Hard Currency and Financial Development[1]

By

Ilan Goldfajn
Departamento de Economia
PUC-Rio
email: goldfajn@econ.puc-rio.br

and

Roberto Rigobon
Sloan School of Management
MIT
email: rigobon@mit.edu

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Abstract

This paper investigates the relationship between hard currency and financial development. It creates four different series of hard currency based on different sets of data. The results of the paper suggest that indeed financial development and the hardness of currencies are highly correlated. However, we find that the relationship from currency hardness to financial development is fully captured by macro variables that represent overall macroeconomic stability. This suggest that having a hard currency is not a pre-condition for financial development but rather establishing a macroeconomic stable environment.

Keywords: Exchange Regimes, Financial Development, Hard Currency

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Table of Contents

I. Introduction

The debate on the effect of exchange regimes on economic performance has reached a new level. In the past, the focus was on the effect of different exchange regimes on growth, inflation and, after the Asian currency crises, on financial fragility.[2] More recently, the emphasis is, perhaps, on a deeper problem. Given the existence of incompleteness in financial markets, most developing countries suffer from an "original sin," they cannot use their currency to borrow abroad or to borrow long term, even domestically.[3] This implies that financial fragility is unavoidable because domestic investments will have either a currency mismatch or a maturity mismatch. It follows that any exchange regime, fixed or floating, is problematic. The only solution, according to some, is to have no exchange rate. That is, developing countries should abolish their domestic "weak" currencies and adopt the dollar or any other "hard currency."

This line of argument raises a few interesting questions. Why is that developing countries have the "original sin" and can only borrow domestically and short term? Or, in other words, why developing countries have weak currencies? Is there any other way to establish a hard currency without resorting to the extreme solution to substitute all domestic currencies for a few international hard currencies? In addition, there are a set of questions on relationship between hard currency and financial development. Does establishing a hard currency induce more credit in domestic currency, in particular, long term?

This paper is an attempt to address these questions using available cross-country information on different currencies (the initial sample has 162 countries during 1989-1998). There are at least two issues that arise immediate once the questions are posed seriously. First, there is no established definition of what constitutes a hard currency. There are at least two different definitions of a hard currency. A stricter definition associates a hard currency with its use as international mean of payments and reserve value. Few currencies have the privilege to be a hard currency under this definition, probably only the dollar, the Euro, the Yen, and some other European currencies. The second definition is broader than the first. A currency is

[2] See, for example, Ghosh, Gulde and Wolf (1997).
[3] The term "original sin" is borrowed from Ricardo Hausmann. See Eichengreen and Hausmann (1999).

hard when it denominates long term nominal contracts and allows long term financial markets to be developed. This definition has the advantage of identifying the welfare gains that a hard currency provides. There are, obviously, more countries under this broad definition than under the narrow definition. The Australian dollar, the Swedish Krona and the New Zealand dollar immediately come to mind as examples of hard currencies under the broad definition. The definition, however, is strict enough to exclude the majority of developing countries' currencies. One could think of the two definitions of hard currency as a part of the same process where initially long term financial markets are formed domestically and subsequently, if the world is relatively scarce in hard currencies, the currency is used internationally (as an export of "hard currency services").

The paper dedicates considerable effort to construct four empirical series (and two additional slightly modified ones), counterparts to the definitions above. Next section summarizes the different definitions and sections III – VI describes how we constructed the series.

The second issue is how to address the fact that hard currency and financial development are both endogenous variables. There is no perfect answer to this issue and the answer provided in this paper is no exception. In order to overcome the problem we performed exercises in the extreme cases and qualified our conclusions based on these results. First, we gave financial development the highest chance to explain as much as possible of the hard currency indices. Then, we invert the procedure and gave hard currency the highest chance to explain financial development. In the exercises we control for important macroeconomic determinants of both financial development and hard currency. For example, macroeconomic stability is certainly an important determinant since uncertainty regarding inflation, or other macroeconomic variables, seems to prevent markets to be formed. Other determinants may include trade and financial openness. Section VII and VIII address this mutual relationship and the effect of macroeconomic variables.

The results of the paper suggest that indeed financial development and the hardness of currencies are highly correlated. However, we find that the relationship from the hardness of the currency to financial development is fully captured by macro variables that represent overall macroeconomic stability. Therefore, if the currency regime has a bear on the

development of the financial sector it passes through establishing a stable macroeconomic environment (measured for example by low and stable inflation and real interest rates). In this regard, if there is an “original sin,” it is the macroeconomic instability that plagues developing countries.

II. What is Hard Currency? Empirical Estimates and Data Used.

There is no clear definition of what exactly is hard currency. At a first glance, the “hardness” of a currency could be defined as the willingness of international agents to hold the currency, as measured by its actual use in cross border financial positions. This is indeed a natural definition of hard currency, but definitely a very restrictive one, since few currencies would classify as such. We think of this definition as the "strong form of hard currency" (SHC).

A second definition uses the same principle, i.e., the willingness of international agents to hold the currency, but tries to incorporate more hard currencies into the sample using a more continuous definition of hardness. The problem, obviously, is how to implement this definition empirically. We will come back to this point later in the paper. We denote this definition as the "weak form of hard currency" (WHC).

A third definition of hard currency is the willingness to use domestic currency in long term contracts. Its main problem, as will be argued below, is that by construction it is highly correlated with the degree of financial development of the country. In what follows, we refer to this definition as the "financial form of hard currency" (FHC or using a slightly different methodology, FHC_OW).

Finally, the last definition of hard currency defines the hardness of the country in proportion to the perceived risk of the currency as embedded in the relative ratings of domestic and foreign currency sovereign debt. We denominated this variable the Credit Rating definition of Hard Currency (CRHC).

A good part of the effort involved in the paper was dedicated to the construction of the empirical counterparts of the definitions above. The next four sections explain in great amount of detail the procedures to create the hard currency series. Table A1 in the appendix lists all definitions of hard currency.

The database used in the paper was constructed using a sample of 162 countries covering the period 1989-1998 in an annual basis. All the regressions are cross-section where the individual observations correspond to the period average (or, alternatively, the standard deviation).

The correlation between the different hard currency series is shown in Table 1. Although there is a high correlation between the series, it is far less than one, which potentially can provide different information.

Table 1

	FHC	FHC_OW	SHC	WHC	CRHC
FHC	1.00	0.611	0.951	0.976	0.543
FHC_OW		1.00	0.608	0.600	0.324
SHC			1.00	0.780	0.414
WHC				1.00	0.480
CRHC					1.00

III. Strong definition of Hard Currency

We constructed the Strong Hard Currency (SHC) definition using information from the Bank of International Settlements (BIS). In order to qualify as SHC a currency has to be "significantly used" by BIS reporting banks in cross border positions. In practice "significantly used" meant that the currency had to be reported separately in the currency breakdown of cross border positions published in the quarterly report of the BIS. Less than 10 percent of all positions held are not reported separately and is composed by the sum of a large number of currencies used in small amounts, usually for idiosyncratic reasons.

