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June 2012

Online at <https://mpra.ub.uni-muenchen.de/42169/>

MPRA Paper No. 42169, posted 24 Oct 2012 14:39 UTC

# **The myth of the “cashless society”: How much of America’s currency is overseas?**

**Edgar L. Feige\***

## **Abstract**

The rapid growth of substitutes for cash, particularly debit and credit cards, has led economists to predict the advent of the “cashless society”. Yet cash holdings in most developed economies continue to grow and in the U.S., per capita currency holdings now amount to \$3000. This paper revisits the long-standing controversy concerning the whereabouts of U.S. cash. Specifically, we employ a previously confidential data source on net shipments of U.S. currency abroad to re-estimate the fraction of U.S. currency held overseas. Contrary to the widely cited figure that 65 percent of U.S. currency is abroad, we now find that direct evidence supports the notion that overseas holdings amount to less than 25 percent.

Currently, the official figure for the percent of U.S. currency held abroad as published by the Federal Reserve in their Flow of Funds Accounts and by the Bureau of Economic Analysis in the U.S. Balance of Payments Accounts is 37 percent. This official figure is a proxy variable that is supposed to mimic the previously confidential data series maintained by the New York Federal Reserve. Judson (2012) made this series public enabling us to discover that the official estimates of currency abroad require downward revision to reflect accurately the newly released data on actual cash shipments abroad.

We also review the “indirect” approaches to estimating the fraction of currency overseas employed by Porter and Judson (1996) and Judson (2012). We find that these indirect methods to be innovative but deeply flawed due to violations of their restrictive assumptions. Moreover, sensitivity analysis reveals the estimates highly sensitive to alternative specifying assumptions. We conclude that the large estimates of currency abroad obtained by these methods are spurious.

The paper also examines the temporal pattern of overseas holdings of U.S. currency and finds that the observed decline in the demand for U.S. cash abroad coincides with the growing popularity of the Euro and its growth as a second currency held outside the Euro area between 2003 and 2008. These new findings have significant implications for estimating the *domestic* money supply and other domestic monetary aggregates; for estimating the net benefits of seigniorage earnings of the Federal Reserve; for forecasting changes in output and prices and for estimating the amount of unreported income and tax evasion in the U.S.

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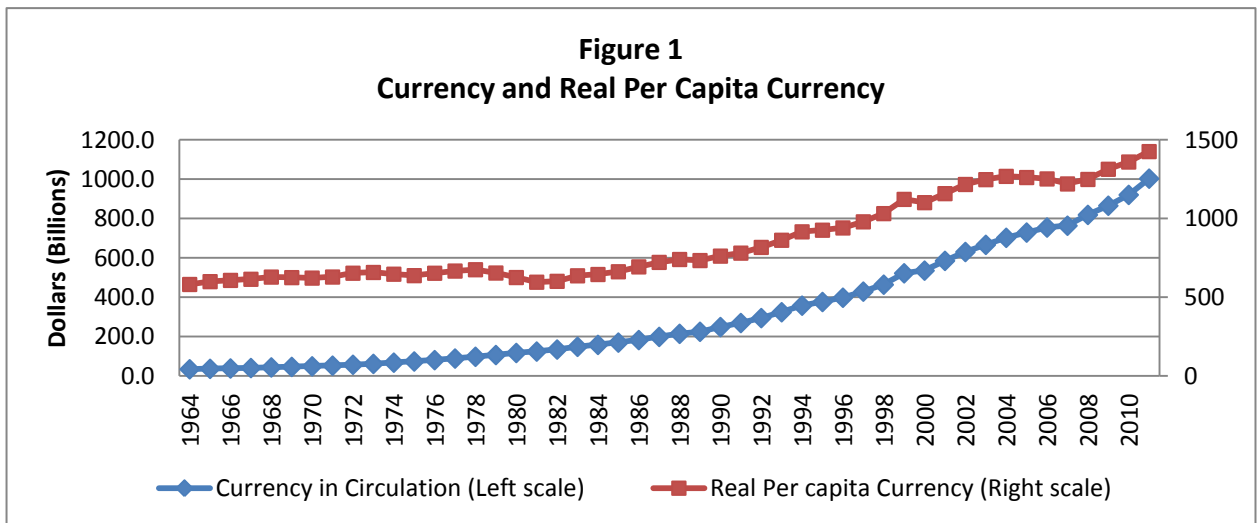
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# The Myth of the “Cashless Society”: How much of America’s currency is overseas?

Edgar L. Feige<sup>11</sup>

## Introduction: The Currency Enigma

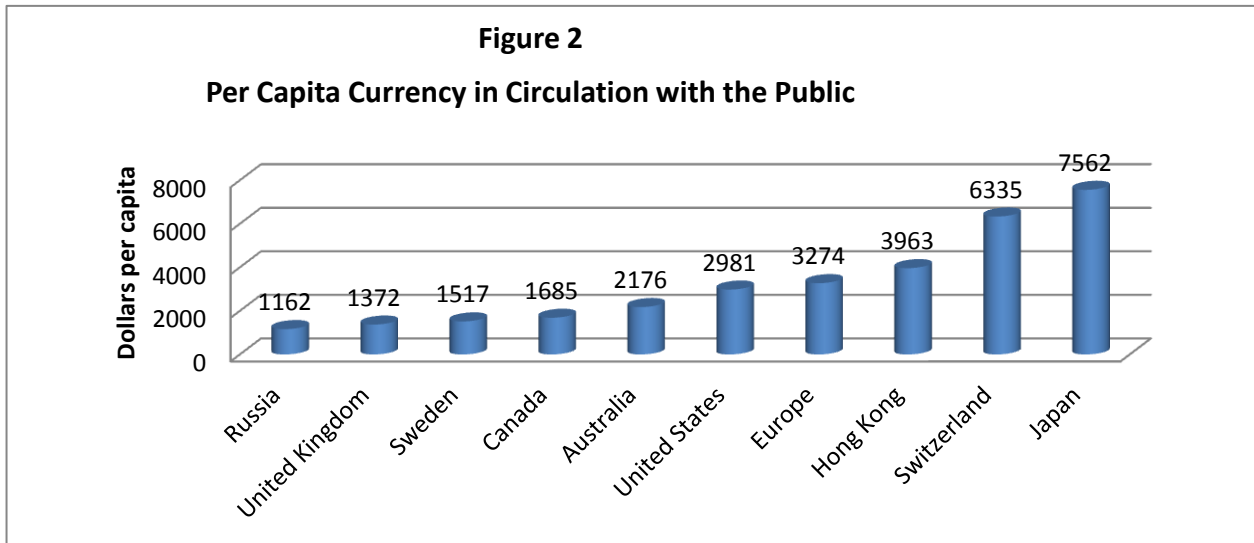
Over the past decades, we have witnessed a host of cash-saving financial innovations, leading to widespread predictions of the advent of the “cashless society”. However, contrary to these expectations, the demand for U.S. dollars continues to rise and we remain awash in cash. As revealed by Figure 1, by the end of 2011, U.S. currency in circulation with the public<sup>2</sup> had risen to \$1 trillion dollars, amounting to more than \$3000 for every man, woman and child in the country. Over the last twenty years, real *per capita* currency holdings increased by 82 percent and currency as a fraction of the M1 money supply increased from 30 percent to 45 percent.



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<sup>2</sup> The currency data used in the paper is the currency component of the M1 money supply defined as currency outside U.S. Treasury, Federal Reserve Banks and the vaults of depository institutions. (Not seasonally adjusted). (<http://www.federalreserve.gov/releases/h6/hist/h6hist4.pdf>). The “currency outside banks” series from the Flow of Funds Accounts of the United States Z.1 (Table L 204, line 6) (not seasonally adjusted) is typically somewhat larger than the currency component series. .

To put these figures in perspective, they imply that the average American’s bulging wallet holds roughly 91 pieces of U.S. paper currency, consisting of: 31 one dollar bills; 7 fives; 5 tens; 21 twenties; 4 fifties and 23 one hundred dollar bills. Few of us will recognize ourselves as “average” citizens. Clearly, these amounts of currency are not normally necessary for those of us simply wishing to make payments when neither credit/debit cards nor checks are accepted or convenient to use. Yet as shown in Figure 2, these surprisingly high U.S. per capita currency values were exceeded by per capita currency values for Europe (\$3274); Hong Kong (\$3963), Switzerland (\$6335) and Japan (\$7562).



