Foreign Official Holdings of U.S. Treasuries and U.S. Interest Rates:

A Lens on the 'Savings Glut'

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Abstract

Foreign holdings of U.S. Treasuries increased from roughly $800 billion in December 1995 to $4.4 trillion in December 2010, with the share of marketable U.S. Treasury securities outstanding held by foreigners increasing from 24 percent to 56 percent during the same period. Most of this growth is accounted for by foreign official reserve accumulators in a handful of emerging market economies that have been running large current account surpluses. Any shift in policy to reduce these surpluses or dampen the rate of reserves accumulation would likely slow the pace of foreign official purchases of U.S. Treasuries. Would such a slowing of foreign official purchases of Treasury notes and bonds affect long-term Treasury yields? Given that private and official investors are likely to have different motives for investing in U.S. Treasuries, we model their purchases separately and treat them as endogenous. First, using two-stage least squares, we find evidence that foreign official purchases of U.S. Treasury notes and bonds exert downward pressure on yields by lowering the risk premium. To address the question of whether U.S. long-term interest rates could be held 'hostage' by foreign official investors should they decide to 'pull out', we use a richer model that allows foreign private investors to react to any price misalignments induced by foreign official inflows. That is, we estimate a dynamic stochastic general equilibrium model featuring the interactions between foreign official and foreign private flows into short- and long-term Treasuries and yields. The impulse response functions from this model suggest that exogenous shocks to foreign official and private flows have little to no effect on yields.

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1 Introduction

As economies are becoming increasingly financially integrated, longer-term bond yields are increasingly determined in international markets. This calls into question the ability of central banks to influence longer-term interest rates by the setting of short-term rates. For example, Greenspan (2005) was concerned about the failure of the longer-term interest rates to rise during 2004-2006 period when the Fed was tightening monetary policy by raising the Fed Funds rate (Figure 1). During this period, foreign purchases of Treasury notes and bonds was particularly strong, and a few studies (Warnock and Warnock (2009) and Bernanke, Reinhart, and Sack (2004)) have found evidence that these purchases contributed to lower bond yields. Such a decoupling of long-term interest rates from the short-term interest rate which is set by the monetary authority would have important implications for the conduct of monetary policy. For one reason, the appropriate policy response to a decline in long-term interest rates would depend on whether the decline was a result of lower inflation expectations or external factors.

Bernanke (2005) has attributed some of the decline in long-term interest rates in the Unites States and other advanced economies to a "global savings glut." Indeed, foreign holdings of U.S. Treasuries increased from roughly $800 billion in December 1995 to $4.4 trillion in December 2010, with the share of marketable U.S. Treasury securities outstanding held by foreigners increasing from 24 percent to 56 percent during the same period. Most of this growth is accounted for by foreign official reserve accumulators in a handful of emerging market economies that have been running large current account surpluses. Any shift in policy to reduce these surpluses or dampen the rate of reserves accumulation would likely slow the pace of foreign official purchases of U.S. Treasuries.

Would such a slowing of foreign official purchases of Treasury securities affect yields? As acknowledged by Wu (2005), answering this question is difficult for many reasons, most of which have not been adequately addressed in the literature. First, the direction of causation between foreign demand for Treasury securities and their prices (or yields) is likely to go both ways. Second, long-term interest rates are influenced by forward looking variables which are typically unobservable, such as expectations of long-run inflation and other macroeconomic variables. Third, misalignments in asset prices induced by changes in foreign official demand may be partially offset by the actions of private investors, so not taking these actions into account may bias the estimated effect of foreign official purchases. Finally, data on interest rates, macroeconomic variables, and foreign holdings are often highly autocorrelated or even non-stationary, so the potential for "discovering" spurious relationships is great when fitting the levels of the economic time series (Granger and Newbold (1974)). The goal of this paper is to uncover the relationship between foreign purchases of U.S. Treasuries and yields while avoiding these traps. This requires a more sophisticated modelling approach than the single-equation methodology which has been popular thus far in the literature.

To address the possibility that the direction of causation between Treasury prices and foreign demand could go both ways, we first test whether foreign official inflows and foreign private inflows are endogenous. Warnock and Warnock (2009) assume foreign official flows to be exogenous "because few governments treat their foreign reserves as a portfolio to optimize." However, there is no evidence supporting this claim that foreign governments do not optimize their reserves portfolios. When we test for the endogeneity of foreign official flows, we strongly reject that these flows are exogenous. Sierra (2010) also treat foreign official and foreign private purchases as endogenous by using two-stage least squares regressions with many instrumental variables. However, because they do not report any formal tests on the strength and validity of their instruments, one cannot judge if their results are biased because of weak or invalid instruments.[1] Our instruments for foreign official flows are valid and appear to pass the weak instruments test of Stock and Yogo (2005) based on TSLS size. However, we did not find satisfactory instruments for foreign private flows.

To address the second concern that long-term interest rates are influenced by forward looking expectations which are typically unobservable, we use the risk-premium of long-term interest rates as our dependent variable. The risk premium captures the extra return that investors demand for holding long-term bonds above and beyond their beliefs about the future path of short-term interest rates. Because short-term interest rates are essentially determined by monetary policy considerations, our hypothesis is that foreign purchases of long-term Treasuries could only affect long-term yields through the risk premium. We use two measures of risk premia: the term-premium derived from the three-factor affine term-structure model of D'Amico, Kim, and Wei (2010), and realized excess holding period returns. By construction, both of these measures of risk premia are undistorted by the effects of expected changes in Fed's monetary policy stance. Instead, they are driven by interest-rate risk factors such as liquidity, volatility, inflation risk, and changes in foreign demand. A recent study by Sierra (2010) which examines the effects of foreign purchases of Treasuries on excess holding period returns finds that foreign official purchases have a small, negative, and statistically significant effect for 2-year bonds, while foreign private flows have a small, positive, and statistically significant effect on longer-maturity bonds. However, as we will discuss later, our methodology is substantially different than theirs.

Controlling for the actions of foreign private investors to any misalignments in Treasury yields induced by changes in foreign official demand requires a more sophisticated model. Foreign private investors may trade both short- and long-term

[1] Although the first stage F-statistics reported by Sierra (2010) are well above 10, they are not high enough to pass the TSLS size test of 0.10 with two endogenous regressors and 5 instruments (Stock and Yogo (2005)). Also, it is difficult to assess the validity of their instruments because the Sargan test is not reported.

securities for hedging or speculative purposes, and may also view U.S. sovereign bonds and say, German sovereign bonds as close substitutes. We use a dynamic stochastic general equilibrium (DSGE) model to try to capture the interactions between foreign official and foreign private flows into both long-term Treasuries and short-term Treasuries. Furthermore, these flows endogenously respond to changes in the slope of the yield curve, changes in the spread between foreign and U.S. interest rates, and other factors such as flight-to-quality behavior.

The last pitfall we try to avoid is running spurious regressions on highly correlated or even non-stationary data. As is common with macroeconomic variables when measured in levels, the ones used in Warnock and Warnock (2009) and Rudebusch, Swanson, and Wu (2006) are either highly autocorrelated, non-stationary, or trend-stationary.[2] Simply correcting the standard errors for heteroscedasticity and autocorrelation is not enough to solve this problem, because the persistence of their data combined with their trending nature makes OLS estimates extremely sensitive to minor changes in the data or model specification, as documented by Beltran, Kretchmer, Marquez, and Thomas (2010). Therefore, we estimate our models by using the data in differences, while insuring that the residuals pass the usual tests for normality, autocorrelation, and heteroscedasticity.

The remainder of this paper proceeds as follows. In the next section, we discuss the data we use in our estimation, paying particular attention to their time-series properties. The following section compares OLS estimates to those obtained using an instrumental variables approach where foreign official and foreign private flows are treated as endogenous. Then, we outline and present the results of a DSGE model featuring the interactions between foreign official and foreign private flows into both long-term Treasuries and short-term Treasuries.

[2] We arrived at this conclusion by examining the augmented Dickey-Fuller statistic and autocorrelation function of the variables used in their regressions. Furthermore, the Durbin-Watson statistics of their regression residuals are close to zero, suggesting that they are highly autocorrelated.

2 Data

The two measures of risk-premium used as the dependent variable in our instrumental variables regressions will be the term-premium and the realized (ex-post) excess holding period return. The term premium is extracted from the 3-factor affine term-structure model estimated by D'Amico, Kim, and Wei (2010). Their model can be used to decompose long-term interest rates into the "expectations hypothesis" component, which measures the expected path of the short rate, and the term-premium component, which measures inflation risk, liquidity risk, and other risk factors that affect the long-rate. Borrowing the notation of Dai and Singleton (2002), the term premium for an n-period bond is defined as

$$c_t^n \equiv R_t^n - \frac{1}{n}\sum_{i=0}^{n-1} E_t(r_{t+i}), \tag{1}$$

where R_t^n is the yield of an n-period zero-coupon bond at time t, and $r_t \equiv R_t^1$ is the short rate. Our a-priori hypothesis is that foreign official and private inflows into U.S. Treasuries exerts upward pressure on bond prices, thus lowering yields and the term premium (assuming the expected path of the short-rate remains unchanged).

Realized excess return is defined as the realized holding period return from buying an n-year bond at time t and selling it as an (n-1)-year bond 1 year later minus the return of a 1-year bond. We compute realized excess returns using the smoothed zero-coupon yield curve estimates of Gurkaynak, Sack, and Wright (2007). That is, letting P_t^n denote the price of an n-period zero-coupon bond, the realized excess returns at time $t+1$ is

$$D_{t+1}^n = \ln(P_{t+1}^{n-1}) - \ln(P_t^n) - r_t. \tag{2}$$

In equation 2, $\ln \frac{P_{t+1}^{n-1}}{P_t^n}$ is simply the capital gain or loss from purchasing an n-year bond at time t, and selling it as an $(n-1)$-year bond at time $t+1$, which is referred to as the holding period return.

