




Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply ☆

Stefania D'Amico, Thomas B. King  

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Abstract

The Federal Reserve's 2009 program to purchase \$300 billion of US Treasury securities represented an unprecedented intervention in the Treasury market and provides a natural experiment with the potential to shed light on the price elasticities of Treasuries and theories of supply effects in the term structure. Using security-level data on Treasury prices and quantities during the course of this program, we document a 'local supply' effect in the yield curve—yields within a particular maturity sector responded more to changes in the amounts outstanding in that sector than to similar changes in other sectors. We find that this phenomenon was responsible for a persistent downward shift in yields averaging about 30 basis points over the course of the program (the “stock effect”). In addition, except at very long maturities, purchase operations caused an average decline in yields in the sector purchased of 3.5 basis points on the days when those operations occurred (the “flow effect”). The sensitivity of our results to security characteristics generally supports a view of segmentation or imperfect substitution within the Treasury market during this time.

Introduction

Do fluctuations in the supply of government debt affect Treasury yields? This possibility is generally ruled out under the expectations hypothesis and canonical arbitrage-free models of the term structure, but it can arise in models that account for imperfect asset substitutability or preferred-habitat investors. Theories consistent with these notions have existed informally for decades (e.g., Culbertson, 1957, Modigliani and Sutch, 1966), and they have recently received greater attention as researchers have begun to supply them with rigorous foundations, as in the models of Andres, Lopez-Salido, and Nelson (2004) and Vayanos and

Vila (2009). Evaluating the significance of these mechanisms has the potential to inform modeling of the determination of bond and other asset prices. It is also important for a variety of policy issues, including the conduct of open market operations by central banks and the structure of debt issuance by governments.

We provide evidence on the response of the US Treasury yield curve to the relative supply of Treasury securities by exploiting the natural experiment of the Federal Reserve's first round of Large Scale Asset Purchases (LSAPs) in 2009. Using new identification and estimation procedures based on security-level price and quantity data, we document what might be viewed as a relative-price anomaly in the Treasury market during this period, in the spirit of the evolving literature on market segmentation and supply shocks. In particular, we estimate a significant "local-supply" effect in the Treasury term structure: the yield on a given security fell in response to purchases of that security and securities of similar maturity. This response is conceptually distinct from—and more suggestive of market segmentation than—other mechanisms by which asset purchases might shift the yield curve, such as by changing the expected path of policy rates and inflation or changing the aggregate duration risk that market participants must bear. The \$300 billion Treasury LSAP program, announced and implemented in the immediate aftermath of the financial crisis, is an ideal testing ground for a local-supply channel, not just because it represented a large (and largely unexpected) exogenous shock to the available Treasury supply, but also because it took place during a period of heightened risk aversion, which is precisely when the Vayanos-Vila (2009) theory predicts such a channel might be most operative. The security-level data allow us to examine how the scale of the local-supply effect varied across security characteristics such as maturity and liquidity and to gauge the degree of substitution across securities by estimating the cross-elasticities of their prices.

Within this framework, we distinguish two ways in which asset purchases might operate—through stock effects and through flow effects. "Stock effects" are defined as persistent changes in prices that result from movements along Treasury demand curves. To estimate stock effects, we model the cumulative change in each CUSIP's price between March 17, 2009 and October 30, 2009 (i.e., the cross-section of Treasury returns) as a function of the total amount that the Fed purchased of that CUSIP and its potential substitutes.¹ Because, over the life of the program, purchased amounts could have responded endogenously to price changes, we instrument these LSAP amounts with the purchased securities' characteristics prior to the announcement of the program. By removing our estimated stock effects from the actual cross section of Treasury prices as of the end of the LSAP program, we are able to construct a counterfactual yield curve that represents what interest rates might have looked like if the local supply channel had not been present. Meanwhile, "flow effects" are defined as the response of prices to the ongoing purchase operations and could reflect, on top of portfolio rebalancing activity due to the outcome of the purchases, impairments in liquidity and functioning that lead to sluggish price discovery. To estimate flow effects, we model the percentage change in each CUSIP's price on each day that purchase operations occurred as a function of the amount of that CUSIP and the amounts of substitute securities purchased on those days. This exercise is similar to the study of Brandt and Kavajecz (2004) on the response of yields to order-flow imbalances.

Our results suggest that, through the local-supply channel, the Fed's 2009 Treasury purchases reduced yields by an average of about 30 basis points over the life of the program (the stock effect) and led to a further 3 to 4 basis point decline in purchased sectors on the days when purchases occurred (the flow effect). We find that the stock effects were driven largely by the responses of less liquid securities, such as those that were several issues off the run. The flow effects were concentrated in securities with remaining maturities of less than 15 years that were eligible for purchase on a given day. Within this set, coefficients across various types of security characteristics and subperiods are quite robust, although we find that the flow effects were more persistent for off-the-run bonds, which is consistent with the stock effect being

mainly driven by this category of assets.² The sample of securities that were ineligible for purchase exhibits some instabilities in its flow effects, but those results are consistent with the results for eligible securities over the second half of the sample, by which time Treasury market conditions had substantially improved.