Source: Bank for International Settlements. 2010 Data.

Federal Reserve surveys (Avery et al. 1986, 1987) of household currency usage found that U.S. residents admitted to holding less than 10 percent of the nation’s currency supply. Businesses (Anderson, 1977; Sumner, 1990) admitted to holding only 5 percent. An even greater puzzle emerges from the Japanese Survey of Household Finances. In 2007, Japanese households admitted to holding only 10 percent of the nation’s cash in circulation.<sup>3</sup> Yet Japan’s per capita currency holdings are two and a half times larger than those in the U.S. These surveys suggest that the whereabouts of 85 -90 percent of some

<sup>3</sup> Fujiki and Tanaka (2009)

nation's currency supplies are unknown, suggesting that the "currency enigma" (Feige 1989, 1994) is still very much with us.

A growing body of evidence suggests that portions of some national currencies are held outside of the issuing country. Leung et. al. (2010) estimates that 50-70 percent of Hong Kong dollars circulate outside of Hong Kong and the European Central Bank (2011) estimates that 20-25 percent of euro banknotes circulate outside the euro area. The amount of Swiss currency in circulation outside of Switzerland is unknown and very few Japanese Yen circulate outside of Japan. The whereabouts of the U.S. currency supply is the key issue this paper seeks to address.

## **2) The controversy over the location of U.S. currency.**

Research in the early nineties witnessed a number of studies attempting to estimate the fraction of U.S. currency held abroad, resulting in an empirical controversy that persists to this day. Examining direct data sources<sup>4</sup> on net outflows of U.S. currency (Feige, 1994), and indirect methods, (variants of monetary demography models) Feige (1996) concluded, "that roughly 36 percent of U.S. currency is held abroad". Examining the veracity of alternative methods of estimating overseas currency holdings, Feige (1997) suggested that the most plausible range of estimates was between 25-45 percent. Doyle (2000) subsequently estimated that in 1995, 30 percent of U.S. currency was abroad.

Porter and Judson (1996) obtained very different results. Their main finding, based on an innovative, albeit fragile, indirect "seasonal" method was that 70 percent of the nation's currency was abroad. Taking account of alternative estimation methods, Porter and Judson reported a "median flow estimate" for 1995 of 55 percent abroad, similar to the estimate produced by Anderson and Rasche (1997) of 53.2 percent. Porter and Judson concluded, "that between 55 percent and 70 percent of the U.S. currency stock" was "held outside the country".<sup>5</sup>

Most recently, Feige (2012) revisited the question of how much of America's currency was held abroad, and brought to light the fact that the Federal Reserve publishes

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<sup>4</sup> These included both Currency and Monetary Instrument Reports (CMIR) and the Federal Reserve Bank of New York's (FSN) confidential wholesale currency bulk transport data.

<sup>5</sup>Porter and Judson (1996), p. 899.

an “official” estimate of the amount of currency held abroad as part of its regular statistical reporting in its Flow of Funds Accounts.<sup>6</sup> The U.S. Department of Commerce’s Bureau of Economic Analysis also employs this estimate and regularly publishes it in the U.S. Balance of Payments Accounts.<sup>7</sup> The official Flow of Funds/Bureau of Economic Analysis (FOF/BEA) figure<sup>8</sup> reveals that at the end of 2010, 37 percent of the nation’s currency supply held outside of banks was overseas (\$342 billion) and the comparable estimate for 2011 was 39 percent or (\$397 billion). Yet despite these official published figures, various Federal Reserve sources continue to cite the much higher figure reported in the fifteen-year-old Porter/Judson (1996) study. For example:

*“Roughly 75 percent of hundred-dollar notes, 55 percent of fifty dollar notes, and 60 percent of twenty-dollar notes are held abroad, while about 65 percent of all U.S. banknotes are in circulation outside the country. Approximately \$580 billion in physical U.S. currency outstanding was circulating overseas at the end of March 2009”* Goldberg (2010a)

*“More than 70% of hundred-dollar notes and nearly 60% of twenty- and fifty-dollar notes are held abroad, while two-thirds of all US banknotes have been in circulation outside the country since 1990”* Goldberg (2010b)

*“The Federal Reserve estimates that as much as two-thirds of currency in circulation is held abroad.”* Roseman (2010)

*“nearly two thirds of U.S. currency is held outside our borders.”* Federal Reserve Bank of San Francisco (2012)

*“Recent estimates show that between one-half and two-thirds of the value of U.S. currency in circulation is held abroad.”* Board of Governors of the Federal Reserve System, (2012)

One cannot readily dismiss the confusion caused by these paradoxical assertions since an accurate estimate of the fraction of U.S. currency held abroad and the frequency of its use (currency turnover) have important implications for a variety of economic issues. From the perspective of conducting domestic monetary policy, the relevant monetary aggregates to consider are the *domestic* money supply and the *domestic* monetary base (Feige, 1994). In order to determine the *domestic* monetary aggregates, the

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<sup>6</sup> Federal Reserve Statistical Release Z.1 Flow of Funds Accounts of the United States. The estimated amount of U.S. currency held abroad appears on line 25 of Table L.204.

<sup>7</sup> Bureau of Economic Analysis, (2008)

<sup>8</sup> Federal Reserve Statistical Release Z.1 Flow of Funds Accounts, June 7, 2012, p.93.

Federal Reserve needs to have an accurate estimate of the fraction of U.S. currency held abroad and the annual net outflow of U.S. currency going abroad. This knowledge is also required for operational decisions regarding the production, provision and maintenance of the U.S. currency supply. Similarly, foreign monetary authorities need to know the extent to which their nations are “*de facto* dollarized” (Feige et. al., 2003), and the magnitude of net inflows of foreign currencies into their economies. *De facto* dollarization reduces the effectiveness of exchange rate stabilization policies and reduces seigniorage revenues. The volatility of foreign demand for U.S. currency increases the difficulty of formulating appropriate domestic monetary policy.

Accurate estimates of the amount of U.S. currency circulating abroad are also essential for calculating the net seigniorage benefit to U.S. taxpayers obtained by virtue of the fact that the U.S. government effectively obtains an interest free loan from foreigners holding U.S. dollars. According to the 2010 annual report of the Board of Governors, the Federal Reserve obtained \$667 billion dollars in total seigniorage income between 1990 and 2010. Domestic seigniorage earnings (based on the fraction of U.S. currency held at home) simply represent a redistribution of income from U.S. currency holders to U.S. taxpayers. On the other hand, seigniorage earnings on currency held abroad represent a net transfer of real resources from foreign currency holders to U.S. taxpayers. Based on official (FOF/BEA) estimates of overseas holdings, American taxpayers experienced a cumulative seigniorage windfall of \$244 billion since 1990 from the overseas holdings of U.S. currency. However, based on the foregoing assertions of Federal Reserve officials who claim that two thirds of the U.S. currency supply was abroad during this period, we would conclude that U.S. taxpayers had obtained a cumulative seigniorage benefit of \$434 billion since 1990. Discrepancies of this magnitude suggest that resolution of this empirical conflict requires serious attention.

Feige (2012) demonstrates that accurate estimates of the fraction of U.S. currency held abroad also have important implications for assessing counterfeiting dangers; for our ability to forecast changes in prices and output; and for estimating the magnitude of the unreported economy and tax evasion. The widespread use of U.S. currency abroad increases the likelihood of counterfeiting, since foreign users are less familiar with the dollar than domestic users, making the passing of counterfeit notes abroad easier than at

home. The whereabouts of America's cash also has fiscal consequences. U.S. currency is a preferred medium of exchange for facilitating clandestine transactions, and for storing illicit and untaxed wealth. Knowledge of its location and usage is required to estimate the origins and volume of illicit transactions. These include the illegal trade in drugs, arms and human trafficking as well as the amount of "unreported" income, that is, income not properly reported to the fiscal authorities due to noncompliance with the tax code. The fiscal revenue lost to the government creates a "tax gap" that measures the extent to which taxpayers do not pay the amount they legally owe to the Federal Government in a timely manner. The problem of tax evasion is even more salient in times of severe fiscal deficits. Improved tax compliance reduces fiscal deficits.

