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THE REST OF THE WORLD'S DOLLAR-WEIGHTED RETURN ON U.S. TREASURYS

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ABSTRACT

Since 1980, foreign investors have timed their purchases and sales of U.S. Treasuries to yield particularly low returns. Their annual dollar-weighted returns, measured by IRRs, are around 3% lower than a buy-and-hold strategy over the same horizon. In comparison, the IRRs achieved by domestic investors are at least 1% higher, while the IRRs achieved by the Federal Reserve are similarly low. Our results are consistent with theories where foreign investors are price-inelastic buyers of safe dollar assets, which provide them with convenience services.

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1 Introduction

The literature on safe assets ascribes a special role to dollar safe assets in the international financial system (Caballero, Farhi, and Gourinchas, 2017; Farhi and Maggiori, 2018; He, Krishnamurthy, and Milbradt, 2016, 2019; Gopinath and Stein, 2021). In terms of quantities, there is a large amount of safe dollar debt outstanding (Shin, 2012; Bruno and Shin, 2015; Maggiori, Neiman, and Schreger, 2020). The U.S. is a major provider of these dollar debt claims, with its gross foreign asset position resembling a long position in risky foreign claims and a short position in safe dollar debt claims (Gourinchas and Rey, 2007). In terms of prices, safe dollar debt claims are highly valued. Jiang, Krishnamurthy, and Lustig (2021) show that U.S. Treasury bonds, on a currency-hedged basis, have lower yields than the sovereign bonds of other G10 countries (see also Du, Im, and Schreger, 2018; Engel and Wu, 2018; Du and Schreger, 2021). Since the Great Financial Crisis in 2008, a similar gap has opened up between U.S. and foreign bank deposit rates (Du, Tepper, and Verdelhan, 2018). The same pattern also holds for short-dated high-grade corporate bonds (Liao, 2020). The picture that emerges from the quantities and prices is that foreign investors hold a large quantity of safe dollar debt claims, accepting a low return on these holdings.

This paper adds a new *timing* dimension to these facts that characterize foreign investors' safe dollar asset portfolios. We track the purchases and sales of U.S. Treasury bonds by foreign investors and show that their market timing yields a return that is substantially below the return on a buy-and-hold strategy. In other words, foreign investors buy U.S. Treasuries when they are expensive and offer low future returns, and they exit their positions when Treasury bonds are cheap and offer high future returns. Not only do foreign investors receive low absolute returns on their Treasury holdings, as shown by other studies, they additionally time their purchases and sales in a manner that yields low returns.

We measure the *dollar-weighted* returns earned by the foreign investors (labeled as the ROW, i.e., the Rest of the World) on their holdings of U.S. Treasuries by computing the internal rate of return (IRR) on their net purchases and sales of Treasuries, as reported in the Flow of Funds and TICS data. The ROW absorbs a significant share of the U.S. issuance of Treasuries, especially between 1990 and 2015. We also compute the *time-weighted* return (i.e., the geometric mean return), which simply measures the return earned by a buy-and-hold investor who invests \$1 dollar and

then holds the investment until the final period.

To understand how the dollar-weighted returns differs from the time-weighted returns, consider the following example with two investment periods. In year 1 the Treasury yield is high at 5%. In year 2 the Treasury yield is low at 1%. [Table 1](#) illustrates the returns and the holdings of home and foreign investors. In this example, the foreigner investors buy more Treasuries when the yield is low. The time-weighted average is simply the geometric mean of the returns over the two years, which is the same 3.0% for the U.S. and the foreign investors. In other words, if we compare the returns on home and foreign investors' Treasury portfolios period by period, we find no difference. In comparison, the dollar-weighted average as measured by the IRR earned by the foreign investors is 1.4% whereas the home investors' IRR is 4.7%—leading to a difference of 3.3% per annum between these two investors. This IRR measure incorporates how well different investors time the market, and suggests that the foreigners earn a much lower return from their dynamic trading strategy.

We document four results following [Krishnamurthy and Lustig \(2019\)](#). First, the dollar-weighted returns (i.e., the IRRs) offer a very different picture than the time-weighted returns (i.e., the geometric mean return). Since 1980, the ROW's dollar-weighted return is at least 300 bps per annum lower than the time-weighted return. The gap is particularly large in the pre-2000 sample, and the gaps are statistically different from zero.

Second, foreign investors consistently earn lower dollar-weighted returns relative to other investors. We compare the foreign investors' IRRs to the IRRs earned by domestic investors excluding the Federal Reserve. In the 1980—2021 sample, home investors' IRR is about 150 bps per annum higher than the ROW's. In comparison, the ROW's IRR is comparable to the IRR earned by the Federal Reserve, which is known to be a price-inelastic buyer in the Treasury market.

Third, there is heterogeneity within foreign investors. We find that the gap is even larger when we focus on the private sector as opposed to the official sector. As a result, the ROW's low dollar-weighted returns cannot be attributed solely to the demand for U.S. dollar reserve assets by foreign central banks.

Fourth, the foreign investors' willingness to buy U.S. Treasuries when they are expensive seems to have diminished in the recent past. In terms of the return gap, we estimate the ROW's IRR in a 10-year rolling window, and find that the ROW's IRR does not underperform the buy-and-hold

strategy in the past 10 years. In terms of quantities, foreigner investors are net sellers of U.S. Treasury notes and bonds during the recent Covid-19 crisis, whereas they used to be net buyers during past global recessions. It is possible that we are witnessing a tipping point in the foreign demand for the U.S. Treasuries as some have argued (see [Duffie \(2020\)](#); [Schrimpf, Shin, and Sushko \(2020\)](#); [Vissing-Jorgensen \(2020\)](#); [He, Nagel, and Song \(2022\)](#)).

