Can Gross Capital Flows Help Us to Understand Net Flows?

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Abstract

This paper presents basic stylized facts about gross equity flows and broadly relates them to issues in international capital markets. Gross flows appear too large to be consistent with models that stress herding behavior and certain types of information frictions as explanations for the volatility of net capital flows. Gross flows are far more volatile than net flows. This implies that gross inflows and outflows are positively correlated, a finding that is inconsistent with aggregate shocks as the main driving force behind international capital flows.

1 Introduction

International capital flows play an increasingly prominent role in macroeconomics. The severe financial turbulence in 1997-98 fueled many discussions on the benefits of free capital mobility and stimulated great efforts to understand the forces behind international capital movements. Existing work on international capital flows focuses on net flows (Calvo et al(1996), Chunan et al(1998), Brennan and Cao(1997), Kim and Wei(1999), Froot et al(1998)). However, net flows are associated with tremendous gross flows. Gross flows result from a vast heterogeneity of assets and investors. This paper investigates whether gross flows can help us to answer some outstanding questions concerning the behavior of international capital markets.

In traditional macroeconomic models, gross flows represent a heterogeneity which cancels out in the aggregate. In this type of model gross flows would be a mere noise which has no effect on net aggregate outcomes. One question this paper tries to answer is whether empirical evidence can support this claim. If gross and net flows are related, then a modeling strategy that includes heterogeneity of assets and/or investors may be more appropriate than models with a representative investor and a single risky asset.

Total gross flows consist of gross inflows and gross outflows. Can the behavior of gross inflows and ouflows help us to differentiate among competing theoretical hypotheses? The behavior of gross flows introduces an additional dimension to the study of international capital flows. Different movements of the two components can potentially identify the type of shocks that are important in explaining capital flows. In particular, herding and information imperfections have implications for the heterogeneity of assets and investors. Gross flows can offer clues as to whether or not these hypotheses are plausible. Even if the ultimate goal is to understand net flows, a research strategy that does not ignore information contained in gross flows could be useful. Moreover, it is possible that gross flows are important in their own right.

Gross flows were introduced in the literature by Tesar and Werner (1994 and 1995). They find that portfolio turnover of foreign holdings is roughly twice the turnover of domestic holdings. They argue that the size of gross flows has implications for home bias. In particular, the magnitude of gross flows suggests that transaction costs in foreign assets are relatively low, and thus can not explain home bias. My paper takes a broader look at the behavior of gross flows. In addition to size, I systematically study the time series behavior of gross inflows and outflows. It is possible that this strategy can uncover further insights into the behavior of international financial markets.

Another important work on gross flows was done by Portes and Rey(1999). They have annual data on bilateral flows for 14 countries and they investigate the geographical pattern of gross flows. In a resulting gravity equation, the variables which come out most strongly are variables related to information flows (such as telephone call traffic, multinational bank branches, etc.). Their paper exploits the cross-sectional variation in gross flows, while my paper looks at the time series properties of gross flows.

Using data on equity flows I describe basic characteristics of gross flows and broadly relate them to existing views and theories. My strategy is to look at predictions for the behavior of gross flows in a simple model of capital flows. I infer predictions for the size, contemporaneous correlations, and persistence of gross flows and compare them to actual behavior. I find that gross capital flows offer a number of insights into the behavior of net flows. Some of the insights appear inconsistent with conventional wisdom about the driving forces behind international capital flows.

2 Measure of Gross Flows

Gross flows can occur for two reasons. First, there is heterogeneity among investors. While one investor may sell a foreign asset, a different investor may buy a foreign asset. As a result, there is no net capital flow. The second reason for gross flows is the heterogeneity of assets. An investor may sell one security and at the same time buy a different one. Once again, there is zero change recorded in net capital flow. The measure of gross flows depends on how much is netted out from the disaggregate information. [1] The capital account balance is equal to the difference between net change in foreign liabilities and net change in foreign assets:

$$capital\ account = net\ \Delta\ in\ foreign\ liabilities - net\ \Delta\ in\ foreign\ assets \tag{1}$$

Equation (1) disaggregates net capital flows into net flows of domestic and foreign assets. The first term captures net changes in investment by foreign residents in the domestic country, while the second term captures net changes in investment by domestic residents abroad. Golub(1990) and Montiel(1993) think of the two terms in (1) as gross flows. They use this measure to study capital mobility. It is unclear which of the terms is gross inflow and which is gross outflow since both can be positive and negative. Notice that both terms on the right hand side of (1) are net changes. This means that gross flows which are due to heterogeneity of assets and investors are netted out.

