

A New Method for Computing Mutual Fund NAV in Light of
Liquidity-Induced Transaction Costs

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Abstract

The practice of pricing open-end mutual funds at the net asset value at the close of trading provides liquidity to mutual fund investors, but imposes costs upon the mutual fund for portfolio adjustments and maintaining cash balances to handle inflows and redemptions. This paper discusses the Sacks Equalization Model which provides a simple algorithm for requiring new purchases and redemptions to bear the costs of providing liquidity to the fund. The Sacks Equalization Model also reduces the incentive for investors to use open-end mutual funds for short-term trading.

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I. Introduction

At the end of daily trading, each open-end mutual fund computes its net asset value (NAV), the liquidating value of all of its holdings at prevailing market prices at the end of the day. Purchases and redemptions of mutual fund shares are priced at the closing net asset value.¹ Pricing mutual funds at the closing net asset value makes open-end mutual funds highly liquid and quite attractive to many investors.

While the current practice of pricing mutual funds at the net asset value at the close of trading provides liquidity to mutual fund investors, the cost of providing this liquidity is considerable. In addition, investors who do not purchase or redeem shares bear a large and unfair portion of these costs. We estimate that the added brokerage commissions and market impact fees incurred by existing shareholders by providing liquidity for equity mutual funds in the year 2010 were between \$10 billion and \$17 billion. In addition, the total cost of providing liquidity should also include lost returns from carrying cash balances. For all mutual funds in the US, the Investment Company Institute estimates that the total inflows and redemptions were \$36 trillion in 2010 (ICI Factbook, 2011). The cost of handling all of these inflows and redemptions is an enormous number, much larger than the \$10-\$17 billion in trading costs given above for equity funds. In summary, the substantial magnitude of these costs and the fact that

¹ In addition, there may be front-end or rear-end sales fees, which we discuss subsequently.

non-trading mutual fund investors bear a large proportion of these costs raises doubts about the fairness of the current method of providing liquidity for mutual fund investors.

II. Establishing a Level Playing Field for Existence Shareholders by Imposing a Fair Price upon Purchases and Redemptions

A substantial portion of providing liquidity for mutual funds is the brokerage commissions required to rebalance the fund's portfolio as a consequence of fund inflows and redemptions. The non-trading shareholders bear a large proportion of the cost of adjusting the portfolio to new inflows of funds. When redemptions occur, the remaining shareholders bear the cost of adjusting the portfolio for the redemptions. Consequently, the costs of providing liquidity for inflows and redemptions are borne disproportionately by shareholders who neither purchase more shares nor redeem shares, creating the inequitable transfer of wealth from these shareholders to shareholders who trade in and out of the fund.

Several procedures have been used or proposed in the past to reduce this wealth transfer from short-term traders to long-term investors.² Examples include redemption fees for a specific time period after purchase, restrictions on the total number of transactions during a specific time interval, and a minimum holding period. While these procedures have some advantages, they also have disadvantages and none have been universally adopted.

This paper examines another approach to correct this inequitable wealth transfer, the "Sacks Equalization Model"³ (Sacks, 2011). In the Sacks Equalization Model, the

² Chen, Goldstein, and Jiang (2010) discuss various strategies used.

³ The Sacks Equalization Model has been proposed and patented by Mr. Seymour Sacks.

brokerage costs for purchasing shares with the proceeds of inflows are added to the purchase price and are added to the general revenues of the fund. The price paid to redeeming investors is the net asset value minus brokerage costs incurred to sell some of the fund's securities.

The Sacks Equalization Model can logically be extended to include the market impact costs of transactions caused by new inflows to the fund or redemptions. Thus, the purchasers of mutual fund shares should pay the net asset value grossed up by the fund's cost of adjusting the fund's portfolio to inflows including brokerage commissions and market impact costs. Redeeming shareholders should receive the net asset value minus the brokerage and transactions costs for selling shares to meet redemptions.

If this cost is c percent, the purchase price should be $NAV / (1 - c)$. Similarly the redemption price should be the net asset value reduced by the fund's cost of selling securities, or $(NAV) (1 - c)$. The differences between this purchase price ($NAV / (1 - c)$) and NAV (namely, $c NAV / (1 - c)$) and between NAV and the amount paid for redemptions $(NAV) (1 - c)$ (namely, $c NAV$) will be added to the total assets of the fund. In cases where portfolio adjustments must be made, these additional fees will be used to cover the brokerage costs and market impact costs. In the case where inflows are matched by redemptions on a particular day or days, the added fees from the inflows and redemptions will become part of the total assets of the fund and will be shared by all investors in the fund. These additional monies will be compensation to the investors in the fund for providing liquidity. Short-term traders will receive part of this compensation. Long-term investors will receive the majority.

