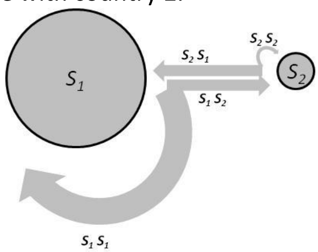
9 The payment world isn't flat

How does money flow between countries? If the world were flat (in the sense of T. Friedman's book) transactions patterns would be global. In such a world the majority of transactions would be cross-border. In fact, the share of domestic transactions (as a percentage of all transactions) would be equal to the sum of the squared population shares of all countries (see inset).

If transaction patterns were global…

If transactions were truly global, a Londoner would be as likely to pay a South African as someone in his own city. The below figure shows such a pattern for a world with a big and a small country with population shares s_1 and s_2. The inhabitants of country 1 will initiate a share s_1 of all transactions. The majority, namely s_1^2, are domestic and the remaining $s_1 s_2$ are with country 2.



More generally, for N countries with population share $s_1, s_2,..,s_N$, it follows that $f_{ij} = s_i s_j$ where f_{ij} denotes the flows between counties i and j, measured as a proportion of total global flows. The global share of domestic transactions is then equal to Σs_i^2 and the share of cross-border equal to $1-\Sigma s_i^2$.

For the world population, this sum of squared shares is about 8%.[1] So if global payment patterns were random, one would expect that about 1-8%=92% of all payments in the world to be cross-border with the remaining 8% being domestic.

[1] This concentration index is largely driven by China and India who account for 0.07 of the 0.08. We could also take the shares of GDP instead of population, in which case we get 0.07 instead of 0.08. Smaller, but not materially different.

Reality is not even close to this prediction. In fact, it is almost the reverse: at most 5% of all payments in the world are cross-border, the rest are domestic.[2] Clearly transactions patterns are heavily domestically biased.

While transaction patterns are local, we do find that country size plays a role in cross-border transactions. A relationship called the payment gravity law (see inset) has been used to model equity flows between two countries.[3] This gravity law has also been found in large value payments flows on the TARGET2 system and international flows of US currency.[4] [5]

Payment gravity

Financial flows between countries, for example cross-border equity flows, have been modelled using the following relationship:

$$f_{ij} = a\frac{m_i m_j}{r_{ij}}$$

Here f_{ij}, represents the flows between countries i and j, m_i and m_j are some measure of their size, r_{ij} is their distance and a is a constant. This model is known as the payment gravity model, due to its similarity to Newton's gravity law.[6]

Applying the gravity model to SWIFT corresponding banking flows between the 50 largest countries yields the following relationship:

$$f_{ij} = 2.32\frac{(m_i m_j)^{1.12}}{(r_{ij})^{1.21}}$$

[2] BCG world payment report

[3] Portes and Rey (2005). They use the stock market capitalization of each country as an approximation of their mass, and the geographical distances between the financial centers as a measure of r_{ij}.

[4] For TARGET see Rosati and Secola (2005), who measure country size by the total balance sheet of the financial institutions in each country.

[5] For US dollar bills see Hellerstein and Ryan (2009).

[6] Albeit that Newton takes the square of the distance.

Here f_{ij} denotes the value of all the SWIFT payments exchanged between countries i and j in millions of US dollars per year. m_i denotes the total assets of the banking system in country i in trillions of US dollars and r_{ij} is the distance between the financial centers of countries i and j measured in ‘000 of km’s.

The estimated parameters are quite close to the theoretical model: the exponent for $m_i m_j$ is 1.12 and the exponent of r_{ij} is 1.21 where the model specifies a value of 1 for both. [7]

[7] The relationship was estimated in log form. The parameter estimates were all significant at the 1% level with an overall R^2=0.62%.