Our finding about investment timing should be understood in conjunction with the findings reported by the papers cited earlier on the demand for dollar safe assets. Our finding is consistent with the notion that U.S. Treasuries are the ROW's preferred safe asset, and foreign investors hoard Treasuries exactly when Treasuries are already expensive. Put differently, the ROW's demand for U.S. Treasuries is price inelastic. [Krishnamurthy and Vissing-Jorgensen \(2007\)](#) estimate demand curves for Treasuries by the main holders of Treasuries and find that the ROW demand curves are far more price inelastic than other holders.

Dollar-weighted returns are standard performance metrics in asset management (see [Dichev and Yu, 2011](#), for an example from the hedge fund industry). To compute the IRR in the data, we assume that in each period the ROW holds the market portfolio of Treasury Notes and Bonds, whose return we measure using standard Treasury bond indices. Our measurement using market returns requires an assumption about the portfolio composition of investors, but not about the timing. In particular, the maturity composition (the fractions of long-term vs short-term bonds) is assumed to be the same across classes of investors. This assumption is validated in recent work by [Tabova and Warnock \(2021\)](#) who use security-level holdings data. They show that the returns on Treasury portfolios of different investor classes, accounting for their compositional differences, are small in each period, thus offering support for our measurement assumption.¹

We also note that the pattern of returns and flows that we document in this paper provides a different but complementary perspective to the analysis of U.S. Treasuries' convenience yields. [Jiang, Krishnamurthy, and Lustig \(2021\)](#) measures the U.S. Treasury basis and its correlation with the dollar exchange rate to infer the size of the convenience yield. Using a demand system ap-

¹We show that the dollar-weighted returns earned by U.S. investors are much lower than the market return and that of domestic investors. The difference in result relative to [Tabova and Warnock \(2021\)](#) is because we focus on timing of flows in and out of the entire Treasury market, whereas they compute returns from consistently investing \$1 in U.S. Treasuries. Borrowing asset management terminology, [Tabova and Warnock \(2021\)](#)'s work only measures cross-sectional selection ability of the ROW in Treasuries, not the timing ability. They measure whether the ROW stand-in investor can alter the duration of her bond portfolio to increase returns, not whether she can time her exposure to the entire asset class.

proach, [Kojien and Yogo \(2019\)](#) estimate foreign convenience yields of 215 bps per annum on U.S. long term bonds. While convenience yields already provide a source of seigniorage revenue for the U.S. government ([Jiang, Lustig, Van Nieuwerburgh, and Xiaolan, 2019](#)), our evidence suggests that the U.S. government further benefits from the market timing of the foreigners' purchases, which significantly reduces the U.S. government's cost of funding on a dollar-weighted basis (see [Hall and Sargent, 2011](#); [Hall, Payne, and Sargent, 2018](#), for an analysis of the determinants). This novel form of U.S. exorbitant privilege also plays a key role in the country-level imbalances, allowing the U.S. to run persistent twin deficits ([Gourinchas and Rey, 2007](#); [Jiang, Krishnamurthy, and Lustig, 2019](#)).

Lastly, there is an ongoing debate about the fiscal capacity of the U.S. (see, e.g. [Blanchard, 2019](#); [Furman and Summers, 2020](#)). Some have argued that low rates have increased the U.S. fiscal capacity. Our evidence suggests that foreign investors' demand for dollar safe assets have lowered the U.S. effective (i.e., dollar-weighted) cost of borrowing, especially since 1980. However, recent quantity evidence from the pandemic suggests that safe asset demand from the ROW has weakened.

2 Data and Methods

2.1 Data Sources

We use four return indices. The Barclays index (Bloomberg Barclays/US Treasury Total Return Index) and the BofA index (ICE BofA US Treasury Return Index) are downloaded from Thomson Reuters Datastream. These indices exclude T-bills. The Barclays index seeks to produce an investable return index, which excludes securities held by the Federal Reserve because these are no longer traded in secondary markets. The BofA index does not. Third, we obtain a CRSP index by directly computing the value-weighted return on all marketable Treasury securities excluding T-bills based on CRSP security-level data. This CRSP index excludes all securities held by the Federal Reserve. Fourth, we obtain a return index from [Hall, Payne, and Sargent \(2018\)](#), which is based on all securities issued by the US Treasury including T-bills.

We do not have security-level data on the portfolio holdings of the ROW. Instead, we assume that the ROW holds the market portfolio. This assumption is validated by the findings of [Tabova](#)

and Warnock (2021) who use security-level data to show that ROW investors roughly hold the market portfolio. Note that in general, we have excluded short-term T-bills in our analysis because there is less consistent data on the quantity and returns on T-bills.

We obtain the flow data from the Flow of Funds Flow Table F.210 for Treasury securities. These series are seasonally adjusted and reported at annual rates. We use the Rest of the World, Other Treasury securities, excluding Treasury bills (FA263061120.Q) as the $NPA(t)$ = Net purchases of Treasuries at annual rates by the ROW. We define $NPQ(t) = NPA(t)/4$ as the quarterly net purchase by ROW of Treasuries. We also use the equivalent series for the Fed (FA713061125.Q), and the total issuance of all other investable securities, excluding T-bills (FA313161275.Q). The net purchases of Treasuries by other investors is defined as Total Issuance minus the Fed and ROWs net purchases.

In addition, we use flow data from TICS to distinguish between the foreign official and the foreign private purchases of U.S. Treasuries. The table we use is called “Net Purchases Of U.S. Treasury Bonds & Notes By Major Foreign Sector: Foreign Official Institutions, Other Foreigners, And International & Regional Organizations”.² This data is reported at monthly frequencies (not seasonally adjusted, not at annual rates). We aggregate these flows by quarter to obtain quarterly end-of quarter series.