This definition implied, as it should be expected, that the "hard currencies" worldwide held are those of the G7 countries (with the exception of Canada) and a couple of other western European countries (Belgium, France, Germany, Italy, Netherlands, Switzerland,

U.K., Japan, and the US). We created a dummy series assigning the value of one to a SHC country and zero otherwise.

It is useful at this time to summarize some of the characteristics of a stable currency that are expected to be correlated with the strong hard currencies definition. The theoretical literature provides several channels through which country characteristics might influence the willingness to hold a currency; (i) the opportunity cost as measured by the average of the inflation and real interest rate; (ii) the volatility of these variables; (iii) the openness of the country and the financial sector, (iv) the level of per capita income (GDP) and; (v) the development of the financial sector. In the rest of this section we report the relationships between these variables and our definition of SHC.

An increase in the opportunity cost of holding money, through an increase in the average inflation or real interest rate, should decrease the willingness to hold the currency, other things equal. This principle bases the original inventory models of holding currency (Miller and Orr 1966) through the most current ones (White 1999).

Table 2 shows the result of a series of Probit regressions. First, it shows the relationship between the inflation rate, real interest rate and Strong Hard Currency (regressions I, II and III). The left-hand side is our SHC dummy and the right hand side variable is either the average inflation for each country between 1989 to 1998 or the average real interest rate for the same period or both. We first run the regressions separately, and then we introduce the three of them at once, because it could be the case that realized ex-post real rates and inflation are highly correlated.[4]

As can be seen in regression I, there is a very important relationship between SHC and inflation. The expected sign goes in the right direction and it is highly statistically significant. Moreover, using the McFadden R-square the average inflation rate explains up to 1/3 of the decision of investors to hold the currency. When the realized real interest rate is used as the only right hand side variable, the estimates are not significant and the explanatory power is poor. Again, the sign goes in the right direction. Finally, in regression III inflation and interest

[4] In fact, in our data, the correlation between average real interest and inflation rates from 1989 to 1998 is only -0.12.

rates are introduced in the right hand side. Note that the signs continue to be in the right direction and the coefficients are both significant.

The uncertainty related to holding a currency is proportional to the volatility of its real value that could be proxied by the volatility of inflation. In analogy with the corporate finance literature, holding a currency could be interpreted as holding a risk free bond, paying the inverse of the average inflation, plus selling a put option. An increase in the volatility of the underlying price (the inflation rate) implies an increase in the value of the option, and therefore, a decrease in the implied value of the currency. Therefore, an increase in the variance of the inflation rate should decrease the willingness to hold a currency. Equation IV in Table I shows that this is indeed the case. The effect of inflation volatility on inflation is negative and significant. In fact, the inflation's volatility series contributes to explain more than 1/3 of the decision to holding a currency.

There may be a relationship between openness and SHC. In principle there are two opposing effects. On one hand, a more open economy (in trade) is more vulnerable to external shocks, and therefore, could destabilize the currency and reduce its demand. On the other hand, as shown by Romer (1993), openness could put a check on inflation and reduce currency instability. Openness is proxied here as the average exports plus imports expressed as a proportion of GDP.

The two effects are reflected in our data. First, when openness is introduced by itself the effect is negative, although not statistically significant (as shown in equation V in Table 2) However, when it is interacted with inflation, in equation VI, the relationship is highly negative and significant.

The level of income of the country can be a measure of the implicit insurance of the stability of a currency. In other words, poor countries cannot offer the same type of guarantee of currency stability that a rich country can tender. Therefore, one should expect a positive correlation between GDP level and the hardness of the currency. In fact, the level of GDP is highly correlated with the hardness of the currency. In fact, it almost explains 60 percent of the variation (see equation VII).

Finally, one should expect that the higher the degree of financial development the more stable the currency will be and the higher the probability of being a SHC. We measure the degree of development of the financial sector as the ratio between the total private credit and M1, weighted by the size of total private credit expressed as a proportion of GDP. Table 2, equation VIII, shows that the coefficient is positive and significant. The larger is the financial sector, the larger the likelihood of holding the currency.

An alternative measure is to compute the implied long-term credit in the banking sector measured as a proportion of M1.[5] As can be seen from comparing the McFadden R-squares of both regressions, the explanatory power of the long-term development of the financial sector is more important than the size of the financial sector.

It is important to mention that there is a very large literature that argues the reverse causality. [6] In other words, that a precondition for a healthy banking and financial sector is the existence of a relatively hard currency. In fact, the result from the previous regression can indeed be the outcome of reverse causality. We come back to this issue later in the paper.

It is useful to present all these channels interacting together to determine hard currency. Since there is an issue regarding the causality of the relationship between financial sector development and hard currency, we will leave out this variable at this first pass on the problem. In fact, one should interpret the overall regression as a reduced form in which we are interested in maximizing the predictable power of the right hand side variables.

The results are shown in regression X, in Table 2. Two remarks are in order. First, note that the signs of all the coefficients behave as expected. Second, the predicted power of the regression is quite high, 73 percent of the variation. And finally, the coefficients across specifications are remarkably stable (with the exception of inflation -average and volatility- coefficients).

[5] In our database, multiplying the ratio of M2 to M1 to the Total Credit measure proxies for long term credit.

[6] Fernandez-Arias and Hausmann 1999.

Table 2: Strong Hard Currency-Probit Regressions

(Dependent Variable: Strong Hard Currency)

Regression number	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*
Constant	0.03	-1.54	1.43	0.24	-1.18	1.54	-7.65	-4.40	-4.04	5.05
	(0.941)	(0.000)	(0.105)	(0.609)	(0.001)	(0.039)	(0.0006)	(0.000)	(0.000)	(0.233)
Average inflation	-0.34		-0.42			-0.41				-1.26
	(0.002)		(0.0042)			(0.0002)				(0.033)
Inflation volatility				-0.78						-2.19
				(0.003)						(0.197)
Real interest rates		-0.002	-0.17							-0.33
		(0.498)	(0.032)							(0.210)
Openness					-0.01	-0.02				-0.02
					(0.251)	(0.032)				(0.212)
GDP							0.000278			9.33E-05
							(0.002)			(0.007)
Private Credit/ M1								0.37		
								(0.018)		
Long Term Credit/M1									1.68	
									(0.026)	
McFadden R-squared	0.304	0.000	0.375	0.356	0.027	0.426	0.593	0.108	0.270	0.733

Note: P-value in parenthesis; definition of variables in the appendix. Cross-section regression using all countries with data available. Standard errors are computed to have robust covariance estimates using the Huber/White method.