As a simple numerical example, if the net asset value is \$10 per share and the cost c is 40 basis points, the fair purchase price for purchasing shares should be \$10.04 and a fair redemption price should be \$9.96. The differences between \$10 and \$10.04 and \$9.96 should cover the cost of fund portfolio adjustments. In a sense, this would introduce a bid-ask “spread” in the trading price (NAV) of a mutual fund, with the proceeds from the spread being used to compensate buy-and-hold investors for the transaction costs that they incur on behalf of short-term investors. The extra \$0.04 from inflows goes to the total net assets of the fund. The 4 cents of cost incurred to redeem shares is borne by redeeming shareholders, and is added to the total net assets of the fund. If shares purchased equal shares redeemed on a particular day, the general revenues of the fund will be increased by 8 cents times the number of shares and these funds will become part of the general assets of the fund and shared by all current investors in the fund.

The elegance of the proposed Sacks Equalization Model is twofold. First, trading by short-term shareholders is not subsidized, nor are investors with liquidity needs punished. Each investor pays exactly the cost imposed on the fund by their trading. Second, when inflows are offset by redemptions on a particular day or on several adjacent days, the fees collected from inflows and redemptions are added to the general assets of the fund and shared by all investors as compensation for providing liquidity. Consequently, purchasers of new shares and redeemers of existing shares pay directly for providing liquidity for the fund. The rate c can be set so that long-term investors are not penalized for providing liquidity.

Each individual fund will have to assess the level of this cost c . Mutual funds investing in small cap stocks tend to face higher commissions and higher market impact costs and should set c to be relatively high compared to a large-cap mutual fund that pays relatively low commissions and incurs relatively small market impact costs.

A number of studies have shown that the cost of equity mutual fund commissions averages between 15 and 20 basis points and market impact costs average between 20 and 40 basis points. To cover brokerage costs and market impact fees, the cost c should be between 35 basis points and 60 basis points depending upon the individual mutual fund. In the year 2010 total purchases and sales of equity mutual funds according to the Investment Company Institute were \$2.86 trillion (ICI Factbook, 2010). Consequently, the brokerage commissions and market impact costs of investing inflows and selling securities to meet redemptions was between \$10 billion and \$17 billion.

Equity mutual funds have additional implicit costs because of the need to maintain cash balances to meet redemptions. In the year 2010 the average equity mutual fund maintained a cash balance of approximately 3.7% of total assets according to the Investment Company Institute. Figure 1 illustrates the levels of cash balances for different investment objectives in the 2010 Morningstar Principia Pro database. Clearly, many types of mutual funds hold very large cash balances, at least partially motivated by the need to accommodate new fund inflows and redemptions. These cash balances typically earn relatively low rates of return and thus impose a cost upon all mutual fund investors. Consequently the current policy of pricing mutual funds at net asset value provides greater liquidity but typically requires larger cash balances and fund

rebalancing. In contrast, the Sacks Equalization Model imposes a fee upon new investors and redeeming investors for providing liquidity.

III. *The Adoption Process*

Adoption of the Sacks Equalization Model by a particular mutual fund would increase the cost to new investors to purchase mutual fund shares and also increase investors' redemption costs. The additional monies collected from fund inflows would go into the general assets of the fund. For new inflows and redemptions, the general assets of the fund would not have to pay portfolio adjustment costs. This arrangement is far more equitable for shareholders who do not trade in and out. New investors or redeeming investors pay a fair price.

The Sacks Equalization Model has two advantages. First, the long-term investors do not bear the cost of adjusting the portfolio to inflows and redemptions. Second, mutual funds can reduce their cash balances. Mutual funds will not have to be as concerned about portfolio adjustments since the cost of these adjustments is included in the price paid by new purchasers and the price received by redeemers. Since the returns on equity are higher in the long run than the returns on holding cash, long-term investors should benefit by the higher returns from the reduced cash balances under the Sacks Equalization Model.

A complicating problem is the difficulty of adjusting a portfolio instantaneously as purchase or redemption orders appear. Especially for orders arriving late in the trading day, necessary portfolio adjustments may not be completed on the same day. As a consequence, the cost adjustment factor, c , should include some premium for delays in

portfolio adjustments. The cost adjustment factor can be varied depending upon market conditions. In fact, the cost adjustment factor can even be tied to a volatility index (such as the VIX index) in order that the cost of purchasing and redeeming mutual fund shares becomes more expensive as security markets become more volatile.