In short, our understanding of a number of key monetary and fiscal issues depends upon answers to two key empirical questions: 1) What fraction of the U.S. currency supply is held abroad and 2) how has the amount of U.S. currency held abroad changed over time? Earlier answers to these questions have relied on two distinct approaches: direct measures of inflows and outflows of U.S. currency and indirect methods employing various versions of monetary demography models.<sup>9</sup> We first update earlier direct estimates of currency abroad with newly acquired direct source data on net bulk currency shipments overseas. This data has been reported to the New York Federal Reserve Bank by wholesale currency shippers since 1988 but was regarded as confidential until Judson (2012) recently released it. To anticipate our results, these newly released data suggest that only 25 percent of U.S. currency is abroad. Further investigation of informal channels of currency flows abroad due to travel and immigrant remittances reinforces this conclusion.

We then reexamine the indirect approaches that were responsible for the initial Porter/Judson (1996) claim that between 55 and 70 percent of U.S. currency was held abroad. We find that some key assumptions of their monetary demography models are grossly violated by available information and that the results of the "seasonal" model are so sensitive to specifying assumptions as to raise serious doubts concerning their reliability.

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<sup>9</sup> Feige (1996; 1997; 2012) presents detailed information concerning each of these approaches.



### **3) Direct Measures of Net Currency Outflows Abroad**

#### **A) Net bulk shipments of U.S. currency abroad**

The most direct methods for estimating the fraction of currency held abroad rely upon data systems designed to track currency outflows and inflows to and from abroad. Two such information systems are the U.S. Customs Service Currency and Monetary Instrument Reports (CMIR)<sup>10</sup> and the New York Federal Reserve Bank's (FSN) records of net international wholesale currency shipments abroad.<sup>11</sup> The CMIR data is not longer readily available and their accuracy has been diminished since the mid 1990's because of the establishment of Federal Reserve Extended Custodial Inventory (ECI) sites abroad.<sup>12</sup> As such, The New York Federal Reserve Bank's data on net bulk shipments of U.S. currency abroad (FSN) are the best measure of net currency flows abroad.

Specialist wholesale bulk banknote dealers handle most of the U.S. currency that flows into or out of the country and they report the amount, origin and destination of their currency shipments to the New York Federal Reserve. These bulk shippers satisfy the overseas demand for U.S. currency by overseas commercial banks that in turn make the U.S. currency available to exchange bureaus, firms and individuals abroad. Similarly, when overseas banks find themselves with excess U.S. currency, they return the banknotes to the U.S via wholesale banknote shippers and who report the transactions to the New York Federal Reserve Bank. Unfortunately, the New York Federal Reserve Bank has historically regarded this critical data set as confidential. As a result, the official Federal Reserve Flow of Funds estimates of U.S. currency flows abroad<sup>13</sup> are based on a proxy variable (NYLAM) designed to mimic the confidential series (FSN) of net bulk shipments of U.S. currency. A recent paper by Judson (2012) presented at this conference, finally disclosed these previously confidential aggregate annual net currency shipments (FSN).

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<sup>10</sup> Currently known as the Report of International Transportation of Currency or Monetary Instruments (FinCEN Form 105).

<sup>11</sup> Both of these data systems are described, compared and evaluated in Feige (1996, 1997, 2012).

<sup>12</sup> See Feige (2012) and Judson (2012) for an elaboration of the present deficiencies of the CMIR data.

<sup>13</sup> Federal Reserve Flow of Funds Accounts, Z.1 Table F -204

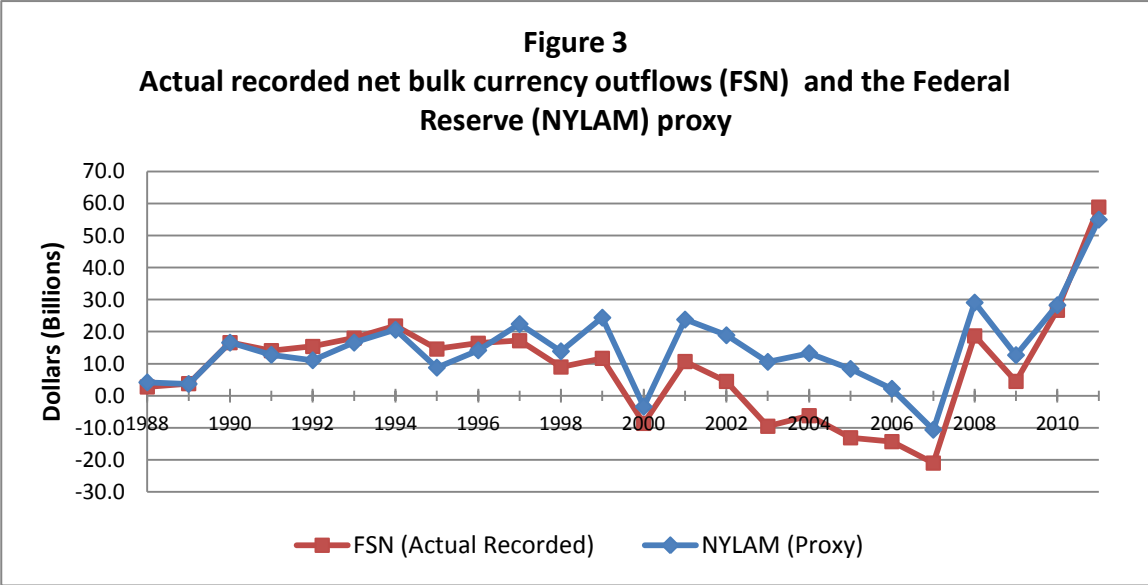


Figure 3 reveals that although the official Federal Reserve (NYLAM) proxy is highly correlated (.87) with the actual recorded bulk shipment (FSN) data it attempts to mimic, between 1997 and 2010 the (NYLAM) proxy consistently overestimated actual net currency outflows.

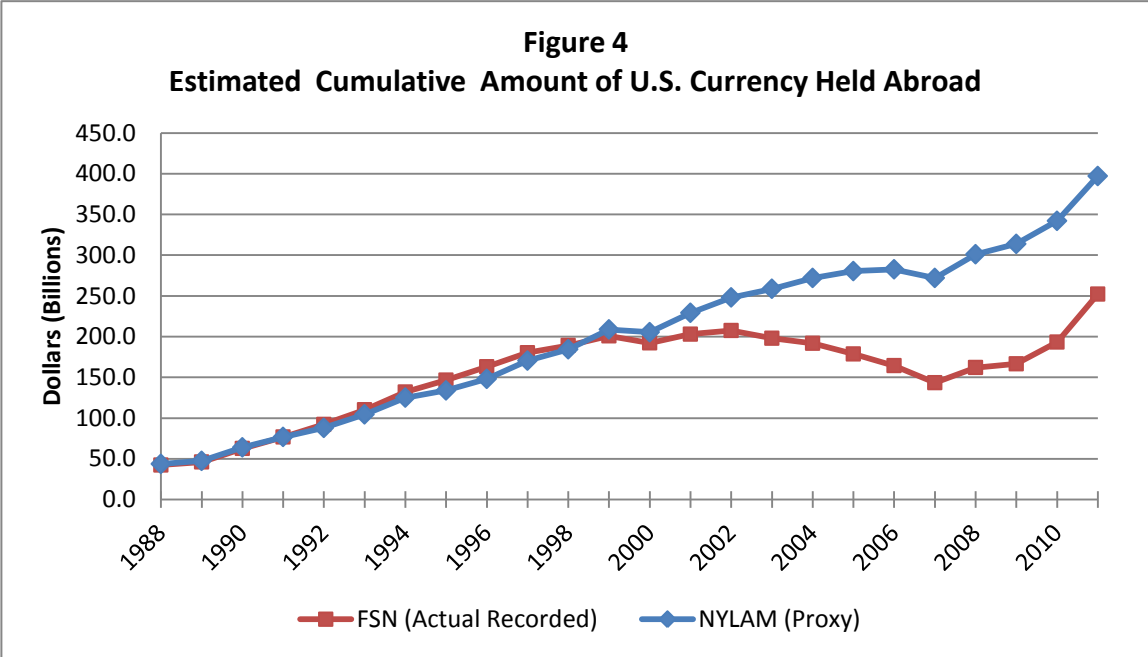


Figure 4 shows that by 2011, the NYLAM proxy (which the Federal Reserve employed as its “official” published figure) estimated the cumulative amount of U.S.