The net change in foreign liabilities can be further disaggregated into the difference between gross sales of domestic assets to foreigners and gross purchases of domestic assets from foreigners. For example, a sale of a Mexican equity by a Mexican broker to a U.S. investor is a gross sale of a domestic asset to a foreigner and a gross capital inflow for Mexico. On the other hand, when the U.S. investor sells the Mexican equity back to the Mexican broker, it is gross purchase of a domestic asset from a foreigner and a gross capital outflow for Mexico. Equation (2) below disaggregates net changes in foreign liabilities into gross purchases and gross sales. It captures all of the flows which are due to the heterogeneity of assets and investors.

$$\begin{aligned} net\ \Delta\ in\ foreign\ liabilities = {} & gross\ sales\ of\ domestic\ assets\ to\ foreigners \\ & -gross\ purchases\ of\ domestic\ assets\ from\ foreigners \end{aligned} \tag{2}$$

[1] Since capital flows are measured over an interval of time, one investor can buy, sell and buy again the same foreign investment many times during this interval. Measured gross flows will also include buying and selling of the same asset by the same investors during the period over which the flows are measured.

Data on gross flows of international capital are not readily available. Any gross flows data set which includes major recipients of international capital will have shortcomings. The U.S. Department of Treasury collects data on transactions in long term securities with residents in foreign countries. The data is based on compulsory reporting by banks, brokers and dealers. It has been collected on a monthly basis since 1977. The data covers 64 countries and 6 categories of assets. It has information on both gross U.S. sales and purchases of foreign equity. This means that one can construct gross flows for the 64 countries with respect to the United States. Unfortunately, this leaves out transactions with foreigners other than Americans. U.S. investors have traditionally played a very important role in international capital markets and the dominant role in many of the countries which I look at in this paper.[2]

In this paper I focus on net changes in foreign liabilities. For capital poor countries, the magnitude of changes in foreign liabilities is much greater than the magnitude of changes in foreign assets. Using quarterly data from *International Financial Statistics*, I decomposed the variance of net equity investment into the variance of equity investment liabilities (line 78bmd), variance of equity investment assets (line 78bkd) and the covariance of the two. For developing countries, the variance of liabilities, assets and the covariance accounted for 85%, 30%, and -20%respectively. Most of the variation in net equity flows comes from changes in liabilities. Therefore, focusing on changes in foreign liabilities is not a serious limitation.

[2]The treasury data has also information on foreign bonds. However, it is unclear whether the reinvestment of maturing bonds is considered a gross sale and a gross purchase. Therefore, at this point I am concentrating on equity flows only. The data set also has information on gross sales and purchases of U.S. equity to foreigners. For a detailed description of the data set, see Tesar and Werner(1994)Appendix A.

For each country in my data set I define the following five variables:

$$\begin{aligned} pos &= \textit{gross U.S. purchases of foreign equity (gross capital inflows)} \\ neg &= \textit{gross U.S. sales of foreign equity (gross capital outflows)} \\ sum &= pos + neg = \textit{total flows} \\ net &= pos - neg = \textit{net capital inflows} \\ exc &= sum - |net| = \textit{excess flows} \end{aligned}$$

I use both scaled series and pure unscaled flows in millions of dollars. I scale the flows with investment positions. Unfortunately, the data on U.S. investment positions in foreign securities is limited. The Department of Commerce provides estimates in July issues of the *Survey of Current Business*, but the geographical breakdown is very broad. Only since 1995 has investment position data been available in the breakdown of 11 countries. Beakert and Harvey(1998) generate the position series by accumulating net flows and adjusting for capital gains. As the authors point out, this method has several drawbacks. Without proper initial stock and capital gain adjustment, the procedure often yields negative ownership.

3 A Very Simple Framework

I use a simple model to study the effects of different shocks on gross flows. I assume that there is a continuum of foreign investors who invest in domestic assets. Foreign investors are subject to two types of shocks: idiosyncratic and aggregate. The idiosyncratic shock ε_i reflects the heterogeneity of investors. Specifically, it represents individual differences in expectations, opinions, risk aversion, time horizons, liquidity constraints, etc. I assume that idiosyncratic shocks are distributed uniformly on interval $(-b, b)$. I interpret an increase in b as an increase in investor heterogeneity. The aggregate shock $\overline{\varepsilon}$ affects all foreign investors equally. It represents those shocks which are common to all foreign investors, such as public information releases, new country risk ratings, news of political instability, a change in U.S. interest rates, etc. I assume that the aggregate shocks are randomly distributed with mean zero and variance σ^2. The sum of the aggregate and idiosyncratic shocks is the investor's private valuation.