2.2 Return Definitions

Next, we describe how we compute the *dollar-weighted* returns. First, we construct the AUM series as follows using the accounting identity

$$AUM(t) = AUM(t - 1) \cdot R(t) + NPQ(t),$$

where $R(t)$ denotes the quarterly return from one of the return indices. We initialize this procedure with $AUM(1979.Q4) = 0$. Then, the cash flow series is given by $CF(t) = -NPQ(t)$ for $t = 1980.Q1$ — $2020.Q4$. In the last period, we define $AUM(T) = AUM(T - 1) \cdot R(T)$, so that the final cash flow is the AUM in the final quarter: $CF(T) = AUM(T)$. Our measure of the dollar-weighted return is the internal rate of return (IRR) such that the net present value (NPV) of these

²This data is available at <https://ticdata.treasury.gov/Publish/tressect.txt>

cash flows is zero:

$$NPV(CF(t = 1, \dots, T); IRR) = 0.$$

For comparison, we also compute the *time-weighted* returns as the standard geometric mean (GM):

$$GM = \left(\prod_{t=1}^T R(t) \right)^{1/T}.$$

If an investor implements a buy-and-hold strategy with no interim cash flow, then the IRR thus computed would equal the geometric mean return. In this paper, we are going to study the difference between the IRR and the geometric mean return, which thus evaluates the performance of various investors relative to the buy-and-hold benchmark.

3 The ROW's Net Purchases of Treasurys

Figure 1, panel (a) plots the annualized flows into U.S. Treasurys (including T-Bills). We decompose the flows into three components: domestic investors, the Fed, and the rest of the world (ROW). The numbers are annualized and expressed as % of GDP. In our sample, until the late 1990s, the U.S. domestic agents, including the financial sector such as banks, insurance companies and pensions and U.S. households, absorbed a significant fraction of the net issuance. There was a distinct shift in the late 1990s when the ROW became significant Treasury buyers while the domestic sector became net sellers. From 1990 through 2015, the ROW was by far the most significant buyer of U.S. Treasurys. Since 2015, we have entered a third regime characterized by much weaker demand from the ROW. In comparison, the Fed became a much more active buyer during the Covid-19 crisis.

When we focus only on T-Notes and Bonds, as in the measurements of the next section, the patterns remain the same. Figure 1, panel (b) plots the annualized flows in U.S. Treasury Bonds and Notes, excluding T-Bills. Between 1995 and 2015, the ROW absorbed a significant fraction of the net issuance. Since 2015, demand for Treasury Notes and Bonds from the ROW has weakened considerably. The primary difference between the flows into T-Bills and the T-Notes and Bonds is during the pandemic: the ROW became large net sellers of Notes and Bonds.

4 The ROW's Dollar-Weighted Returns

4.1 Main Results

Now, we report the IRRs and geometric mean returns using expressions in Section 2.2. Table 2 reports these numbers using different return indices, time periods, and for different sets of investors. We report the returns realized by the ROW, the Fed and the remaining domestic investors³. We also include a row representing the aggregate market.

We start by reporting the returns obtained with the Barclays index. The IRR realized by the ROW is 5.14%, whereas the geometric mean return (GM) is 10.44%. In other words, the ROW investors underperform the buy-and-hold benchmark by 529 basis points (bps) per annum. One concern is that Barclays reports anomalously high returns in the early 1980s (see Appendix Figure A1). To ensure that our results are not driven by the most volatile periods of Treasury returns⁴, we exclude the first 5 years and start from 1985. The gap between the ROW's IRR and geometric mean return is still large at 290 bps per annum (see Table 2, Panel (b)).

We also confirm this result using other return series. Consider, for example, the most comprehensive CRSP index. We still see a gap of 267 bps per annum between the ROW's dollar-weighted returns and the buy-and-hold returns. This same gap is 284 bps per annum when we use the BofA index and 285 bps per annum when we use the Hall, Payne, and Sargent (2018) index.

Our table also shows that the gaps in the returns are almost all statistically different from zero. We report standard errors in parentheses, which are bootstrap standard errors of the difference between the IRR and the GM returns. Specifically, we draw 10,000 samples of the index returns with replacement from the original data set. We then calculate the IRR and GM within each simulated sample of returns and produce the standard error estimates using the 10,000 values of $IRR - GM$. Note that we use the flows as measured in the data. Under the null that flows are unrelated to future returns, there should be no difference between the IRR and GM returns.

The comparison across investor categories is also revealing. Using the Barclays index, we find that the IRR realized by the U.S. domestic investors is 7.51% per annum, which is 237 bps higher than the ROW's IRR. In other words, the foreign investors not only underperform relative to the

³The cash flows for the remaining domestic investors are determined by the issuance less the quantities purchased by foreign investors and the Fed.

⁴This follows a suggestion by Tabova and Warnock (2021).

buy-and-hold benchmark, they also underperform relative to the domestic investors. When we use the ICE BofA index, the gap shrinks to 153 bps per annum. When we use the return index from [Hall, Payne, and Sargent \(2018\)](#), the gap is 152 bps. When we use the CRSP data which contain the most comprehensive bond portfolio, the gap is 145 bps per annum.

We also compare the ROW's IRRs to those realized by the Fed. The ROW does between 36 bps (CRSP) and 63 bps (Ice BofA) better than the Federal Reserve bank in dollar-weighted terms. We find the small gap illuminating, since the Fed's Treasury holdings are driven by its monetary policy objectives that are orthogonal to risk vs. return objectives. In recent years, the Fed tends to purchase Treasuries precisely when economic conditions are weak and bond yields are low. The fact that the ROW's IRR is closer to the Fed's than to the domestic investors therefore suggest that the ROW's Treasury holdings are likewise not driven by risk vs. return trade-off.

Finally, we also report the IRR for the aggregate market, whose cash flows are simply the total issuance by the Treasury. For the comprehensive CRSP measure, the Market IRR is 5.20%, which could be interpreted as the effective cost of funding for the government (excluding T-bills). This IRR is also lower than the geometric mean return, which suggests that the the government tends to set their aggregate issuance in a way that exploits low bond yields.

We can perform the same calculation in shorter sub-periods. [Figure 2](#) plots the 10-year IRR realized by the ROW against the 10-year GM using a rolling window. In this computation, we initialize the AUM at zero in the period prior to the start of the rolling window, and then calculate the IRR based on the actual flows during the 10 year window. We find that the ROW's IRR consistently underperforms the GM in the rolling windows, although this underperformance is larger in magnitude in the 1980's. In our sample, the average 10-year IRR is 70 basis points lower than the geometric average return per annum. However, over the last decade, this gap between the ROW's IRR and GM is shrinking and it is close to zero in the last 10-year window in our sample.

