Research Proposal:
Asset Purchase Rules:
How QE Transformed the Bond Market

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Summary statement

This project aims at studying how the use of quantitative easing and tightening policies affects risk-taking in the financial sector and asset price dynamics. We argue that these policies should be viewed as a dynamic state-contingent plan — in short, a policy rule — as opposed to a succession of independent interventions: QE purchases occur in bad economic states (e.g., 2008-2009 or 2020) when the supply of government debt increases. This view changes the main reason QE is effective by adding an insurance channel to the static effect of absorbing bond supply in a given period. Increasing long-term bond prices in bad economic states increases their safety, driving up their value and thus lowering ex-ante yields. We are especially interested in three crucial questions for the design and evaluation of asset purchase policies:

1. What do market participants expect about the future conduct of asset purchases?
2. How do these expectations affect the behavior of asset prices and risk premia?
3. How does risk-taking migrate through the financial sector in response to the planned policy?

The research team has no financial or other interests that might bear on the proposed work.

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1. Overview

The supply of US government debt has increased dramatically in the past two decades, yet long-term Treasury yields remain low relative to historical standards or relative to either expected future short-rates or to very safe AAA rated corporate bonds of similar maturities.[1] This is surprising – historically increases in debt supply raise term premiums and lower Treasuries yields relative to close substitutes (Greenwood and Vayanos, 2014; Krishnamurthy and Vissing-Jorgensen, 2012). At the same time, the Federal reserve has greatly expanded their holdings of long-term government bonds over this period, and an event study literature finds large effects of bond purchase announcements in lowering Treasury yields. We aim to provide a joint explanation of these facts through a dynamic QE purchase rule: expansions and contractions in the Fed's balance sheet do not occur randomly, but routinely occur during bad economic times when the supply of debt increases (e.g., 2008-2009 or 2020).

The central contribution of this project is to estimate the effects of a dynamic asset purchase policy on the level, dynamics, and volatility of government bond yields, as well as risk-taking by market participants. Our preliminary results highlight that the state-dependence, or conditionality, of future purchases is critical to understand the effect of QE on the bond market, including both the event studies and broad patterns on yields listed above. By purchasing in bad economic states, where the term premium would otherwise be large, the Fed smooths fluctuations in future term premia coming from supply and demand shocks and thus makes yields far less sensitive to these shocks. This makes long-term Treasuries safer ex-ante to investors and lowers ex-ante yields substantially.

2. Preliminary results

We first constructed a set of empirical facts that motivate our analysis. First, there is currently still a large yield spread between very safe AAA rated corporate bonds and US Treasuries, despite a large increase in supply. The Krishnamurthy and Vissing-Jorgensen (2012) view predicts convenience yields would have gone down by roughly 100 bps given

[1] A widely used measure of the term premium, from Kim and Wright (2005), puts the term premium on a 10 year zero coupon Treasury bond at 0% as of February 2024. See https://fred.stlouisfed.org/series/THREEFYTP10.

the expansion in US debt issuance. Accounting for the expansion of the Fed balance-sheet to date only explains about 20 bps of this movement. We show that the conditional properties of these policies– large purchases in states where supply is large and the term premium is high, for example driven by an economic recession or a financial crises– can fully account for this excess convenience yield. We show how a regime transition to such a purchase rule can quantitatively account for the excess sensitivity of prices around early asset purchase announcements, and is also consistent quantitatively with the reduction in long-term measures of implied volatility in bond markets. We can then not only account for the new yield curve in the post-2008, but also estimate the present value of asset purchases expected by investors that is consistent with these different empirical facts.

We document similar results for the slope of the yield curve. Greenwood and Vayanos (2014) document that higher bond supply increases the slope of the yield curve by raising the term premium in a sample from 1952-2007. We show that this relationship breaks down in the post QE era and, if anything, supply increases are associated with a lower slope. Given the increase in supply in the last 15 years, the earlier relationship between slope and supply would predict long-term bond yields about 150 bps above current levels. Accounting for realized purchases lowers this by only around 40 bps.