currency overseas to be \$397 billion, whereas the cumulative amount overseas estimated by the actual net bulk shipment series (FSN) amounted to only \$252 billion. Moreover, the temporal pattern suggested by the two series is quite distinct. According to the actual reported FSN data, overseas demand for U.S. currency declined substantially between 2003 and 2007 by roughly \$50 billion and rose again in the aftermath of the financial crisis of 2008. This pattern is entirely consistent with the findings of the European Central Bank (2011) and Augustin (2011), which suggest that the demand for Euros outside the euro area increased substantially during the period that the demand for dollars fell. In short, the decline in overseas demand for dollars is entirely consistent with the hypothesis that the euro was substituted for the dollar as a second currency in countries on the periphery of the euro area. Conversely, shipments of Euros to regions outside the euro area ceased to grow after 2008 while the demand for U.S. currency abroad resumed its upward trend, suggesting that U.S. currency replaced Euros in periphery countries because of the growing debt crisis in Europe.

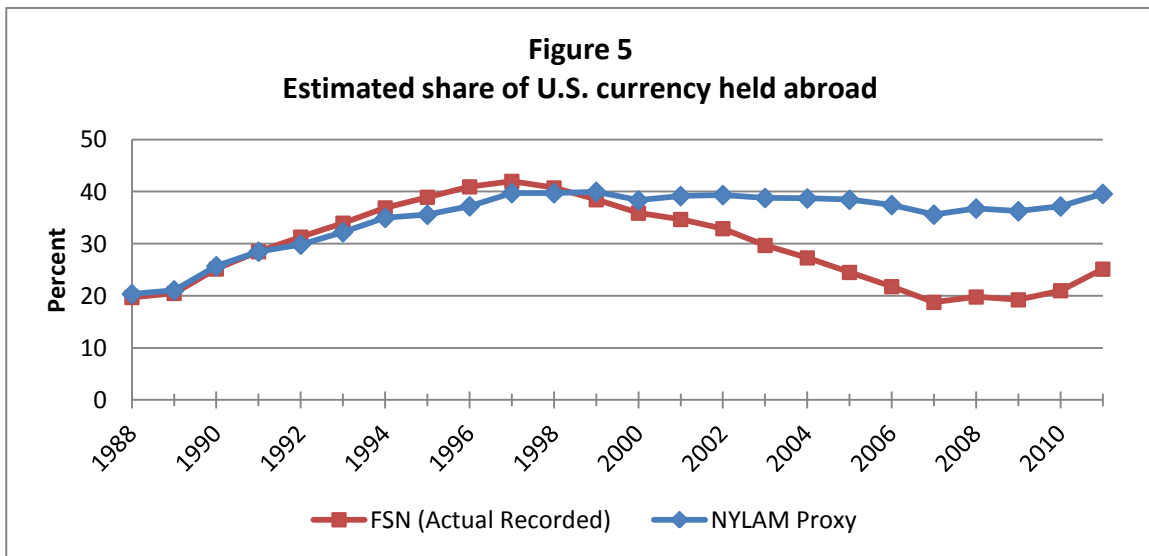


Figure 5 displays the alternative estimated shares of U.S. currency held abroad. According to the “official” FOF/BEA published NYLAM proxy based figures, the share of U.S. currency held abroad remained within the narrow range of 35-40 percent between 1994 and 2011. The newly released bulk shipment data (FSN) suggest that the share of currency held abroad peaked at 42 percent in 1997 and then fell dramatically to a low of

19 percent in 2007, recently increasing to a share of 25 percent by the end of 2011. The dramatic in U.S. cash shipments to the former USSR and Argentina between 1989 and 1997 and the equally dramatic fall in such shipments between 1997 and 2008 explains this pattern.<sup>14</sup>

To summarize, the newly released New York Federal Reserve data on recorded net bulk shipments of U.S. currency abroad indicate that the “official” FOF/BEA estimates of overseas currency based on the NYLAM proxy have overestimated the amount of U.S. currency abroad since 1998. By 2011, it appears that \$150 billion of U.S. cash previously believed to be abroad was in fact in circulation domestically. Moreover, the current share of U.S. currency held abroad is closer to 25 percent than the officially published estimate of 40 percent. The recorded decline in the demand for U.S. currency abroad between 2002 and 2007 appears to be the result of euro substitution for the dollar in countries outside the euro area.

#### **B) Informal net flows of currency abroad due to travel and immigrant remittances**

The foregoing estimates of U.S. held abroad based on net bulk wholesale shipments are incomplete insofar as they do not reflect currency hand carried or mailed in to or out of the country by travelers or guest workers in the form of immigrant remittances. They may also exclude some currency shipments into or out of the country by non-reporting shipping entities and may include errors due to some deliberate falsification of reports by bulk shippers.<sup>15</sup> However, we have no a priori way of knowing whether such omissions lead to an over or under estimate of the amount of currency held abroad.

Judson (2012) makes the highly implausible claim that informal or “retail” channels of net U.S. currency outflows could exceed recorded wholesale net shipments (FSN) by more than \$300 billion.<sup>16</sup> If her “admittedly crude”<sup>17</sup> approach were taken seriously, it would imply that 52-53 percent of U.S. currency is presently held abroad,

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<sup>14</sup> See Judson (2012) Figure 8.

<sup>15</sup> In 2003, the Federal Reserve terminated its Extended Custodial Inventory (ECI) agreement with UBS and in 2004 followed with a \$100 million civil penalty after discovering that UBS had falsified its reports of overseas shipments to the Federal Reserve over an eight year period. (Pasley, 2005)

<sup>16</sup> Judson (2012) Figure 11A.

<sup>17</sup> Judson, (2012) p. 16.

more than double the estimate based on the FSN data. Rather than attempt to directly estimate the impact of travel and immigrant remittances on the amount of U.S. cash held overseas, Judson arbitrarily selects a group of countries “known to have significant tourism or significant populations of immigrants or migrant workers in the United States” and “ a group of countries whose total net shipments is substantial and negative”.<sup>18</sup> Without identifying the countries she has thus selected, nor indicating the amounts of net shipments of cash to or from those countries, she simply assumes that the currency flowing back into the U.S. from each of these unspecified countries was zero. This is tantamount to simply throwing out over \$300 billion dollars of net currency inflows reported to the Federal Reserve Bank of New York by bonded professional wholesale currency shippers. This “very rough adjustment”<sup>19</sup> is both arbitrary and implausible. Similarly, Judson’s use of the “adjusted shipment proxy series” lacks credibility since the Federal Reserve and the Bureau of Economic Analysis<sup>20</sup> abandoned it fifteen years ago precisely because it took no account of reflows of currency known to be received by the Miami cash office from Latin America and from the Los Angeles cash office from Asia.

Judson’s general observation that “retail” or informal channels of currency flows may affect our estimates of the amount of U.S. currency held abroad is indisputable, as is her suggestion that the primary informal currency flows are likely to arise due to immigrant remittances and travel. The challenge is therefore to estimate the net size of these flows from the available evidence.