IV. Weak Definition of Hard Currency

The Weak Hard Currency (WHC) definition is trickier to construct. The decision to use a currency for international trade or to hold in cross border financial positions is not a continuos variable. Since there are externalities in the use of a common currency as a unit of account or a store of value the natural equilibrium is the use of a limited number of currencies. There may exist other currencies with desirable properties that the agents would be willing to hold but those currencies were crowded out from international use. In order to get a grip on the willingness to use a currency we correlate the characteristics of a stable currency with the decision to use a currency internationally (our observed SHC currencies) in a Probit model. We construct the WHC definition by assigning to each country the predicted value of this Probit model regression. This procedure will give us a more continuos hard currency variable.

The fitted values are shown in Table A1 (in the appendix). It is possible to compare the predicted value of the model with the actual series of hard currency (comparing WHC with SHC). Assuming the cutoff occurs at 0.20 the mode predicts the all the strong hard currencies without mistake, and it only over-predicts 3 out of 119 of the other currencies.

Table 3: Comparing the predicted value with SHC

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
P(Dep=1)<=C	116	0	116	119	6	125
P(Dep=1)>C	3	6	9	0	0	0
Total	119	6	125	119	6	125
Correct	116	6	122	119	0	119
% Correct	97.48	100.00	97.60	100.00	0.00	95.20
% Incorrect	2.52	0.00	2.40	0.00	100.00	4.80
Total Gain*	-2.52	100.00	2.40			
Percent Gain**	NA	100.00	50.00			

V. Financial definition of hard currencies

The third definition of hard currency is related to the existence of long term contracts denominated in domestic currency. This measure is hard to construct in practice given that information about the long term financing is not readily available for a large number of countries. In order to deal with this problem we take a short cut and construct proxies for the degree of development of the financial sector. We use three variables (the last two obtained from the BIS): (i) The size of the private credit measured as a proportion of M1 (*cpriv_m1*), (ii) the proportion of domestic currency lending by foreign banks as a proportion of GDP (*lc_posit*), and (iii) the proportion of total cross border lending as a proportion of GDP (*tot_posit*). Index series are constructed for each variable.

The first index captures the notion that total private credit, as a proportion of liquid assets, should be proportional to the proportion of long term credit available in the economy. The index is constructed as follows:

$$index\_cpriv\_m1 = 1\left[cpriv\_m1 > mean(cpriv\_m1) + 1.5 * stdev(cpriv\_m1)\right]$$

where the index assumes the value of 1 out when the variable assumes extreme values as expressed by the mean plus 1.5 times the standard deviation. This configuration captures a little bit less than 7 percent of the cases (1.3 would capture around 10 percent of the cases and the results are qualitatively the same). We should expect this index to be positively correlated to the hardness of a currency.

The second index looks at lending in domestic currency extended by foreign banks as a proportion of GDP. The idea is that the larger the magnitude of domestic lending by foreign banks the stronger is the currency. Therefore, the following index is constructed:

$$\begin{aligned} index\_lc\_posit = &-1\left[lc\_posit < mean(lc\_posit) - 1.5 * stdev(lc\_posit)\right] \\ &+1\left[lc\_posit > mean(lc\_posit) + 1.5 * stdev(lc\_posit)\right] \end{aligned}$$

The index takes values of *{-1,0,1}* where the lower the number of the index the lower is the strength of the currency. Note that the procedure to define the index indicate that the lowest 10 percent of the countries with *lc_posit* will have a negative coefficient, the highest 10 percent will have a one and the remaining 80 percent will get a zero. The intuition is that a very small proportion of loans extended in domestic credit indicates that the currency is weak.

Equivalently, we construct the third index using the notion that the larger is the proportion of foreign loans (large total cross border positions) the more fragile is the currency in question. A positive index indicates a weak currency:

$$index\_tot\_posit = -1[tot\_posit < mean(tot\_posit) - 1.5 * stdev(tot\_posit)] + 1[tot\_posit > mean(tot\_posit) + 1.5 * stdev(tot\_posit)]$$

With these indices at hand, we first show the relationship between these indices and the previous definitions of strong currency. Instead of running a Probit regression (which will be perfectly predicted by just assigning the *index_lc_posit>2*) we just report the correlation between this indices and the SHC definition:

Table 4:

	SHC	INDEX_CPRIV_M1	INDEX_LC_POSIT	INDEX_TOT_POSIT
SHC	1.000	0.457	0.089	-0.038
INDEX_CPRIV_M1		1.000	0.057	-0.024
INDEX_LC_POSIT			1.000	-0.136
INDEX_TOT_POSIT				1.000

Similarly for the weak hard currency definition:

Table 5:

	W_HC	INDEX_CPRIV_M1	INDEX_LC_POSIT	INDEX_TOT_POSIT
W_HC	1.000	0.596	0.083	-0.039
INDEX_CPRIV_M1		1.000	0.057	-0.024
INDEX_LC_POSIT			1.000	-0.136
INDEX_TOT_POSIT				1.000

The correlations between the indices and our previous definitions of hard currency are strong only with respect to the private credit index.

The second step is to construct a single series of Financial Hard Currency (FHC) using the indices created above. Two procedures are used to define the FHC. First, we define the series using the weights that maximize the correlation with the weak definition of hard currency. We call this definition the "optimal weights". Running a Tobit we find the following results:

Table 6: Dependent Variable -Weak Hard Currency

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.11	0.0433	-2.62	0.009
Index_TOT_Posit*TOT_Posit	-0.001	0.0009	-1.37	0.172
Index_LC_Posit*LC_Posit	0.007	0.0027	2.42	0.016
Index_Cpriv_M1*Cpriv_M1	0.129	0.0551	2.33	0.020
R-squared	0.362			

We use the coefficients of this regression in order to construct the index:

$$fhc\_ow = \begin{bmatrix} 0.129 \cdot cpriv\_m1 \cdot index\_cpriv\_m1 + \\ 0.007 \cdot lc\_posit \cdot index\_lc\_posit - \\ 0.001 \cdot tot\_posit \cdot index\_tot\_posit \end{bmatrix}$$

The second procedure is to estimate the FHC series as the predicted value of a regression of the weak hard currency (WHC) series using all the macro variables and our three indices. This is similar to the procedure used to define the weak hard currency using the SHC series. This definition is simply called the *FHC*. The results of the regression are as follows:

Table 7: Dependent Variable - Weak Hard Currency

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.1404	0.0458	3.07	0.002
INFLATION_AV	0.0049	0.0016	2.92	0.004
INTEREST_AV	-0.0030	0.0018	-1.63	0.104
INFLATION_SD	-0.0218	0.0080	-2.72	0.007
INTEREST_SD	-0.0408	0.0164	-2.48	0.013
OPEN	0.0008	0.0004	-1.89	0.059
GDP	3.08E-05	0.0004	4.62	0.000
LC_POSIT*INDEX_LC_POSIT	-0.0030	0.0014	-2.17	0.030
TOT_POSIT*INDEX_TOT_POSIT	0.0001	0.0002	0.54	0.590
CPRIV_M1*INDEX_CPRIV_M1	0.0082	0.0380	0.22	0.828
R-squared	0.949			

The predicted values from this regression imply, then, the financial measure of hardness of the currency (FHC) shown in Table A1 in the appendix.