The term premium is closely related to *expected* future excess returns, defined as

$$E_t(D^n_{t+1}) = E_t(\ln(P^{n-1}_{t+1})) - \ln(P^n_t) - r_t.. \tag{3}$$

Cochrane and Piazzesi (2008) show that the average of expected future excess returns for bonds of declining maturity is equal to the difference between the current yield and expected future short rates. That is,

$$\frac{1}{n}\sum_{i=1}^{n-1} E_t(D^{n-i+1}_{t+i}) = R^n_t - \frac{1}{n}\sum_{i=0}^{n-1} E_t(r_{t+i}). \tag{4}$$

Therefore, combining equations 1 and 4, we obtain the equivalence between the term premium and the average of expected future excess returns for bonds of decreasing maturity

$$c^n_t = \frac{1}{n}\sum_{i=1}^{n-1} E_t(D^{n-i+1}_{t+i}). \tag{5}$$

Expected future excess returns are not observable, but in principle they could be backed out by the same 3-factor affine term-structure model of D'Amico, Kim, and Wei (2010) that we used for obtaining the term-premium. But *realized* (ex-post) excess returns can be easily measured using data on bond prices. Our a-priori hypothesis regarding the two measures are different– we expect that foreign official inflows should have a negative effect on expected future excess returns (as we expect for the term premium), but a positive effect on realized (ex-post) excess returns.

The reasoning behind this apparent contradiction is as follows. If at time t market participants are surprised by a surge in foreign official inflows which raise bond prices (P^n_t), equation 3 implies that expected future excess returns would fall (as would the term-premium because R_t^n would be lower). However, if foreign official flows occurring during the holding period are higher than those anticipated at the beginning of the holding period, our hypothesis is that these unexpected flows would raise bond prices by the end of the holding period (P_{t+1}^{n-1}), increasing excess returns realized at time $t+1$. Therefore, because we use *realized* excess returns in our regressions, we should try to control for events occurring during the entire holding period which could potentially affect bond prices and consequently excess returns realized at $t+1$. For example, the appropriate measure of foreign inflows would be the sum of the flows that occurred during the 1-year holding period.

The treatment of the explanatory variables is a major difference between our approach and that of Sierra (2010). The excess returns regressions of Sierra (2010) is similar in spirit to those of Cochrane and Piazzesi (2005), who find that linear combinations of forward rates today can predict excess returns realized in the future. Sierra (2010) try to determine if foreign official flows at time t (the beginning of the holding period) can help forecast excess returns realized at time $t+1$ (the end of the holding period), even after taking into account the information content of the forward rates observed at time t. By using just the 1-month flow at the beginning of the holding period, Sierra (2010) do not control for the fact that flows *during* the 1-year holding period can also affect excess returns realized at the end of the holding period. That is, in their regressions all explanatory variables are measured in the month that marks the beginning of the holding period. For the case of monthly foreign official flows which are extremely volatile and have a low autocorrelation, higher inflows at time t would affect the initial purchase price (P_t^n in equation 2), but would likely have little to no effect on the sale price 1-year ahead (P_{t+1}^{n-1}). However, foreign official flows (and movements in the other explanatory variables as well) occuring during the 1-year holding period will likely affect the sale price at the end of the holding period and therefore influence excess returns at time $t+1$. Because Sierra (2010) focus on "forecasting" regressions similar to Cochrane and Piazzesi (2005), they do not consider events ocurring during the holding period, whereas we do.

If realized excess returns (D^n_{t+1}) equal expected excess returns ($E_t(D^n_{t+1})$) plus some random noise (ε_t), equation 5 becomes

$$c^n_t = \frac{1}{n}\sum_{i=1}^{n-1}\left(D^{n-i+1}_{t+i} + \varepsilon_{t+i}\right). \tag{6}$$

That is, equation 6 implies that the term premium measured at time t (when future expectations are formed) is positively correlated with excess returns realized in the future (at time $t+1$). This positive correlation between the term-premium measured at time t and future realized excess returns is shown in the top panel of Figure 2. However, it is worth emphasizing that the term premium measured at time t need not be correlated with excess returns also realized at time t. The reason is that excess returns realized at time t are entirely determined by events that occurred in the past year (the holding period), whereas the term-premium at time t is purely forward-looking in nature.[3] In fact, the bottom panel of Figure 2 shows that the 5-year nominal term-premium at time t is negatively correlated with excess returns from holding a 5-year Treasury note realized at time t.

The explanatory variables of interest are foreign official flows and foreign private flows into long-term Treasuries. Later on in our DSGE analysis, we also control for foreign official and private flows into short-term Treasuries. We will first discuss the sources of these data, and then describe how we construct our preferred measure for these flows. The most complete source for data on foreign official and foreign private net purchases of U.S. Treasury securities (gross purchases by foreign residents

[3] With a little algebra, one can see that the term premium at time t is negatively related to excess returns realized at time t. As demonstrated by Dai and Singleton (2002), this negative relationship becomes evident when one decomposes realized excess returns into a pure "premium" part, D^{*n}_{t+1}, and an "expectations" part: $D^n_{t+1} = D^{*n}_{t+1} + \sum_{i=i}^{n-1}(E_t r_{t+i} - E_{t+1} r_{t+i})$, where $D^{*n}_{t+1} = -(n-1)(c^{n-1}_{t+1} - c^{n-1}_t) + p^{n-1}_t$.

minus gross sales by foreign residents) are the Treasury International Capital (TIC) reporting system's monthly "S" survey forms (for notes and bonds), and "B" forms (for bills).[4] A well known problem with the TIC S data is that they undercount foreign official acquisitions of U.S. securities because they do not capture acquisitions through foreign intermediaries (Bertaut, Griever, and Tryon (2006)) For example, an acquisition of a U.S. security by a foreign official institution from a private foreign entity on a foreign securities exchange will not be recorded in the TIC S because it is not a U.S. cross-border transaction. Note, however, that the initial acquisition of the U.S. security by the foreign private investor should have been recorded in the TIC S data.

More timely data (released weekly on Wednesdays) on foreign official flows into U.S. Treasury securities are available from the Federal Reserve Bank of New York's (FRBNY) H.4.1 release that includes the amounts of U.S. government securities FRBNY holds in custody on behalf of foreign official institutions. However, changes in these holdings account for just a fraction (about 60 percent) of overall foreign official flows.

As in Warnock and Warnock (2009), we prefer to use the broader TIC S data to capture foreign net purchases of Treasury notes and bonds, but adjust private and official flows for the amount we think is being under- or over-reported. To estimate the "missing flows," we make use of the detailed and more accurate annual reports on foreign holdings of U.S. securities (as in Bertaut and Tryon (2007) and Warnock and Warnock (2009)), as well as data on custodial holdings at FRBNY.[5] The adjusted flows are "survey consistent" because they insure that the change in measured holdings between two annual surveys equals the sum of cumulated flows

[4] These data can be found on the Treasury Department's website at www.treasury.gov/tic.

[5] We use confidential data on amounts held in custody accounts for individual countries at FRBNY to perform these adjustments. In another paper which is still in progress, we provide details on how these adjustments are made, and hope to make these estimates of adjusted aggregate flows publicly available.

during the period and the estimated valuation change. Thus, any flows unaccounted for by the TIC S data and changes in the FRBNY custody data will result in a gap between the measured position from the current survey and the estimated position based on the previous survey. Assuming that the valuation change is correctly estimated, this gap can be interpreted as the sum of unreported flows between the two surveys. These "missing flows" are then distributed among the between-survey months based on the relative volume of gross transactions that occured in each month. To clarify, our approach for estimating flows improves upon the approach of Warnock and Warnock (2009) and Bertaut and Tryon (2007) because we perform an additional adjustment based on changes in custody holdings at FRBNY.

If foreign investors are passively acquiring a fixed portion of new Treasury issuance, foreign flows would rise with increased issuance of Treasuries, despite no real change in foreign appetite for these securities. Therefore, we scale foreign flows by the amount of marketable Treasury securities held by the public outstanding (excluding holdings of the Federal Reserve system). Figure 3 shows net foreign official and private purchases of U.S. short-term Treasuries (bills) and long-term Treasuries (notes and bonds) as a share of outstanding.

Other explanatory variables used in our regressions include: the implied volatility of options on U.S. and German five-year sovereign note futures, the liquidity premium measured as the difference between the synthetic off-the-run and on-the-run five-year Treasury note yields, the VIX index of stock market volatility, changes in industrial production, federal government budget surplus/deficit, and VAR estimates of exogenous oil-specific supply and demand shocks (from Kilian (2009)). We also include versions of the Cochrane and Piazessi factor, which are linear combinations of forward rates that have been shown to forecast excess returns well (Cochrane and Piazzesi (2005)). Because the Cochrane and Piazessi factors (CP_t^{1-5} and CP_t^{6-9}) are influenced by the same factors that affect the term-premium (including foreign official flows), they may be soaking up explanatory power from the other variables. To address this issue, we also use "orthogonalized" versions of these factors. That is, we use the residuals of regressions of the Cochrane and Piazessi factors on all the other explanatory variables. As we demonstrate later, our coefficient estimates capturing the effect of foreign official flows on the risk premia become stronger and more statistically significant when the orthogonalized versions of the Cocharane and Piazessi factors are used.