Each foreign investor buys or sells only one unit of the domestic asset in a single period. The price of the domestic asset is P. Investors face fixed cost on transactions c. They follow a simple rule: they buy one unit of an asset if their private valuation exceeds the sum of the price and transaction cost, and sell one unit of an asset if the private valuation falls below the price minus the transaction cost. While the decisions of investors are not derived, they capture the essence of many optimizing models. The setup is summarized below.

$$\overline{\varepsilon}_t \sim (0, \sigma^2)$$

$$\varepsilon_{i,t} \sim U(0, \tfrac{b}{3})$$

$$\textit{buy if} \quad \varepsilon_{i,t} + \overline{\varepsilon}_t > P_t + c$$

$$\textit{sell if} \quad \varepsilon_{i,t} + \overline{\varepsilon}_t < P_t - c$$

I assume that the asset demand from *domestic* investors is perfectly elastic. In this case, foreigners face a perfectly flat supply of assets. Therefore, any shifts in net demand by foreign investors do not change the price of domestic assets. There is mixed evidence as to whether net flows are related to price changes and whether the supply of assets is perfectly elastic. Note that the heterogeneity of foreign investors renders their aggregate demand curve for the domestic asset downward sloping. Heterogeneity has similar effects in Cragg and Malkiel(1982).

I am now ready to derive gross and net flows. The mass of foreign investors is normalized to 1. Since each investor can buy only only one unit of the asset, total gross inflows are equal to the probability that the private valuation exceeds the price plus the transaction cost. Total gross outflows are derived analogously. Let *pos*, *neg*, *net*, *sum* denote gross inflows, outflows, net and total flows respectively.

$$
\begin{aligned}
pos_t &= \frac{1}{2b}(b - (P_t + c - \overline{\varepsilon}_t)) \qquad for \quad P_t + c - \overline{\varepsilon}_t \in (-b, b) \\
neg_t &= \frac{1}{2b}(b + (P_t - c - \overline{\varepsilon}_t)) \qquad for \quad P_t - c - \overline{\varepsilon}_t \in (-b, b) \\
net_t &= \frac{-P_t + \overline{\varepsilon}_t}{b} \\
sum_t &= \frac{b - c}{b}
\end{aligned}
$$

The above framework allows me to analyze the effects of different shocks on gross flows. Note that changes in price will have exactly the opposite effect as aggregate shocks. I will study the effects of the changes in the three parameters in the model: aggregate shocks, investor heterogeneity, and transaction costs. Let me begin with the effects of aggregate shocks.

$$
\frac{\partial pos}{\partial \overline{\varepsilon}} > 0 \qquad \frac{\partial neg}{\partial \overline{\varepsilon}} < 0 \qquad \frac{\partial net}{\partial \overline{\varepsilon}} = \frac{1}{b} > 0 \qquad \frac{\partial sum}{\partial \overline{\varepsilon}} = 0 \tag{3}
$$

As one would expect, a positive aggregate shock increases gross capital inflows and decreases gross outflows. If mean valuations increase, more foreigners tend to buy and fewer sell. As a result, net capital flows increase. There is no effect on total flows. It is important to point out that $\overline{\varepsilon}$ represents shocks to valuations of foreigners only, and does not affect valuations of domestic investors. If $\overline{\varepsilon}$ were a truly aggregate shock and affected all investors, there would be no flows and the change in valuations would be reflected in the price.

I will now concentrate on the first two derivatives. Consider an increase in U.S. interest rates. On aggregate, foreign investors would like to reallocate their investments to U.S. assets. In this case we would expect that gross purchases of foreign assets would decrease while sales of foreign assets increase. If aggregate shocks such as this are an important driving force behind international capital flows, one would expect the contemporaneous correlation between gross inflows and outflows to be negative. Let me state this as proposition 1:

Proposition 1: *Aggregate shocks cause gross inflows and outflows to move in opposite directions.*

The third derivative in (3) indicates that effects of aggregate shocks on net capital inflows depends on b which represents investor heterogeneity. Specifically, $\frac{\partial^2 net}{\partial b \partial \bar{\varepsilon}} = -\frac{1}{b^2} < 0$, the larger the investor heterogeneity, the weaker the effect of an aggregate shock. If the heterogeneity is large, the idiosyncratic shocks are also large. A large negative aggregate shock in necessary to persuade an investor with a large positive idiosyncratic shock to react. Hence, the heterogeneity parameter determines the effects of aggregate shocks on net flows. This alone may seem like an interesting result, but I think it is something we already know: if investors are all the same, a little perturbation results in large swings in net capital flows. The more important issue is where changes in b come from, how they evolve over time, and what their contribution is to the variance of net flows. It is clear that gross flows could help identify changes in b over time. The effects of changes in b on gross and net flows are as follows:

$$\frac{\partial net}{\partial b} = \frac{P - \bar{\varepsilon}}{b^2} \qquad \frac{\partial sum}{\partial b} = \frac{c}{b^2} > 0 \tag{4}$$

