

Not Waving but Drowning: The Difficulties of Exiting Quantitative Easing

By

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Abstract

Quantitative easing—the policy of buying bonds to stimulate asset prices and activity—has succeeded in supporting the economy after the 2008 and 2020 recessions. However, the exit strategy poses difficult issues. The current policy rule is highly asymmetric: central banks buy large amounts of bonds in recessions but reduce these holdings only gradually during a recovery. This paper documents this asymmetry and explains its causes. It argues that, on current policies, central banks will not be able to exit from quantitative easing programs on any reasonable time scale, creating a series of policy headaches. A better policy would have been to buy risky assets, such as equity, rather than safe assets such as bonds, as these assets would have been easier to sell in a recovery.

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“Nothing is so permanent as a temporary government program.”
Milton and Rose Friedman, “Tyranny of the Status Quo,” (1984) p. 115

Introduction

The title character of Stevie Smith’s iconic poem *Not Waving But Drowning* appears to be completely in control (waving) when he is actually in deep trouble being “much further out than you thought”. This is an excellent analogy for the current state of several major advanced country central banks, most notably the Federal Reserve, the European Central Bank, the Bank of England, and the Bank of Japan. They are stuck in a problem of their own creation through their choice to combat the risks from the 2008 financial crisis through quantitative easing (the policy of buying up large amounts of safe bonds with the aim of lowering interest rates and support economic recovery).

This paper argues that the chosen approach to quantitative easing was always problematic. While it provided helpful support for the economy, quantitative easing has created a series of dilemmas for central banks, who are learning the aptness of the phrase “Act in haste, repent at leisure”. The fundamental issue is that in response to a rise in risk aversion these central banks focused on buying relatively safe assets, which investors were also clamoring for, rather than the risky assets that investors were fleeing. The logic was that buying safe bonds would force investors back to the riskier assets that they were shunning. It was as though, faced with a sudden but temporary fall in the price of oranges and rise in the price of apples, the government decided to buy currently expensive apples, driving up their price further so as to incentivizing others to buy oranges. Such an approach would generally appear quixotic. Why choose to buy expensive apples rather than cheap oranges? And how can you sell the apples without incurring losses?

So why would a central bank decide to buy temporarily expensive safe assets (apples) rather than cheap risky assets (oranges)? The general answer lies in risks to the balance sheet (in the case of the US Federal Reserve there was also a legal prohibition on buying private assets, which I discuss further below). Like all financial institutions, central banks have a capital

cushion to protect against unexpected losses. Central bankers were worried that if they bought a lot of risky assets then, if the price of these assets continued to fall, they could run out of capital and be theoretically insolvent.² However, such reasoning missed the fact that buying expensive “safe” bonds rather than cheap risky assets had its own balance sheet risks, namely that selling those bonds without incurring losses would inevitably be tricky.³

The result has been a policy dead end. What started as a temporary measure to provide some relief to distressed financial markets has become a long-term intervention in bond markets. Over a decade after quantitative easing was introduced, central banks have generally continued to expand their balance sheets by buying more and more bonds. While this partly reflects the slow recovery after the financial crisis and the new COVID-19 emergency, it also reflects a more fundamental market truth. While it always appears to be a good time for a major player such as a central bank to buy expensive assets, it never appears to be a good time to sell them because of the risk that prices will fall and yields will spike.

The next section of this paper discusses the US Federal Reserve’s decision to start quantitative easing, its impact, and the experience of other major central banks engaged in the same policy.⁴ This includes quantitative easing’s antecedents in Asia, including the experience in Japan since 2001 and in Hong Kong over the Asia crisis of the late 1990s. Next, I present a portfolio model of asset markets and central bank intervention to show the impact of quantitative easing on asset prices. This is followed by a policy discussion, outlining both the dilemmas that quantitative easing has caused and how these could have been avoided by an alternative policy that focused on buying risky assets in 2009 rather than safe ones, the policy that Hong Kong successfully pursued over the Asia crisis. The last section concludes.

² The descriptor “theoretically” is deliberate. Because central banks have a monopoly on creating “high powered” money, they can operate with negative capital and indeed some central banks have done so for long periods of time. However, it is legitimate to note that such a bank would be more dependent on the political authorities, and hence that those in charge of the major central banks may have had a genuine concern about the consequences of large losses for the political independence of the bank.

³ For a discussion of the particular case of the Euro area see Nugee (2021).

⁴ The focus on the Fed largely reflects its status as the most important central bank in the world, itself reflecting the importance of US financial markets in the global economy.

QUANTITATIVE EASING: A BRIEF HISTORY

The Fed's Bold New Policy

On November 25, 2008 the Federal Reserve System issued a brief public statement announcing the start of what later blossomed into quantitative easing. By later standards, the announcement was both limited in size and specific in aims. It explained that the Fed would:

“initiate a program to purchase the direct obligations of housing-related government-sponsored enterprises (GSEs)—Fannie Mae, Freddie Mac, and the Federal Home Loan Banks—and mortgage-backed securities (MBS) backed by Fannie Mae, Freddie Mac, and Ginnie Mae” of “up to \$100 billion”.⁵

The release explained that this action was being taken as:

“Spreads of rates on GSE debt and on GSE-guaranteed mortgages have widened appreciably of late” and that the objective was “to reduce the cost and increase the availability of credit for the purchase of houses, which in turn should support housing markets and foster improved conditions in financial markets more generally.”

Unusually, this new policy was not announced at a scheduled Federal Open Market Committee (FOMC) meeting.⁶ Rather, it was in a press statements released between the regular October 30 and December 16 meetings. The policy decisions at these two meetings were more conventional. On October 30 the Federal Funds rate was cut to 1½ percentage points while on December 16 it was further lowered to its floor of 0-¼ percentage points.

This policy innovation of buying bonds soon expanded in size and in scope. Already, by the December 16 FOMC meeting the Committee was hinting at this path:

“The focus of the Committee's policy going forward will be to support the functioning of financial markets and stimulate the economy through open market operations and other

⁵ Federal Reserve (2008a).

⁶ The FOMC is the committee that decides monetary policy. It meets every 6 weeks.

measures that sustain the size of the Federal Reserve's balance sheet at a high level. As previously announced, over the next few quarters the Federal Reserve will purchase large quantities of agency debt and mortgage-backed securities to provide support to the mortgage and housing markets, and it stands ready to expand its purchases of agency debt and mortgage-backed securities as conditions warrant. The Committee is also evaluating the potential benefits of purchasing longer-term Treasury securities.”⁷

At its January meeting, the FOMC provided further hints that the policy might be expanded, stating that:

“The Federal Reserve will employ all available tools to promote the resumption of sustainable economic growth and to preserve price stability. The focus of the Committee's policy is to support the functioning of financial markets and stimulate the economy through open market operations and other measures that are likely to keep the size of the Federal Reserve's balance sheet at a high level. The Federal Reserve continues to purchase large quantities of agency debt and mortgage-backed securities to provide support to the mortgage and housing markets, and it stands ready to expand the quantity of such purchases and the duration of the purchase program as conditions warrant. The Committee also is prepared to purchase longer-term Treasury securities if evolving circumstances indicate that such transactions would be particularly effective in improving conditions in private credit markets.”⁸

Finally, at its March meeting the FOMC took the plunge. Given “some risk that inflation could persist for a time below rates that best foster economic growth and price stability in the longer term” and that it would use “available tools to promote economic recovery and to preserve price stability” the committee announced that the Fed would:

“increase the size of the Federal Reserve’s balance sheet further by purchasing up to an additional \$750 billion of agency mortgage-backed securities, bringing its total purchases of these securities to up to \$1.25 trillion this year, and to increase its purchases of agency debt this year by up to \$100 billion to a total of up to \$200 billion. Moreover, to help improve conditions in private credit markets, the Committee decided to purchase up to \$300 billion of longer-term Treasury securities over the next six months.”⁹

⁷ Federal Reserve Board (2008b).