To evaluate statistical significance, we also bootstrap the bond returns and generate the 10-year IRRs in rolling windows. As discussed above, our null hypothesis posits that flows are unrelated to future returns and there is no difference between the IRR and GM returns. Under this null, we find that only in 0.8% of our simulated samples, the average gap between the IRR and the geometric average across 10-year windows is greater than or equal to what we observe in the data.

4.2 Official vs. Private Foreign Sectors

Using the TICS data of sector-specific capital flows, we can drill down and analyze the dollar-weighted returns of the foreign official sector (Official ROW) and the foreign private sector (Private ROW). We report the results in [Table 3](#). First, we note that the dollar-weighted returns obtained for Total ROW using TICS data are very close to the numbers reported in [Table 2](#) obtained using the Flow of Funds data. Second, we note that the dollar-weighted returns realized by the foreign private sector (i.e., Private ROW) are even smaller. The gap with the domestic investors' IRR increases from 237 bps to 265 bps per annum for Barclays index. Using the comprehensive CRSP measure, the Private ROW's dollar-weighted returns are 278 bps lower than the buy-and-hold returns, while the Official ROW's returns are 220 bps lower. Therefore, the low IRRs realized by the ROW are not only a feature of the official sector, which is mainly based on central bank foreign reserves, but equally a feature of foreign private investors.

4.3 Inflation Timing vs. Real Return Timing

We further ask whether the foreign investors' low dollar-weighted returns on U.S. Treasurys are due to their timing in inflation or timing of real returns. In [Appendix Table A1](#), we compute the real IRR and real GM returns by deflating cash flows and returns at the CPI. The gap between the ROW's IRR and the geometric mean continue to be large and significantly different than zero, albeit somewhat smaller than the gaps computed using nominal yields. This comparison indicates that the ROW's demand for U.S. Treasurys is mainly characterized by their real return timing rather than their inflation timing.

In [Appendix Table A2](#), we repeat our exercise in [Table 3](#), which uses the breakdown between foreign official and private sectors, and also convert the flows and returns in real terms. We find similar underperformance of the foreign private sector.

4.4 Longer Sample

In [Appendix Table A3](#), we repeat our exercise in [Table 2](#) but start our sample in 1952, which is when the Flow of Funds data begins. In this longer sample, only the CRSP index and the [Hall, Payne, and Sargent \(2018\)](#) index are available to measure returns. Based on the CRSP index,

the gap between the ROW's IRR and the domestic investors' IRR over this 70-year sample is 99 basis points, and the gap between the ROW's IRR and the geometric mean return is 80 bps. These numbers are smaller than those in [Table 2](#). The evidence across different samples indicates that the underperformance of the ROW's dollar-weighted returns is particularly pronounced in the period from 1980 to 2010.

4.5 Including T-Bills

Finally, in Appendix [Table A4](#), we repeat our exercise in [Table 2](#) but use flow and return data that include T-bills. We obtain flow data that include not only Treasury notes and bonds but also bills from the Flow of Funds. We construct a new CRSP index from security-level data including the T-bills, and we also use the [Hall, Payne, and Sargent \(2018\)](#) since it includes all Treasury debt securities. The results are similar to that of [Table 2](#). For example, the ROW return gap in the post-1985 sample is 212 bps when including T-bills and using the [Hall, Payne, and Sargent \(2018\)](#) data, while it is 210 bps in our baseline results in [Table 2](#).

5 Conclusion

We show that the stand-in foreign investor *times* their purchases and sales of U.S. Treasuries to yield a return that is lower than the buy-and-hold strategy over the same investment period. These gaps are large in the period from 1980 to 2010 and have diminished more recently. Our timing fact should be understood in conjunction with the facts documented in other papers that foreign investors own a large quantity of safe U.S. Treasury bonds and that U.S. Treasury bonds have unconditionally low average returns relative to the bonds of other G-10 sovereigns. Our timing fact additionally shows that foreign investors time their purchases and sales to deliver particularly low returns. The results are consistent with theories that emphasize that U.S. dollar safe assets are in special demand around the world, carrying a convenience yield, and that this special demand is due to price-inelastic foreign investors. Given the quantitative importance of foreign Treasury purchases, the ROW investments have significantly lowered the effective cost of funding of the U.S. government.