We extend this result to international data using staggered introduction of QE policies across many countries. This setting allows us to include time-fixed effects that control for potential global trends in long-term rates. It also helps alleviate concerns of other changes specific to the US that happen around the time QE is introduced. We find that the slope of the yield-curve is, on average, about 80 bps lower after central bank asset purchases are introduced. Further, the coefficient on supply is strongly positive before the introduction of QE, but drops to near zero or negative afterwards.

Last, option price data show a marked decline in the volatility of long-term rates after QE is introduced. Bond market volatility is around 17% lower in the post QE era.

We then turn to event study effects on days around asset purchase announcements. We show that the response of yields on these few announcement days accounts for the magnitudes in the broad patterns discussed earlier. We find measures of convenience yield go up by 50 to 100 bps in total across these announcement days depending which proxy we use. Thus, the high-frequency well identified announcement effects line up well with the level effects we estimate in the low frequency data. While this suggests that the excess convenience yield can be ultimately explained by the asset purchase policies

the Fed pursued, it leaves unexplained why markets were so much more sensitive to the reduction in the supply due to the bonds that the Fed bought, than due to the expansion in supply coming from increased issuance. Put differently, while the cumulative effects on convenience yields around QE announcement days are enough to explain the gap discussed earlier, the actual purchases to date are not large enough to account for this gap. Similarly, the slope of the yield curve on QE announcement days declines by about 135 bps, almost exactly enough to explain the "slope gap" described earlier. If we remove changes in yields on these few days, there is no sense in which long-term yields appear "too low" relative to those at shorter maturities.

Importantly, we show that QE announcement days show stark declines in implied volatilities of long-term Treasuries. This is true using options on 10 year Treasury futures, though the maturity of these options is fairly short in the span of 1-12 months. Using data on swaptions, which are liquid at much longer exercise maturities out to 5-10 years, we find a similar result. Implied volatilities on swaptions with a 10 year exercise maturity on a 10 year swap decline by over 30% on these days. Thus, QE announcement days appear to dramatically reduce the volatility of long-duration assets even at very long horizons, supporting the idea that that these policies have an important state-contingent component. Moreover, the reduction in implied volatilities suggests that QE made long-term treasuries less risky, and through this risk reduction, it increased their price.

We then show how thinking about asset purchase rules – or dynamic, state-contingent asset purchases –can potentially solve this puzzle. The Fed not only holds a very large fraction of the bond market, but also acts as a large player in this market in terms of aggressively adjusting its position in response to negative economic shocks – a salient example is the purchase of over $1 trillion in Treasury securities in March of 2020. Central banks in the Euro area, Japan, UK, and Canada have balance sheets that are similarly large, ranging from 20-90% of GDP and 20-70% of public debt outstanding, and increase substantially during bad economic times for these countries.

We estimate a term-structure model in the spirit of Greenwood and Vayanos (2014), fit the model to pre-QE era data, and evaluate a dynamic QE policy that is consistent with observed dynamics of the Fed's balance sheet as well as many other facts. Our main estimates suggest that the presence of the Fed in the Treasury market as a conditional buyer (or seller) has reduced 10 year Treasury yields by around 115 basis points. Of this amount, only 40 basis points can be attributed to the direct effect of what the Fed has

purchased. The other 75 basis points come from state-contingent expectations of future purchases and the insurance effect they provide.

3. Research plan and use of funds

While these early results are enlightening, the support from the grant would allow us to substantially improve the precision and range of our conclusions. Beyond taking these early results to a more formal setting, two main dimensions for sharp improvement stand out.

First, data on option prices are a key source of information to understand conditional policy perceptions, as we previously highlighted in Haddad et al. (2024). To study long-term policy perceptions, contracts such as swaptions starting at future dates are particularly relevant, and we would need to purchase some of this data (e.g., from the Chicago Mercantile Exchange). In addition, the peculiarity of specific option contracts requires time-consuming attention, and support by research assistants is crucial for timely progress.

Second, we are particularly interested in moving beyond asset pricing data and measure the impact of policy perceptions on institutional risk-taking. Our early results suggest that the asset purchase rule encourages more willingness to take on duration risk. A key question is where and how. We view the potential collaboration with researchers at the OFR in terms of obtaining regulatory data on asset holdings as a main avenue to address this type of questions. Such data would shed light not only on how QE changed the bond markets, but how these policies transfer to other asset classes and the real economy.

References

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