The effect of the variance of idiosyncratic shocks on net flows is ambiguous. It depends on the relative size of price P and the realization of the aggregate shock. However, the effect of the variance of idiosyncratic shocks on total gross flows is always positive: the greater the variance, the greater the gross flows. I state this result in proposition 2:

Proposition 2: *Greater heterogeneity of investors results in greater total gross flows.*

The first derivative in (4) shows that changes in b have an effect on net capital inflows. As mentioned previously, prior studies have concentrated on aggregate shocks and aggregate fundamentals. It is often claimed that the withdrawal of capital during crises is not justified by aggregate fundamentals. Changes in the heterogeneity of investors can have an effect on net capital inflows. This means that one can observe changes in net capital flows without the occurrence of any changes in aggregate "fundamentals." Micro fundamentals, which are related to investor heterogeneity, can be an important determinants of net capital flows. Again, the question which remains is what drives these changes in micro fundamentals. Gross flows offer one venue to study this question.

Table 1: Annual Gross Flows as a Fraction of Investment Positions
Total flows (*sum*) are gross inflows plus gross outflows. Excess flows (*exc*) are total flows minus the absolute value of net flows. Annual flows are divided by the U.S. investment positions. Regional totals are reported.

	1989		1990-93		1994-97	
	sum	exc	sum	exc	sum	exc
World	2.5	2.4	2.1	2.0	1.2	1.2
Western Europe	2.1	2.0	2.3	2.1	1.2	1.2
Latin America	6.7	6.5	2.7	2.3	2.2	2.2

$$\frac{\partial pos}{\partial c} < 0 \qquad \frac{\partial neg}{\partial c} < 0 \qquad \frac{\partial net}{\partial c} = 0 \qquad \frac{\partial sum}{\partial c} < 0 \tag{5}$$

Lastly, I show the effects of a change in transaction costs. The results are stated in proposition 3:

Proposition 3: *An increase in transaction cost reduces gross flows and has no effect on net flows.*

The three propositions make simple predictions about the co-movement and size of gross flows. The next section presents basic characteristics of gross flows data and relates them to the predictions derived above.

4 Characteristics of Gross Flows Data

4.1 The Size of Gross Flows

Tesar and Werner(1995) were the first to document the large transaction volume in foreign securities. They report the ratio of the sum of U.S. sales and purchases of foreign securities to the U.S. investment position in foreign securities. They find that in 1989, U.S. investors bought and sold their foreign position 2.5 times. This is approximately twice the domestic turnover rate. Table 1 reports annual gross flows as a fraction of investment position. The top left cell is Tesar and Werner's result.

The size of gross flows is strikingly large. Statistics which report net capital flows capture only a small fraction of actual capital flows. In the same vein, models which concentrate only on net capital flows ignore much greater capital movements. In addition to total flows I also report excess flows. Excess flows subtract the absolute value of net flows from total flows and represent transactions which are "unnecessary" for the net redistribution of savings between countries. Table 1 shows that excess flows are also large and differ only slightly from total flows. This indicates that the size of gross outflows and gross inflows is similar. In other words, net flows are very small compared to gross flows. I will argue below that the size of gross flows has implications for the recent debate on the volatility of net flows.

As mentioned earlier, there are two main sources of gross flows: asset and investor heterogeneity. Investors change assets in their portfolios and investors themselves change. As one investor pulls out of a market and a different investor enters. This "investor turnover" reflects the different characteristics of investors. Similarly, portfolio turnover is the result of changing characteristics of individual assets. From the point of view of the individual investor, these changes are optimal. Two related propositions were recently put forward as explanations for large swings in net capital flows: herding behavior and asymmetric information. These propositions have implications for both the heterogeneity of investors and the number of transactions in multiple assets. Since gross flows depend on investor and asset heterogeneity, they can give clues about the plausibility of these hypotheses.

One way to interpret the outcome of herding models is to say that investors behave the same way. One test of herding by foreigners, conducted by Kim and Wei(1999), investigates whether foreign investors tend to be net buyers and sellers simultaneously. If all foreign investors buy or sell at the same time, gross flows should be small. It is unclear what is considered small, but herding is often thought to be more prevalent with respect to developing countries. Therefore, one may expect gross flows in developing countries to be lower than those in developed countries. Contrary to this expectation, table 1 shows that gross flows in Latin America are greater than gross flows in Western Europe.