⁸ Federal Reserve Board (2009a).

⁹ Federal Reserve Board (2009b).

This decision represented a major switch in the Fed's approach. It was the start of the policy of quantitative easing, involving buying bonds to "help improve conditions in private markets" rather than buying assets to support specific market segments that were in distress. And the new policy was significant. As discussed further below, these purchases were large when compared with the pre-crisis balance sheet of some \$900 billion.

This discussion of the origins of quantitative easing illustrates two important features of the program. First, bond buying started as one of many programs designed to ease stress in specific segments of financial markets. The November 2008 decision to buy housing agency debt and mortgage-backed securities followed the same logic as the decision to supply liquidity to other segments of the financial markets that were exhibiting stress, for example buying asset backed commercial paper. These other credit operations expanded rapidly but then withered away. In stark contrast, the Fed's holding of securities have risen, albeit in fits and starts, almost continually between 2008 and 2021.

The expansion of the Fed's securities holdings over time reflected the second feature of the quantitative easing program. While the initial purpose for buying bonds in November 2008 was to support the mortgage market and hence the housing sector, by March 2009 the objective has widened to promoting "a gradual resumption of sustainable economic growth" by "actions to stabilize financial markets and institutions, together with fiscal and monetary stimulus". This widening can be seen by comparing the texts of the November 2008 and March 2009 statements. In November, the objective was "to reduce the cost and increase the availability of credit for the purchase of houses" with beneficial knock-on effects to market functioning more generally. By March, the objective of Treasury bond purchases had become improving "conditions in private credit markets."

The quantitative easing initiated in March 2009 has had profound effects on the Fed's balance sheet. Chart 1 reports the weekly value of the Fed's balance sheet, divided into securities holdings, other credit facilities (essentially emergency operations to support

distressed parts of the market), and non-credit assets such as land holdings—which are trivial throughout the period. The trajectory of the balance sheet can be divided into five phases:

- Before the 2008 crisis, the Fed's assets were around \$900 billion, of which almost all were Treasury securities with minor sums devoted to other credit facilities.
- Over 2008, as financial strains grew, the Fed's balance sheet more than doubled to \$2¼ trillion. This was almost entirely due to market support through other credit facilities. Until the collapse of Lehman Brother on September 24, the gradual increase in market support was offset by reductions in holdings of securities. After the Lehman collapse market support ballooned, peaking just before Christmas at around \$1¾ trillion while holdings of securities remained stable and smaller than before the crisis.
- From early 2009 through late 2014 the balance sheet doubled again to \$4½ trillion. Through 2009 and 2010 the Fed mainly bought mortgage-backed securities, which it was now allowed to do since the agencies had been put into federal conservatorship over the crisis and were hence government obligations. The balance sheet, however, remained relatively stable as these purchases were basically offset the rapid reduction in other credit facilities. As a result, the balance sheet again became dominated by securities holdings. The subsequent expansion in the balance sheet from early 2011 to the end of 2014 reflected further acquisition of securities, both government bonds and mortgage-backed assets.
- From late 2014 to late 2019 the balance sheet first stabilized and then fell steadily to \$3¾ trillion as part of an exit strategy (discussed further below). Securities holdings stabilized after October 29, 2014, when the Fed announced that it would stop buying bonds but continue to reinvest all principal payments in new securities. The Fed started to raise the federal funds rate around a year later, but it was not until September 2018 that the Fed decided to reinvest only some of the principal payments, causing the

balance sheet to fall in nominal terms. The rate of reduction started at \$20 billion a month and ratcheted up gradually to \$50 billion a month, a level that was reduced to \$35 billion in early 2019. This caused a gradual fall in bond holdings—over the next year securities holdings fell by some \$600 billion, around 15 percent of the initial holdings.

- From late 2019 through the end of 2020 the Fed almost doubled its balance sheet to close to \$7½ trillion after the onset of the COVID-19 recession. In October 2019, in response to tremors in the Treasury market, the Fed decided to again reinvest all principal payments of securities and also conduct some time-limited purchases of Treasury bills. This led to a modest expansion of the balance sheet even before the COVID-19 virus was identified. As the extent of the COVID-19 pandemic became apparent, the Fed announced plans to buy both Treasury and (to a less degree) mortgage backed securities at an unscheduled FOMC meeting on March 15, 2020. The associated market turmoil also led to a rapid increase in emergency credit facilities that began to wind down in mid-2020.

In summary, by late 2020, the Fed's assets had swelled to almost \$7½ trillion compared to some \$900 billion before the 2008 financial crisis. There is a striking contrast between the temporary impact on the balance sheet of emergency facilities, aimed at market support for segments of the financial market under immediate stress, and the much more long-lived balance sheet effects from purchases of securities to support activity more generally. The emergency facilities expanded rapidly in response to market disfunction in 2008 and 2020 but also fell rapidly subsequently. By contrast, holdings of securities have grown almost continuously. As a result, securities holdings dominated the Fed's balance sheet in 2020, just as it did in 2007. But in 2020 the balance sheet was eight times larger.¹⁰

The composition of Fed holdings of securities is shown in Chart 2. The initial expansion in bond holdings during 2009 mainly involved mortgage backed securities guaranteed by the

¹⁰ By comparison, GDP had only risen by around one-third over this period.

housing agencies. As already noted, since the mortgage backed securities market was exhibiting stress in the form of unusually high risk premiums, these initial purchases can be seen as a form of emergency market support. By mid-2009, however, the unusually high spread had dissipated and such mortgage backed securities reverted to safe assets with low risk premiums. From then on, all of these securities holdings can be considered as safe assets.

The Impact of Quantitative Easing

Quantitative easing succeeded in improving conditions in credit markets. The March 2009 statement was bolder than markets were expected. According to the New York Times investors responded with:

“surprise and enthusiasm. The Dow Jones industrial average, which had been down about 50 points just before the announcement, jumped immediately and ended the day up almost 91 points at 7,486.58. Yields on long-term Treasury bonds dropped markedly, and analysts predicted that interest rates on fixed-rate mortgages would soon drop below 5 percent.”¹¹

Indeed, the speed and determination of the Fed’s response to the crisis has been almost universally praised. This is fair. At a time of widespread financial panic, the decisive (if somewhat scattershot) approach of the Fed to support the economy helped reduce fears of a new Great Depression.¹²

Research also suggests that quantitative easing has provided significant economic support. Gagnon (2016) surveys the results from 24 studies of its impact, mainly using event studies (measuring the impact of quantitative easing announcements on bond yield) or time series analysis (looking at the relationship between quantities of bonds and their yields).¹³

¹¹ New York Time (2009).

¹² There are many excellent descriptions of the 2008 financial crisis and the Fed’s response, including Sorkin (2010), Blinder (2013), Geithner (2015), and Tooze (2018).