Estimates of immigrant remittances are obtained from the U.S. Balance of Payments records of “private remittances and other transfers”,<sup>21</sup> a key component of which are remittances representing “personal transfers by foreign born population”. In order to estimate the fraction of these transfers made in cash, we rely on survey information provided by the Banco de Mexico of remittances by type of transfer payment.<sup>22</sup>

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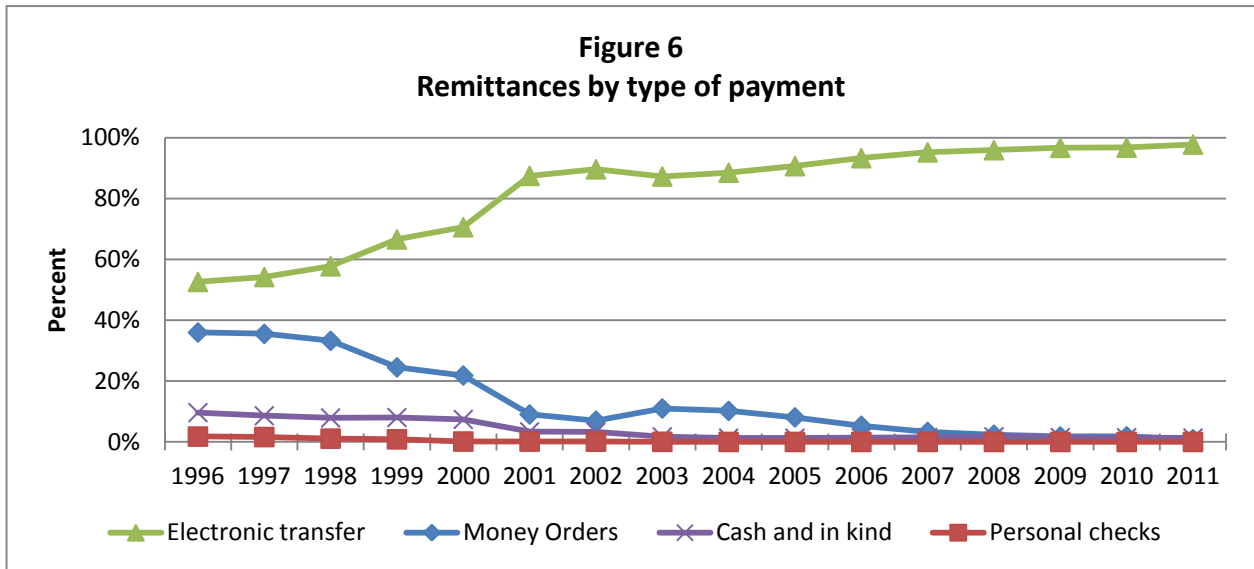
<sup>18</sup> Judson (2012) p. 15.

<sup>19</sup> Judson (2012) p.15.

<sup>20</sup> Bach (1997)

<sup>21</sup> U.S. International Transactions Accounts: June 13, 2012 Table 1 Line 38.

<sup>22</sup> I am indebted to Roberto Coronado of the San Francisco Federal Reserve for providing the data and necessary translations of the Banco de Mexico survey.



Source: Banco de Mexico

Figure 6 reveals that the vast majority of immigrant remittances are transferred by electronic means, which presently amount to 98 percent of all transfers. Cash payments, which in 1996 accounted for roughly 10 percent of all remittance transfers now account for just 1 percent. We obtain our annual estimate of total cash outflows of U.S. currency due to immigrant remittances by multiplying the personal transfers of foreign born by the fraction of remittances transferred in cash. We find that cumulative cash remittances made since 1988 amount to roughly 11 percent of cumulative wholesale shipments as recorded in the FSN data.

The U.S. Balance of Payment Accounts also records travel and tourism expenditures of inbound (exports) and outbound (imports) travelers.<sup>23</sup> Moreover, the Commerce Department’s Office of Travel and Tourism conducts annual surveys of overseas travelers to the U.S. and of U.S. resident travelers visiting overseas destinations. These inbound and outbound survey profiles include estimates of the fraction of total travel expenditures made in cash by incoming and outgoing travelers. We are therefore able to estimate the volume of cash expenditures made by inbound and outbound travelers. A sizable and growing portion of these cash expenditures are made with currency obtained from ATM machines or exchange bureaus in the destination country.

<sup>23</sup> The data source is U.S. Department of Commerce, (2012)

Assuming that foreign travelers to the U.S. bring U.S. currency into the country for twenty percent of their cash expenditures and American travelers going abroad make twenty percent of their cash expenditures with dollars taken out of the U.S. and, we can estimate the magnitude of informal “retail” inflows and outflows of U.S. currency due to travel. We find that the net effect of travelers transferring cash is to reduce the estimate of currency abroad since inbound travelers bring more cash into the country than outbound travelers take out.<sup>24</sup>

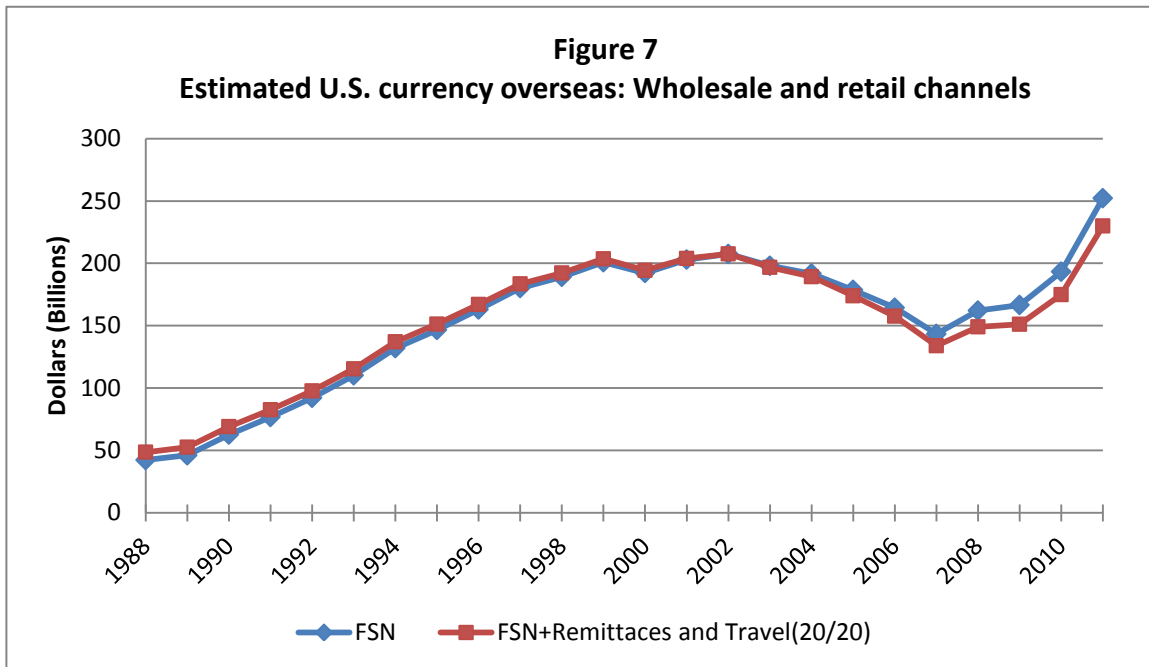


Figure 7 summarizes our estimates of the amounts of U.S. currency held abroad taking account of both net wholesale shipments as reported to the New York Federal Reserve (FSN) and estimates of “retail” or informal channels of cash transfers arising from immigrant remittances and travel. By 2011, these direct measurements suggest that U.S. currency abroad amounts to roughly \$230 billion, or 23 percent of the outstanding currency supply held by the public. The most significant conclusion resulting from our

<sup>24</sup> It should be noted that if we alternatively assume that inbound travelers pay 20 percent of their cash expenditures with U.S. currency obtained abroad and that U.S. travelers going overseas pay for 15 percent of their cash expenditures with dollars taken abroad, this reduces our estimate of overseas currency by an additional \$20 billion.

review of direct measures of overseas currency is that far less currency appears to be circulating overseas than was previously thought to be the case.