The second proposition concerns information gathering. Specifically, there are concerns that international investors are reluctant to acquire costly information about the fundamentals of particular countries but rather prefer to view entire regions as one entity. Calvo and Mendoza(2000) show that in a globalized economy investors have little incentive to acquire information about particular countries. Likewise, the IMF often urges international investors to differentiate between countries with sound and unsound policies. If we think that investors do not distinguish between countries, we can hardly expect them to distinguish between different securities within one country. Yet, table 1 presents evidence that investors change the mix of their portfolios quite frequently. If the information gathering problem is more acute with respect to developing than to developed countries, one would expect gross flows in developing countries to be smaller than in developed ones. Once again, this expectation is not validated by the data. The fact that gross flows in Latin America are greater than in Western Europe casts doubt on the herding and information gathering hypotheses.

There are two other factors which strengthen the expectation that gross flows in developing countries should be smaller than in developed countries. Firstly, proposition 3 indicates that higher transaction costs reduce gross flows. Communication lines and settlement systems are by definition more advanced in developed than in developing countries. Secondly, the number of listed and actively traded securities is greater in developed countries. In 1996, the average number of domestic companies listed on the stock market was twice as high for developed countries (see International Finance Corporation (1997)). My framework is too simple to capture the effects of differences in the number of securities listed in a particular country. One may expect that the greater the number of securities, the greater the scope for gross flows. However, table 1 shows that gross flows are greater in Latin America than in Western Europe.

There are three potential objections to the result in table 1. Firstly, the investment position may not be the proper scaling factor. The U.S. investment position in developing countries is much smaller than in developed ones, thus inflating the measure of gross and

Table 2: Excess Flows as a Fraction of Total Flows

Excess flows are total flows minus the absolute value of net flows. Total flows are gross inflows plus gross outflows. Monthly flows are calculated for each country and averages of geographic regions are reported.

	1977-88	1989	1990-93	1994-97
World	0.61	0.68	0.69	0.73
Western Europe	0.66	0.69	0.74	0.82
Latin America	0.47	0.52	0.59	0.72
East Asia	0.58	0.72	0.68	0.78
Eastern Europe	n/a	n/a	0.18	0.41

net flows. Secondly, the use of regional flows instead of the average of individual country flows inflates the measure of gross flows. Excess flows for a region are always greater than or equal to the sum of individual country flows. This is because excess regional flows are calculated using the absolute value of the sum of net flows, while average excess flows are based on the sum of absolute values. The sum of absolute values is always greater than or equal to the absolute value of the sum. Finally, annual flows are always greater than the sum of monthly flows. Once again, annual flows are calculated using the absolute value of the sum of monthly flows, while monthly flows take the sum of absolute values.

Table 2 addresses these issues and offers a different measure of gross flows. Excess flows are taken as a fraction of total flows. This measure falls between zero and one. Instead of scaling excess flows with investment positions, I use total flows as a scaling factor. Thus, I no longer use the data on investment positions. This allows me to calculate flows for individual countries. I report monthly averages for each region.[3]

Average excess flows account for over 70% of total flows. This confirms my previous

[3]Western Europe countries include: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. East Asia includes: China-Mainland, China-Hong Kong, China-Taiwan, Indonesia, Malaysia, Thailand, Singapore, and the Philippines. Eastern Europe includes: Bulgaria, the Czech Republic, Hungary, Poland, Romania, and Russia. Latin America includes: Argentina, Brazil, Chile, Colombia, Ecuador, Guatemala, Mexico, Panama, Peru, Uruguay, and Venezuela.

Table 3: Contemporaneous Correlations

Gross and net flows are linearly detrended. Absolute value of net flows is taken after detrending. Monthly data for for 42 countries from 1989 through 1999 were used. Correlation coefficients for geographic regions are reported. A star indicates significance at 1%.

	pos,neg	sum,net	exc,net	exc,|net|
Western Europe	0.95*	-0.44*	-0.44*	0.13*
Latin America	0.68*	-0.10*	0.03	0.16*
East Asia	0.76*	0.03	-0.08	0.14*
Eastern Europe	0.76*	0.41*	0.16*	0.22*

finding that only a small fraction of total flows (roughly 1/3) is "necessary" for net redistribution of savings between the U.S. and an average foreign country. According to this measure, gross flows in Western Europe are only slightly higher than in to the three developing regions. However, these differences are not statistically significant. Admittedly, this is partly due to the high volatility of flows in developing regions.

Contrary to many expectations, the transaction volume in developing countries is strikingly large. Investors appear to behave heterogeneously and constantly re-balance their portfolios. Allowing for differences in transaction costs and the number of listed securities, investors re-balance more intensely with respect to developing than to developed countries. This casts doubts on both the arguments of herding behavior and information gathering problems.

