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The Estimated Macroeconomic Effects of the Federal Reserve's Large-Scale Treasury Purchase Program

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Abstract:
This brief examines an issue of current importance to the conduct of U.S. economic policy: how has the Federal Open Market Committee (FOMC) plan to purchase up to $600 billion of Treasury securities by June 30, 2011 affected the movement of inflation, GDP, and employment to more desirable medium-term and long-term levels? Following the FOMC's announcement of the plan on November 3, 2010, other events that potentially influence Treasury yields have been at play. To estimate the effects that the FOMC Treasury purchases may have on the goal of achieving more desirable levels of inflation and employment, the authors make use of different models to gauge the likely effect upon interest rates, the interest rate effects on real spending (GDP), and how changes in GDP may be affecting the employment rate.

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On November 3, 2010, the Federal Open Market Committee (FOMC) announced its intention to purchase up to $600 billion of Treasury securities by the end of 2011:Q2—a program subsequently dubbed "QE2" by the media, signifying the second round of quantitative easing. In the weeks leading up to that date, partly in response to comments by Chairman Bernanke at the Kansas City Fed's Jackson Hole conference, markets appeared to have priced in the potential effects of such a purchase program. Of course, the magnitude and timing of the program could only be guessed in advance of the FOMC's official announcement, but market participants appear to have acted in a way that suggested the Fed's purchases of Treasury securities would lower medium- and long-term Treasury yields.

It remains controversial to determine what effects the program has had and will continue to have going forward. This is a difficult question to answer, as the world hardly stood still following the FOMC's November announcement. At that time, a number of other events that plausibly could affect Treasury yields were at play: expectations about U.S. growth were improving, discussions about longer-run fiscal plans were underway, whether to extend the Bush tax cuts was under consideration, and foreign developments (such as the possibility of European sovereign debt default) that might make U.S. Treasuries more attractive were still swirling.

Because this confluence of events makes it difficult to clearly distinguish the effects of Fed actions from other influences on financial markets, in this *Brief* we employ some simple models to estimate the effects these purchases may have had on the macroeconomy. We stress that the estimates are subject to considerable uncertainty, and this *Brief* provides some assessment of the extent of that uncertainty.

Nonetheless, gauging the effect of the Fed's actions is critical, as the purpose of the program was to support attaining the FOMC's "dual mandate" to guide employment and inflation toward socially desirable levels. The Committee needs to be able to gauge the effects of the large-scale Treasury purchase program in order to assess the likely progress of employment and inflation towards their desirable levels, and therefore to gauge whether its policy is taking an appropriate course.

We break the estimation of the effects of the large-scale Treasury purchase program into its component parts[1]:

1. The effect of these purchases on Treasury and related interest rates;
2. The likely effect of such interest rates on real spending (GDP);
3. The likely effect of real spending changes on employment.

[1] Macroeconomic Advisors provides a similar breakdown for their estimates and those of the Boston and San Francisco Federal Reserve Banks. See "The Macro Effects of LSAPs II: A Comparison of Three Studies," Monetary Policy Insights *Policy Focus*, Feb. 7, 2011.

1. Estimates of the Purchases' Effects on Interest Rates

For this *Brief*, we draw on estimates of the response of interest rates from other sources (see Gagnon et al. (2010) and Hamilton and Wu (2011)). Clearly, estimating the response of yields to an exogenous purchase is fraught with difficulty, as (a) such events happen only rarely, and (b) these rarely occur in isolation, so that a multitude of potential influences on yields must be disentangled.

Thus the estimates are necessarily imprecise, but obtaining a ballpark magnitude for the effect of such purchases is still of value. These estimates suggest that Treasury purchases of this magnitude are likely to elicit a response of 20 to 30 basis points in the 10-year Treasury yield. Because we view this action as "removing duration" from the markets—that is, withdrawing a portion of the assets with relatively long duration from private circulation—other assets with similar risk and duration characteristics will also respond to these purchases. The spending responses described in the next section will try to account for these complementary movements in other interest rates.

2. Estimates of the Interest Rate Effects on Real Spending

Models differ in their estimates of the effect of a 1 percentage-point change in the long-term nominal interest rate on real GDP. In Table 1, Panel A reports evidence from a vector autoregression on the impact that a persistent 100 basis points decline in the 10-year Treasury yield has on GDP and some of its components.[2] The only structure imposed on this exercise is that we assume that the decline in the Treasury rate has a lagged effect on the real economy and on inflation. The table shows that after eight quarters, the persistent 100 basis points decline in the long-term rate generates an increase in GDP of roughly 265 basis points. Table 1 also shows that investment responds more strongly than consumption to the change in the interest rate. Other evidence on the impact that a change in the 10-year Treasury yield has on the macroeconomy can be obtained from models that articulate more clearly the ways in which the interest rate decline works through the economy than does the simple and largely unstructured vector autoregression we just discussed. An example is given in Table 1, Panel B which reports the interest rate effect on final demand estimated from the Federal Reserve Bank of Boston's model. The GDP multiplier is roughly 2.5—meaning that each 1 percentage point decline in the 10-year Treasury rate results in a 2.5 percentage point increase in the level of GDP. This model's multiplier is similar to the one estimated with the vector autoregression.