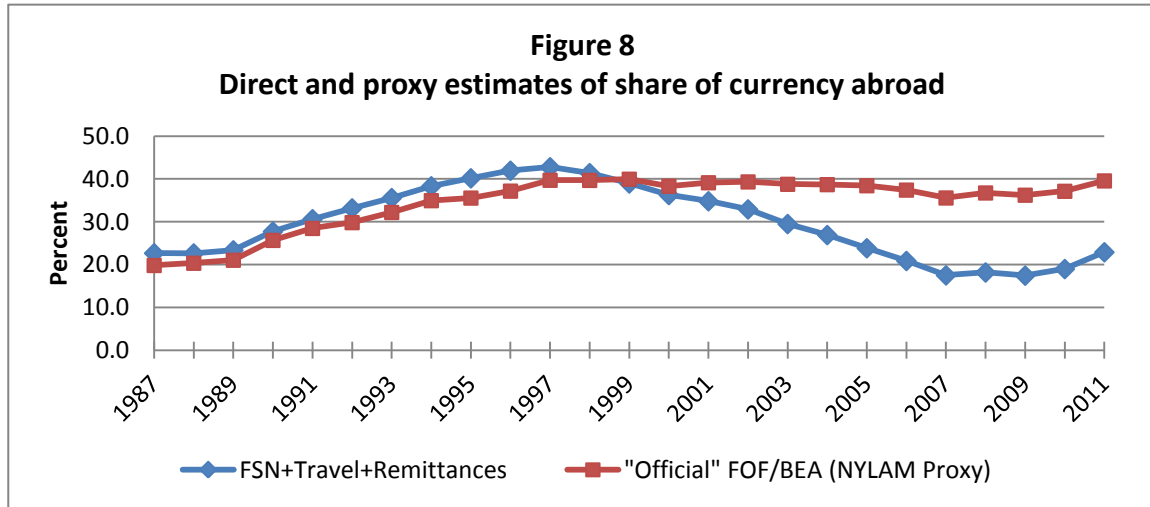


Figure 8 compares the share of U.S. currency held abroad as measured by direct estimates of wholesale and retail cash flows to the “official” published FOF/BEA estimates that relied on the NYLAM proxy. It appears that from 1987-1998, the NYLAM proxy underestimated the share of currency abroad, whereas in the most recent decade, the proxy appears to have overestimated the share of currency abroad. The direct measurement approach reveals that the share abroad rose abruptly from 23 percent in 1987 to a high of 43 percent in 1997 and then subsequently declined reaching a low point of 18 percent at the end of 2007. Note that both series suggest that the amount of currency held abroad was significantly less than the oft-cited claim that between 55 to 70 percent of U.S. currency was abroad. We now turn to an investigation of the indirect methods of estimating overseas currency that are the basis of this latter claim.

#### 4) Indirect Measures of Currency Abroad

##### A) The simple monetary demography model.

A simple indirect means of estimating currency abroad employs some variant of the monetary demography model<sup>25</sup>. The monetary demography model (MDM) basically

<sup>25</sup> Feige (1996,1997)



assumes that any observed characteristic of the U.S. currency supply ( $X$ ) can be decomposed into an unobserved domestic component ( $X^d$ ) and an unobserved foreign component ( $X^f$ ) such that  $X = X^d + X^f$ . Now assume that there exists a country very similar to the U.S. (say Canada) except that it must neither import foreign currency nor export its own currency to other countries. Since its own currency is assumed to have no foreign characteristic,  $Y$  might then be assumed to behave like the domestic component of the U.S. currency supply such that,  $Y \approx X^d$ .

Then, if  $X = Y + X^f$ , one can obtain an estimate of the unobserved fraction of  $X$  made up by its foreign component since,  $X^f/X = 1 - Y/X$ . Often some observable Canadian characteristic related to Canadian currency is taken to represent the comparable unobserved domestic characteristic of the U.S. currency supply. For example, we can consider the currency/GDP ratio (Judson, 2012), currency per capita, or the ratio of currency to wages and salaries (WS) as possible characteristics.<sup>26</sup>

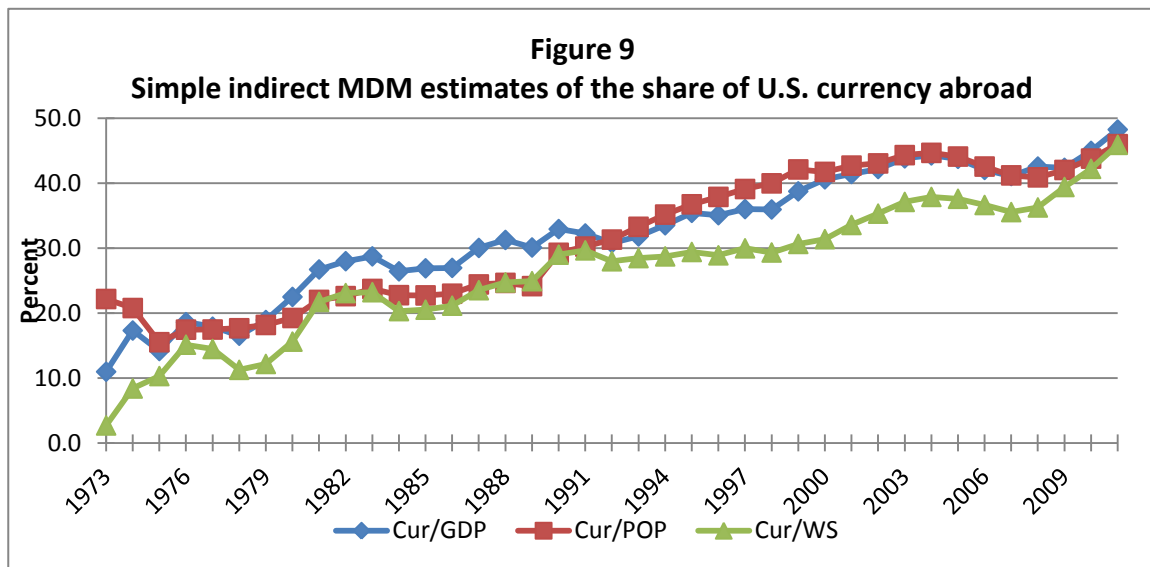


Figure 9 presents the results of some simple variants of the MDM model.<sup>27</sup> First, we note that the temporal path is highly sensitive to the particular characteristic chosen; hence, the estimates are not robust to simple changes in the model specification. The

<sup>26</sup> Feige (1996, 1997), Porter, and Judson (1996) also employ age, note quality, coin/note ratios and seasonal characteristics.

<sup>27</sup> Judson (2012) p.11-12 obtains similar results.

results also suggest that 46 percent of U.S. currency is currently overseas, roughly double the figure obtained by the direct estimation procedure.

This discrepancy is likely due to a serious violation of one of the key assumptions underlying the simple MDM model, namely, that Canada does not import any foreign currency. If for example, Canadians at various times employed U.S. dollars as a substitute currency, this would violate the assumption that  $Y \approx X^d$ , because the observed Canadian currency supply would be abnormally small, resulting in an overestimate of the share of U.S. currency held abroad ( $X^f/X$ ). Murray and Powell (2002) present evidence that demonstrates that this key assumption is violated.

*“CMIR data suggest that the amount of U.S. dollars in circulation at their peak in 1994 was more than 30 percent of the outstanding stock of Canadian notes and coin in circulation.” (P.23) “Fed data for 1990-2001 generally corroborate the CMIR data, although the cumulative net inflows are roughly double those of the CMIR” (p. 21)*