4.2 Contemporaneous Correlations

Proposition 1 in section 3 predicts that if aggregate shocks are an important driving force behind international capital flows, the correlation between gross inflows and outflows should be negative. This prediction is quite intuitive. If there is an aggregate shock to reallocate investments to U.S. assets, one would expect that gross outflows from emerging countries would be high and gross inflows low. Table 3 presents contemporaneous correlations between the detrended series of gross and net flows.

The first column indicates that correlations are far from being negative. In fact, for most of the countries these correlations are positive, large and significant. This is a surprising finding because positive comovement is inconsistent with aggregate shocks as the driving force of capital flows. The notion that aggregate shocks significantly influence international capital flows is thus undermined.

The positive correlation between gross inflows and outflows is robust to different detrending and scaling methods and is apparent even in annual figures. For example, 1993 net flows in Mexico were \$5.7 billion, an increase of 56% from 1992. This indicates very favorable investment conditions. One would expect this large increase in net flows to be associated with an increase in gross inflows and a decrease in gross outflows. However, *both* gross inflows and gross outflows increased. Similarly, the general retreat from the Mexican market in 1998 was accompanied by a fall in both gross inflows and outflows. This data questions the role of aggregate shocks and indicates that a country with large net inflows does not necessarily experience high gross inflows and low gross outflows.

Why are large gross inflows associated with large gross outflows? The covariance of gross inflows and outflows can be expressed as the difference between the variance of total flows and the variance of net flows.

$$4cov(pos, neg) = var(sum) - var(net) \tag{6}$$

Equation (6) is an identity from which no causality can be deduced. Large variations in transaction volume and small variations in net flows imply a positive correlation between gross inflows and gross outflows. This means that the relative volatility of total gross flows and the positive correlation between gross inflows and outflows are one phenomenon. In the next section I consider the volatility of gross and net flows and possible sources of this relationship.

Correlations between excess flows and the absolute value of net flows in the last column show that any net change is associated with "excess" trading. While the correlation coefficient is rather low, it is statistically significant. If heterogeneity was a mere noise which cancels out, there should be no relationship between excess and net flows. This is not

Table 4: Variance of Gross Flows as a Fraction of Investment Positions
Monthly flows are divided by U.S. investment positions. Regional totals are reported.

	pos	neg	net	sum
World	0.18	0.18	0.02	0.71
Western Europe	0.19	0.16	0.02	0.68
Latin America	1.38	1.09	0.58	4.35

the case. Net capital flows are associated with a "re-shuffling" of assets and investors. In other words, shocks that affect excess flows are also important to net flows. The dichotomy between heterogeneity and net aggregate outcomes does not exist.

4.3 The Variance of Gross Flows

This section describes the variance of gross and net flows. To facilitate the comparison across countries, I use flows scaled by investment positions. Table 4 presents the variance of gross and net flows.

The most striking feature of table 4 is the high variance of total flows. Total gross flows are far more volatile than net flows. The relative volatility of total gross flows is reflected in the positive correlation between gross inflows and outflows as discussed in the preceding section. It is unclear what type of shocks drive the variance of total flows. In terms of the framework of section 3, there are two factors which affect total flows: changes in transaction costs, c; and changes in the variance of idiosyncratic shocks b.