In recent years a number of open-end mutual funds have started Exchange Traded Funds (ETFs) that are essentially clones of the open-end funds. ETFs provide very high liquidity for investors. A nice solution to providing liquidity for mutual fund investors is to have open-end funds with the Sacks Equalization Model for sales and redemptions and an exchange traded fund for investors who would like higher levels of liquidity.

IV. Incentives for Short-Term Trading

The practice of pricing purchases and redemptions at net asset value creates a benefit for short-term traders to invest through mutual funds as opposed to making direct investments. Consider a mutual fund without front-end, rear-end loads, or redemption fees. Then a short horizon trader can purchase a portfolio of securities at the net asset value of the mutual fund. The trader's alternative is to buy those securities directly and pay brokerage fees and possible market impact costs. By investing in the mutual fund, the individual purchaser of mutual fund shares avoids these personal brokerage fees and market impact costs.

Inflows of money may require a purchase of securities by mutual funds and redemptions may require the sale of securities, although mutual funds typically maintain a cash balance to reduce the number of security purchase and sale transactions. Thus the pricing of mutual fund inflows and redemptions at net asset value imposes a cost

upon all investors in the fund either in the form of low returns from holding cash or the cost of purchase of additional securities and sale of existing securities. The old investors bear a large part of the cost of investing new money or selling securities to pay redemptions, as well as a drain on returns from cash holdings by the fund. The short horizon trader in the mutual fund bears only a fraction of these costs.

The short horizon trader must pay a prorated portion of the expense ratio during the period when the mutual fund shares are held. The expense ratio paid by the short horizon investor has to be compared with the avoidance of personal purchase and sale costs. For example, if the short horizon trader has a two-month holding period, the investor is assessed $1/6$ of the annual expense ratio. With an annual expense ratio of 120 basis points, a trader holding a position for two months pays 20 basis points in expenses, but avoids the costs of acquiring securities and selling them. The cost of the expense ratio for a relatively short period can easily be far less than the cost of creating a similar portfolio by investing directly. In summary, by buying and then selling shares in a mutual fund, a short horizon trader avoids the cost of direct purchase and sale of securities, and transfers most of these costs to the remaining investors.⁴

If the number of shares purchased equals the number of shares redeemed on a particular day, there is no net cost to the other shareholders. However, the short horizon trader still avoids the cost of purchasing and selling securities directly, a potentially much higher benefit than the prorated share of the expense ratio that must be paid to the fund.

⁴ During the time interval for which short-term traders are invested in the mutual fund, other individuals may engage in short-term trading of this fund and impose costs upon the short-term trader if the fund finds it necessary to purchase or sell securities or maintain a cash balance to meet the purchase and redemption requests of investors.

If funds have front-end, rear-end loads, or redemption fees, the costs of short-term trading through mutual funds may exceed any potential savings in direct costs of purchases and sales of securities. However, most mutual fund families do not assess loads for switches between funds in the same family. The number of funds imposing redemption fees is relatively small (Greene, Hodges and Rakowski (2007)). An investor in a large family of funds can typically transfer funds from a money market account in any of the funds in the family without any loads.

As a result, the current practice of using the end of day net asset value for purchases and sales of mutual fund shares can encourage the use of mutual funds for short-term trading vehicles.

V. The Problem of Portfolio Rebalancing

If inflows do not equal redemptions on a particular day, portfolio rebalancing may be necessary. If orders to purchase or redeem arrive late in the trading day, portfolio adjustments may have to be made on subsequent days. Because of the time required to process orders from mutual fund investors, the fund may not know the amount of net inflows or net outflows until long after the end of regular trading hours. If large market price movements are occurring, the portfolio may have to be adjusted at unfavorable prices compared to the net asset value, imposing a cost upon the old investors. The net asset value adjustment factor (c) should reflect these potential losses.

Rakowski and Wang (2009) have shown that net inflows and net outflows tend to not be serially correlated. That is, inflows (outflows) on one day are not necessarily followed by inflows (outflows) on the next day. Quite plausibly, mutual fund managers

may wait several days before adjusting for differences in the amount of inflows and redemptions. Net inflows (redemptions) on one day may be offset by net redemptions (net inflows) on subsequent days.

