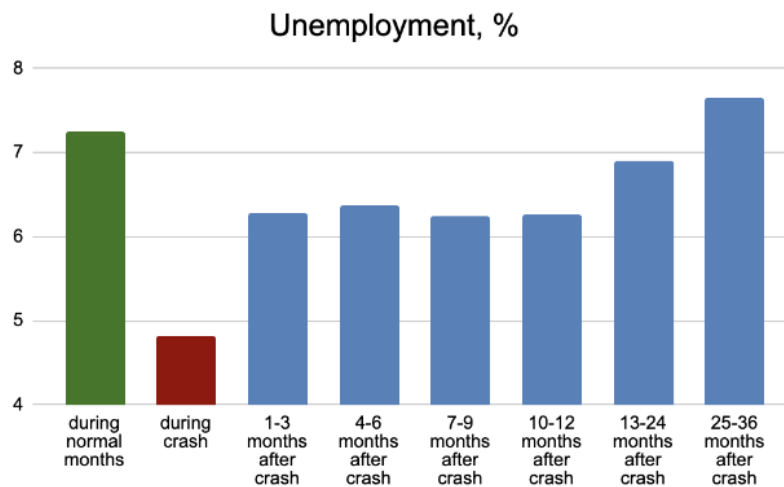

Figure 13. Unemployment Rate for the period from January 1921 to May 2024, Source: U.S. Bureau of Labor Statistics, Federal Reserve Bank of St. Louis and the U.S. Census Bureau "Bicentennial Edition: Historical Statistics of the United States, Colonial Times to 1970".

I use CPI as a measure of purchasing power, the amount of goods and services people can buy per one unit of currency. During market crash months CPI rate was 3.07% which is higher than 2.70% during the twelve months prior to the market events, which points to overheating economy. I observed that there was deflation of 2.08% three months following the market events. Generally, CPI would recover to pre-market crash levels within 3-12 months.
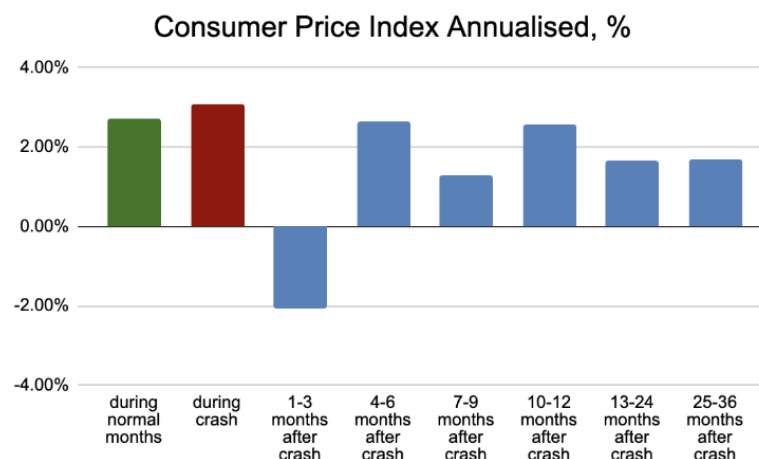

Figure 14. Consumer Price Index for the period from January 1921 to May 2024, Source: Shiller (2016), Yale Department of Economics.

Conclusions

The contribution of this paper is threefold. First, this paper analyzes eight financial market crashes that span 105 years. I enhanced Shiller's data set by adding unemployment data for the 1920s up to 1948 from the US Census Bureau and extending the GDP time series the same way. Second, I extended previous research that analyzes previous market crashes in isolation by looking at their impact on the real economy. I observed that there was a negative impact on both economic activity and financial situation. I also identified divergence between the stock market and the fixed income market and the real economy preceding market crashes. Third, I identified the negative impact of the financial market on the economy and how that affects the employment and purchasing power of the general population.

Limitations

In this paper, I studied the effects of the financial market on the real economy and from there onto the general population. For future research, I could study the impact of the economy, such as Federal Reserve policies and fluctuation in supply and demand for goods and services, on the financial market and investigate the lead-lag relationships between the two. Additionally, measures such as stock market volatility and inflation expectations could be included in future research to investigate the interconnectedness between the stock market and the real economy. Furthermore, I could extend this research to other countries or regions around the globe.

Acknowledgments

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