3 Regressions Using Instrumental Variables

3.1 Foreign official flows and the term-premium

We first examine the effects of foreign official and foreign private flows into Treasury notes and bonds on monthly changes in the 5-year nominal term premium. Table 1 shows OLS and two-stage least squares (2SLS) estimates; the latter approach assuming foreign flows to be endogenous. The explanatory variables include year-over-year changes in industrial production, monthly changes in the VIX index of stock market volatility, the exogenous oil demand shocks of Kilian (2009), and monthly changes in the Cochrane and Piazzesi factors. In columns 2 and 3, we use the regular Cochrane and Piazessi factors. In columns 4 and 5, we use the orthogonalized versions of these factors. In the OLS specification, the effects of foreign official and foreign private flows are small and insignificant. The instrumental variables model is specified as

$$\Delta TP_t = \alpha + \gamma t + \mathbf{X}_t \beta_1 + \mathbf{Z}_t \beta_2,$$

where ΔTP_t is the monthly change in the five-year term premium, $\mathbf{X}_t$ are the regressors assumed to be exogenous, and $\mathbf{Z}_t$ are the regressors assumed to be endogenous.[6] The endogenous regressors are the monthly foreign official and foreign private flows

[6] In describing the data used in our regressions, the time index t refers to monthly intervals. Elsewhere in the paper, t refers to yearly intervals.

into U.S. Treasury notes and bonds as a share of marketable Treasury notes and bonds outstanding (lagged one month), denoted as $FOI_t/DEBT_{t-1}$ and $FPVT_t/DEBT_{t-1}$. Following Sierra (2010), we instrument foreign official purchases of Treasury notes and bonds with Japanese foreign exchange interventions by Japan's Ministry of Finance ($JPYFXINT_t$), measured in billions of dollars. Japanese interventions totalled $547 billion between April 1993 and March 2004, and were particularly strong in 2003 ($177 billion) and 2004 ($138 billion) as the Ministry of Finance attempted to slow the yen's appreciation. Because a sizable portion of the proceeds from these interventions were invested in U.S. Treasuries, the interventions can be thought of as an "exogenous" shock to foreign official inflows into U.S. Treasuries. Furthermore, these interventions are likely only weakly linked to the U.S. term premium (as confirmed by our Sargan test). However, as recognized by Bernanke, Reinhart, and Sack (2004), the potential for joint endogeneity can occur if, for example, weak economic data simultaneously lowers Treasury yields and depreciates the dollar, prompting the Japanese finance ministry to intervene to prevent the Yen's appreciation. We also use the exogenous oil supply shocks from Kilian (2009) as an instrument. The Craig-Donald Wald F-statistic in specifications 3 and 5 exceeds the critical value of the Stock and Yogo (2005) size test with size $r = 0.10$, so our instruments do not appear to be weak. The Hausmann-Wu endogeneity test rejects the null hyptothesis that foreign official flows are exogenous at the 10 percent level of significance (column 3), and at the 1 percent level of significance (column 5). The Pagan-Hall and Cumby-Huizinga tests also indicate that we cannot rule out homoscedastic and non-autocorrelated residuals. Turning to the coefficient on foreign official inflows from the 2nd stage results shown in column 5, it is negative and statistically significant. The magnitude of the effect implied by this coefficient will be discussed later on in the context of a counterfactual exercise. The coefficient on foreign private flows is small, positive, but not significant. We tried treating both foreign official and foreign private flows as endogenous regressors, but had difficulty finding valid and strong instruments for foreign private flows. The best instrument we found, the federal government's structural budget surplus/deficit, did not pass the weak instrument size test of Stock and Yogo (2005). Despite the weak instruments problem, the coefficient on foreign official inflows remained negative and statistically significant at the 5 percent significance level.

In Table 2, we show the same regressions but instead of scaling foreing official and foreign private flows by Treasuries outstanding, we scale them by the level of U.S. nominal GDP (which is far greater than the level of marketable Treasury securities outstanding). As in Table 1, column 3 shows the 2SLS estimates using the regular Cochrane and Piazessi factors, and column 5 shows the estimates using the orthogonalized factors. The interpretation of the results is similar to that of Table 1, but as expected, scaling flows by GDP made the coefficients on official larger in absolute size. However, our first stage F-statistic shown in column (3) and (5) suggest that our instruments are weaker when we scale flows by GDP. We also tried broadening our measure of foreign official and foreign private flows to include foreign official net purchases of U.S. agency securities. As of June 2010, foreigners held over $1 trillion in U.S. government agency securities. Because these securities are often perceived by market participants as being guaranteed (at least implicitly) by the U.S. government, they may be considered close substitutes to Treasuries. When scaling this broader measure of foreign flows by GDP, the resulting estimates (not shown) are very close to those presented in Table 2.

As a robustness check, we experiment with different combinations of included instruments and different measures of foreign official flows. The results are presented in Table 3. The new instruments are foreign exchange reserve accumulation of all countries (RES_t) scaled by world exports, and the sum of the Chinese trade and direct investment inflows (BOP_CN_t). We expect that strong trade surpluses or DI inflows into China would place pressure on the People's Bank of China to intervene to prevent the Renmimbi from appreciating. In turn, these interventions would likely be correlated with larger Chinese foreign official flows into the United States. Specifications (1) and (3) appear to suffer from a weak instruments. In specifications (2), the instruments appear to be valid and strong, and the results obtained are similar to those shown in Table 1. In columns (4)-(6), we run regressions using foreign official flows from Japan, China, and the mid-east oil exporters seperately.[7] The first-stage F-statistic of 104 shown in column (4) of Table 3 confirms that foreign exchange interventions by Japan's Ministry of Finance is a very strong predictor for Japanese foreign official flows into U.S. Treasury notes and bonds. The second stage results from this specification indicate a similar effect of Japanese foreign official flows to the one presented in Table 1. For the China regression shown in column (5), the varaible measuring the Chinese trade balance and DI inflows is positively correlated with Chinese foreign official inflows into U.S. Treasuries, but the small first-stage F-statistic signals a weak instruments problem. Similarly, although the exogenous oil supply shock is signficant in the first stage of the the regression using foreign official inflows from the mid-east oil exporters, we again have a weak instruments problem (column 6). All told, we obtain similar effects of foreign official flows on the term-premium when the set of instruments used are strong. In turn, the instruments are strong only when Japanese interventions are included among them.

What impact did the recent episode of high foreign official flows have on the term-premium, and hence on the 5-year Treasury yield? To address this question, we conduct a counterfactual exercise using the estimates shown in specification (5) of Table 1 and a hypothetical scenario for foreign flows. Suppose that foreign official holdings as a share of U.S. marketable Treasuries outstanding were to remain constant

[7] The authors have access to the TIC data on the geographic distribution of foreign official flows. But in order to preserve the confidentiality of the end-investors, these data are not available to the public.

after June 2004, when the share was 36.5 percent. The top left panel of Figure 4 compares the actual path of foreign official holdings with the counterfactual path. The top-right panel shows the flows which give rise to these holdings. Adding up the flows between June 2004 and June 2007, there are $381 billion fewer inflows in the counterfactual than in the actual data. As shown in the bottom-left panel, the cumulative effect of the smaller inflows implied by the counterfactual would have resulted in a much higher term-premium by June 2007. The bottom-right panel show that the difference between the term-premium implied by the counterfactual inflows and the term-premium implied by the actual inflows reached 248 basis points in June 2007. These estimates imply that, all else equal, a $100 billion drop in foreign official inflows into U.S. Treasury notes and bonds raises the 5-year term-premium, and hence the 5-year yield, by 65 basis points. If instead we had used the estimates of specification (3), in which the Cochrane and Piazessi factors are not orthogonalized, the effect would decrease to 30 basis points per $100 in foreign official inflows.

Using the estimates from specification (5) of Table 2, one could perform a similar analysis with foreign official flows scaled by GDP instead of Treasuries outstanding. As shown in Figure 5, when we assume that foreign official holdings of Treasury notes and bonds as a share of nominal U.S. GDP remains constant at 7.4 percent after June 2004. This implies $414 billion fewer foreign official flows than observed in the actual data. The reduction in flows raises the term premium by 305 basis points by June 2007. By this measure, when foreign official inflows drop by $100 billion dollars, the term-premium increases 74 basis points. Using the estimates of specification (3) in which the Cochrane and Piazessi factors are not orthogonalized, the effect would decrease to 35 basis points per $100 in foreign official inflows.

Although the effect of foreign official inflows on the term-premium implied by our counterfactual seems large, it is in the same ballpark as those of other studies. For example, using an event study of Japanese interventions, and excluding days of major U.S. data releases, Bernanke, Reinhart, and Sack (2004) find that for every $100 billion in Japanese interventions the 5-year Treasury yield falls by 66 basis points. Similarly, Warnock and Warnock (2009) find that $100 billion dollars of foreign official inflows into U.S. Treasuries and agencies lowers the 10-year yield by 40 basis points, although their results are not robust to minor changes in specification. Also, using an OLS regression on Treasury yields, a recent report by J.P. Morgan (2011) finds that $100 billion drop in foreign inflows would raise 10-year yields by 56 basis points. One explanation for the large effects found in our analysis and in the other studies is that these single-equation models do not take into account the reaction of foreign private investors to the change in Treasury yields induced by the lower foreign official flows. We examine this possibility later by estimating a DSGE model featuring both foreign official and foreign private flows.

3.2 Foreign official flows and realized excess returns

Using the same instrumental variables as in the term-premium regressions, we estimate the effect of foreign official inflows into U.S. Treasury notes and bonds on the excess return for holding a 6-year bond for one year. Figure 6 illustrates the timing of bond-purchases that give rise to the excess returns realized one-year ahead. At time t, the investor borrows funds for 1-year at a fixed rate r_t to purchase a 6-year Treasury bond. The investor holds the bond for 1 year (the holding period), during which its price will fluctuate because of changing macroeconomic fundamentals and possibly (as we will test) changes in foreign demand for Treasury securities. Excess returns are realized at time $t+1$ when the 6-year bond is sold as a 5-year bond, and the 1-year loan is paid off. That is, the excess 1-year holding period return of a 6-year bond is $D^6_{t+1} = \ln \frac{P^5_{t+1}}{P^6_t} - r_t$. Because foreign official flows occur during the holding period, they can only influence the price of the 5-year bond (originally purchased as a 6-year bond) when it is sold at the end of the holding period, P^5_{t+1}. Our a-priori hypothesis is that unanticipated foreign bond purchases occurring during the holding period would exert upward pressure on P^5_{t+1}, thus increasing excess returns realized at time $t + 1$. Because foreign inflows during the entire 1-year holding period could potentially influence excess returns realized at the end of the holding period, our explanatory variable of interest is the rolling 1-year sum of monthly foreign official inflows into Treasury notes and bonds.