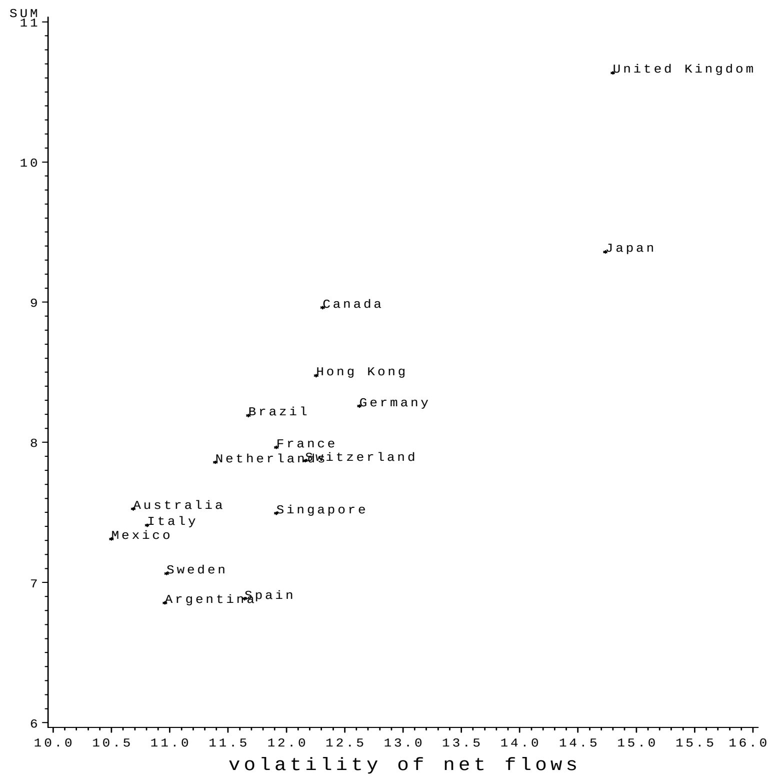
Effects of transaction costs on trading volume are studied in Campbell and Froot(1994). The higher these costs, the lower the gross flows. Changes in transaction costs are typically slow and infrequent. It is difficult to imagine that such changes could generate a high variance of total flows at high frequencies. This leaves changes in the variance of idiosyncratic shocks as an explanation. Karpoff(1986) describes how information flows affect trading volume. It is certainly conceivable that public announcements can change the variance of the idiosyncratic distribution. Straightforward and revealing information made available to all market participants can entirely collapse the idiosyncratic distribution (reduce b). Ambiguous or hard to interpret information may increase the variance of idiosyncratic shocks. The high variance of total flows suggests that these types of shocks are important. It appears that these shocks dominate shocks which affect net flows. It is curious that we know so little about where these shocks come from.

Both gross and net capital flows as a proportion of investment positions are markedly more volatile in Latin America than in Western Europe. This is entirely consistent with the popular perception that capital flows to developing markets are more volatile. Using table 4 I test another popular proposition. Foreign investors are often described as "rushing to exit" or "yanking out their investments". This view suggests that the volatility of sales should be greater than the volatility of purchases. Table 4 shows that this is not the case. In fact, gross outflows appear somewhat less volatile than gross inflows.

Another interesting question is whether the variance of net capital flows is related to the size of gross flows. If larger gross flows are associated with increased volatility of net flows, one may make an argument that reducing the volume of cross border trading could reduce the volatility of net capital flows. This is at the heart of the recent proposals for the introduction of a tax on cross border transactions (Tobin(1984), Eichengreen and Wyplosz(1996)). Such a tax would affect not only net flows but all flows. Therefore, this issue should be analyzed in the framework of gross flows. Yet, most of the attention focuses on net flows (see Dooley(1996)). Figure 1 shows scatter plots where the horizontal axis is the variance of net flows and the vertical axis is the size of gross flows. The net and gross flows are scaled by investment positions and the time period is 1995 through 1998. For this period, the investment positions are available for 14 countries. The graph shows that the size of gross flows is positively related to volatility of the net flows. This suggests that countries with relatively active foreign investors also have volatile net flows. While the causality of this relationship is unclear, the evidence suggests that scaling down gross cross border transactions may have an effect on the volatility of net flows.

Figure 1: Size of gross flows and variance of net flows

Gross and net equity flows are scaled by investment positions. The data are for 1995-1998, except for Brazil, Argentina and Singapore for which the data are 1997-98. The horizontal axis is the log of the variance of net flows; the vertical axis is the log of the mean of total gross flows.



4.4 The Persistence of Gross Flows

Gross flows are more persistent than net flows. Table 5 shows the coefficients on lagged terms in a simple AR(1) model of gross and net flows. It shows that both gross inflows and gross outflows are more persistent than net flows. This finding is robust to a different number of autoregressive terms. Table 3 in Froot et al(1998) show the same result, however, no comment is made in the text. Policy makers in countries which have been receiving a substantial amount of capital inflow are often concerned with their low persistence. Claessens et al(1996) show that different types of net capital inflows (foreign direct investment, portfolio flows, bank lending) are equally persistent. One way to address the persistence of net flows is to look into the persistence of gross flows and its sources.

Why are gross flows more persistent? Suppose that aggregate shocks were persistent.

Table 5: Average Auto-correlation Coefficients of Gross and Net Flows

Monthly gross and net flows for the period from 1989 through 1998 were linearly detrended. Auto-correlation coefficients were calculated from an AR(1) model run on a linearly detrended series. Average coefficients for geographic regions are reported.

	pos	neg	net	sum
Western Europe	0.74	0.81	0.24	0.81
Latin America	0.58	0.68	0.20	0.62
East Asia	0.76	0.86	0.29	0.83
Eastern Europe	0.37	0.32	0.17	0.39

This is quite plausible. For example, reforms in the economy are not isolated events but rather a series of actions (see Henry(1998)). Under rational expectations, investors would modify their trading strategies to account for this persistence and would follow a different decision rule. However, let us look at the implications of persistent aggregate shocks when investors follow our simple decision rules. Specifically, suppose that

$$\bar{\varepsilon}_t = \omega_t + \gamma\omega_{t-1}$$

where γ is less than one in absolute value and ω_t is white noise. It is easy to show that the autocorrelation coefficient for gross and net flows is the same and is equal to $\frac{\gamma}{(1+\gamma)}$. In the simple model of section 3, persistence of aggregate shocks results in equal persistence of gross and net flows. Persistent aggregate shocks therefore can not account for the observed persistence pattern.