VI. Credit Rating Definition of Hard Currency

Another way we measure the hardness of a currency is through the use of the information provided by credit ratings as published by Standard and Poors (S&P). Some countries, in particular developing countries, tend to have better ratings on their local currency denominated instruments than on their foreign currency denominated ones. The reasoning provided by S&P is that it is far easier for governments to fulfill obligations in the currency that they are allowed to print. In other words, the right to inflate away the debt reduces, ceteris paribus, the probability of default. The credit agency, therefore, implicitly estimates the probability that a country will resort to inflationary finance to liquify its debt. The paper uses the relative ratings on domestic and foreign currency sovereign debt as a measure of the weakness of several domestic currencies.

The S&P classification contains 23 categories for long-term credit instruments and 9 for short-term ones for both foreign and domestic currency denominated debt. In order to construct our credit rating based measures of hardness; the first step was to transform the S&P scales (based in letters) into numerical scales. We assigned a number for each category, beginning with 1 for D (Default, the worst category in both scales) and finishing in 23 for AAA (the best category in the long-term instruments classification) and 9 for A1+ (the best category in the short-term instruments classification), for both foreign and local-currency denominated instruments. The second step was to calculate the ratio between the numerical indexes of foreign and local currency instruments for both short (*CRHC_short*) and long (*CRHC_long*) term, where the higher the index the harder is the currency.

In order to compare this alternative with our previous SHC definition, we estimate a binary probit with SHC as the dependent variable and our credit ratings based measures of hardness on the right side. The results are shown in Table 8. Observe that in both cases we obtained, as expected, positive and statistically significant estimates for the coefficients of our measures of hardness. Additionally, we estimate a binary probit with SHC as the dependent variable using both *CRHC_short* AND *CRHC_long* and other variables as explanatory

variables. Note that CRHC_long have the right signal and it is statistically significant at the 10% level but, surprisingly, CRHC_short appears with the wrong sign.

Finally, we ran OLS regressions for each measure (CRHC_short and CRHC_long) on inflation, real interest rates, their respective volatilities, openness and per capita income. Table 9 shows the results. Observe that the explanatory power of the variables (measured by the R2) is higher in the CRHC_short regression than in the CRHC_long one.

Table 8: Dependent Variable SHC

Constant	-9.55 (0.001)	-7.09 (0.003)	-4.68 (0.503)
Inflation_AV			1.08 (0.024)
Interest_AV			0.16 (0.697)
Inflation_SD			-3.90 (0.042)
Interest_SD			-4.38 (0.042)
Openness			-0.004 (0.316)
GDP			9.07E-05 (0.141)
CRHC_short		6.32 (0.013)	-60.52 (0.087)
CRHC_long	9.04 (0.005)		73.58 (0.099)
R-Squared	0.253	0.150	0.774

Notes: P- Value in Parenthesis; definitions of variables in appendix. Cross-section regression using all countries with data available.

Table 9

	CRHC_short	CRHC_long
Constant	0.808 (0.000)	0.820 (0.000)
Inflation_AV	-0.0004 (0.165)	0.0001 (0.707)
Interest_AV	0.001 (0.281)	-0.0004 (0.783)
Inflation_SD	0.0003 (0.061)	-8.99E-05 (0.675)
Interest_SD	-0.0002 (0.720)	0.0006 (0.535)
Openness	0.0001 (0.497)	0.0002 (0.462)
GDP	5.79E-06 (0.000)	6.37E-06 (0.000)
R-Squared	0.43	0.31

VII. Financial Development and Hard Currency

In this section, we tackle the question whether financial development help determine the hardness of the currency. The problem here is the existence of the reverse causality, the alleged effect of hard currency on the development of the financial sector. In fact, according to one of our definitions, hard currency is defined as the existence of long term financing in the currency. The latter is also a measure of the development of the financial sector. Because there is a high correlation between financial sector development and our macro economic variables, running an overall Probit regression using all the variables is not ideal. Instead we proceed using a two step approach.

First, we run a regression in which only a constant and financial development are used to explain hard currency. Second, we take the residuals from the first step and study how much is explained by inflation, interest rates, etc. In this way, since financial development depends on the same macro variables as hard currencies, the second step will measure how much the macro variables explain the innovations after we have controlled for financial development.

Using this two step procedure we are maximizing the explanatory power of financial development. Therefore, if the macro variables are still significant in the second step, we can indeed conclude that our measure of hard currency is capturing something beyond the usual correlation between financial development and the hardness of the currency. Second and more importantly, we would be able to conclude what factors are more important in describing the hardness of currencies, even after controlling for financial development. We follow this procedure with all the definitions of hard currencies.

1. Strong definition of hard currency and financial development

The first step is to run a Probit regression where the dependent variable is *SHC* and the explanatory variable is total private credit as a proportion of M1.[7] The specification is given by:

$$shc = \Pr\{c + a\ Credit > 0\},$$

and the results are presented in Table 10.

Taking the residuals from the Probit regression we estimate the following equation:

$$resid\_hc\_credit = c + \alpha\ Inflation\_av + \beta\ Interest\_av + \gamma\ Inflation\_sd + \eta\ Open + \nu\ GDP + \varepsilon$$

The results are presented in Table 11. Note that in this residual regression, the coefficients of average interest rate, openness?, and GDP are statistically different from zero and with the correct sign. In conclusion, even after we have controlled for financial development, interest rate, openness, and GDP still have explanatory power. Inflation, who was highly significant before, is fully captured by the first step.

2. Weak definition of hard currency and financial development

We repeat the procedure from the previous section using our measure of weak hard currency (*WHC*). Remember that *WHC* is not a {0,1} variable because it reflects the likelihood of holding the currency. Thus, instead of running a Probit regression we use a Tobit specification.

The results in Tables 10 and 11 show that it is also the case that GDP and openness continue to be significant in the determination of the hardness of the currency, after we have controlled for financial development. In fact, it should not be surprising that after we have controlled for financial development, inflation, interest rates, and its volatility have no further explanatory power in the computation of the hardness of the currency.

[7] We run the same regression using alternative measures of financial development and consistently we got the same results.

3. Financial definition of hard currency and financial development

We repeat the exercise with our financial definitions of hard currency. Here we have two definitions; thus each of them is analyzed separately. We estimate the effect of FHC using a Tobit specification, given that the index is censored at 0 and 1, and we run an OLS specification for the optimal weight index FHC_OW.