The first column of Table 4 presents the results of OLS regressions on excess holding period returns for a 6-year Treasury note. The other controls are expressed as averages (or sums) during the holding period, except for industrial production and the Cochrane and Piazessi factors, the latter of which we use 12-month lags from the time excess returns are realized.[8] The coefficients on foreign official and foreign private flows are not statistically significant. However, the residuals of this regression fail the usual tests for autocorrelation, heteroscedasticity, and normality (not shown). The source of the problem is that most of the series used in this regression, including the rolling 1-year sum of monthly foreign official and foreign private flows, are non-stationary. To address the problem of non-stationarity, we take first differences of all the series; the estimates are shown in column (2). The coefficients on foreign official and foreign private flows are now negative and statistically significant, and the Durbin-Watson statistic suggests the residuals are not autocorrelated. However, when we assume foreign official flows to be endogenous, the 2SLS estimate for the effect of foreign official flows shown in column (4) becomes positive and statistically significant. We instrument foreign official flows with the first difference of the 12-month sum of the interventions by Japan's Ministry of Finance. The Craig-Donald Wald F-statistic passes the weak instruments test. Furthermore, the Hausman-Wu endogeneity test strongly rejects that foreign official flows are exogenous. We were unable to find valid instruments for foreign private flows, so for lack of a better

[8] Since we view 12-month lags of the CP factors as sufficiently exogenous to excess returns realized contemporaneously, we do not orthogonalize the CP factors.

alternative, we modelled them as exogenous.[9]

Table 5 shows the results of excess return regressions using the measure of foreign official flows that is scaled by U.S. nominal GDP. Not surprisingly, when we scale by GDP, which is much larger than the amount of marketable U.S. Treasury notes and bonds outstanding, the coefficient on foreign official flows becomes larger. As a robustness check, Table 6 shows estimates obtained using different combinations of instruments and different measures of foreign official flows. The combination of instruments used in specifications (1), (3), (5) and (6) are weak. The set of instruments used in specifications (2) and (4) appear to be strong, and deliver estimates similar to those presented in Table 4. As was the case for the term-premium regressions, we only obtain similar effects of foreign official flows when the set of instruments used are both valid (uncorrelated with the error terms) and strong.

To compare the magnitude of the effect of foreign official flows from the excess return regressions shown in Tables 4 and 5 with those implied by the term premium regressions discussed earlier, we conduct a similar counterfactual exercise in which, starting at a given point in time, we keep the share of foreign holdings as a percent of Treasuries outstanding constant. The difference here is that because the holding period is 1-year, we need to perform a series of rolling 1-year counterfactuals. That is, at each point in time, we take the prevailing share of foreign holdings as a percent of Treasuries outstanding as our starting point. For example, the first counterfactual exercise begins in June 2004, when foreign official holdings as a share of Treasuries outstanding was 36.5 percent. Assuming the share remains constant between June 2004 and May 2005, we back out the monthly flows that are consistent with this constant share, and compute the first difference of the rolling 1-year sum of these flows, analogous to the measure used in the regression shown in column (4) of Table

[9] If we model foreign private flows as endogenous, and use the structural component of the U.S. federal government deficit as our (weak) instrument, the coefficient on foreign official flows is roughly unchanged.

4. Then using the coefficients from specification (4), we calculate the counterfactual path for the change in realized excess returns, or $\Delta\tilde{D}_t^6$. The next step is to cumulate these monthly changes in excess returns during the 12-month holding period ending in May 2005 to obtain $\tilde{D}_{t+1}^6$. Then using equations 2 and the standard bond pricing relation, and taking $\tilde{D}_{t+1}^6$, r_t, and P_t^6 as given, we back out the yield of the 5-year bond (originally purchased as a 6-year bond back in June 2004) sold in May 2005 ($\tilde{R}_{t+1}^5$) that is consistent with the realized excess return implied by our counterfactual flow. We repeat these counterfactual exercises by shifting the time window forward one month at a time, until we reach the end of our sample period. The difference between the model-implied 5-year yield using the counterfactual flows ($\tilde{R}_{t+1}^5$) and model-implied 5-year yield using the actual flows ($\hat{R}_{t+1}^5$) captures the effect of the (lower) counterfactual flows on yields (bottom panel of Figure 7). The 5-year yield implied by our counterfactual flows are on average 136 basis points higher than the fitted 5-year old. The 12-month sum of foreign official flows implied by our counterfactuals are on average \$125 billion lower than the actual foreign official flows. Therefore, these simulations imply that a \$100 billion drop in foreign official inflows raises the 5-year yield by 109 basis points.

This effect seems implausibly large, as was the case for the counterfactuals performed on the term-premium. When we conduct the same type of counterfactual on excess returns using the measure of foreign official flows scaled by GDP the effects are even larger. However, because these counterfactuals do not incorporate the possible reaction of foreign private investors to the misalignment in prices induced by the drop in foreign official flows, they may be overstating the true effect of the foreign official flows on the 5-year yield. To address this issue, we need a more sophisticated model, which is the topic of the next section.

4 A DSGE Model for Foreign Flows

still work in progress

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	(1)	(2)	(3)	(4)	(5)
	OLS:	IV: 1st Stage	IV: 2nd Stage	IV: 1st Stage†	IV: 2nd Stage†
	ΔTP_t	FOI_t / $DEBT_{t-1}$	ΔTP_t	FOI_t / $DEBT_{t-1}$	ΔTP_t
CONSTANT	0.200	-1.876***	0.034	-1.880***	-0.136
	(0.157)	(0.332)	(0.170)	(0.335)	(0.196)
TREND	-0.000	0.004***	0.000	0.004***	0.000
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Flow Variables					
FOI_t / $DEBT_{t-1}$	0.005		-0.084*		-0.180***
	(0.032)		(0.045)		(0.055)
$FPVT$ / $DEBT_{t-1}$	0.015	-0.007	0.017	0.007	0.044
	(0.022)	(0.051)	(0.024)	(0.051)	(0.027)
Control Variables					
ΔIP_t^{yoy}	0.018	0.008	0.020	0.011	0.025
	(0.015)	(0.034)	(0.014)	(0.034)	(0.016)
ΔIP_{t-1}^{yoy}	-0.030**	0.012	-0.031**	0.009	-0.037**
	(0.015)	(0.034)	(0.014)	(0.034)	(0.016)
ΔVIX_t	-0.005	-0.015*	-0.007**	-0.018**	-0.012***
	(0.003)	(0.008)	(0.003)	(0.007)	(0.003)
ΔVIX_{t-1}	-0.007**	-0.016**	-0.009***	-0.016**	-0.007**
	(0.003)	(0.007)	(0.003)	(0.007)	(0.004)
ΔDE_VOL_t	-0.002	-0.062	-0.004	-0.048	0.012
	(0.030)	(0.069)	(0.029)	(0.069)	(0.031)
ΔUS_VOL_{t-1}	0.058**	0.012	0.056**	0.006	0.036
	(0.023)	(0.052)	(0.027)	(0.053)	(0.027)
$\Delta LP5_{t-1}$	0.000	0.001	0.000	-0.002	-0.003
	(0.005)	(0.011)	(0.005)	(0.011)	(0.006)
$OIL\_DEMAND\_SHOCK_t$	0.023*	-0.033	0.020*	-0.033	0.014
	(0.011)	(0.026)	(0.011)	(0.026)	(0.013)
ΔCP^{1-5}_t	0.062***	0.000	0.061***	-0.000	0.076***
	(0.014)	(0.031)	(0.014)	(0.031)	(0.016)
ΔCP^{6-9}_t	0.028***	0.022	0.029***	0.000	0.026***
	(0.006)	(0.013)	(0.006)	(0.014)	(0.006)
Instruments					
$JPYFXINT_t$		0.017***		0.016***	
		(0.003)		(0.003)	
$OIL\_SUPPLY\_SHOCK_t$		0.105**		0.098**	
		(0.045)		(0.045)	
Observations	160	160	160	160	160
R-squared	0.383	0.428	0.350	0.417	0.207
Durbin-Watson	2.039	1.398		1.402	
Craig-Donald Wald F-Stat			20.38		18.79
Endogenous Variables			1		1
Exogenous Instruments			2		2
Pagan-Hall Test (P-Value)			0.573		0.825
Cumby-Huizinga Test (P-Value)			0.844		0.486
Endogeneity Test (P-Value)			0.0781		0.00438
Sargan Test (P-Value)			0.9061		0.862

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

† In this specification, we regress on the residuals of the *CP* factors not explained by any of our independent variables

TABLE 1. Term premium regressions using foreign official flows as a share of Treasuries outstanding.