¹³ Examples of papers using event studies include Krishnamurthy and Vissing-Jorgensen (2011), Neely (2012), and Christensen and Rudebusch (2016). Time series analysis include Greenwood and Vayanos (2008), Chadha, Turner, and Zampolli (2013), and Fukunaga, Kato, and Koeda (2015) (using Japanese data). Papers using both approaches

Almost all of these studies find significant effects from announcements of quantitative easing. The effects are generally larger in the early period, when the direct benefits from buying securities were likely boosted because these announcements also helped quell market disfunction and convince markets that the Fed was prepared to keep policy rates low for a long time. But later announcements are also generally found to have significant effects.

Based on these results, Gagnon argues that a sensible metric for most advanced economy central banks is that via the portfolio balance channel a promise to buy bonds worth 10% of GDP provides as much stimulus as a $\frac{1}{2}$ percentage point cut in policy rates (although he notes the impact may be smaller in Japan given its much larger government bond market).¹⁴ This implies that the current level of securities help by the Fed (30% of GDP) is providing significant economic support. More recently, Bernanke (2000) also concludes that quantitative easing provided significant benefits to activity, including evidence from papers that look at the impact of unexpected changes in the composition of bond purchases on relative asset prices that were not covered by Gagnon.¹⁵ He suggests that in the future a combination of forward guidance on the future path of policy rates and quantitative easing through its portfolio effect can provide support equivalent to a 3 percent reduction in short-term interest rates.

Further evidence for the effectiveness of quantitative easing comes from the May 2013 “taper tantrum”. On May 22, Governor Bernanke’s testimony to Congress was interpreted by markets as suggesting an earlier-than-expected end to Fed bond purchases. The result was a spike in bond yields and a fall in stock prices. In response, the Fed emphasized that any policy changes would be slow and respond to changing economic conditions. Markets stabilized as the Fed continued to buy large amounts of securities. The taper tantrum did, however, put renewed focus on the Fed’s exit strategy from quantitative easing.

include Gagnon, Raskin, Remache, and Sack (2011) and Joyce, Lasao, Stevens, and Tong (2011) (using UK data). Studies using somewhat different techniques include D’Amico and King (2013) and Meaning and Zhu (2013).

¹⁴ The benefits are found when the policy is announced, rather than when the bonds are purchased.

¹⁵ Cahill and others (2011) and Di Maggio, Kermani and Palmer (2015)

The Evolving Exit Strategy

Understandably given the ferocity of the financial crisis after the collapse of Lehman Brothers, the Fed announced its policy of quantitative easing without providing an explicit exit strategy. Such a strategy was first outlined in 2011. After an initial discussion in the April FOMC meeting, the minutes of the June 2011 meeting announced an exit strategy that was endorsed by all but one member of the Committee. When the situation was appropriate, the Committee stated that it would “cease reinvesting some or all payments of principal on the securities holdings”. This would be followed by increases in the federal funds rate and, likely subsequently, outright sales of securities would commence. These sales would bring securities (and bank reserves) back to “the smallest levels that would be consistent with the efficient implementation of monetary policy” in 3-5 years. Finally, balance sheet operations would be largely passive since “changing the level or range of the federal funds rate target will be the primary means of adjusting the stance of monetary policy”.

In September 2014, over a year after the “taper tantrum”, the Committee amended the exit strategy, delaying the start of balance sheet reduction and slowing its pace. Specifically, the Committee announced that the balance sheet reduction would likely come after it started to increase the federal funds rate, and stated that it “did not anticipate” outright sales of securities, but instead planned to “reduce the Federal Reserve's securities holdings in a gradual and predictable manner primarily by ceasing to reinvest repayments of principal on securities”. As discussed earlier, the Fed started to reinvest only part of the principal payments in September 2018, although it never went so far as to cease all reinvestments.

Subsequently, on March 20, 2019 the Committee decided to exit this policy of balance sheet reduction at the end of September of that year, at which point its \$3½ trillion holdings of securities would constitute “no more securities than necessary for efficient and effective policy implementation”—although note that this statement dropped the language in the 2011 announcement about the “smallest levels” consistent with policy implementation. In addition,

this decision to stabilize the balance sheet came as the Committee was pausing policy rate hikes, suggesting that the balance sheet policy was not completely passive, with at least some linkage with changes in policy rates. In the event, balance sheet reduction ended two months earlier than planned and was replaced by a gradual increase in securities that became a rapid increase after the COVID pandemic. At the end of 2020, the Fed held around \$6.7 trillion in securities, almost double the 2019 planned stabilization level of \$3½ trillion.

Bernanke (2020) also discusses exit from quantitative easing. He notes that after the taper tantrum the Fed worked to develop methods “for raising policy rates at the appropriate time—including the paying of interest on bank reserves”. These allowed the Fed to start hiking rates in late 2015, well before the balance sheet started to shrink. On the subject of potential capital losses on securities holdings, the paper observes that the FOMC worried about “the political fallout and threats to Fed independence that large losses could have produced”.¹⁶ The paper notes, however, that the Fed’s income statement benefits from seigniorage—it pays no interest on cash and low interest rates on bank reserves. Another point that Bernanke makes is that Fed purchases had been hugely profitable, netting the Fed some \$800 billion between 2009 and 2018, presumably due to larger holdings of securities since the bonds were held to term. Finally, Bernanke also observes that the Fed was prohibited from buying private assets, which explains why the Fed chose to buy Treasuries and agency-back securities (the agencies were transferred to government hands during the crisis). On this point, however, it is important to note that over the crisis the Fed succeeded in finding legal work arounds for other prohibited actions (such as lending to broker dealers), and almost certainly could have found a way of buying private assets if it had been a policy priority.

Quantitative Easing by Other Major Central Banks

Despite institutional and timing differences, the basic patterns seen in the Fed’s implementation of quantitative easing are mirrored in other major advanced country central

¹⁶ He also notes that getting the Treasury to indemnify such losses, as occurred in the United Kingdom, does not fully solve these concerns.

banks' balance sheets. Security holdings have climbed steadily even as exit strategies remained hazy. Indeed, the Fed is notable as the only central bank to have succeeded in any significant nominal reduction of its balance sheet, albeit one that was subsequently reversed. Astonishingly, no major central bank seems to have outright sold any securities bought as part of quantitative easing.

The Bank of England started purchasing securities in March 2009, slightly before the Fed, through a wholly owned subsidiary, the Asset Purchasing Facility. This reflected the agreement that any losses would be indemnified by the UK Treasury. Although the Facility could buy a range of assets, in practice its balance sheet has always been dominated by government bonds, known as gilts. Chart 3 shows that these holdings of gilts have risen jerkily over time. By the end of November 2020, the Facility held 602 billion pounds of government bonds, or just over 80% of the Bank of England total assets of 735 billion pounds.¹⁷ A similar pattern of intermittently rising ownership of securities is shown by the European Central Bank (Chart 4). In the case of the ECB, securities make up a significantly smaller proportion of the ECB's balance sheet compared to that of the Fed, as the ECB also provided significant amount of general economic support in the form of loans to commercial banks (this is also true of the Bank of England, although to a somewhat lesser extent).