The results are shown in Table 10. Total private credit and a constant explain more than 40 percent of the variation of the FHC index and almost 50 percent of the variation of the FHC_OW index. The next step is to take the residuals from each of the regressions and verify the remaining explanatory power of the macro variables. We compare the coefficients with the ones estimated from a normal regression between financial hard currency and private credit as a ratio of M1.

The results are shown in Table 11. For the *FHC* definition, the residual and non-residual coefficients estimates are very similar. In fact it is not possible to reject the hypothesis that they are the same across specifications. For the FHC_OW, there are indeed important changes in the coefficients, at least in their significance. When financial development is not taken into account GDP and inflation are the most important explanatory variables. When the development of the financial sector is taken into account only openness has the right sign and is significant (the coefficient of interest_av is significant, but it has the wrong sign). However, it is important to highlight that it is not possible to reject the hypothesis that the estimates are the same across specifications.

Another exercise to determine the relationship between financial sector development and these two indices is to do the opposite: take the residuals from the macro variable regression and determine the remaining explanatory power of the financial sector variable. The results are shown in Tables 12. For the *FHC* index, note that the private credit has no explanatory power on the residual after macro variables have been included (R squared of 0.017). This should be contrasted with the previous results where a constant and private credit explain 43 percent of the variation of *FHC* with a very significant coefficient. Similarly, for

the optimal weighting financial definition, FHC_OW, there is no remaining explanatory power to the financial sector development variable when the regression is run on the residuals.

A final exercise is to include all the variables in the same regression and determine the importance of financial development. The results are shown in Table 13. It is important to note that when *FHC* is estimated (using a Tobit regression) financial development is insignificant. Similar results are obtained when the *FHC_OW* variable is used.

4. Credit Rating of hard currency and financial development

We repeated the exercises above for the credit rating definition of hard currency. First, we estimate the OLS regression of *CRHC_Long* (alternatively, *CRHC_Short*) on a constant and *CPRIV_M1* and save the residual series. Then we estimate a second OLS regression of these residuals on inflation and real interest rates, their respective volatilities, openness and per capita income. The results are shown in Tables 10 and 11. Observe that in both cases GDP was the most important explanatory variable, even after controlling for private credit as a proportion of GDP in the first-step regressions.

Again we reverted the order of the variables in our two-step strategy. First we ran OLS regressions of each credit rating based measure on the macro variables and saved the residuals. Then we ran OLS regressions of these residuals on private credit over M1. The results are shown in Tables 12. Again the private credit variable is insignificant once the other macroeconomic variables are taken into account.

Finally, we estimate OLS regressions of our credit rating based measures of hardness on the macro variables (inflation, real interest rates, their respective volatilities, openness and GDP) plus a measure of financial development (*priv/m1*). The results are shown in Table 13. Again, the variable private credit over M1 seems to loose significance once other macroeconomic variables are taken into account.

In conclusion, in this section we adopted a critical view on the relationship between hard currency and financial development, given the risk of a spurious correlation. Given that no good exclusion restriction is acceptable, in order to test for spurious correlation, we

investigated the extreme positions. First, we gave financial development the highest chance to explain as much as possible of the hard currency indices. We took the residuals from those regressions and verified the remaining explanatory power of the other macro variables. As it was argued, in most of the cases, the coefficients in these regressions are similar to the ones obtained when the first step was not performed. Second, we gave the macro variables the best chance to explain the index. When we correlated the residuals of these regressions using the financial development measure we found no relationship. Finally we run the pooled regressions and indicate that financial development is insignificant to explain hard currency, once other macro variables are taken into account. In other words, it is possible to argue that the correlation between financial development and hard currency is due to the fact macroeconomic stability is associated with both and not because of any direct effect of financial development on the hardness of the currency.

Table 10:

	SHC	WHC	FHC	FHC_OW	CRHC_LONG	CRHC_SHORT
Constant	-2.34	-0.36	-0.10	-0.07	0.85	0.86
	(0.000)	(0.0002)	(0.003)	(0.002)	(0.000)	(0.000)
Private Credit/M1	0.20	0.06	0.11	0.08	0.01	0.01
	(0.007)	(0.012)	0.000	(0.001)	(0.042)	(0.017)
R-squared	0.24	-0.038	0.435	0.486	0.076	0.110

Notes: P-Value in Parenthesis; definition of variables in appendix. Cross-section regression using all countries with data available.

Table 11: Regressions of Residuals of Hard Currency after controlling for Financial Development

	SHC	WHC	FHC	FHC (not residual)	FHC_OW	FHC_OW (not residual)	CRHC_L	CRHC_S
Constant	0.0435	-0.025	-0.035	-0.012	0.015	-0.039	-0.047	-0.045
	(0.301)	(0.276)	(0.062)	(0.412)	(0.417)	(0.005)	(0.076)	(0.209)
Average Inflation	-0.0001	1.81E-05	-0.001	-0.0007	-0.0001	0.0008	-0.0006	-2.35E-05
	(0.154)	(0.522)	(0.000)	(0.005)	(0.635)	(0.007)	(0.100)	(0.963)
Average Interest Rates	-0.0008	-1.16E-07	-0.001	-0.0006	-0.0002	0.0006	0.0010	-0.0008
	(0.117)	(0.318)	(0.003)	(0.162)	(0.682)	(0.107)	(0.410)	(0.596)
Inflation Volatility	6.61E-05	0.0022	0.0006	0.0002	3.10E-05	-0.0004	0.0003	3.93E-06
	(0.266)	(0.477)	(0.000)	(0.015)	(0.763)	(0.001)	(0.036)	(0.987)
Interest Rate Volatility			0.0029	0.0025	0.0026	0.0013	1.51E-05	0.0012
			(0.002)	(0.005)	(0.013)	(0.213)	(0.987)	(0.306)
Openness	-0.001	-0.0007	-0.0007	-0.0005	-0.0008	-0.0004	-1.07E-05	-6.65E-05
	(0.044)	(0.002)	(0.0003)	(0.006)	(0.002)	(0.092)	(0.963)	(0.840)
GDP	1.16E-05	1.27E-05	1.85E-05	3.22E-05	5.13E-06	1.83E-05	4.39E-06	4.85E-06
	(0.007)	(0.000)	(0.000)	(0.000)	(0.326)	(0.002)	(0.001)	(0.011)
R-Squared	0.237	0.421	0.823	0.947	0.299	0.719	0.331	0.163

Notes: P-Value in Parenthesis; definition of variables in appendix. Cross-section regression using all countries with data available.