	(1)	(2)	(3)	(4)	(5)
	OLS:	IV: 1st Stage	IV: 2nd Stage	IV: 1st Stage†	IV: 2nd Stage†
	ΔTP_t	FOI_t / GDP_{t-1}	ΔTP_t	FOI_t / GDP_{t-1}	ΔTP_t
CONSTANT	0.200	-0.307***	0.049	-0.309***	-0.107
	(0.152)	(0.077)	(0.168)	(0.078)	(0.201)
TREND	-0.000	0.001***	0.000	0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Flow Variables					
FOI_t / GDP_{t-1}	0.048		-0.447*		-0.957***
	(0.144)		(0.249)		(0.315)
$FPVT / GDP_{t-1}$	0.070	0.029	0.091	0.040	0.211*
	(0.098)	(0.052)	(0.102)	(0.052)	(0.117)
Control Variables					
ΔIP_t^{yoy}	0.018	0.000	0.019	0.001	0.024
	(0.015)	(0.008)	(0.014)	(0.008)	(0.017)
ΔIP_{t-1}^{yoy}	-0.030**	0.004	-0.030**	0.004	-0.035**
	(0.015)	(0.008)	(0.014)	(0.008)	(0.017)
ΔVIX_t	-0.005	-0.003*	-0.007**	-0.004**	-0.013***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
ΔVIX_{t-1}	-0.007**	-0.004**	-0.009***	-0.004**	-0.008**
	(0.003)	(0.002)	(0.003)	(0.002)	(0.004)
ΔDE_VOL_t	-0.001	-0.016	-0.006	-0.013	0.009
	(0.030)	(0.016)	(0.029)	(0.016)	(0.033)
ΔUS_VOL_{t-1}	0.058**	0.004	0.057**	0.003	0.039
	(0.023)	(0.012)	(0.027)	(0.012)	(0.027)
$\Delta LP5_{t-1}$	0.000	0.000	-0.000	-0.000	-0.004
	(0.005)	(0.002)	(0.005)	(0.002)	(0.006)
$OIL\_DEMAND\_SHOCK_t$	0.023**	-0.008	0.019	-0.008	0.012
	(0.011)	(0.006)	(0.012)	(0.006)	(0.013)
$\Delta CP^{1\text{-}5}_t$	0.062***	-0.002	0.061***	0.000	0.077***
	(0.014)	(0.007)	(0.014)	(0.007)	(0.016)
$\Delta CP^{6\text{-}9}_t$	0.028***	0.005	0.029***	-0.000	0.026***
	(0.006)	(0.003)	(0.006)	(0.003)	(0.006)
Instruments					
$JPYFXINT_t$		0.003***		0.003***	
		(0.001)		(0.001)	
$OIL\_SUPPLY\_SHOCK_t$		0.023**		0.022**	
		(0.010)		(0.010)	
Observations	160	160	160	160	160
R-squared	0.383	0.326	0.334	0.314	0.141
Durbin-Watson	2.039	1.381		1.387	
Craig-Donald Wald F-Stat			13.35		12.14
Endogenous Variables			1		1
Exogenous Instruments			2		2
Pagan-Hall Test (P-Value)			0.712		0.916
Cumby-Huizinga Test (P-Value)			0.910		0.347
Endogeneity Test (P-Value)			0.0784		0.00582
Sargan Test (P-Value)			0.973		0.9829

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

† In this specification, we regress on the residuals of the *CP* factors not explained by any of our independent variables

TABLE 2. Term premium regressions using foreign official flows as a share of U.S. nominal GDP.

	(1) IV: ALL COUNTRIES	(2) IV: ALL COUNTRIES	(3) IV: ALL COUNTRIES	(4) IV: JAPAN	(5) IV: CHINA	(6) IV: MID-EAST OIL EXPORTERS
First Stage: Instruments						
RES_t	0.037***		0.009			
	(0.008)		(0.009)			
$JPYFXINT_t$		0.019***	0.017***	0.017***		
		(0.003)	(0.004)	(0.002)		
BOP_CN_t		0.004	0.007		0.005*	
		(0.006)	(0.006)		(0.002)	
$OIL\_SUPPLY\_SHOCK_t$	0.075		0.069			0.018**
	(0.046)		(0.050)			(0.008)
$BUDGET_t$	-0.258**		-0.211*			
	(0.103)		(0.114)			
Second Stage: Official Flows						
$FOI_t / DEBT_{t-1}$	-0.018	-0.162***	-0.150***			
	(0.065)	(0.044)	(0.045)			
$FOI\_JAPAN_t / DEBT_{t-1}$				-0.176***		
				(0.054)		
$FOI\_CHINA_t / DEBT_{t-1}$					0.846	
					(0.812)	
$FOI\_MIDEAST_t / DEBT_{t-1}$						-1.400
						(1.157)
Observations	160	126	126	160	126	160
R-squared	0.351	0.310	0.326	0.317	0.097	0.003
Craig-Donald Wald F-Stat	13.10	19.09	9.403	104.2	3.657	5.896
Endogenous Variables	1	1	1	1	1	1
Exogenous Instruments	3	2	5	1	1	1
Pagan-Hall Test (P-Value)	0.442	0.510	0.420	0.612	0.897	0.919
Cumby-Huizinga Test (P-Value)	0.868	0.710	0.643	0.712	0.603	0.363
Endogeneity Test (P-Value)	0.711	0.00793	0.00729	0.00773	0.149	0.0376
Sargan Test (P-Value)	0.3015	0.3402	0.4937			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 3. Alternative specifications for the effects of foreign official flows on the term premium. All specifications use 2SLS and include the full set of explanatory variables shown in Table 1.

	(1)	(2)	(3)	(4)
	OLS:	OLS:†	IV: 1st Stage†	IV: 2nd Stage†
	XR_6_t	ΔXR_6_t	$\Delta FOI_t / DEBT_{t-12}$	ΔXR_6_t
CONSTANT	2.742	1.786	0.235	0.292
	(6.450)	(1.671)	(0.462)	(2.021)
TREND	-0.002	-0.003	-0.000	-0.001
	(0.010)	(0.003)	(0.001)	(0.004)
Flow Variables±				
$FOI_t / DEBT_{t-12}$	0.080	-0.734**		1.411***
	(0.135)	(0.281)		(0.546)
$PRIV_t / DEBT_{t-12}$	0.105	-0.530***	-0.071	-0.314
	(0.151)	(0.188)	(0.051)	(0.220)
Control Variables‡				
ΔIP_t^{yoy}	-0.584**	-0.182	-0.081*	-0.009
	(0.245)	(0.171)	(0.046)	(0.193)
ΔIP_{t-1}^{yoy}	-0.081	-0.091	0.003	-0.102
	(0.244)	(0.164)	(0.045)	(0.194)
VIX_t	0.778**	0.866**	-0.208**	1.354***
	(0.390)	(0.356)	(0.096)	(0.416)
VIX_{t-1}	-0.387	-0.471	-0.068	-0.091
	(0.392)	(0.363)	(0.100)	(0.426)
DE_VOL_t	-5.151***	-6.652**	1.269*	-12.185***
	(1.127)	(2.567)	(0.712)	(3.025)
US_VOL_{t-1}	2.497***	3.250*	0.733	1.290
	(0.782)	(1.895)	(0.515)	(2.481)
$LP5_{t-1}$	-0.825***	-1.266***	-0.157	-0.847**
	(0.152)	(0.350)	(0.095)	(0.350)
$OIL\_DEMAND\_SHOCK_t$	-1.508	-0.200	-0.318	1.401
	(1.012)	(1.157)	(0.320)	(1.133)
$CP^{1\text{-}5}_{t-12}$	1.189***	0.681***	0.024	0.599***
	(0.186)	(0.126)	(0.034)	(0.144)
$CP^{6\text{-}9}_{t-12}$	0.479***	0.314***	-0.023	0.353***
	(0.108)	(0.076)	(0.021)	(0.093)
Instruments				
$JPYFXINT_t$			0.018***	
			(0.003)	
Observations	150	149	149	149
R-squared	0.830	0.515	0.456	0.306
Durbin-Watson	0.788	1.965	1.622	
Craig-Donald Wald F-Stat				33.69
Endogenous Variables				1
Exogenous Instruments				1
Pagan-Hall Test (P-Value)				0.812
Cumby-Huizinga Test (P-Value)				0.463
Endogeneity Test (P-Value)				0
Sargan Test (P-Value)				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

±Flow variables represent 12-month flows ending at time *t*.
‡Monthly average over the year ending at time *t*, except for *IP* and *CP*.
†All explanatory variables, except constant and trend, are expressed as changes in this specification.

TABLE 4. Excess return regressions using foreign official flows as a share of Treasuries outstanding.

	(1)	(2)	(3)	(4)
	OLS:	OLS:†	IV: 1st Stage†	IV: 2nd Stage†
	XR_6_t	ΔXR_6_t	$\Delta FOI_t / GDP_{t-12}$	ΔXR_6_t
CONSTANT	-0.120	1.821	0.044	0.237
	(5.870)	(1.646)	(0.104)	(2.273)
TREND	0.002	-0.004	-0.000	-0.001
	(0.010)	(0.003)	(0.000)	(0.004)
Flow Variables±				
FOI_t / GDP_{t-12}	-0.391	-4.303***		9.331**
	(0.657)	(1.303)		(3.963)
$PRIV_t / GDP_{t-12}$	-0.328	-2.076***	-0.039	-1.332
	(0.585)	(0.784)	(0.049)	(1.057)
Control Variables‡				
ΔIP_t^{yoy}	-0.533**	-0.198	-0.020*	0.070
	(0.245)	(0.169)	(0.010)	(0.223)
ΔIP_{t-1}^{yoy}	-0.091	-0.103	-0.003	-0.060
	(0.244)	(0.162)	(0.010)	(0.216)
VIX_t	0.859**	0.770**	-0.051**	1.513***
	(0.394)	(0.352)	(0.022)	(0.488)
VIX_{t-1}	-0.484	-0.466	-0.014	-0.048
	(0.397)	(0.357)	(0.023)	(0.487)
DE_VOL_t	-5.147***	-6.469**	0.290*	-13.171***
	(1.129)	(2.516)	(0.160)	(3.530)
US_VOL_{t-1}	3.097***	3.545*	0.221*	0.171
	(0.716)	(1.880)	(0.116)	(2.952)
$LP5_{t-1}$	-0.960***	-1.310***	-0.036*	-0.735*
	(0.151)	(0.346)	(0.021)	(0.405)
$OIL\_DEMAND\_SHOCK_t$	-1.997**	-0.458	-0.118	2.057
	(0.987)	(1.150)	(0.072)	(1.370)
CP^{1-5}_{t-12}	1.190***	0.687***	0.005	0.582***
	(0.184)	(0.124)	(0.008)	(0.163)
CP^{6-9}_{t-12}	0.392***	0.316***	-0.005	0.368***
	(0.106)	(0.075)	(0.005)	(0.103)
Instruments				
$JPYFXINT_t$			0.003***	
			(0.001)	
Observations	150	149	149	149
R-squared	0.830	0.527	0.397	0.143
Durbin-Watson	0.723	1.931	1.664	
Craig-Donald Wald F-Stat				15.90
Endogenous Variables				1
Exogenous Instruments				1
Pagan-Hall Test (P-Value)				0.932
Cumby-Huizinga Test (P-Value)				0.431
Endogeneity Test (P-Value)				0
Sargan Test (P-Value)				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

±Flow variables represent 12-month flows ending at time *t*.
‡Monthly average over the year ending at time *t*, except for *IP* and *CP*.
†All explanatory variables, except constant and trend, are expressed as changes in this specification.