The Bank of Japan's asset holdings are of particular interest as they experimented with a somewhat different approach to quantitative easing in 2001, before starting a more conventional program in April 2013. Having lowered the policy rate to zero in 1999, the 2001 policy was aimed at supporting bank lending so as to combat deflation. More specifically, the Bank of Japan set a target for commercial bank reserves that it achieved in part through buying government bonds. This program was more similar to later initiatives by the ECB and Bank of England to support commercial banks by providing secure funding than it was to later quantitative easing programs. Its impact on bond holdings was modest. As shown in Chart 5, the Bank of Japan's stock of government bonds approximately doubled between end-2001 and

¹⁷ Tracking the Bank of England balance sheet since 2007 is complicated and hence is not shown.

end-2005 before falling back to close to its initial value by end-2008 after the policy was abandoned in 2006. Vigorous quantitative easing of the type pursued by other major central bank's started in 2013, resulting in a quintupling of the Bank of Japan's balance sheet. It is also notable that the size of the Bank of Japan's balance sheet as a ratio of the economy (not shown for brevity) is much larger than that of the other major central banks, possibly reflecting Japan's equally outsized level of government debt.

The Bank of Japan's post-2013 quantitative easing program is also notable as the only quantitative easing program to have bought equities, albeit in small quantities. A much better example of buying equities to support the economy was in 1998 during the Asia crisis, when the Hong Kong Monetary Authority bought around 10% of the value of the Hang Sang index. The HKMA was responding to a speculative attack over the Asia crisis involving simultaneously short selling the Hong Kong dollar and the stock market. The logic of these speculative attacks was that the fixed exchange rate between the Hong Kong and US dollars at a time when other regional currencies were depreciating against the dollar implied a major loss of competitiveness for Hong Kong, which would weaken exports and activity. The speculators believed that either the currency would need to be significantly devalued against the dollar or the economic cost of retaining the fixed exchange rate would lead to a deep depression that would lower stock market prices. Either way, the speculators believed they would make money. Indeed, in the 5 months before the HKMA's intervention, the Hang Seng index fell by 40%.

In a surprise move, over two weeks in August 1998 the HKMA used its Exchange Fund to buy HK\$118 billion (\$15 billion) in shares of companies in the Hang Seng index, as well as some shorter-term positions in the futures market that were unwound by the end of September.¹⁸ The policy succeeded in supporting the economy and ending financial speculation. Over the intervention period the Hang Seng index rose by 18% and by the end of October almost all of the speculative short positions had been closed. The stock market intervention also resulted in a large increase in the balance sheet of the HKMA. As can be seen in Chart 6, the assets of the

¹⁸ The justification for the intervention is provided in Yam (1998).

Exchange Fund rose from HK\$637 billion at the end of 1997 to HK\$912 at the end of 1998 as the value of the Fund's investment assets almost doubled (both totals include some capital gains). This unconventional action was heavily criticized by western commentators at the time, most notably by the Chair of the Fed, Alan Greenspan, for interfering with normal market mechanisms.¹⁹

The exit from this operation turned out to be surprisingly smooth and fast, despite initial concerns (including from within the HKMA), particularly when compared to the difficulties of exiting from recent quantitative easing programs.²⁰ The HKMA started selling its equities holdings in November 1999, just over a year after the intervention, through an Exchange Traded Fund it created called The Tracker Fund of Hong Kong. Sales involved an initial public offering and then a Tap facility that was wound down in September 2002. In those three years the HKMA sold HK\$140 billion in equities, HK\$22 million more than the cost of buying them, while retaining the remaining HK\$51 billion in equities as long-term investments. Clearly, the intervention netted the HKMA a significant capital gain and explains the small reduction in its assets from 1998 to 2002 despite large equity sales.

To summarize, when central banks have provided emergency support to distressed assets, they have generally been able to exit these facilities relative quickly and generally at a profit (including in the case of the HKMA's massive purchase of equities). By contrast, when central banks have bought large numbers of safe bonds, they have found it difficult to exit these programs. While some of this may reflect circumstances, for example the HKMA was reacting to a speculative attack that artificially lowered the value of equities, the pattern is sufficiently general to require an explanation. The next section provides a theoretical model to help answer this question.

¹⁹ Other skeptical reactions include Wall Street Journal (1998) and Federal Reserve of Dallas (2001). For a more sympathetic treatment of the HKMA's approach see Bayoumi and Gagnon (2018), which also discusses monetary policies in several other countries hit by the Asia crisis.

²⁰ Chan (2018) discusses these issues in detail.

MODELING QUANTITATIVE EASING

This section first presents a theoretical model of quantitative easing and then uses its insights to discuss policy implications. The model itself is kept simple so that the underlying mechanisms are clear. In particular, it is assumed that two long-term assets are issued at the same time and last for the same length of time, which allows us to examine different policies using comparative statics. The subsequent discussion of policy implications implicitly switches to a more realistic environment in which long-term assets of different maturities and risk levels are being constantly issued and withdrawn.

A Portfolio Balance Model of Quantitative Easing

Consider an economy with a single representative buy-and-hold investor with mean-variance preferences. The investor can purchase either a long-term government bond (G), with a certain future payout of one dollar, or a risky long-term corporate asset (S) with an uncertain payout of P_{St} , with an expected value $E_t(P_{St})$ and a realized payout of $E_t(P_{St}) + d_t$, where d_t has an expected value of zero and a variance of $V(P_{St})$. The investor collects the proceeds from her holdings of the government bond and private security last period and uses them to invest in this period's bond and private security (which for simplicity we will call a stock).

We first solve the model in a steady state, in which the amounts of both assets are set at unity and the expected value of the stock, $E_t(P_{St})$, is also a constant that, without loss of generality, is also set at one.

Formally, the problem is:

$$\text{Max}(G + S(1 - \alpha V(d_t))) \text{ given the constraint } P_{Gt}G + P_{St}S \leq G + P_{St-1}S. \quad (1)$$

The solution is:

$$P_{Gt}(G - S\alpha V(P_{St})) = G + P_{St-1}S. \quad (2)$$

Assuming $\alpha V(P_{St})$ is small, a first order approximation to the prices of the assets is:

$$P_{Gt} = 1 + \frac{S}{G+S} (P_{St-1} - 1) + \frac{G}{G+S} \alpha V(P_{St}) \quad (3)$$

$$\text{and } P_{St} = 1 + \frac{S}{G+S} (P_{St-1} - 1) - \frac{S}{G+S} \alpha V(P_{St}). \quad (4)$$

The prices of the bond and the stock depend on an income effect and a substitution effect, as shown by the second and third terms in equations (3) and (4). The income effect depends on the payoff of the private asset in last period, P_{St-1} . The larger it is, the higher the price of both assets since the investor has more money to buy current assets. The importance of the income effect increases when the quantity of private assets (S) is large compared to government bonds (G), since this raises the uncertainty of the overall payoff to the investor. The substitution effect comes from the variance of the current payoff of the share $V(P_{St})$ as well as the risk aversion of the investor, α . A rise in the variance increases the price of the government bond (and hence decreases its yield and its term premium versus the numeraire, money) while depressing the price of the stock (increasing its expected yield).