While this lack of time patterns may be true for the average day, there can easily be sequences of days when market prices move in the same direction and inflows (outflows) persist over these days. Suppose market prices drop every day for four days in a row and net outflows occur each day. On the second and subsequent days, a fund may be forced to sell securities at prices below the net asset value paid out on the previous day. Frequently, reversals will occur in prices from one day to the next. If a day with declining prices and net fund redemptions is followed by a day with rising prices, the portfolio adjustments on the second day will result in a net benefit to the remaining fund investors. Because of the uncertainty about net inflows and outflows and price changes on subsequent days, mutual funds are forced to take protective action, typically holding a cash balance.

Some mutual funds may try to deal with net inflows or net redemptions by taking positions in futures contracts. However, this strategy is suitable primarily for index funds or other large funds whose returns are highly correlated with changes in index futures prices.

Gastineau (2004) has argued that mutual funds should stop accepting orders before the close of regular trading hours. If trading stops at 4 PM, he has suggested that orders received before 2:30 PM are filled at the net asset value at 4 PM. Orders received between 2:30 PM and 4 PM are filled at the closing net asset value on the next day. Vanguard has followed this type of policy for some of its funds. One problem with

an early cut off time for orders is the possibility that rebalancing may occur at 2:30 PM and new orders may arrive between 2:30 PM and 4 PM that would make the rebalancing unnecessary. In addition, short-term traders can simply submit orders at 2:25 PM.

VI. Estimates of the Costs of Providing Liquidity

The Investment Company Institute Yearbook provides some statistics on the total inflows and redemptions of mutual funds in individual calendar years. From these numbers, the potential benefit of using mutual funds as trading vehicles can be determined. For example, Tables 1 and 2 from the 2011 Investment Company Institute Factbook show that for all mutual funds in the year 2010 purchases were approximately \$18 trillion and redemptions were also approximately \$18 trillion, although total assets were approximately \$11 trillion. Total purchases and redemptions were more than three times total assets!

The 2011 ICI Yearbook Table 3 shows that total assets of equity mutual funds in 2010 were \$5.667 trillion. The ICI Yearbook Table 20 shows that sales of equity mutual funds were \$1.412 trillion and redemptions were \$1.448 trillion. The total of sales and redemptions were more than half of the amount of funds invested in equity mutual funds. The numbers for earlier years are of the same order of magnitude. Clearly, there are large amounts of inflows and redemptions into equity mutual funds in any year.

The Investment Company Institute numbers are for the year as a whole. On any given day there will tend to be both inflows and outflows. Then net inflow and net

outflow determines the need for a fund to purchase securities or sell securities to meet redemptions.

Suppose that we take the sum of the inflows and outflows for equity mutual funds and assume hypothetically that these funds adjusted their portfolios on a daily basis. The sum of the inflows and outflows is \$2.86 trillion for the year 2010. Suppose that the cost of brokerage commissions is 20 basis points. Several papers document the size of mutual fund brokerage commissions including Chan and Lakonishok (1995), Conrad et al. (2001), Edelen et al. (2011), Keim and Madhavan (1997), Livingston and O'Neal (1996). Then the brokerage commissions from daily adjustment would be approximately \$5.7 billion per year - a very sizable amount of money. \$5.7 billion is a lower bound for the amount saved by investors who purchase equity mutual fund shares or redeem equity mutual fund shares since individual investors most likely will pay higher commissions than large financial institutions. In addition, individual investors will also save market impact fees and these would easily be 40 basis points on average or approximately \$11.4 billion.

There are several academic studies that estimate the net inflows and outflows on a daily basis. Papers by Greene and Hodges (2002), Greene, Hodges and Rakowski (2007) and Rakowski and Wang (2009) consistently find absolute daily percentage flows to be in the range of about 40 to 50 basis points. Absolute daily flows give a good indication of the magnitude of daily liquidity needs that a fund manager must be prepared to provide to investors.

Signed daily flows are of smaller magnitude and show much greater variation than absolute flows over different time periods and across investment objectives. On

the high end, Rakowski (2010) finds average absolute daily flows of about 17 basis points for a sample of 4,772 funds. If we multiply the figure of 17 basis points from Rakowski (2010) times 250 trading days per year, we arrive at roughly 42.50% of assets involved net inflows or net outflows during the course of the year. This number seems quite plausible in view of Rakowski's estimate that 40% of the time the net cash flows are negative on a particular day. Thus the Investment Company Institute estimates of equity mutual fund inflows are consistent with these estimates.