Suppose that idiosyncratic shocks are persistent,

$$\varepsilon_{i,t} = \omega_{i,t} + \gamma\omega_{i,t-1}$$

Under this condition, the distribution of the idiosyncratic shock $\varepsilon_{i,t}$ depends on the distribution of $\omega_{i,t}$ and $\omega_{i,t-1}$. However, this distribution is time invariant. Gross flows are derived as the probability that an idiosyncratic shock falls into an interval. This probability is independent of the previous period probability. Therefore, the persistence of idiosyncratic shocks can not account for any persistence in aggregate gross and net flows. This suggests that low persistence of net flows may be due to heterogeneity rather than to non-persistent behavior or non-persistent shocks. At the individual level, flows may be persistent, but in the aggregate the persistence disappears. Still, the persistence patterns are puzzling.

Suppose the persistence of gross flows is taken as a given. Net flows are simply the difference between gross inflows and gross outflows. Given the persistence of gross flows, the persistence of the net flows can be derived. I assume that gross flows are generated by the following process:

$$\begin{aligned} pos_t &= \psi_t + \gamma\psi_{t-1} \\ neg_t &= \omega_t + \delta\omega_{t-1} \end{aligned}$$

where $E(\psi_t\psi_t) = \sigma_\omega$, $E(\omega_t\omega_t) = \sigma_\omega$, $E(\psi_t\psi_{t-1}) = 0$, $E(\psi_t\omega_t) = \rho_{\psi\omega}$, $E(\omega_t\omega_{t-1}) = 0$, $E(\psi_t\omega_{t-1}) = 0$. Shocks are independent across time but not contemporaneously. Under these conditions the persistence of gross and net flows is:

$$\begin{aligned} E(pos_t, pos_{t-1}) &= \gamma\sigma_\psi \\ E(neg_t, neg_{t-1}) &= \delta\sigma_\omega \\ E(net_t, net_{t-1}) &= \gamma\sigma_\psi + \delta\sigma_\omega - (\gamma+\delta)\rho_{\psi\omega} \end{aligned}$$

Since I assume that gross flows are persistent, both γ and δ are greater than zero. If the persistence of net flows is lower, it must be that the shocks ψ and ω co-vary positively, i.e. $\rho_{\psi\omega}$ is positive. This in turn implies that gross inflows and outflows are positively correlated. This again points to a contemporaneous relationship between gross inflows and gross outflows.

5 Conclusion

A number of patterns emerge from gross flows data. Firstly, gross flows in developing countries are strikingly large. They appear too large to be consistent with models which stress herding behavior and informational frictions as an explanation for the volatility of net capital flows. Secondly, total flows are highly volatile relative to net flows. The relative volatility implies a positive correlation between gross inflows and gross outflows. This positive co-movement is inconsistent with the notion that aggregate shocks are the main driving force behind capital flows. The high volatility of total flows is also related to a lower persistence of gross flows relative to net flows.

My interpretation of these findings is that shocks to total gross flows are larger and more volatile than shocks to net capital flows. A variation in the amount of trading by foreigners completely dominates the variation in net capital flows. Heterogeneity can give rise to trading and gross flows, but only changes in the level of heterogeneity will make gross flows volatile. What type of event can generate this variation? In the literature on trading volume, information flows and their dispersion create changes in trading (see Copeland(1976) and Comiskey et al(1986)). Perhaps a modeling strategy that includes information frictions may shed more light on the behavior of gross flows. The model in section 3 provides strong and provocative results. It captures plausible determinants of capital flows in a partial equilibrium setting, and serves as an instructive guide through the discussion of the stylized facts of gross flows. However, it is admittedly simple and ad-hoc, and it is possible that a different framework might be necessary to better explain the stylized facts.

Gross flows offer a new and exciting dimension to the study of capital flows. There is evidence that gross flows are related to the behavior of net flows. This means that gross flows do not represent a mere noise. Rather, there is a particular relationship which could be an important source of variation in net flows. In light of recent volatility and difficulties in managing international capital flows, it is essential to improve our understanding of both gross flows and the exact relationship between gross and net capital flows. This paper is a modest attempt to do so.

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