To allow for quantitative easing, we now add a central bank that issues dollars (the numeraire) and can use the proceeds to invest in the two assets. The motivation for such intervention is to support the economy following a crisis by raising the price of the stock and thereby increasing the corporate sector's ability to borrow (to keep matters simple, these benefits are not modeled). Any increase in central bank holdings of the government bond or stock reduces the quantity of such assets available to the private investor since:

$$G_t + CG_t = G \text{ and } S_t + CS_t = S, \quad (5)$$

where CG_t and CS_t are central bank holdings of bonds and shares, respectively. Accordingly:

$$\Delta CG_t = -\Delta G_t \quad (6)$$

$$\text{and } \Delta CS_t = -\Delta S_t. \quad (7)$$

The problem for the investor now becomes:

$$\text{Max}(G_t + S_t(1 - \alpha V(P_{St}))) \text{ subject to } P_{Gt}G_t + P_{St}S_t \leq G_{t-1} + P_{St-1}S_{t-1}. \quad (8)$$

A first order approximation to the asset prices is:

$$P_{Bt} = 1 + \frac{S_{t-1}}{G_{t-1} + S_{t-1}} ((P_{St-1} - 1) + \Delta CB_t + \Delta CS_t) + \frac{G_t}{G + S_t} \alpha V(P_{St}). \quad (9)$$

$$\text{and } P_{St} = 1 + \frac{S_{t-1}}{B_{t-1} + S_{t-1}} ((P_{St-1} - 1) + \Delta CB_t + \Delta CS_t) - (1 - \frac{G_t}{G_t + S_t}) \alpha V(P_{St}). \quad (10)$$

Quantitative easing, in the form of the central bank buying long-term government bonds (ΔCB_t), raises the prices of both government bonds and the stock through a portfolio effect (as seen in the second terms on the right hand side of equations 9 and 10). As the quantity of government bonds available to the private sector falls, the price of such bonds increases, depressing the term premium compared to cash. It also induces the investor to switch funds to the stock so as to re-equilibrate the risk premium. This is the basic portfolio effect that underlaid the quantitative easing policy, as stressed by Gagnon and Bernanke.

It is important, however, to note that the same amount of stimulus to the economy can always be provided more cheaply by buying private assets rather than government bonds. To see this, simply observe that the term $\Delta CB_t + \Delta CS_t$ implies that buying equivalent quantities of the government bond and the stock produces the same amount of stimulus. Since the price of the stock is always lower than the safe government bond due to the risk premium, buying stocks will always be a cheaper form of stimulus.

Finally, central bank purchases also have further, second order, impact on asset prices through a second portfolio effect. This can be seen by looking at the law of motion of $G_t/(G_t+S_t)$, the term that defines the size of the substitution effect. To a first order approximation, this law of motion is:

$$\frac{G_t}{G_t+S_t} = \frac{G_{t-1}}{G_{t-1}+S_{t-1}} \left(1 + \frac{S_{t-1}\Delta C G_t - G_{t-1}\Delta C S_t}{S_{t-1}(G_{t-1}+S_{t-1})} \right). \quad (11)$$

If the central bank buys bonds then this expression increases, boosting the price of bonds and stocks through the last term in equations (9) and (10). This effect comes from the fact that the price of safe government bonds is always higher than risky private assets. As a result, central bank purchases of the government bonds reduce the relative amount of expensive bonds in the private sector portfolio, boosting asset prices in general. Conversely, if the central bank buys stock the effect goes in the opposite direction.

A final extension of the model is to allow the expected value of the company in the long term ($E_t(P_{St})$) to vary over time rather than be fixed at unity. Such a reevaluation of the future value of the firm could reflect a major shock to the economy. It produces the following slightly more complex expression for the two asset prices:

$$P_{Gt} = 1 + \frac{S_{t-1}P_{St-1}}{G_{t-1} + P_{St-1}S_{t-1}} \left(((P_{St-1} - 1) + \Delta C B_t + P_{St-1}\Delta C S_t - S_{t-1}\Delta E_t(P_{St})) \right. \\ \left. + \frac{S_t P_{St}}{G_t + S_t P_{St}} \alpha V(P_{St}) \right). \quad (12)$$

$$P_{St} = \Delta E_t(P_{St}) + P_{St-1} \left(1 + \frac{S_{t-1}(P_{St-1} - 1)}{B_{t-1} + P_{St-1}S_{t-1}} (P_{St-1} + \Delta C B_t + D_{t-1}\Delta C S_t - S_{t-1}\Delta E_t(P_{St})) \right) \\ - \frac{G_t}{G_t + S_t P_{St}} \alpha V(P_{St}) \quad (13)$$

And the impact on the proportion of government bonds and private assets becomes:

$$\frac{G_t}{G_t + S_t P_{St}} = \frac{G_{t-1}}{G_{t-1} + S_{t-1} P_{St-1}} \left(1 + \frac{S_{t-1} P_{St-1} \Delta CG - G_{t-1} P_{St-1} \Delta CS_t + G_{t-1} S_{t-1} \Delta P_{St}}{S_{t-1} (B_{t-1} + S_{t-1} P_{St-1})} \right). \quad (14)$$

Changes in the expected future value of the firm primarily affect its own stock price (the first term in equation 13). However, there are also second order effects on all asset prices through the two portfolio channels. The main portfolio channel is negative because the investor has the same income but the expected future value of assets has increased. This is slightly offset by a small boost to asset prices as the value of relative cheap shares rise compared to bonds.

Analysis of Quantitative Easing

This framework can be used to think about the impact of quantitative easing in response to a financial shock. This shock is assumed to be reflected in: (1) a negative value of d_{t-1} and hence a low price for the maturing stock, P_{St-1} ; (2) a rise in the variance of the expected future price of the stock $V(P_{St})$; and, possibly, (3) a fall in the expected future price of the stock ($E_t(P_{St})$). All three effects lower the current value of the stock, each through a different channel. The lower value of the maturing stock depresses investor income and hence the funds available to buy assets; the higher anticipated volatility of the stock increases its risk premium and lowers its price; and a lower future expected value for the stock dampens its current price. By contrast, the impact of the crisis on the price of the government bond is ambiguous. Lower investor incomes and lower expected stock values depress government bond prices, but the rise in the risk premium boosts them. In practice, it is often believed that the flight to safety dominates, implying that the price of bonds increases.

It is this financial shock that is assumed to prompt the central bank to intervene to support the economy. Let us now consider the impact of a quantitative easing program involving buying government bonds so as to boost the price of risky assets to reduce borrowing costs and support economic recovery. Let us initially consider an announcement that the central bank will steadily buy a certain quantity of bonds, as the Fed promised to do in March

2009. Consistent with the evidence discussed above, markets will react to the announcement of this policy rather than the purchases themselves (this is clear from the term in ΔCB_t equations 9 and 10). The rise in government bond prices (in other words, the fall in the term premium) will spillover and boost stock prices, providing support for the economy.

The exit strategy is murkier. Recall that the initial impact of the crisis on the government bonds price is ambiguous and that quantitative easing will further raise its price. Exit thus involves economic and balance sheet risks. On the economic side, as the taper tantrum demonstrated, reductions in the expected future level of Fed bond holdings will raise yields and lower activity. However, exactly the same issues occur with a conventional monetary tightening (monetary policy is normally mildly asymmetric, largely because recessions are difficult to predict so that policy loosening is more hurried). But the degree of asymmetry involved in quantitative easing is much greater. This is because of the less standard balance sheet issue, which involves disposing of expensive government bonds without losing money. This can generally be achieved by holding the bonds to term, since the final payout will be larger than the price that was paid (at least as long as bond yields are positive). Outright sales of government bonds are trickier, since any decision to do so will lower their price, possibly below the prices at which they were bought. This may explain the remarkable fact, discussed earlier, that no major central bank involved in quantitative easing has sold any bonds outright. In short, while it is always a good time to buy bonds, as such purchases boost economy activity, there is rarely a good time to sell them outright since such sales will not only lower activity but also risks losing the central bank money, with its attendant political risks.