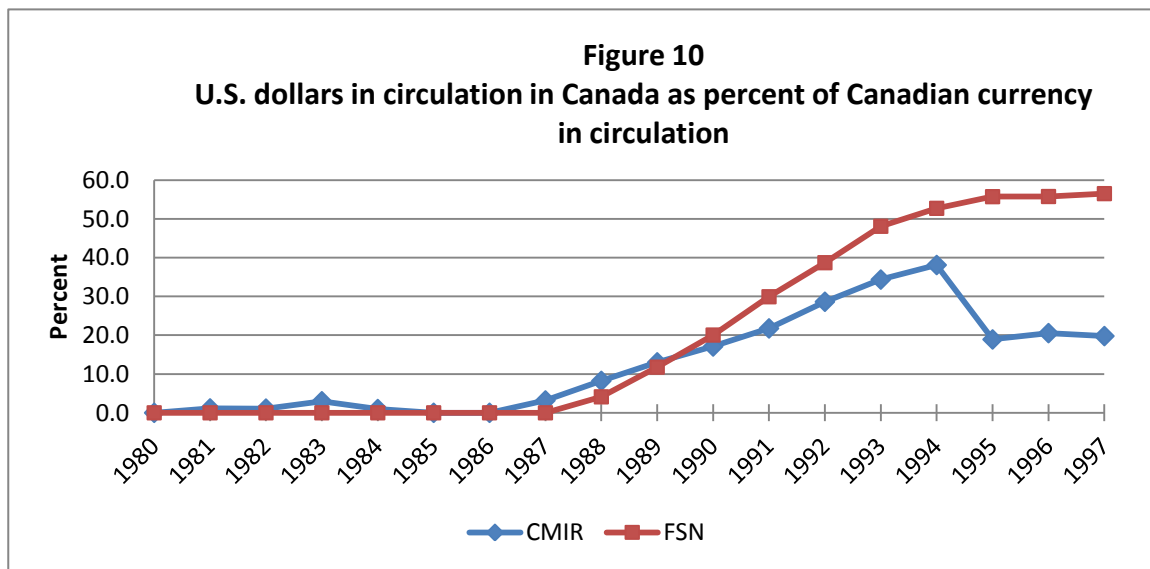


Figure 10 displays the extent of the use of U.S. dollars in Canada based on the actual CMIR and Federal Reserve (FSN) data for the period 1980 – 1997. According to the CMIR data, by 1994, U.S. currency amounted to 38 percent of Canadian currency in circulation, whereas the FSN data suggest that this percentage had risen to 57 percent by 1997. The fact that between 28 and 36 percent of all currency in circulation (U.S. plus

Canadian) was in the form of U.S. dollars implies a gross violation of the key assumptions of the MDM models and hence makes the results presented in Figure 9 and the similar ones presented by Judson (2012) highly suspect. Since neither the CMIR data nor the FSN data are available on a country basis for the period of the past decade, it is impossible to tell whether the demand for U.S. currency increased or decreased during this period.

**B) The “seasonal” variant of the monetary demography model.**

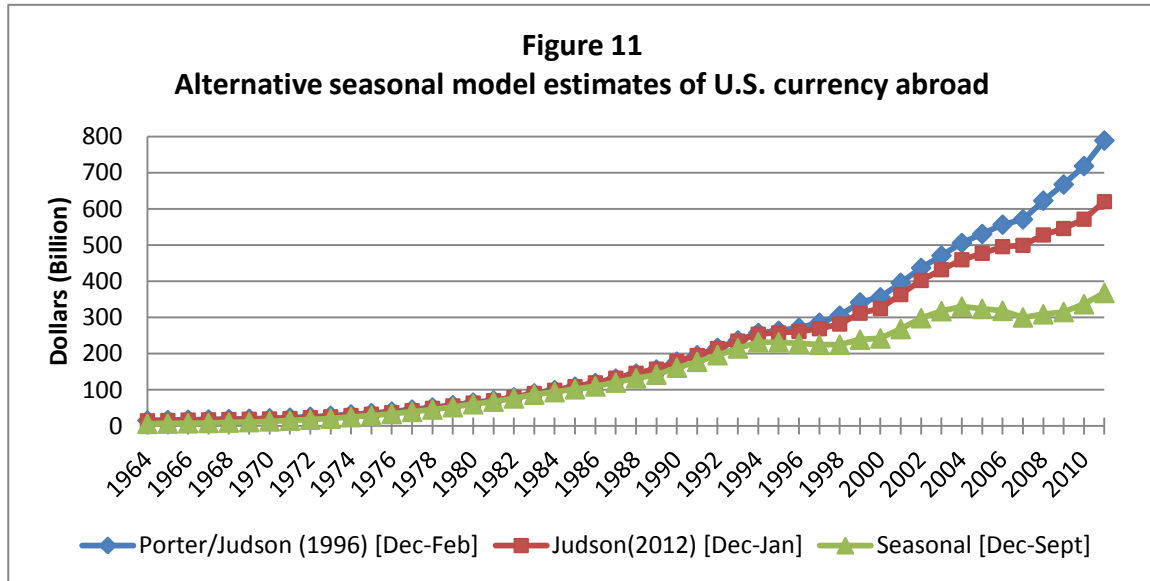
At the outset, it is important to note that the repeated assertions that as much as two thirds of the U.S. currency supply circulates abroad is almost entirely based on the results reported by Porter and Judson (1996) derived from the “seasonal” variant of the monetary demography model. The seasonal variant of the monetary demography model requires a set of highly restrictive assumptions. Porter and Judson (1996) and Judson (2012) assume that:

- 1) “the seasonal amplitude, or the percentage difference between the seasonal peak and trough of the domestic demand for U.S. currency is virtually identical to the demand within Canada for Canadian dollars”;
- 2) “that the foreign demand for U.S. dollars has no significant seasonal pattern, or correspondingly, that the seasonal amplitude for the foreign component of demand for U.S. dollars is zero”;
- 3) “that the circulation of Canadian dollars outside of Canada is negligible.”
- 4) “that U.S. currency is not used to a substantial degree inside Canada.”

As demonstrated in section 3A above, the fourth assumption is grossly violated, thereby invalidating empirical results based on it. Furthermore, as demonstrated by Feige (1997, p 91) the estimation procedure is highly arbitrary, and the results can fluctuate substantially depending upon which seasonal metric is employed.

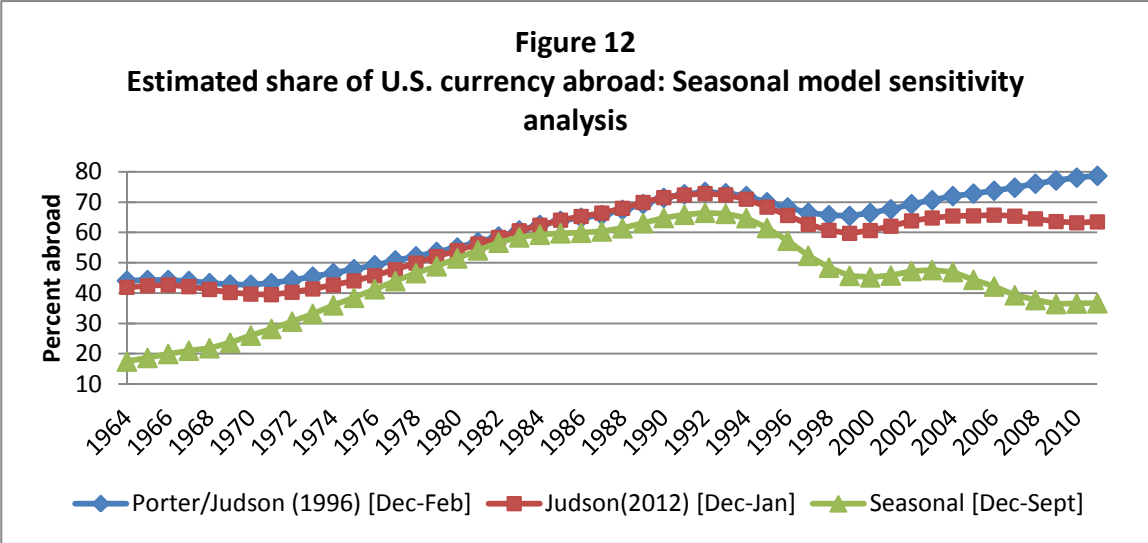
Figure 11 illustrates the sensitivity of the seasonal results to alternative specifications concerning which seasonal characteristic the researcher chooses to employ. The first estimate labeled (Porter/Judson (1996) [Dec-Feb] is simply an updating of the seasonal model originally proposed and estimated by Porter/Judson (1996) employing the

difference between the December and February seasonal.<sup>28</sup> This seasonal model suggests that in 2011, \$790 billion of U.S. currency was abroad, 79 percent of the total U.S. currency in circulation.