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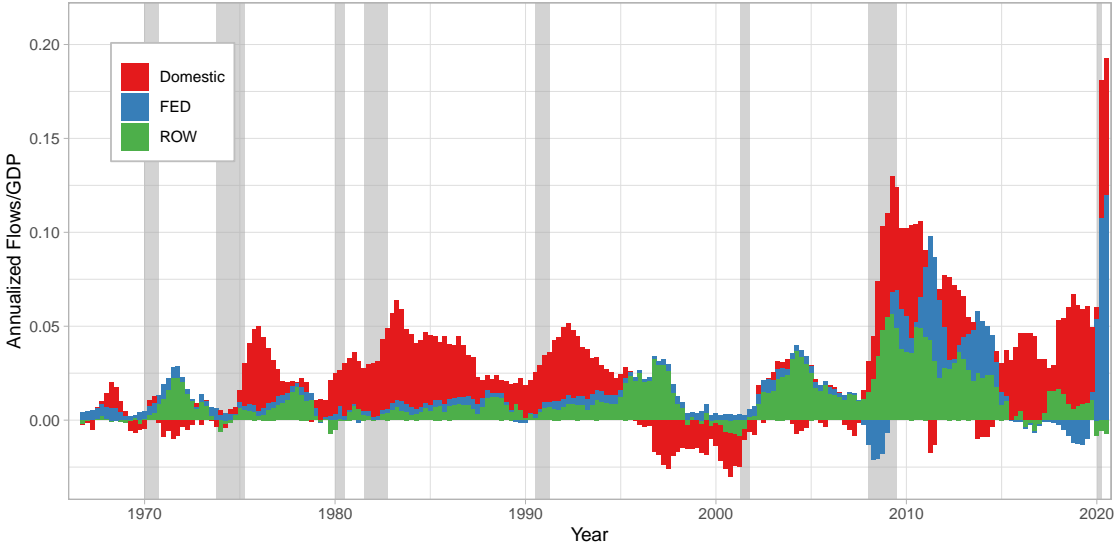
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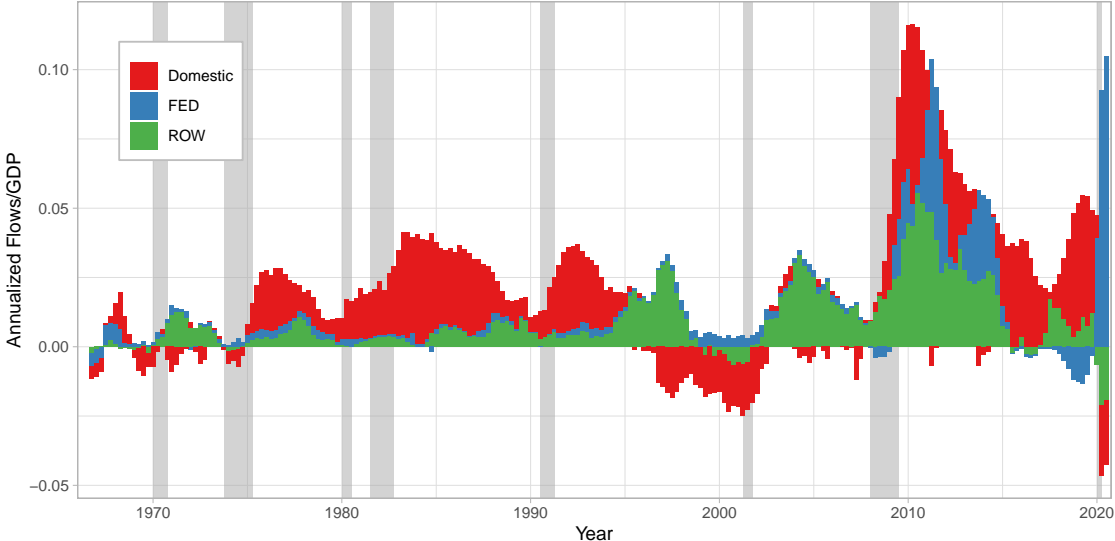
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Figures and Tables

Figure 1: Net Flows to U.S. Treasurys



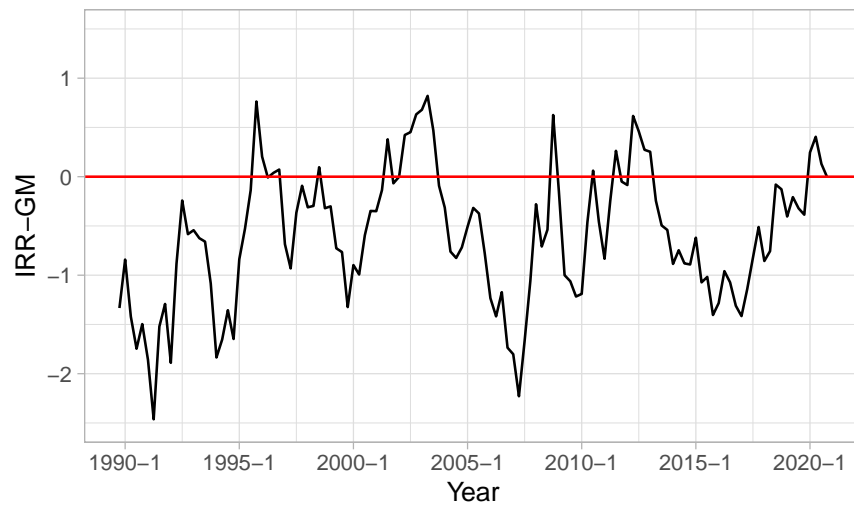
Panel (a): Total Net Flows to U.S. Treasurys



Panel (b): Total Net Flows to U.S. Treasury Notes and Bonds, Excluding T-Bills

We report annualized flows (4-quarter rolling average) as a fraction of GDP.

Figure 2: ROW's IRR in 10-year Rolling Windows.



We plot the difference between foreign investors' GM and IRR, computed over 10-year rolling windows ending at the year indicated in the x axis. We use the Barclays return index and our flow data exclude T-Bills.

Table 1: Example of Cash Flows and the IRR Computation

<i>Panel A: Description of the Example</i>				
Year	Foreign Investors		Home Investors	
	Holdings	Yield	Holdings	Yield
1	1	5%	10	5%
2	10	1%	1	1%
Time-Weighted Return (Geometric Mean)		2.98%	2.98%	
<i>Panel B: IRRs of Cash Flows</i>				
Year	Foreign Investors		Home Investors	
	Holdings	Cash Flows	Holdings	Cash Flows
1	1	-1	10	-10
2	10	-8.95	1	9.5
3	10.09	10.09	1.01	1.01
Dollar-Weighted Return (IRR)		1.37%	4.65%	

Table 2: Nominal Dollar- and Time-Weighted Returns of U.S. Treasury Holdings by Different Investor Types.