As time has passed, the Fed's policy rule has become more sophisticated and included an exit strategy. A reasonable characterization of the policy since 2011, when the exit strategy was first articulated, is that at the zero bound the Fed will buy bonds rapidly in the face of negative economic shocks but will dispose of them extremely gradually when the economy recovers, a strongly asymmetric policy rule. In addition to the channels discussed above, by curtailing the downside risks to stock prices this policy provides an additional boost to stock

prices through two new channels (Chart 7). It raises the expected future value of the stock and it also lowers its expected variance.²¹ This further fillip to stock prices can help to explain why stock valuations see so have been so divorced from the underlying economic situation over the COVID-19 recession.

While this asymmetric policy provides a larger boost to activity, it further complicates the exit strategy. The promise to buy bonds quickly and sell them slowly can be derailed by future shocks that lead to further accumulation of bonds. Indeed, this is exactly what happened to the Fed in 2013 and 2020, when new shocks interrupted the plan for gradual exit. More generally, this explains the pattern we have seen across the major central banks in which short periods of large bond purchases are followed by periods of balance sheet stability. And while the COVID-19 pandemic was clearly a huge and unexpected shock that could have justified larger securities holdings, the Fed had already decided to stabilize its asset holdings at an elevated value of \$3½ trillion in March 2019, well before COVID-19 was identified. This underlines the difficulties of exiting a highly asymmetric policy.

Indeed, these concerns about the impact of an asymmetric policy on stock prices are not new. They were at the heart of an earlier debate that a “Greenspan put”, where critics argued that the Fed had a policy of cutting rates rapidly in response to bad shocks but only raised them slowly subsequently, and that this was boosting stock market values excessively. This concern about the impact of asymmetry in interest rate policy is only compounded by the additional difficulties of exiting quantitative easing without experiencing politically embarrassing investment losses.

To understand quite how asymmetric the quantitative easing policy is, Chart 8 shows the Fed balance sheet and securities holdings as a ratio to GDP, the metric suggested by Gagnon. The balance sheet rose by some 10 percent of GDP immediately after the Lehman

²¹ The impact additional on the price of the government bond is negative. The risk premium compresses and the increase in the value of risky assets diverts buying power to away from safe assets.

crisis and a further 5 percent of GDP over 2013. By contrast, during the 5 year stretch from late 2014 to late 2019 (when the Fed initially stabilized the balance sheet in nominal terms and then started to reduce it) the balance sheet only fell by some 7 percent of GDP. With outright sales of bonds unlikely, it is difficult to see how the exit from quantitative easing can occur within (say) a five year time frame. In addition, the balance sheet tightening was slow when compared to interest rate hikes. Using the Gagnon metric, the balance sheet tightening from 2014 to 2019 was equivalent to a hike of 35 basis points in the federal funds rate. During the same time, the Fed raised the federal funds rate by 250 basis points (Chart 9).

Let us now consider a completely different form of quantitative easing, in which the Fed promised to buy stocks rather than safe bonds. As noted above, because stocks were so out of favor over the crisis, the same support to the economy could have been achieved at a much lower cost. In addition, the exit strategy would have been much easier. Since the central bank would have bought stocks at highly discounted prices, there would have been few problems associated with disposing of these assets in a recovery. Indeed, this is exactly what occurred in Hong Kong. Soon after the recession ended, the HKMA started selling equities relatively quickly and at a large profit. This rapid disposal of assets is also seen in emergency support for distressed markets, and for the same reason. Asset prices in distressed markets are so depressed that it is easy to sell them subsequently at a profit. It seems reasonable to assume that, if the Fed had bought stocks, it could have liquidated them well before the COVID-19 crisis caused a new buying spree.

There is a deep irony here. Central banks' have traditionally avoided buying shares as their prices are volatile, leading to risk of balance sheet losses. In the face of a crisis, on the other hand, stock prices were so depressed that they are less of a headache for the central bank's balance sheet than "safe" bonds whose value had been boosted by a flight to safety.

Finally, some might wonder whether large central bank holdings of bonds are a significant issue. After all, the Fed has consistently stated that interest rates would be the

primary instrument in conducting monetary policy. So why not continue to hold large amounts of bonds for the foreseeable future? The answer is that being an important holder of bonds creates multiple complications for central banks. First, as shown by the taper tantrum, markets care about, and respond to, balance sheet policy and, in particular exit policy. Hence the emphasis in central bank communication on a gradual exit from quantitative easing. Second, buying and holding large amounts of securities leaves the central bank open to accusations that they are artificially supporting wealthy financial institutions and individuals, particularly in the current circumstance which juxtaposes high asset prices with an iffy economy. Third, central banks may be tempted to provide preferential support for particular companies, either through emergency loans or by buying bonds of preferred enterprises (there is an active debate in Europe about whether to use QE to assist green companies). Importantly, these last two actions move central banks away from “technical” decisions and closer to “political” policies that are typically carried out by elected officials, potentially eroding arguments for independence from the government.²² Finally, there is an international aspect. When a central bank buys safe domestic assets, investors often diversify into risky foreign assets. This creates capital flows from the advanced economies to other countries, flows that could reverse rapidly with important domestic financial consequences, especially for emerging markets. By contrast, if central banks had bought risky assets, investors would have been more likely to have sought refuge in still-plentiful safe domestic bonds rather than switching to risky foreign ventures.

CONCLUSIONS

This paper has examined the origins of quantitative easing, the policy of buying up large amounts of safe assets to boost economic activity. It has argued that while this approach was effective in supporting the economy, this came at a significant price. The policy is beset by issues of time inconsistency. Buying bonds to boost the economy is easy, while selling was

²² See Tucker (2018).

always going to be tricky since such sales would not only depress activity but also politically inconvenient risk balance sheet losses.

The difficulty in exiting quantitative easing stands in marked contrast to ease of reversing emergency interventions to support distressed financial market sectors. When the Fed bought distressed assets, such as asset backed commercial paper, it was relatively easy to sell them once markets stabilized since their prices had risen. Indeed, the Fed's quantitative easing policy had origins in this type of emergency operation. The Fed started buying government agency debt and associated mortgage backed securities when they were exhibiting unusually large risk premiums. Relatively quickly, however, this morphed into buying safe assets, primarily Treasury securities as well as continuing to buy mortgage backed securities after their spread over Treasuries reverted to its usual low level.

A better policy would have been to follow the earlier lead of the Hong Kong Monetary Authority and to buy risky equities rather than safe bonds. While such a policy might appear riskier since equity prices are more volatile than bond prices, it would actually have been both cheaper and easier to reverse. Since stock prices were so depressed over the 2008 crisis, selling stocks during the recovery would have been easy as investors moved back into stocks and prices rose. Indeed, this is exactly what occurred in Hong Kong.

Milton Friedman famously wrote "Nothing is so permanent as a temporary government program." While this is clearly an overstatement—there are lots of government programs that are indeed temporary—quantitative easing shows every sign of being here to stay for a long time despite initial assumptions that the program was a temporary response to an emergency. The error was not the bold decision to prop up the economy by buying large amounts of securities, it was choosing the wrong securities to buy.