Table 12: Residual Regressions of Hard Currency after controlling for other macroeconomic variables

	FHC	FHC_OW	CRHC-Long	CRHC_Short
Constant	-0.005 (0.523)	-0.01 (0.551)	-0.008 (0.517)	-0.012 (0.508)
Private Credit/M1	0.004 (0.337)	0.01 (0.370)	0.002 (0.478)	0.002 (0.621)
R-Squared	0.017	0.015	0.006	0.004

Notes: P-Value in Parenthesis; definition of variables in appendix. Cross-section regression using all countries with data available.

Table 13: Overall Regression

	FHC	FHC_OW	CRHC_Long	CRHC_Short
Constant	0,055 (0,017)	-0,043 (0,001)	0,806 (0,000)	0,817 (0,000)
Average Inflation	-7.04E-05 (0,920)	0,0005 (0,106)	-0,0005 (0,154)	0,0001 (0,830)
Average Interest Rates	-0,0002 (0,817)	0,0004 (0,322)	0,0011 (0,340)	-0,0006 (0,708)
Inflation Volatility	-0,002 (0,146)	-0,0002 (0,051)	0,0003 (0,061)	-5.80E-05 (0,806)
Interest Rates Volatility	-0,004 (0,150)	0,0017 (0,098)	-0,0001 (0,848)	0,0009 (0,448)
Openness	-0,0009 (0,000)	-0,0005 (0,028)	8.77E-05 (0,721)	0,0001 (0,743)
GDP	2.96E-05 (0,000)	1.44E-05 (0,007)	5.02E-06 (0,001)	5.60E-06 (0,004)
Private Credit/M1	0,007 (0,336)	0,024 (0,129)	0,0037 (0,442)	0,004 (0,513)
R-Squared	0,977	0,732	0,397	0,281

Notes: P- Value in Parenthesis; definitions of variables in appendix. Cross-Section regression using all countries with data available.

VIII. Hard Currency and Financial Development

In this section we are interested on the effect of hard currency on financial development. Three variables measuring financial development are studied: private credit as a proportion of M1, total credit as a proportion of M1, and long term credit as a proportion of M1.

In this case because the financial development variables are not limited, we can run the test by simply adding the hard currency measures to the explanatory variables. The idea of the exercise is to compare the regressions with and without the measure of hardness. The results for private credit are shown in Tables 14. First, note that in the regression without including hard currency (first column), the most important explanatory variables are the average interest rate and the level of income. The former gives incentive for banks to take advantage of a higher spread over M1 and the latter increases the demand for credit. Second, note that the inclusion of the strong hard currency, weak hard currency or credit rating hard currency measures do not affect the significance nor the estimates of the interest and GDP coefficients. The numbers are almost numerically identical. This should cast some doubts on the causality from hard currencies to financial development.

However, when the financial hard currency definitions are included in the regressions several changes occur. First the overall explanatory power of the regressions is higher. This result should have been expected given that the variable on the left-hand side was used to construct the variables in the right hand side. Second, it is the case that the coefficients on inflation, interest, inflation variance, interest variance, and openness are stable to the inclusion of the hard currency indices. The coefficient on the GDP changes only when *FHC* is used.

Similar results are obtained if total credit as a proportion of GDP is used as dependent variable (Table 15). The inclusion of hard currency measures does not seem to explain the degree of financial development.

One could argue that the previous regressions did not give a fair chance to the hardness of the currency to explain financial development. Therefore, the next exercise is to

repeat the methodology used in the previous section. The first step is to project financial development on the hardness of the currency and then run the second step regression. The results are shown in Tables 16 and 17.

Note that the significance of the interest rate and GDP remain the same when we controlled for hard currency using SHC, WHC and FHC. In fact, the coefficients are not statistically different from the non-residual regression. This reinforces the result that the hard currency measures do not have an effect on financial development beyond the observed effect of macroeconomic variables.

In sum, this section showed that the hardness of the currency does not provide additional information on the development of the financial sector that is not already included in other country characteristics. The coefficients on the hard currency definitions are not significant in the overall regressions. In addition, the coefficients of all the other variables remained equally significant and almost unchanged once we included our hard currency definitions. Not even in the case where the first step of the regression maximized the explanatory power of the hard currency definitions, the other variables lost their explanatory power.

Table 14 – Dependent Variable Private Credit / M1

Constant	-0.095 (0.873)	-0.133 (0.824)	-0.112 (0.849)	0.200 (0.419)	0.224 (0.381)	-2.779 (0.479)
Average Inflation	0.013 (0.000)	0.013 (0.000)	0.013 (0.000)	0.014 (0.001)	0.009 (0.012)	0.015 (0.194)
Average Interest Rate	0.016 (0.021)	0.017 (0.013)	0.016 (0.015)	0.013 (0.024)	0.009 (0.115)	0.023 (0.535)
Inflation Volatility	-0.006 (0.000)	-0.006 (0.000)	-0.006 (0.000)	-0.006 (0.000)	-0.004 (0.006)	-0.007 (0.176)
Interest Rate Volatility	-0.026 (0.007)	-0.028 (0.007)	-0.027 (0.007)	-0.024 (0.043)	-0.017 (0.147)	-0.032 (0.254)
Openness	0.008 (0.226)	0.009 (0.159)	0.009 (0.169)	0.006 (0.040)	0.005 (0.068)	0.016 (0.025)
GDP	0.0001 (0.0001)	0.0001 (0.008)	0.0001 (0.017)	3.28E-05 (0.654)	0.0001 (0.000)	9.07E-05 (0.056)
SHC		1.745 (0.197)				
W_HC			0.835 (0.634)			
FHC				3.903 (0.098)		
FHC_OW					1.882 (0.070)	
CRHC_LONG						3.661 (0.442)
R-Squared	0.363	0.377	0.365	0.691	0.689	0.316

Note: P-Value in parenthesis; Definitions of Variables are expressed in the appendix. Cross-Section regression using all countries with data available.

Table 15 : Dependent Variable Total Credit/M1

Constant	0.08 (0.908)	0.03 (0.964)	0.05 (0.941)	-1.00 (0.465)	-0.95 (0.496)	0.87 (0.823)
Average Inflation	0.04 (0.018)	0.04 (0.018)	0.04 (0.018)	0.03 (0.019)	0.02 (0.107)	0.03 (0.000)
Average Interest Rate	0.004 (0.869)	0.01 (0.808)	0.01 (0.830)	-0.03 (0.285)	-0.04 (0.187)	-0.01 (0.823)
Inflation Volatility	-0.02 (0.022)	-0.02 (0.022)	-0.02 (0.023)	-0.01 (0.010)	-0.01 (0.068)	-0.01 0.000
Interest Rate Volatility	-0.07 (0.140)	-0.07 (0.138)	-0.07 (0.141)	0.01 (0.851)	0.03 (0.460)	-0.03 (0.217)
Openness	0.01 (0.144)	0.02 (0.113)	0.02 (0.131)	0.04 (0.168)	0.03 (0.176)	0.01 (0.447)
GDP	0.0001 (0.000)	0.0001 (0.030)	0.0001 (0.059)	-0.0001 (0.503)	9.46E-05 (0.223)	0.0001 (0.061)
SHC		2.34 (0.147)				
W_HC			1.48 (0.487)			
FHC				11.71 (0.188)		
FHC_OW					5.05 (0.132)	
CRHC_LONG						0.55 (0.902)
R-Squared	0.363	0.371	0.366	0.445	0.437	0.299

Note: P-Value in parenthesis; Definitions of Variables are expressed in the appendix. Cross-Section regression using all countries with data available.