Both the stock- and flow-effect results provide support for preferred-habitat theories, as they demonstrate that Treasury rates at a given maturity can be sensitive to the amount of privately held Treasury debt available around that maturity. Our results further indicate that, on the days when a security was eligible to be bought, purchases of securities with similar maturities had almost as large effects on its yield as did purchases of the security itself—that is, the cross- and own-elasticities for flow effects were nearly identical—while purchases of maturities further away had smaller effects. This supports the view that Treasuries of similar maturities are close substitutes but that substitutability diminishes as maturities get farther apart, consistent with imperfect substitutability across the term structure. This set of results is also consistent with a series of papers, including Greenwood (2005), Gabaix, Krishnamurthy, and Vigneron (2007), Garleanu, Pedersen, and Poteshman (2009), Vayanos and Vila (2009), and Greenwood and Vayanos (2010b), where arbitrageurs transmit demand shocks for one asset to other assets, with the effects being the largest for assets that covary the most with the original asset—that is, for close substitutes. In addition, we find that certain types of Treasury securities exhibit greater evidence of segmentation, which is also supportive of preferred-habitat theories. For example, we generally reject equality of the own- and cross-elasticities in far-off-the-run Treasuries, suggesting that limits to arbitrage may play an even greater role among those securities.

Our paper fits within a growing literature studying the relations between Treasury prices and quantities, including Bernanke, Reinhart, and Sack (2004), Engen and Hubbard (2005), Han, Longstaff, and Merrill (2007), Krishnamurthy and Vissing-Jorgensen (2007), Greenwood and Vayanos, 2010a, Greenwood and Vayanos, 2010b, and Hamilton and Wu (2012). Much of this literature has relied on time-series studies of constant-maturity yields and aggregate characteristics of Treasury debt. Our panel-data approach offers a number of advantages over these methods. As noted above, the panel data allow us to get a granular picture of how supply effects differ across different types of securities and to estimate cross-elasticities of individual Treasuries with respect to their potential substitutes, procedures that are not generally feasible with aggregate data. In addition, the results of time-series studies may be affected by endogeneity problems typical of any estimated relations between prices and quantities—indeed, these problems likely became more severe during the LSAP period as the Fed may have attempted to purchase securities that it viewed as underpriced. Security-level data allow us to build instrumental variables to address this endogeneity. Finally, analysis based on the aggregate characteristics of Treasury debt outstanding is not equipped to separate *local* supply effects from other mechanisms through which a change in supply may affect yields. By employing the prices of multiple securities and controlling for changes in the overall shape of the yield curve, we are able to isolate the local price responses to changes in the supply within specific, narrow maturity sectors.

The following section of the paper discusses the theory and notation behind our tests and positions our work within the existing theoretical and empirical literature. Section 3 gives an overview of our data. Section 4 develops our general empirical specification and presents our results, with Section 4.2 considering stock effects, and Section 4.3 considering flow effects. Section 5 offers a comparison with subsequent Fed programs. Section 6 concludes.

Theory and evidence on the effects of Treasury supply

In this paper, we ask whether, during the first LSAP program, changes in the stock of Treasuries affected the yields on Treasuries in the specific sectors where purchases occurred—a possibility that we term the “local supply” effect. A number of previous studies (most explicitly, Greenwood and Vayanos, 2010b) have argued that Treasury supply may affect the term structure by changing the total quantity of duration risk that arbitrageurs must hold—when debt in public hands increases or shifts...

A first look at the data

Our empirical work attempts to test for local-supply effects—that is, to characterize the functions L_n that determine how shocks to quantities translate into changes in yields on the securities that are directly affected by these shocks and in yields on nearby securities—using as a natural experiment the program to purchase up to \$300 billion of Treasury coupon securities that the Federal Open Market Committee (FOMC) announced on March 18, 2009.⁸...

Empirical tests for local-supply effects

This section presents our main tests for the presence of local-supply effects using the security-level purchase and price data during the LSAP program. We test for both stock effects (the cumulative shift in yields) and flow effects (the changes in yields at the times when purchases took place). We first discuss some specification issues that are common to both sets of tests....

Implications for subsequent LSAPs

The previous section demonstrates that, during the period of the Fed’s first LSAP program, Treasury yields responded significantly to purchases in the specific sectors where those purchases occurred. Collectively, these local-supply effects resulted in a downward shift of Treasury yields at most maturities on the order of 30 basis points. If this decline was passed through to private credit markets—as the FOMC’s announcement made clear was the intent of the program—it would have represented a...

Conclusion

In this paper, we have used CUSIP-level data to estimate the local flow and stock effects of the Federal Reserve’s 2009 program to purchase nearly \$300 billion of nominal Treasury coupon securities. We find that both the flow and stock effects were statistically and economically significant. Specifically, we estimate that the average purchase operation temporarily reduced yields by about 3.5 basis points in the sector of the purchase and that the local-supply effects of the program as a whole...

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