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Chart 1. Fed Balance Sheet
(\$m weekly averages)

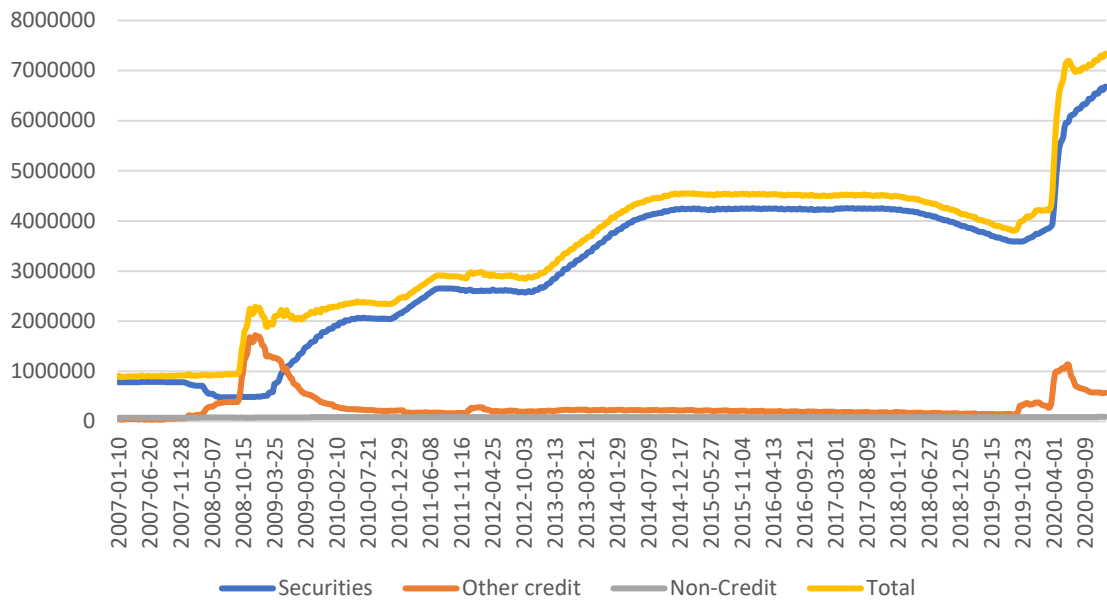


Chart 2. Fed Holdings of Securities
(\$m weekly averages)

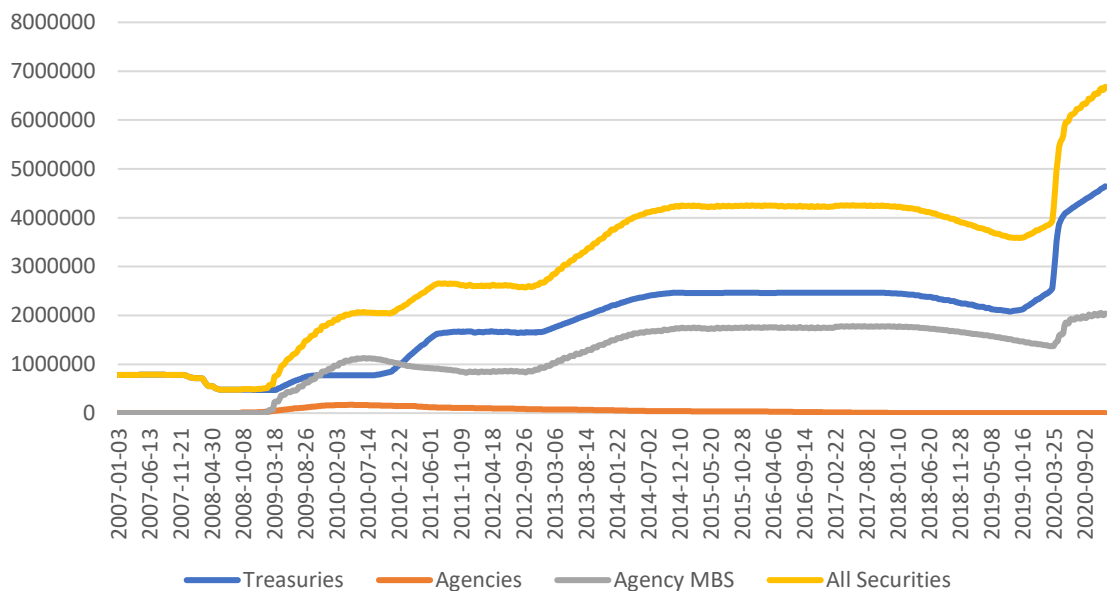


Chart 3. UK Asset Purchase Facility Gilt Holdings
(Millions of pounds, monthly)

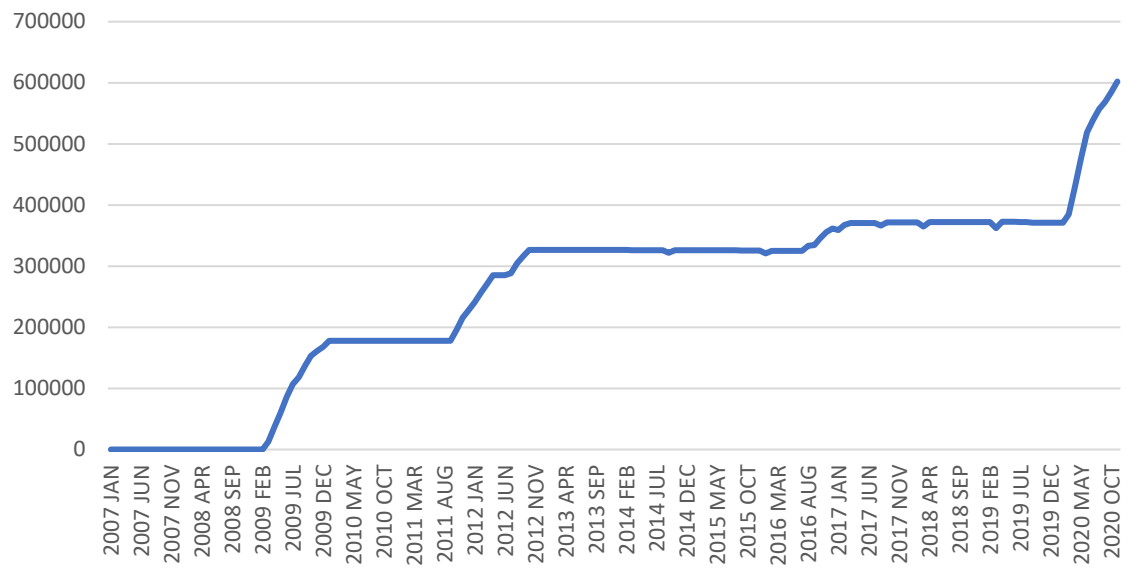
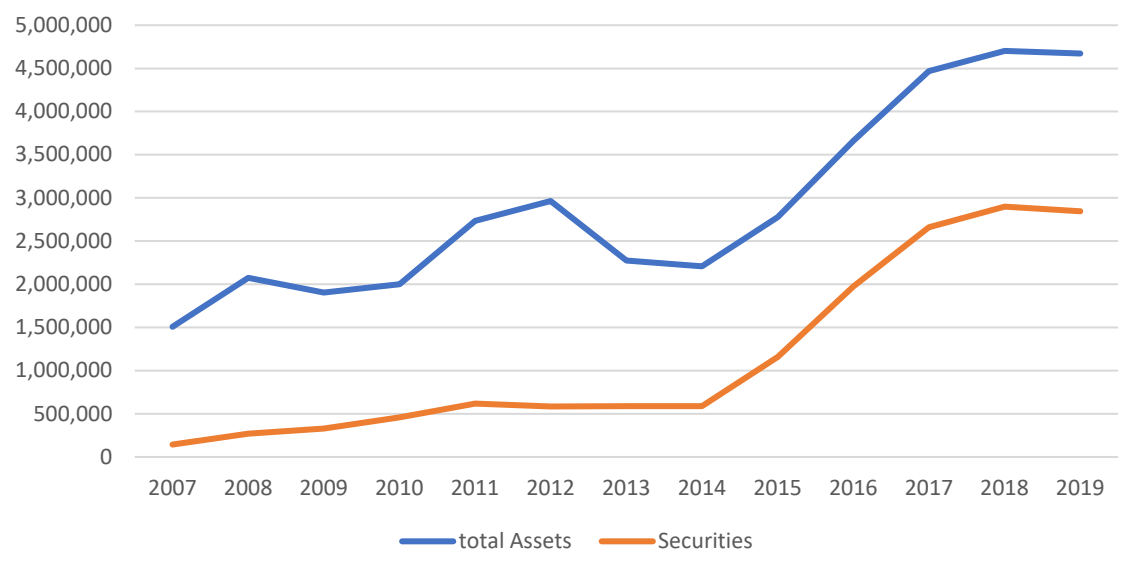