The Boston model provides more detail about the impact of the interest rate decline on the different components of investment demand. For example, the estimated multiplier for residential investment is large, though this component represents a relatively small portion of demand. It is interesting to note that the contribution of net exports to GDP growth is negative. The decline in the 10-year Treasury rate depreciates

[2] The estimation period for this exercise is 1987:Q1 to 2007:Q4.

the dollar. But the effect of a depreciating dollar is more than offset by the higher demand for imports brought about by the faster underlying pace of growth.

Other models of the U.S. economy have different estimates of the GDP multiplier. For example, the Federal Reserve Board's FRB/US model implies a higher multiplier, closer to 4.0. For the estimates provided in this brief, summarized in Table 2, we simply average the multipliers implied by these alternative models, as those estimates more-or-less span the range of estimates among models in current usage. This implies that a decline in Treasury yields of 20-30 basis points tresulting from (the anticipation or the realization of) the FOMC purchases can be expected to raise real GDP by 60-90 basis points. The Boston model suggests that it takes about two years for this effect on GDP to take place.

3. Estimates of Spending Effects on the Unemployment Rate

Given the range of estimated effects on real spending (GDP), the translation to employment effects is accomplished by use of an Okun's Law relationship that links GDP growth and changes in the unemployment rate. The typical relationship expressed in quarterly changes is summarized as:

Change in unemployment = -0.125 (GDP growth – potential GDP growth).

GDP growth for one-quarter that exceeds potential GDP growth by 1 percentage point results in a one-eighth (0.125) percentage point decline in the unemployment rate. Equivalently, quarterly growth in GDP that exceeds potential growth by 1 percentage point for a year typically lowers the unemployment rate by about one-half percentage point. Figure 1 displays the performance of an empirical Okun's Law of this form over the past 25-year period.[3] Despite the extreme simplicity of this version of Okun's Law, the figure suggests the strong correlation between changes in the unemployment rate and GDP growth.

Combining this simple Okun's Law with the estimated effects on GDP discussed in the preceding section implies a decline in the unemployment rate of 30-45 basis points over the 2-year period it takes for the spending rate change to feed through the economy. With the U.S. labor force currently at just over 150 million people, this translates to an increase of about 700,000 jobs, a figure quoted by Boston Fed President Eric Rosengren in his speech of November 17, 2010. Table 2 summarizes the computations discussed in this *Brief*.

[3] The chart is created by comparing the actual four-quarter change in unemployment to the predicted change, computed as -0.5 times the four-quarter average deviation of GDP growth from an assumed fixed potential growth rate of 2.5 percent. Of course, the empirical implementations of Okun's Law used by the Boston Fed and many other models are more nuanced than this simple model.

References

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Table 1

10-year Treasury Rate Lowered by 100 Basis Points

A. Vector Autoregression, 1987:Q1 to 2007:Q4

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
GDP	0.00	0.13	0.46	0.64	1.00	1.47	2.03	2.63
Private Consumption Expenditures	0.00	0.09	0.56	0.63	1.08	1.50	2.03	2.69
Investment	0.00	0.39	1.34	1.21	2.01	2.75	3.35	4.29
10-yr Treasury Rate	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00

B. Federal Reserve Bank of Boston Model

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
GDP	0.05	0.48	0.72	1.08	1.43	1.82	2.21	2.50
Private Consumption Expenditures	0.00	0.38	0.59	0.82	1.08	1.38	1.69	1.97
Residential Investment	0.09	3.21	5.67	7.84	9.80	11.72	13.38	14.37
Investment in Equipment and Software	0.00	1.09	2.53	3.91	5.62	7.54	9.45	11.10
Investment in Nonresidential Structures	0.00	1.41	1.34	2.31	3.96	5.82	7.79	9.84
Net Exports (contribution to GDP growth)	0.05	0.03	-0.04	-0.02	-0.09	-0.16	-0.25	-0.38
10-yr Treasury Rate	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00

Note: Data are percent change from baseline, with the exception of the 10-yr Treasury rate, which is a simple change from baseline

Table 2 Breakdown of estimated effects of $600B Treasury purchases		
Component	**Effect**	**Implication**
Effect of purchases on interest rates	20-30 basis points	Treasury and related yields reduced by this amount
Effect of interest rates on spending (GDP)	2 to 4 times rate changes	Real GDP about 40-120 basis points higher after 1-2 years. We use 75-80 bps as a reasonable compromise.
Effect of spending increase on unemployment	0.5 times spending change	Unemployment rate about 0.3 to 0.4 ppt lower after 2 years
Employment effect	With a labor force of about 153 million	Implies an additional 700,000 jobs

Figure 1
Predictions of an Okun's Law rule of thumb