TABLE 5. Excess return regressions using foreign official flows as a share of U.S. nominal GDP.

	(1) IV: ALL COUNTRIES	(2) IV: ALL COUNTRIES	(3) IV: ALL COUNTRIES	(4) IV: JAPAN	(5) IV: CHINA	(6) IV: MID-EAST OIL EXPORTERS
First Stage: Instruments						
RES_t	0.329***		0.092			
	(0.106)		(0.113)			
$JPYFXINT_t$		0.020***	0.019***	0.015***		
		(0.003)	(0.003)	(0.002)		
BOP_CN_t		-0.016	-0.015		0.013**	
		(0.012)	-0.012		(0.005)	
$OIL\_SUPPLY\_SHOCK_t$	-0.145		0.824			0.171**
	(0.532)		(0.550)			(0.081)
$BUDGET_t$	-0.140		-0.147			
	(0.187)		(0.189)			
Second Stage: Official Flows						
$FOI_t / DEBT_{t-1}$	-2.916***	1.227***	1.047**			
	(1.116)	(0.473)	(0.489)			
$FOI\_JAPAN_t / DEBT_{t-1}$				1.498***		
				(0.580)		
$FOI\_CHINA_t / DEBT_{t-1}$					-3.922	4.376
					(2.567)	(10.012)
$FOI\_MIDEAST_t / DEBT_{t-1}$						
Observations	149	114	114	149	114	149
R-squared	0.316	0.475	0.499	0.477	0.596	0.465
Craig-Donald Wald F-Stat	3.496	22.58	9.778	63.30	5.721	4.411
Endogenous Variables	1	1	1	1	1	1
Exogenous Instruments	3	2	5	1	1	1
Pagan-Hall Test (P-Value)	0.999	0.756	0.790	0.648	0.802	0.880
Cumby-Huizinga Test (P-Value)	0.0852	0.402	0.351	0.713	0.752	0.684
Endogeneity Test (P-Value)	0.00827	0.000461	0.0174	0.00165	0.502	0.306
Sargan Test (P-Value)	0.3699	0.6453	0.0036			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE 6. Alternative specifications for the effects of foreign official flows on excess returns. All specifications use 2SLS and include the full set of explanatory variables shown in Table 4.

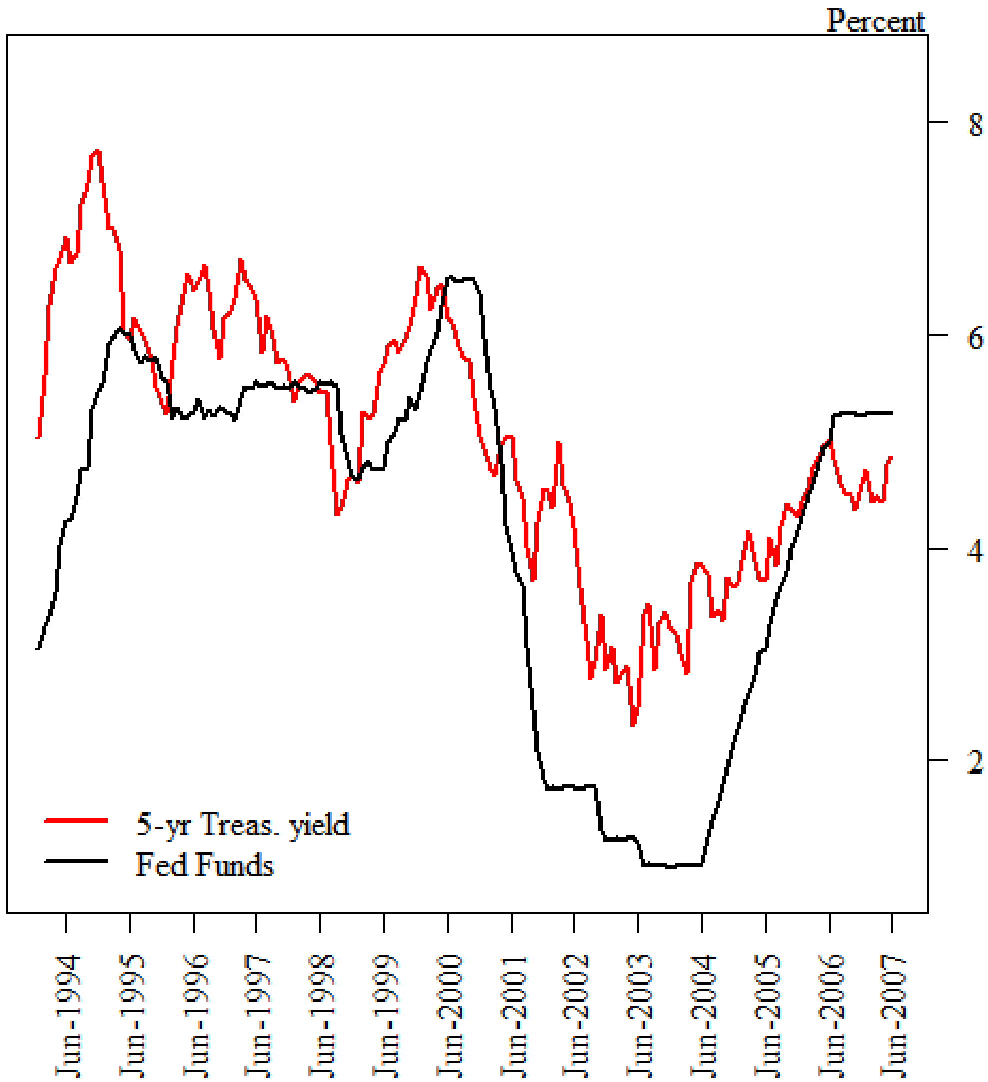


FIGURE 1. Federal funds rate and nominal Treasury 5-year zero-coupon rate

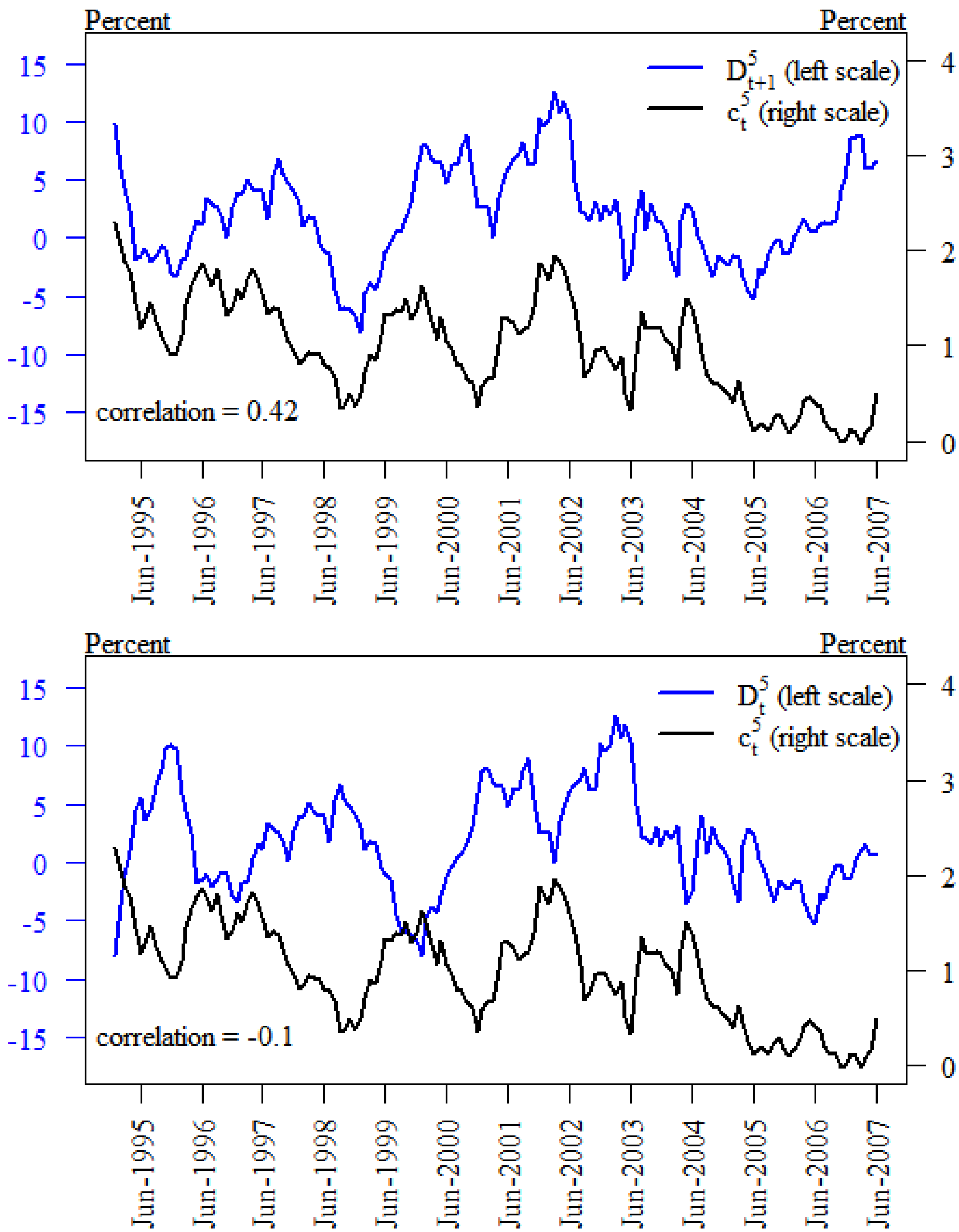


FIGURE 2. Top panel: Nominal 5-year term premium (black line) and excess returns realized at time $t+1$. Bottom panel: Nominal 5-year term premium (black line) and excess returns realized at time t.