While data on daily inflows and outflows is unavailable, we are able to generate statistics on net daily flows by combining the CRSP mutual fund database with data provided by Lipper. We collect data on daily net fund flows for an expanded sample of open-end funds over the 2000-2006 period. We include funds with valid observations for returns, total net assets (TNA), and investment objectives over the 2000-2006 period. We then equally weight averages across years for all funds in our selected investment classes with at least 30 daily observations per year. Daily percentage flows are then annualized based on 250 trading days. Flows are calculated assuming the current day's TNA does not include the current day's flow, as in Rakowski and Wang (2009).

Figure 2 presents estimates of average net daily flows for a sample of funds and Figure 3 illustrates average absolute daily flows. Figure 3 shows that absolute daily flows are even greater than those in other studies, approaching 1% of total net assets on average for domestic equity funds and exceeding this amount for international equity funds. Average daily net flows are in the range of 2 to 11 basis points, depending on the investment objective. This fits within the range reported by other studies. The

differences in absolute flows given in Figure 3 and net flows given in Table 2 can be used to judge the extent to which flows cancel out on subsequent days.

The ICI Factbook (Table 17) shows that in year 2010 the average equity fund maintained a cash balance of 3.7% of assets. The numbers for earlier years are quite similar. Our Figure 1 shows that many investment objectives hold substantially higher cash balances. The very large level of inflows and outflows from funds and the cost of daily adjustment are obvious determinants of these sizable cash balances. Wermers (2000) found that funds' average returns are lowered by 70 basis points per year due to the underperformance of cash holdings.

The total cost for the typical equity mutual funds for providing liquidity to mutual fund investors has three components - brokerage commissions, market impact costs, and opportunity costs from holding cash with low returns. Edelen (1999), Wermers (2000), and Dubofsky (2010) show that the total cost of providing liquidity is approximately 1.50% per year, although there can be significant differences between individual mutual funds. With total assets of approximately \$5.67 trillion in 2010 invested in equity mutual funds, the cost of providing liquidity was approximately \$85 billion ($\$5.6 \text{ trillion} \times 0.0150$).

VII. Conclusion

Pricing open-end mutual funds at the net asset value at the close of trading provides liquidity to mutual fund investors. On the other hand, pricing at net asset value imposes portfolio rebalancing costs and opportunity costs from holding cash balances to meet redemptions and temporarily hold funds from new inflows. The Sacks

Equalization Model provides a simple algorithm for requiring new purchases and redemptions to bear the costs of these actions. These rules protect the nontrading mutual fund investors from the costs imposed by trading investors. The Sacks Equalization Model also reduces the incentive for investors to use open-end mutual funds for short-term trading.

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Figure 1: Cash Balances

Data are for Morningstar Investment Objectives from the 4th quarter 2010 Morningstar Principia Pro database.