	IRR	GM	IRR-GM	SE	IRR	GM	IRR-GM	SE
	Panel (a): 1980.Q1—2021.Q1				Panel (b): 1985.Q1—2021.Q1			
Barclays								
ROW	5.14%	10.44%	-5.29%	(1.28%)	4.62%	7.51%	-2.90%	(0.78%)
FED	4.76%	10.44%	-5.68%	(1.39%)	3.81%	7.51%	-3.71%	(0.97%)
Domestic	7.51%	10.44%	-2.93%	(0.62%)	5.96%	7.51%	-1.55%	(0.43%)
Market	6.54%	10.44%	-3.90%	(0.83%)	5.06%	7.51%	-2.45%	(0.62%)
Domestic-ROW	2.37%			(0.92%)	1.35%			(0.55%)
Fed-ROW	-0.39%			(1.06%)	-0.81%			(0.70%)
ICE BofA								
ROW	4.42%	7.26%	-2.84%	(0.82%)	4.20%	6.37%	-2.17%	(0.70%)
FED	3.79%	7.26%	-3.47%	(0.96%)	3.43%	6.37%	-2.95%	(0.88%)
Domestic	5.96%	7.26%	-1.31%	(0.39%)	5.13%	6.37%	-1.25%	(0.43%)
Market	5.20%	7.26%	-2.07%	(0.57%)	4.45%	6.37%	-1.92%	(0.58%)
Domestic-ROW	1.53%			(0.58%)	0.92%			(0.47%)
Fed-ROW	-0.63%			(0.72%)	-0.78%			(0.59%)
CRSP								
ROW	4.45%	7.12%	-2.67%	(0.70%)	4.26%	6.18%	-1.93%	(0.60%)
FED	4.09%	7.12%	-3.03%	(0.81%)	3.78%	6.18%	-2.40%	(0.75%)
Domestic	5.90%	7.12%	-1.22%	(0.33%)	5.19%	6.18%	-1.00%	(0.36%)
Market	5.20%	7.12%	-1.92%	(0.48%)	4.55%	6.18%	-1.63%	(0.50%)
Domestic-ROW	1.45%			(0.49%)	0.93%			(0.40%)
Fed-ROW	-0.36%			(0.60%)	-0.47%			(0.51%)
Hall, Payne, and Sargent (2018)								
ROW	3.96%	6.81%	-2.85%	(0.70%)	3.76%	5.86%	-2.10%	(0.59%)
FED	3.35%	6.81%	-3.46%	(0.82%)	3.02%	5.86%	-2.83%	(0.74%)
Domestic	5.48%	6.81%	-1.33%	(0.34%)	4.67%	5.86%	-1.18%	(0.37%)
Market	4.70%	6.81%	-2.10%	(0.49%)	4.00%	5.86%	-1.86%	(0.50%)
Domestic-ROW	1.52%			(0.49%)	0.92%			(0.39%)
Fed-ROW	-0.61%			(0.61%)	-0.73%			(0.49%)

We report annualized nominal IRRs (internal rate of return) and GMs (geometric mean return). We obtain different investors' cash flows from the Flow of Funds, excluding T-bill holdings. Market is the aggregate flow, which is equal to total issuance. Domestic is the market minus Fed and ROW purchases. Sample: 1980.Q1—2021.Q1.

Table 3: Breakdown by ROW Official and Private

	IRR	GM	IRR-GM	SE	IRR	GM	IRR-GM	SE
	Panel (a): 1980.Q1—2021.Q1				Panel (b): 1985.Q1—2021.Q1			
Barclays								
Total ROW	5.39%	10.44%	-5.05%	(1.22%)	4.73%	7.51%	-2.79%	(0.75%)
Official ROW	6.16%	10.44%	-4.28%	(1.32%)	5.19%	7.51%	-2.32%	(0.61%)
Private ROW	4.86%	10.44%	-5.57%	(1.40%)	4.49%	7.51%	-3.03%	(0.83%)
Domestic-Official ROW	1.35%			(1.06%)	0.77%			(0.49%)
Domestic-Private ROW	2.65%			(1.06%)	1.47%			(0.61%)
ICE BofA								
Total ROW	4.58%	7.26%	-2.68%	(0.77%)	4.30%	6.37%	-2.07%	(0.66%)
Official ROW	5.05%	7.26%	-2.22%	(0.64%)	4.67%	6.37%	-1.71%	(0.55%)
Private ROW	4.30%	7.26%	-2.97%	(0.87%)	4.12%	6.37%	-2.25%	(0.74%)
Domestic-Official ROW	0.91%			(0.43%)	0.46%			(0.45%)
Domestic-Private ROW	1.66%			(0.64%)	1.00%			(0.52%)
CRSP								
Total ROW	4.56%	7.12%	-2.56%	(0.66%)	4.30%	6.18%	-1.88%	(0.57%)
Official ROW	4.92%	7.12%	-2.20%	(0.54%)	4.56%	6.18%	-1.63%	(0.47%)
Private ROW	4.34%	7.12%	-2.78%	(0.74%)	4.18%	6.18%	-2.00%	(0.64%)
Domestic-Official ROW	0.98%			(0.37%)	0.63%			(0.39%)
Domestic-Private ROW	1.56%			(0.55%)	1.00%			(0.44%)
Hall, Payne, and Sargent (2018)								
Total ROW	4.11%	6.81%	-2.70%	(0.66%)	3.86%	5.86%	-2.00%	(0.56%)
Official ROW	4.57%	6.81%	-2.23%	(0.54%)	4.22%	5.86%	-1.64%	(0.46%)
Private ROW	3.84%	6.81%	-2.97%	(0.74%)	3.68%	5.86%	-2.18%	(0.62%)
Domestic-Official ROW	0.91%			(0.37%)	0.46%			(0.39%)
Domestic-Private ROW	1.64%			(0.54%)	0.99%			(0.42%)

We report annualized nominal IRRs (internal rate of return) and GMs (geometric mean return). We obtain different investors' cash flows from the Flow of Funds, excluding T-bill holdings. Domestic is the market minus Fed and ROW purchases. Sample: 1980.Q1—2021.Q1.

Online Appendix

This appendix contains additional empirical results for the manuscript “The Rest of the World’s Dollar-Weighted Return on U.S. Treasurys”.

Figure A1: Quarterly Returns for Barclays, ICE BofA and CRSP indices.