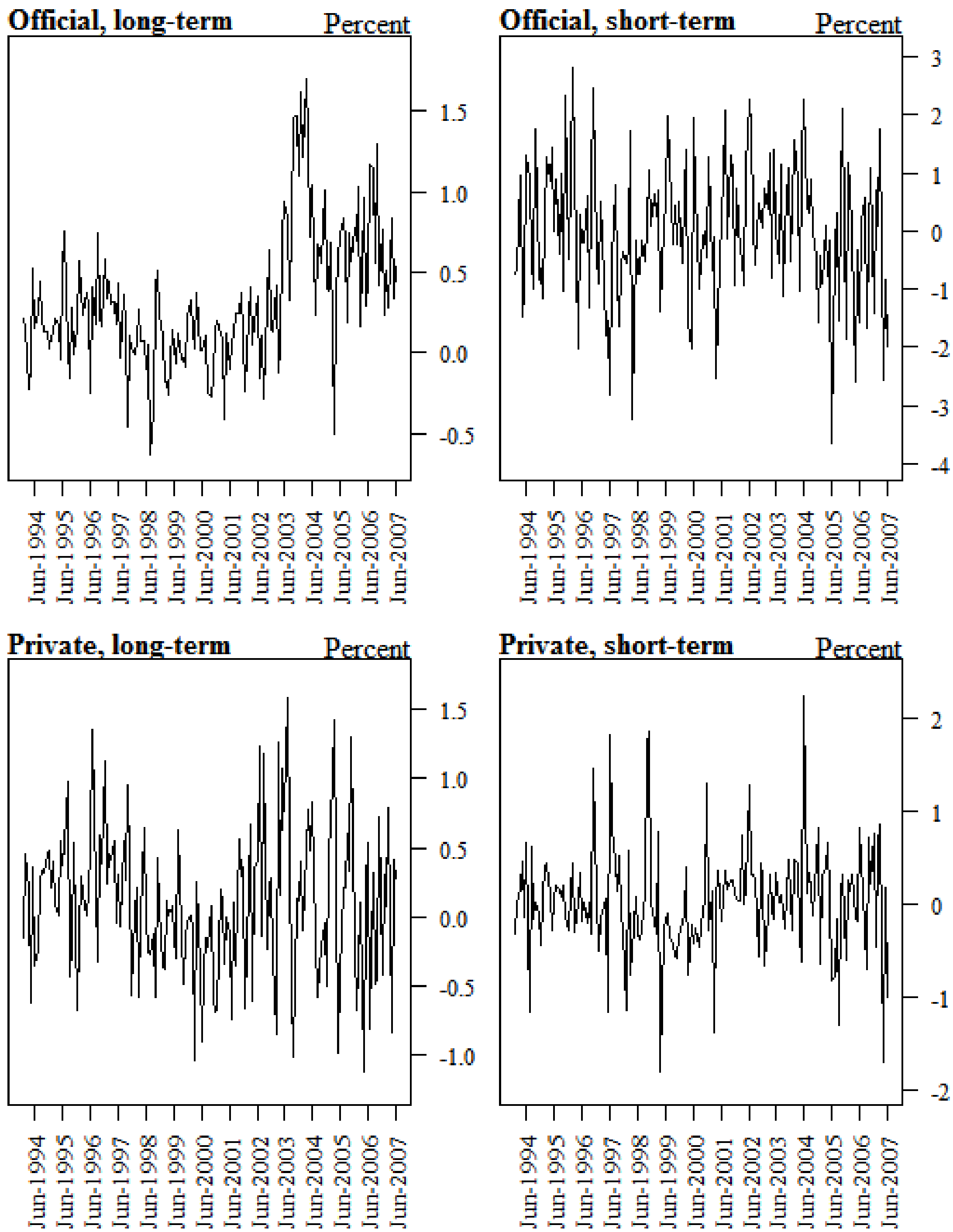


FIGURE 3. Monthly foreign official and foreign private flows into short- and long-term Treasury securities as a share of outstanding.

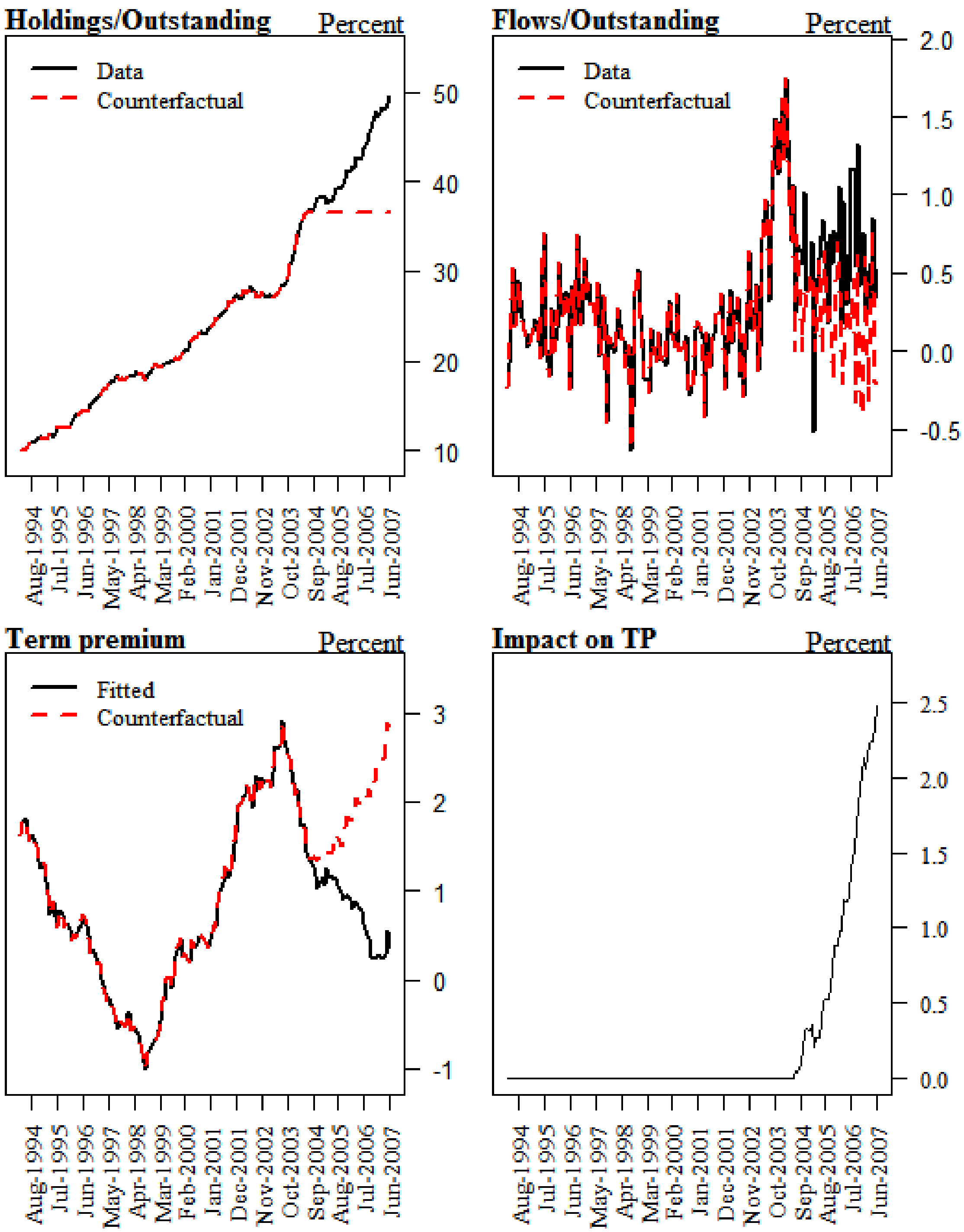


FIGURE 4. Effect of lower foreign official inflows on the term-premium, when flows are scaled by marketable Treasury notes and bonds outstanding.