Table 16 : Dependent Variable Private credit/ M1

Constant	2.12 (0.000)	2.27 (0.000)	0.91 (0.000)	0.99 (0.000)	-4.48 (0.121)
SHC	2.32 (0.007)				
W_HC		2.15 (0.052)			
FHC			4.52 (0.000)		
FHC_OW				5.84 (0.000)	
CRHC_Long					8.01 (0.024)
R-Square	0.052	0.032	0.438	0.486	0.076

Note: P-Value in parenthesis; Definitions of Variables are expressed in the appendix. cross-section regression using all countries with data available.

Table 17 : Regressions of Residuals of Private Credit after controlling for Hard Currency

	SHC	WHC	FHC	FHC_OW	CRHC
Constant	-0.64 (0.119)	-0.77 (0.060)	-0.70 (0.007)	-0.605 (0.012)	-1.81 (0.147)
Inflation Average	-0.0003 (0.294)	-0.0003 (0.296)	0.01 (0.000)	0.006 (0.037)	0.02 (0.001)
Interest Rate Average	1.30E-06 (0.0002)	1.25E-06 (0.000)	0.01 (0.023)	0.006 (0.225)	0.02 (0.393)
Inflation Volatility	-0.04 (0.044)	-0.04 (0.048)	-0.01 (0.0001)	-0.003 (0.025)	-0.01 (0.000)
Interest Rate Volatility			-0.03 (0.022)	-0.022 (0.034)	-0.03 (0.082)
Openness	0.01 (0.189)	0.01 (0.214)	0.01 (0.013)	0.007 (0.010)	0.02 (0.330)
GDP	6.68E-05 (0.010)	7.10E-05 (0.011)	1.28E-05 (0.339)	5.14E-05 (0.081)	6.70E-05 (0.143)
R-Square	0.127	0.131	0.449	0.220	0.249

Note: P-Value in parenthesis; Definitions of Variables are expressed in the appendix. Cross-Section regression using all countries with data available.

IX. Conclusions

This paper investigated the relationship between hard currency and financial development. There were several issues to consider. First, it is not straightforward to define hard currency. A reasonable effort was made in this paper to create empirical counterparts of theoretical definitions of hard currency. The paper creates four different definitions of hard currency based on different sets of data. These are series that could be potentially used in other work. The series created cast doubts about interpretations that equate financial development to the hardness of the currencies since they are indeed quite different variables. Moreover, and perhaps a bit surprising, the results of the paper are extremely robust to the hard currency definition used.

A second issue is the problem of endogenous variables. In order to overcome the problem we performed exercises in the extreme cases and qualified our conclusions based on these results. First, we gave financial development the highest chance to explain as much as possible of the hard currency indices. We took the residuals from those regressions and verified the remaining explanatory power of the other macro variables. As it was argued in the text the coefficients in these regressions are similar to the ones obtained when the first step was not performed. Second, we gave the macro variables the best chance to explain the index. When we correlated the residuals of these regressions using the financial development measure we found no relationship. Finally we run the pooled regressions and indicate that financial development is insignificant to explain hard currency, once other macro variables are taken into account. In other words, it is possible to argue that the correlation between financial development and hard currency is due to the fact macroeconomic stability is associated with both and not because of any direct effect of financial development on the hardness of the currency.

It is often argued that establishing a hard is a pre-condition for financial development and all the benefits that it generates. In the limit countries unable to establish their own stable currencies should dollarize their economies. The results of the paper suggest that indeed financial development and the hardness of currencies are highly correlated. However, we found that the relationship from the hardness to financial sector is fully captured by macro

variables that represent overall macroeconomic stability. Therefore, if the currency regime has a bear on the development of the financial sector (and therefore on productivity and growth) it passes through establishing a stable macroeconomic environment (measured for example by low and stable inflation and real interest rates). The results also suggest that having a hard currency is not a pre-condition for financial development but rather establishing a macroeconomic stable environment, which in principle could be established independent of the exchange regime.

X. References

BERG, ANDREW AND EDUARDO BORENSZTEIN (1999). "Full dollarization". IMF Policy Discussion Paper (in preparation). Washington D.C.

BLEJER, MARIO, FRENKEL, JACOB, LEIDERMAN, LEONARDO, ASSAF RAZIN, AND D.M. CHENEY (EDS.) (1997). ***Optimum Currency Areas: New Analytical and Policy Developments***. International Monetary Fund. Washington D.C.

CALVO, GUILLERMO (1998). "On Dollarization". Available from http://www.bsos.umd.edu/econ/ciecalvo.

---------- (1999). "Testimony on Full dollarization". Available from http://www.bsos.umd/econ/ciecalvo.

COOPER, RICHARD N. (1997)."Key currencies after the Euro". Mimeo, Department of Economics, Harvard University.

---------- (1999). "Exchange Rate Choices". Mimeo, Department of Economics, Harvard University.

EDWARDS, SEBASTIAN AND MIGUEL SAVASTANO (1999). "Exchange rates in emerging economies: What do we know? What do we need to know?". NBER Working Paper No. 7228.

FERNÁNDEZ-ARIAS, EDUARDO AND RICARDO HAUSMANN (1999). "International initiatives to bring stability to financial integration". IADB Working Paper No. 402.

FRANKEL, JEFFREY (1999). "No Single Currency Regime is Right for All Countries or at All Times". NBER Working Paper No. 7338.

FUNKE, NORBERT AND MIKE KENNEDY (1997). "International implications of the European economic and monetary union". OECD Working Paper No. 174.

GHOSH ,ATISH; ANNE-MARIE GULDE AND HOLGER WOLF (1997). "Does Nominal Exchange Regimes Matter?" NBER Working Paper No. 5874.

HAUSMANN, RICARDO, AND BARRY EICHENGREEN (1999). "Exchange Rates and Financial Fragility". NBER Working Paper No. 7418.

IZE, ALAIN, AND EDUARDO LEVY-YEYATI (1998). "Dollarization of Financial Intermediation: Causes and policy implications". IMF Working Paper No. 98/28.

KRUGMAN, PAUL (1999). "Monomoney mania". Available from http://www.slate.com.

MCNELIS, PAUL AND LILIANA ROJAS-SUÁREZ (1996). "Exchange rate depreciation, dollarization and Uncertainty: A comparison of Bolivia and Peru". IADB Working Paper No. 325.