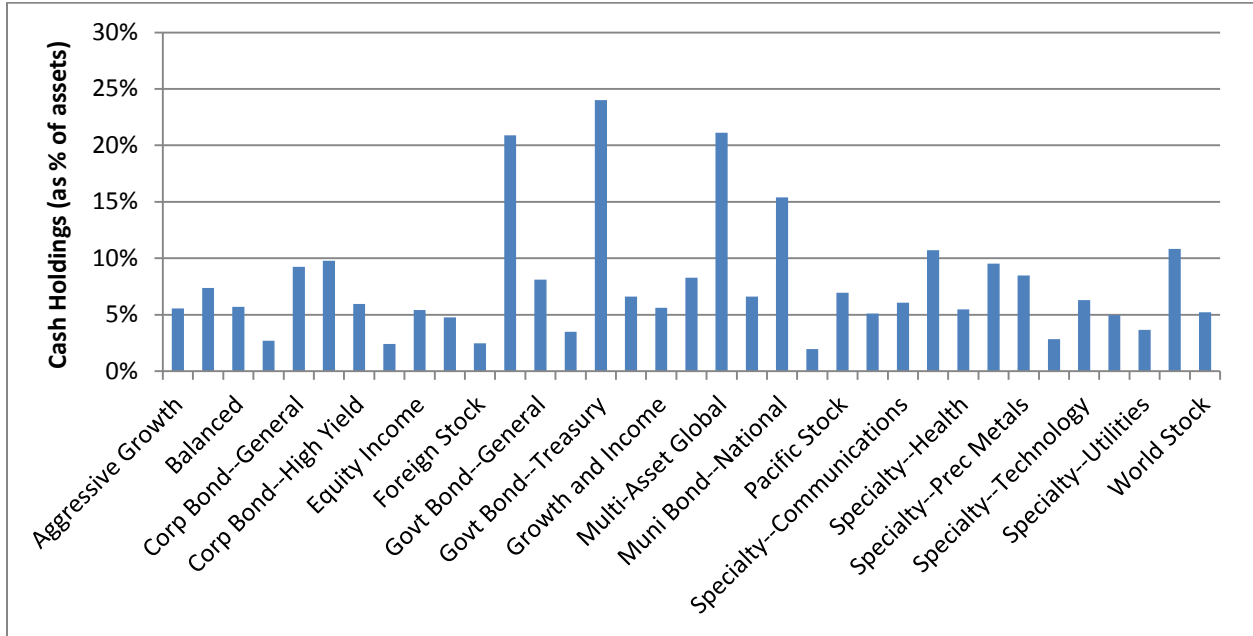


Figure 2: Average Annualized Daily Fund Flows

Data are from Lipper and the CRSP MF databases over the 2000-2006 period. Statistics are equally weighted across years. A fund is included in a given year if it has valid TNA, return, and investment objective data for at least 30 daily observations. Annualized figures are nominal values based on 250 trading days. Flows are calculated assuming the current day's TNA does not include the current day's flow, as in Rakowski and Wang (2009).

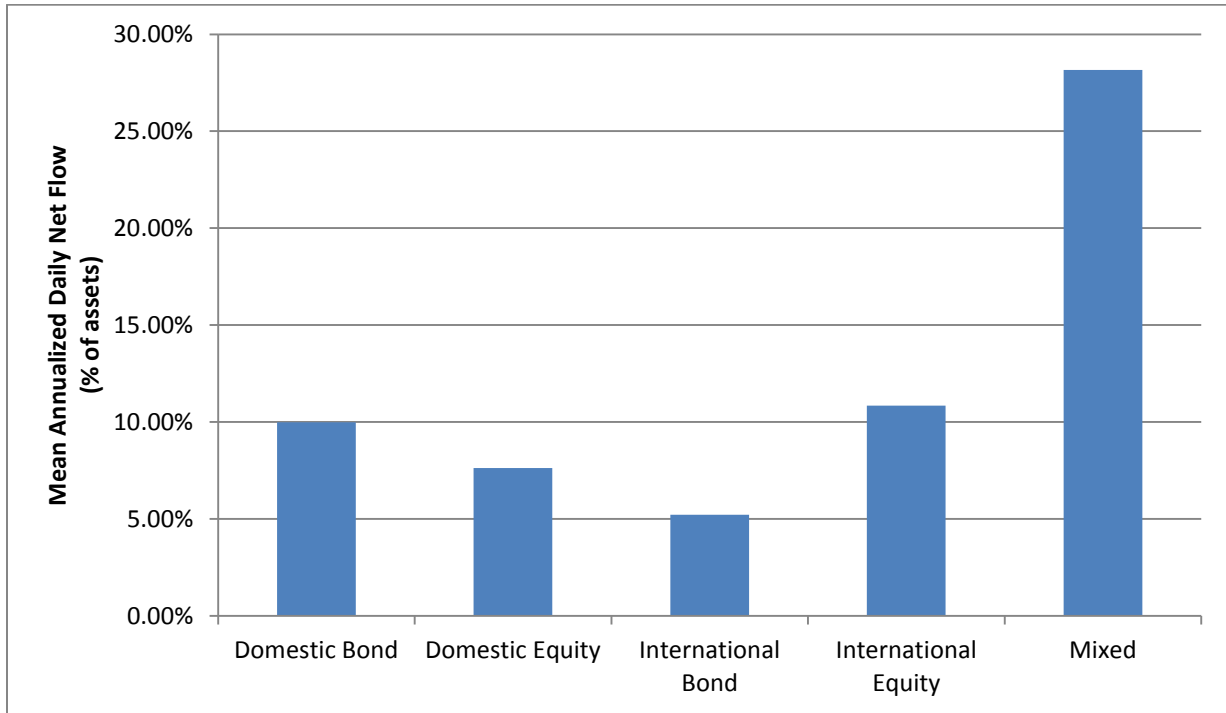


Figure 3: Average Absolute Daily Fund Net Flows

Data are from Lipper and the CRSP MF databases over the 2000-2006 period. Statistics are equally weighted across years. A fund is included in a given year if it has valid TNA, return, and investment objective data for at least 30 daily observations. Flows are calculated assuming the current day's TNA does not include the current day's flow, as in Rakowski and Wang (2009).