Judson (2012) finds that the seasonal trough has shifted from February to September but changes the model’s specification to the difference between the December and January seasonal. The results are charted in Figure 11 (labeled Judson (2012) [Dec-Jan]). This alternative specification reduces the estimated amount of U.S. currency abroad by \$170 billion, and lowers the share abroad to 64 percent. However, had Judson employed the same criterion for choosing the seasonal characteristic as used in the 1996 paper, namely the difference between the seasonal peak and the seasonal trough, she would have calculated the model employing the difference between the December peak and the new September trough. Figure 11 also displays these results (labeled Seasonal [Dec–Sept]). Not only does this seemingly minor modification drastically change the entire estimated temporal pattern of the estimates, it lowers the estimated amount of U.S. currency abroad to \$368 billion, or to 37 percent of the U.S. currency supply.

<sup>28</sup> Porter and Judson (1996) claim that the “best estimate of the model is obtained by measuring the seasonal variation around Christmas, specifically from the seasonal high that is reached in currency in December to the seasonal low in February.”



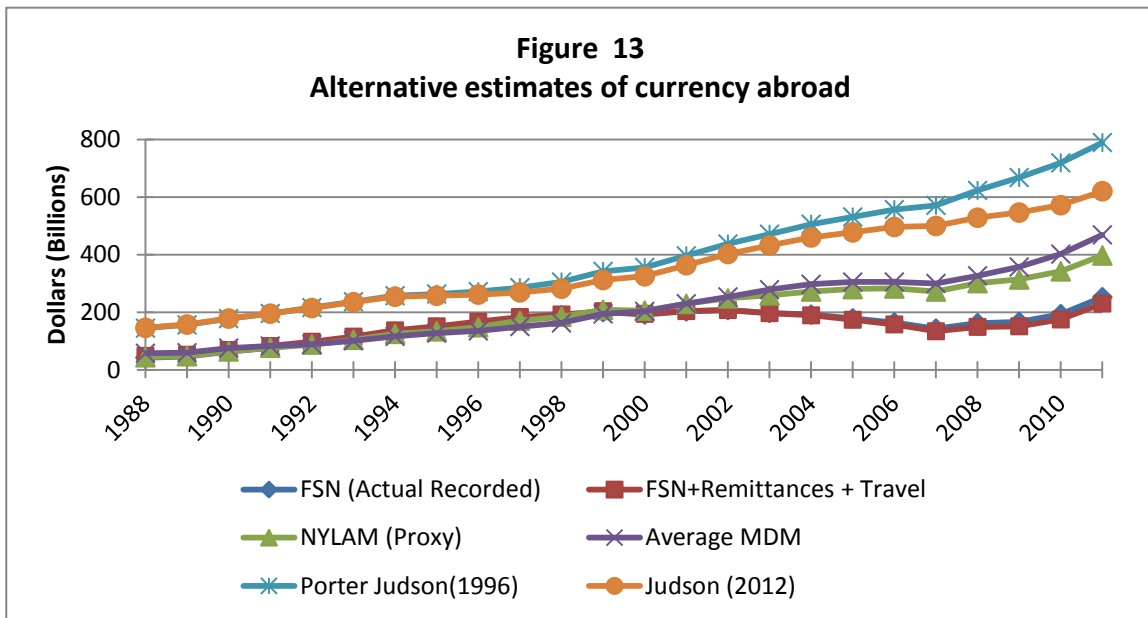
The sensitivity of the share results to minor alternative specifications of the seasonal model are displayed in Figure 12. Given the radical changes in both the temporal pattern and the magnitude of the estimated shares resulting from these alternative specifications of the model, we conclude that this indirect approach is unfit for estimating the share of U.S. currency abroad. This conclusion is bolstered by the empirical finding that one of the key assumptions of the model is violated namely that U.S. currency is not used inside Canada.

**5) Summary and Conclusions**

Even a cursory examination of the growth and magnitude of the U.S. currency supply in circulation with the public reveals that predictions of the advent of the “cashless society” are unfounded. Despite financial innovations giving rise to convenient substitutes for cash, per capita cash holdings continue to increase and by the end of 2011, amounted to \$3000 for every man woman and child residing in the U.S. While this figure does not comport with our common sense notion of how many dollars the average person holds in her wallet, we show that Europeans and Japanese citizens hold even larger amounts of cash. Two explanations are offered for these large cash holdings. The first posits that a large fraction of U.S. currency is held abroad, the second that large amounts of cash are employed to undertake transactions that individuals and firms prefer to hide from the government either to avoid taxes, regulations or punishment for illegal activities.

Cash, being an anonymous medium of exchange leaving no paper trail, is the logical choice for undertaking such transactions.

Feige(2012) employed the official estimates<sup>29</sup> (FOF/BEA) of the amount of U.S. currency believed to be overseas, to derive estimates of U.S. seigniorage earnings, the *domestic* money supply, and estimates of the unreported economy and the “tax gap”. This official FOF/BEA estimate of the share of U.S. currency abroad is based on a proxy measure (NYLAM) that was designed to mimic a confidential data series controlled by the New York Federal Reserve (FSN) that tracks bulk shipments of wholesale currency dealers into and out of the U.S. This confidential aggregate shipment data was recently published in a paper by Judson (2012), enabling researchers to reexamine the veracity of the official FOF/BEA (NYLAM) proxy estimates of the amount of U.S. currency held abroad.



As displayed in Figure 13, the NYLAM proxy appears to track the formerly confidential FSN series reasonably closely between 1988 and 2001, after which time the proxy begins to substantially overstate the series it is supposed to mimic. By 2011, the official FOF/BEA (NYLAM) estimate of overseas currency is roughly \$150 billion larger than the amount reported to the New York Federal Reserve (FSN) by wholesale bulk

<sup>29</sup> As published by the Federal Reserve in its Flow of Funds Accounts and by the Bureau of Economic Analysis in the U.S. Balance of Payment Accounts.

shippers of currency. Judson (2012) suggests that the the FSN series may be an understatement of the amount of U.S. currency abroad because it omits net currency shipments abroad through informal channels such as immigrant remittances and travel. We therefore directly estimate cash flows through these informal channels and find that taking account of immigrant remittances and cash transported by inbound and outbound passengers leads to a slight increase in our estimate of U.S. cash held abroad between 1988 and 2002. Thereafter, informal flows reduce our estimates of currency abroad. We conclude that by the end of 2011, the best direct estimates of U.S. currency held abroad suggest that \$230 billion is held overseas, that is 23 percent of the currency in circulation with the public. This estimate implies that per capita *domestic* cash holdings amount to roughly \$2300. We strongly suggest that the Federal Reserve and the Bureau of Economic Analysis downward revise their official estimates of overseas currency to bring them into conformity with the New York Federal Reserves (FSN) series and the available estimates of immigrant remittances and travel flows.

We then turn to a reexamination of “indirect” means of estimating the amount of U.S. currency abroad. These indirect methods, based on variants of monetary demography models, are the basis for the oft cited claims, that as much as 55 -70 percent of the nation’s currency supply is held overseas. While these indirect methods are admittedly innovative, we demonstrate that they require highly restrictive assumptions which can be shown to be significantly violated by available empirical data. Figure 13 reveals that an average of simple monetary demography models suggests that \$470 billion of U.S. currency (47 percent) is currently held abroad. We also update the “seasonal” models proposed by Porter and Judson (1996) and Judson (2012) also displayed in Figure 13. If taken at face value, they suggest that between \$620 - \$790 billion (62-79 percent) of U.S. currency is held abroad. As such, the indirect approaches produce estimates exceeding the direct estimates by an astounding \$390-550 billion. They also suggest a temporal path at variance with that of direct estimates. The direct estimates reveal that the introduction of the Euro led to a substitution of Euros for U.S. dollars until the financial crisis. The seasonal models suggest a continual upward trend in the demand for U.S. dollars abroad. We not only demonstrate that a key assumption underlying these indirect models is false but also show that the results from these models

are highly sensitive to slight variations in their specifying assumptions. We conclude that these indirect models, particularly the seasonal models, are unfit as measures of the amount of U.S. currency held abroad.

It is beyond the scope of the present paper to examine many of the interesting implications that follow from our finding that the amount of currency overseas is less than 25 percent of the nation's cash in circulation with the public. We do however strongly urge Federal Reserve officials to come to some agreement concerning the amount of currency held abroad so that the current discrepancies between their published data, their internal data and their public pronouncements can finally be put to rest.



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