Chart 4. ECB Balance Sheet
(Millions of Euros, year end)



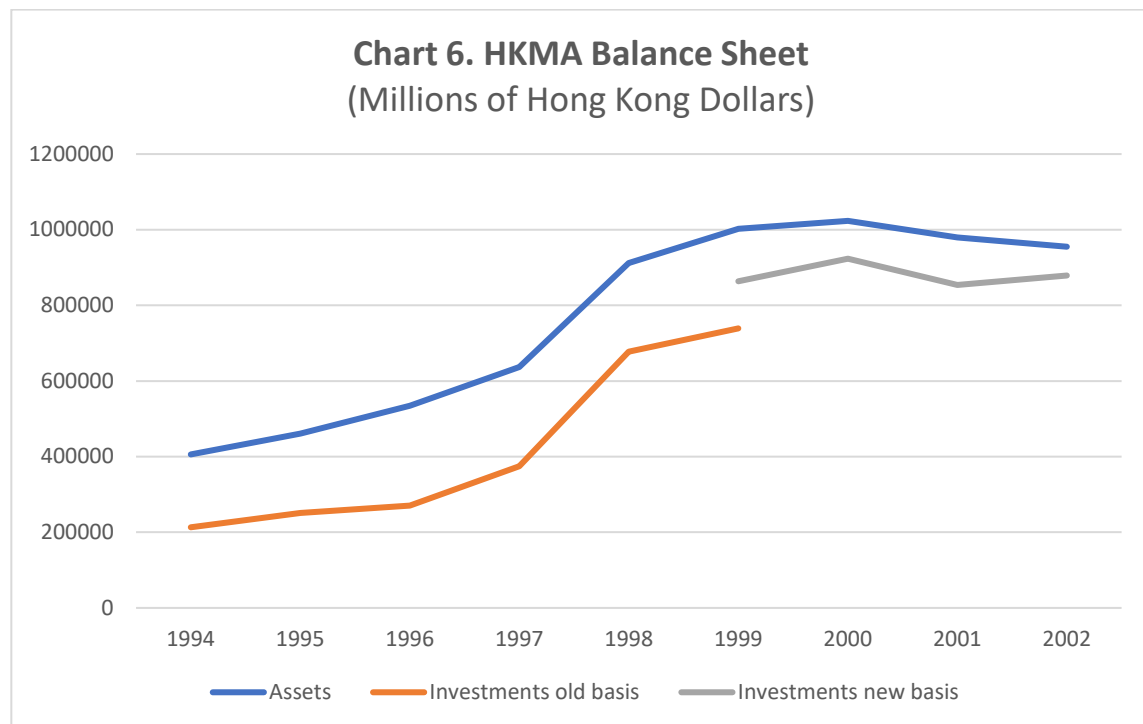
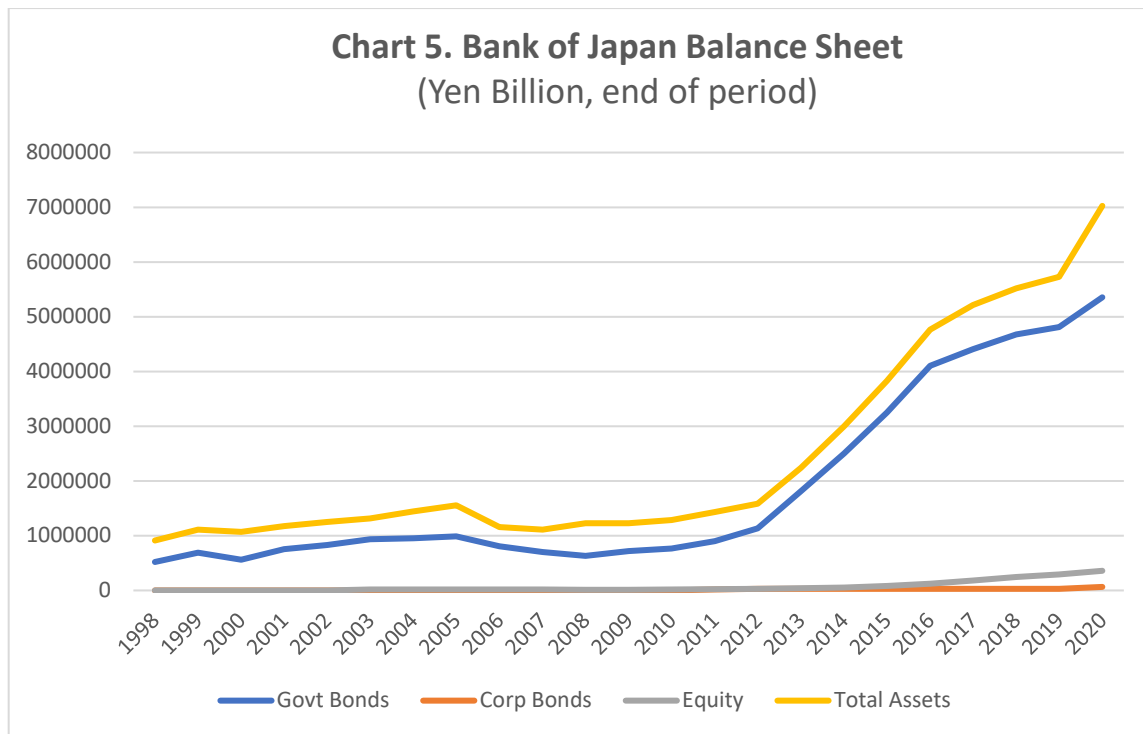


Chart 7. Impact of Fed Censoring Bad Outcomes on the Stock's Mean and Variance