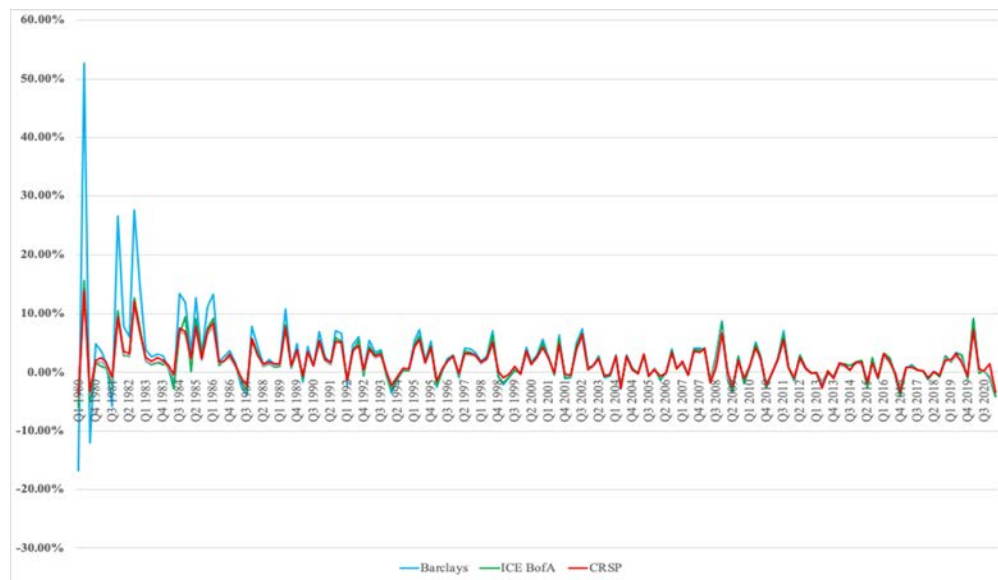


Table A1: Real Dollar- and Time-Weighted Returns of U.S. Treasury Holdings by Different Investor Types.

	IRR	GM	IRR-GM	SE	IRR	GM	IRR-GM	SE
	Panel (a): 1980.Q1—2021.Q1				Panel (b): 1985.Q1—2021.Q1			
Barclays								
ROW	2.98%	7.26%	-4.29%	(1.27%)	2.51%	4.84%	-2.33%	(0.79%)
FED	2.62%	7.26%	-4.65%	(1.40%)	1.76%	4.84%	-3.08%	(0.98%)
Domestic	4.87%	7.26%	-2.40%	(0.61%)	3.53%	4.84%	-1.31%	(0.43%)
Market	4.11%	7.26%	-3.16%	(0.82%)	2.84%	4.84%	-1.99%	(0.62%)
Domestic-ROW	1.89%			(0.91%)	1.02%			(0.55%)
Fed-ROW	-0.36%			(1.06%)	-0.75%			(0.71%)
ICE BofA								
ROW	2.29%	4.18%	-1.89%	(0.86%)	2.11%	3.72%	-1.61%	(0.72%)
FED	1.70%	4.18%	-2.48%	(1.01%)	1.39%	3.72%	-2.33%	(0.91%)
Domestic	3.38%	4.18%	-0.80%	(0.41%)	2.74%	3.72%	-0.99%	(0.43%)
Market	2.84%	4.18%	-1.34%	(0.59%)	2.26%	3.72%	-1.46%	(0.60%)
Domestic-ROW	1.09%			(0.60%)	0.62%			(0.48%)
Fed-ROW	-0.59%			(0.75%)	-0.72%			(0.62%)
CRSP								
ROW	2.36%	4.05%	-1.69%	(0.73%)	2.21%	3.56%	-1.34%	(0.63%)
FED	2.06%	4.05%	-1.99%	(0.85%)	1.83%	3.56%	-1.73%	(0.79%)
Domestic	3.35%	4.05%	-0.70%	(0.35%)	2.84%	3.56%	-0.72%	(0.38%)
Market	2.88%	4.05%	-1.17%	(0.51%)	2.41%	3.56%	-1.15%	(0.52%)
Domestic-ROW	0.99%			(0.51%)	0.62%			(0.42%)
Fed-ROW	-0.30%			(0.63%)	-0.39%			(0.53%)
Hall, Payne, and Sargent (2018)								
ROW	1.85%	3.74%	-1.89%	(0.74%)	1.69%	3.22%	-1.54%	(0.62%)
FED	1.27%	3.74%	-2.46%	(0.87%)	1.00%	3.22%	-2.22%	(0.78%)
Domestic	2.93%	3.74%	-0.81%	(0.36%)	2.31%	3.22%	-0.91%	(0.38%)
Market	2.37%	3.74%	-1.36%	(0.52%)	1.83%	3.22%	-1.39%	(0.52%)
Domestic-ROW	1.08%			(0.51%)	0.62%			(0.40%)
Fed-ROW	-0.57%			(0.64%)	-0.68%			(0.52%)

We report annualized real IRRs (internal rate of return) and GMs (geometric mean return). We obtain different investors' cash flows from the Flow of Funds, excluding T-bill holdings. We deflate the nominal cash flows and returns using the U.S. CPI. Market is the aggregate flow, which is equal to total issuance. Domestic is the market minus Fed and ROW purchases. Sample: 1980.Q1—2021.Q1.