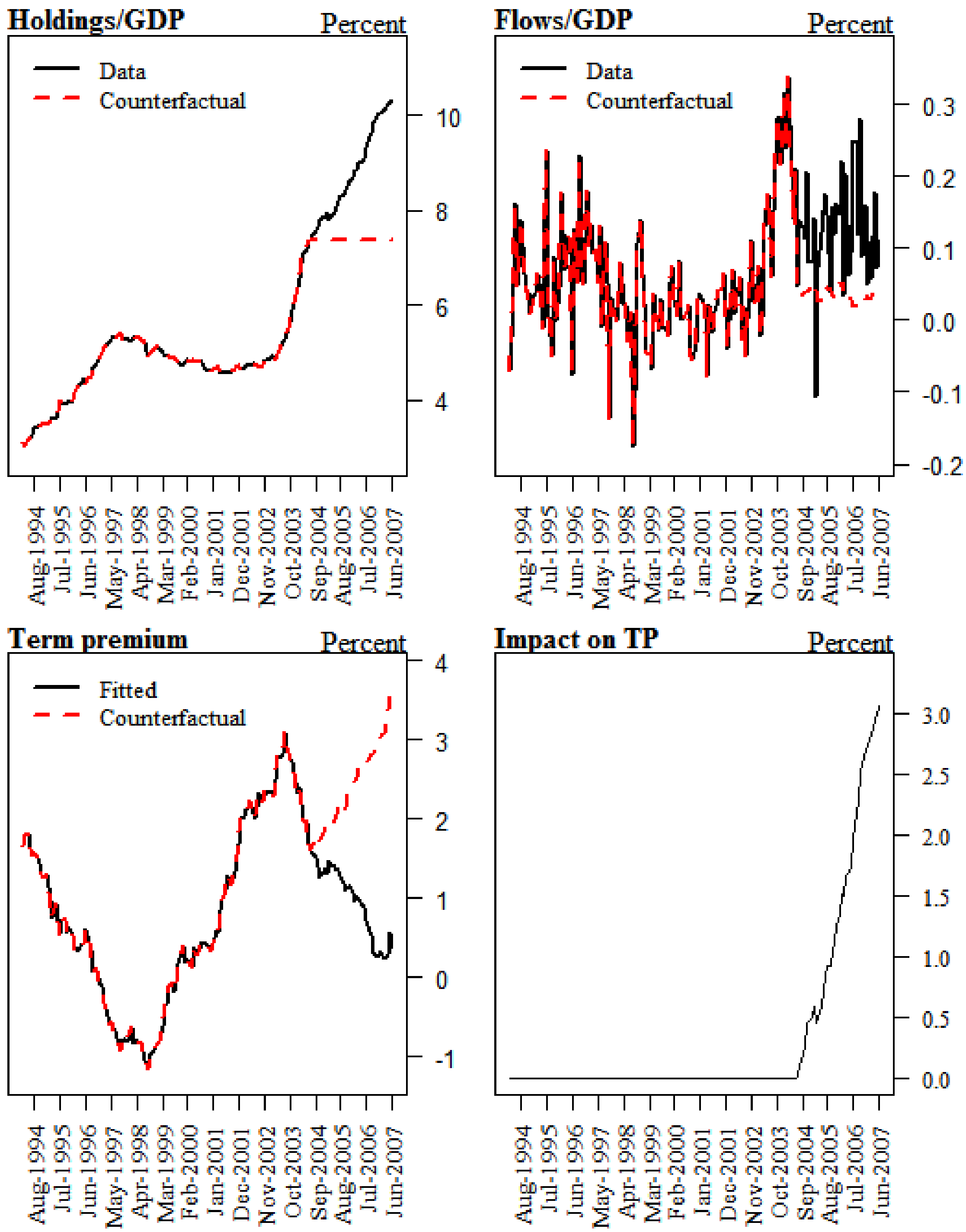


FIGURE 5. Effect of lower foreign official inflows on the term-premium, when flows are scaled by GDP.

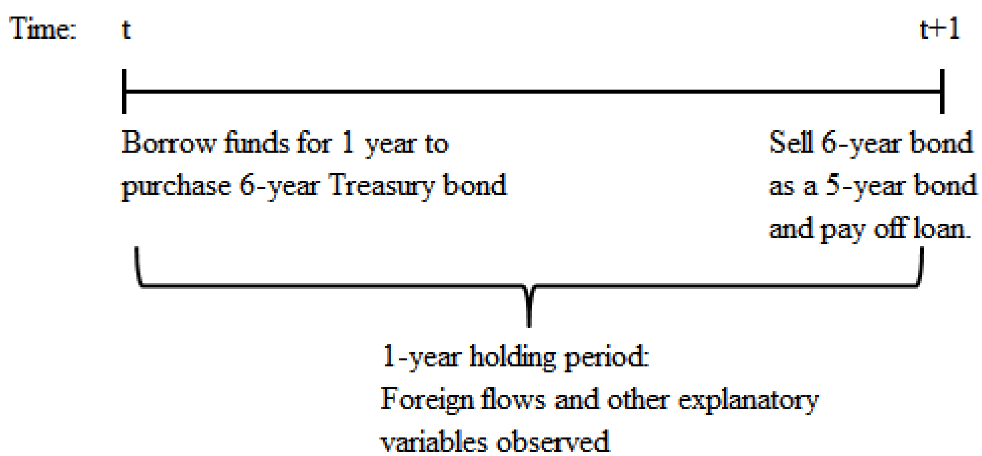
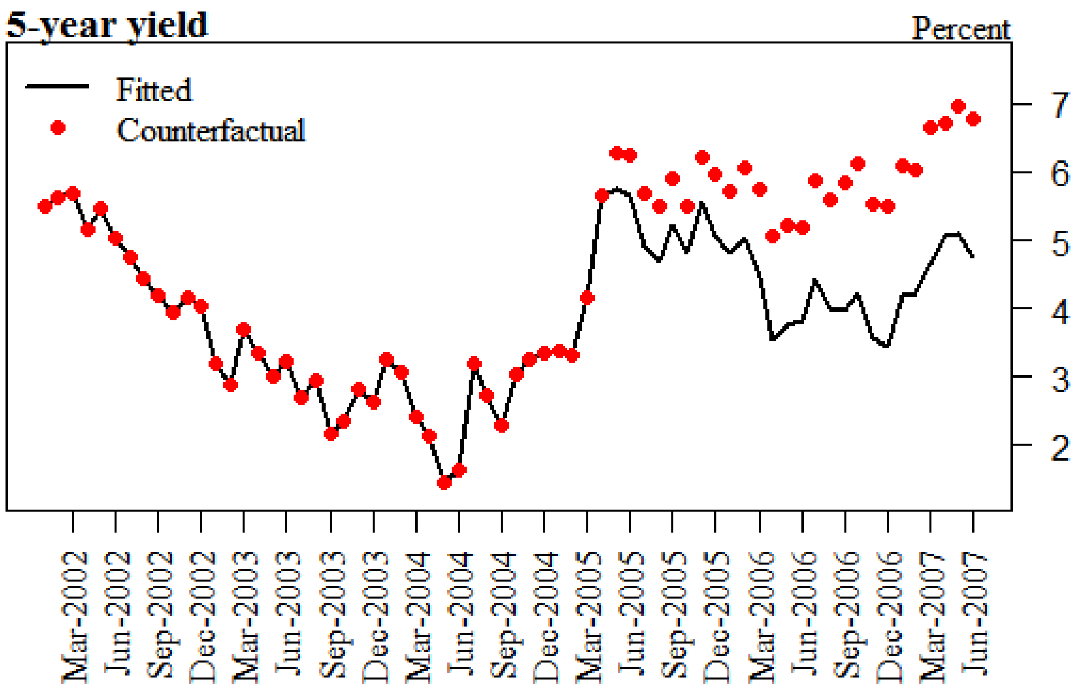


FIGURE 6. Excess returns realized at time $t+1$.



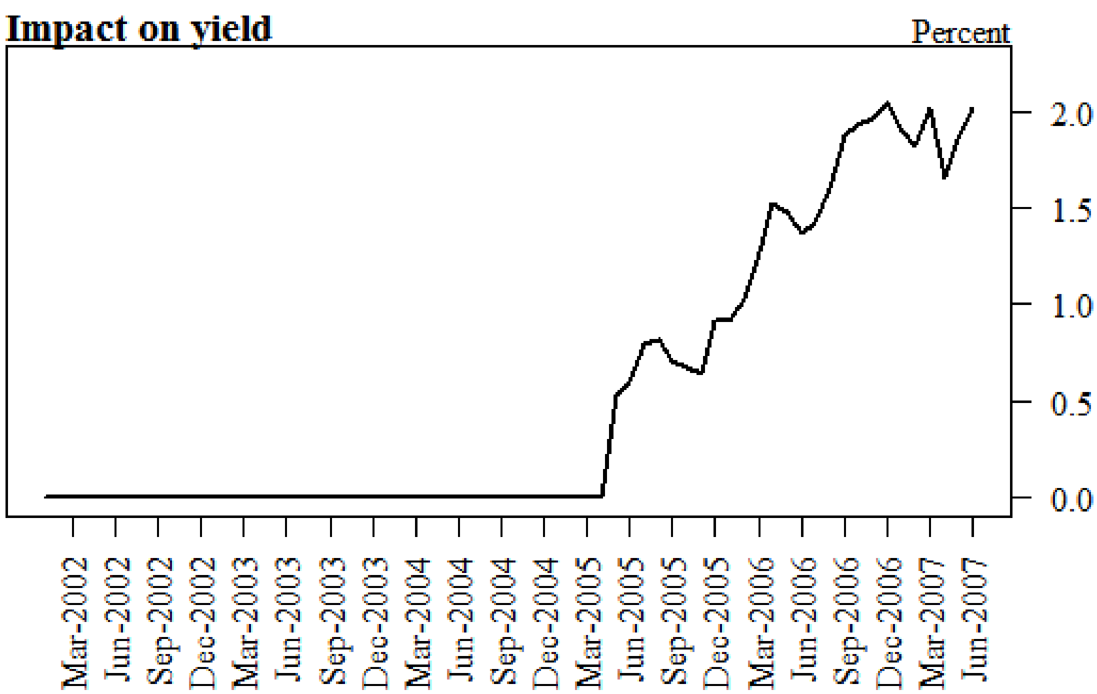


FIGURE 7. Counterfactual simulations using excess returns regression estimates. Top panel: Yields implied from rolling counterfactuals (red dots), versus fitted 5-year yield (solid line). Bottom panel: Difference between counterfactual and fitted 5-year yield.