Table A2: Breakdown by ROW Official and Private, Real Returns

	IRR	GM	IRR-GM	SE	IRR	GM	IRR-GM	SE
	Panel (a): 1980.Q1—2021.Q1				Panel (b): 1985.Q1—2021.Q1			
Barclays								
Total ROW	3.19%	7.26%	-4.08%	(1.20%)	2.60%	4.84%	-2.23%	(0.75%)
Official ROW	3.82%	7.26%	-3.44%	(1.08%)	2.97%	4.84%	-1.86%	(0.61%)
Private ROW	2.74%	7.26%	-4.52%	(1.39%)	2.41%	4.84%	-2.43%	(0.85%)
Domestic-Official ROW	1.05%			(0.77%)	0.56%			(0.49%)
Domestic-Private ROW	2.12%			(1.05%)	1.12%			(0.62%)
ICE BofA								
Total ROW	2.41%	4.18%	-1.77%	(0.80%)	2.20%	3.72%	-1.53%	(0.68%)
Official ROW	2.77%	4.18%	-1.42%	(0.66%)	2.47%	3.72%	-1.25%	(0.56%)
Private ROW	2.19%	4.18%	-1.99%	(0.91%)	2.06%	3.72%	-1.67%	(0.76%)
Domestic-Official ROW	0.62%			(0.45%)	0.27%			(0.47%)
Domestic-Private ROW	1.19%			(0.66%)	0.68%			(0.53%)
CRSP								
Total ROW	2.43%	4.05%	-1.62%	(0.69%)	2.24%	3.56%	-1.32%	(0.60%)
Official ROW	2.67%	4.05%	-1.39%	(0.57%)	2.39%	3.56%	-1.17%	(0.49%)
Private ROW	2.28%	4.05%	-1.77%	(0.78%)	2.16%	3.56%	-1.39%	(0.67%)
Domestic-Official ROW	0.69%			(0.39%)	0.45%			(0.40%)
Domestic-Private ROW	1.07%			(0.57%)	0.67%			(0.46%)
Hall, Payne, and Sargent (2018)								
Total ROW	1.97%	3.74%	-1.77%	(0.69%)	1.77%	3.22%	-1.45%	(0.58%)
Official ROW	2.32%	3.74%	-1.42%	(0.57%)	2.04%	3.22%	-1.18%	(0.48%)
Private ROW	1.76%	3.74%	-1.98%	(0.78%)	1.63%	3.22%	-1.59%	(0.65%)
Domestic-Official ROW	0.61%			(0.39%)	0.27%			(0.41%)
Domestic-Private ROW	1.17%			(0.56%)	0.68%			(0.44%)

We report annualized real IRRs (internal rate of return) and GMs (geometric mean return). We deflate the nominal cash flows and returns using the U.S. CPI. Sample: 1980.Q1—2021.Q1.

Table A3: Nominal Dollar- and Time-Weighted Returns of U.S. Treasury Holdings by Different Investor Types, Longer Sample.

	Nominal				Real			
	IRR	GM	IRR-GM	SE	IRR	GM	IRR-GM	SE
CRSP								
ROW	5.04%	5.83%	-0.80%	(0.66%)	2.55%	2.36%	0.19%	(0.65%)
FED	5.38%	5.83%	-0.45%	(0.55%)	2.50%	2.36%	0.14%	(0.51%)
Domestic	6.02%	5.83%	0.19%	(0.53%)	3.33%	2.36%	0.97%	(0.55%)
Market	5.59%	5.83%	-0.25%	(0.56%)	2.92%	2.36%	0.56%	(0.56%)
Domestic-ROW	0.99%			(0.33%)	0.78%			(0.31%)
Fed-ROW	0.35%			(0.29%)	-0.05%			(0.28%)
Hall, Payne, and Sargent (2018)								
ROW	4.56%	5.62%	-1.06%	(0.66%)	2.10%	2.15%	-0.05%	(0.66%)
FED	4.81%	5.62%	-0.81%	(0.56%)	1.99%	2.15%	-0.16%	(0.53%)
Domestic	5.63%	5.62%	0.01%	(0.53%)	2.94%	2.15%	0.79%	(0.55%)
Market	5.13%	5.62%	-0.49%	(0.56%)	2.48%	2.15%	0.33%	(0.57%)
Domestic-ROW	1.07%			(0.33%)	0.84%			(0.31%)
Fed-ROW	0.25%			(0.30%)	-0.11%			(0.28%)

We report annualized nominal IRRs (internal rate of return) and GMs (geometric mean return). We obtain different investors' cash flows from the Flow of Funds, excluding T-bill holdings. Market is the aggregate flow, which is equal to total issuance. Domestic is the market minus Fed and ROW purchases. Sample: 1952:Q1—2021:Q1.

Table A4: Nominal Dollar- and Time-Weighted Returns of U.S. Treasury Holdings by Different Investor Types, Including T Bills.

	IRR	GM	IRR-GM	SE	IRR	GM	IRR-GM	SE
	Panel (a): 1980.Q1—2021.Q1				Panel (b): 1985.Q1—2021.Q1			
CRSP								
ROW	4.49%	7.12%	-2.63%	(0.67%)	4.24%	6.18%	-1.94%	(0.59%)
FED	4.61%	7.12%	-2.51%	(0.62%)	4.19%	6.18%	-2.00%	(0.59%)
Domestic	5.89%	7.12%	-1.23%	(0.33%)	5.02%	6.18%	-1.16%	(0.39%)
Market	5.29%	7.12%	-1.83%	(0.45%)	4.55%	6.18%	-1.64%	(0.49%)
Domestic-ROW	1.40%			(0.44%)	0.78%			(0.34%)
Fed-ROW	0.12%			(0.38%)	-0.05%			(0.32%)
Hall, Payne, and Sargent (2018)								
ROW	3.99%	6.81%	-2.81%	(0.67%)	3.74%	5.86%	-2.12%	(0.58%)
FED	3.95%	6.81%	-2.86%	(0.63%)	3.48%	5.86%	-2.38%	(0.59%)
Domestic	5.43%	6.81%	-1.37%	(0.34%)	4.43%	5.86%	-1.42%	(0.40%)
Market	4.78%	6.81%	-2.02%	(0.46%)	3.98%	5.86%	-1.88%	(0.49%)
Domestic-ROW	1.44%			(0.43%)	0.70%			(0.32%)
Fed-ROW	-0.05%			(0.38%)	-0.26%			(0.31%)

We report annualized nominal IRRs (internal rate of return) and GMs (geometric mean return). We obtain different investors' cash flows from the Flow of Funds, including T-bill holdings. The CRSP and [Hall, Payne, and Sargent \(2018\)](#) return indices also include T-bills. Sample: 1980.Q1—2021.Q1.