MILLER, MARCUS H. AND DANIEL ORR (1966). "A model of the demand of money by firms". *Quarterly Journal of Economics*, 80, 413-435.

MISHKIN, FREDERIC (1999). "International experiences with different monetary policy regimes". *Journal of Monetary Economics*, 43, pages 579-605.

ROMER, DAVID (1993). "Openness and Inflation: Theory and evidence". *Quarterly Journal of Economics*, 108, 869-903.

TOBIN, JAMES (1998). "Financial globalization: Can national currencies survive?". Paper presented at the Annual World Bank Conference on Development Economics, Washington, D.C., April 20-21.

XI. Appendix

Appendix A: Definition of variables used in the regressions:

All the variables (except when explicitly indicated) were constructed using raw IFS data covering the period 1989-1998 in an annual basis.

- Inflation (*inflation_av*): Average inflation.
- Inflation volatility (*inflation_sd*): Standard deviation of inflation.
- Real interest rates (*interest_av*): Average real interest rate.
- Real interest rates volatility (*interest_sd*): Standard deviation of real interest rates.
- Openness (*open*): Average of export plus imports as a proportion of GDP.
- GDP per capita (*gdp*): Average of GDP per capita.
- Private Credit / M1 (*cpriv_m1*): (Private credit / M1) * (Total credit / GDP).
- Total Credit / M1 (*ctotal_m1*): (Total credit / M1) * (Total credit / GDP).
- Long -Term Credit / M1: (M2 / M1) * (Total credit / GDP).
- Lc_posit: Domestic currency lending by foreign banks as a proportion of GDP. Source: BIS.
- Tot_posit: Total cross-border lending as a proportion of GDP. Source: BIS.

Measures of Hard Currency:

- SHC (Strong definition of Hard Currency): See description on page 6.
- WHC (Weak definition of Hard Currency): See description on page 11.
- FHC (Financial definition of Hard Currency): See description on pages 13-14.
- FHC_OW (Financial definition of Hard Currency - Optimal weights): See description on pages 13-14.
- CRHC_short (Credit rating definition of Hard Currency - Short-term): See description on page 15.
- CRHC_long (Credit rating definition of Hard Currency - Long-term): See description on page 15.

Appendix B

Table A1

	HC	W_HC	FHC	FHC_OW	CR_HC
ALBANIA	0	0.00			
ALGERIA	0	0.01		0.00	
ANGOLA	0	0.00			
ANTIGUA AND BARBUDA	0	0.00			
ARGENTINA	0	0.00	0.00	0.00	0.82
ARMENIA	0	0.00			
ARUBA	0	0.29			
AUSTRALIA	0	0.03			0.91
AUSTRIA	0	0.63			1.00
AZERBAIJAN	0	0.03			
BAHAMAS, THE	0	0.00			
BANGLADESH	0	0.00	0.05	0.00	
BARBADOS	0	0.00	0.03	0.13	
BELARUS	0	0.00			
BELGIUM	1	0.57			0.96
BELIZE	0	0.00	0.02	0.00	
BENIN	0	0.00	0.00	0.00	
BHUTAN	0	0.00			
BOLIVIA	0	0.00	0.00	0.00	0.85
BOTSWANA	0	0.00	0.03	0.00	
BRAZIL	0	0.00	0.00	0.72	0.81
BULGARIA	0	0.00	0.00	-0.05	0.69
BURKINA FASO	0	0.00			
BURUNDI	0	0.00	0.00	0.00	
CAMBODIA	0	0.00			
CAMEROON	0	0.00			
CANADA	0	0.07			0.97
CAPE VERDE	0	0.01			
CENTRAL AFRICAN REP.	0	0.00			
CHAD	0	0.00			
CHILE	0	0.00	0.01	0.00	0.74
CHINA,P.R.: MAINLAND	0	0.00	0.00	0.00	
CHINA,P.R.:HONG KONG	0	0.00			0.95
COLOMBIA	0	0.00	0.03	0.00	0.75
CONGO, DEM. REP. OF	0	0.00	0.00	0.00	
CONGO, REPUBLIC OF	0	0.00	0.00	0.00	0.92
COSTA RICA	0	0.00			
COTE D IVOIRE	0	0.00			0.85
CROATIA	0	0.45			0.91
CYPRUS	0	0.00	0.00	0.00	0.85
DENMARK	0	0.73			0.95
DOMINICA	0	0.00	0.02	0.00	
DOMINICAN REPUBLIC	0	0.00	0.00	0.00	0.83
ECUADOR	0	0.00	0.00	0.00	

Table A1- Cont.

	HC	W_HC	FHC	FHC_OW	CR_HC
EGYPT	0	0.00	0.00	0.00	0.82
EL SALVADOR	0	0.00	0.00	0.00	0.75
EQUATORIAL GUINEA	0	0.00			
ESTONIA	0	0.00			0.94
ETHIOPIA	0	0.00			
FIJI	0	0.00	0.01	0.00	
FINLAND	0	0.07			0.95
FRANCE	1	0.93	0.74	0.00	1.00
GABON	0	0.00	0.00	0.00	
GAMBIA, THE	0	0.00			
GERMANY	1	0.87	0.81	0.71	1.00
GHANA	0	0.00	0.00	0.00	
GREECE	0	0.00			0.83
GRENADA	0	0.15	0.39	0.00	
GUATEMALA	0	0.00	0.00	0.00	
GUINEA-BISSAU	0	0.00			
GUYANA	0	0.00	0.00	0.00	
HAITI	0	0.01		0.00	
HONDURAS	0	0.00	0.00	0.00	
HUNGARY	0	0.00	0.06	0.00	0.78
ICELAND	0	0.00			0.85
INDIA	0	0.00	0.03	0.00	0.84
INDONESIA	0	0.00	0.00	0.00	0.90
IRAN, I.R. OF	0	0.01		0.00	
IRELAND	0	0.04			0.91
ISRAEL	0	0.00			0.80
ITALY	1	0.46			0.94
JAMAICA	0	0.00	0.00	0.00	
JAPAN	1	1.00	0.99	0.64	1.00
JORDAN	0	0.00			0.77
KENYA	0	0.00			
KOREA	0	0.01			1.17
KUWAIT	0	0.00			0.95
KYRGYZ REPUBLIC	0	0.01			
LAO PEOPLE'S DEM.REP	0	0.01			
LATVIA	0	0.01		0.00	0.88
LEBANON	0	0.00			0.92
LESOTHO	0	0.00			
LIBERIA	0	0.00			
LIBYA	0	0.00			
LITHUANIA	0	0.00			0.88
LUXEMBOURG	0	0.57			1.00
MACEDONIA, FYR	0	0.00			
MADAGASCAR	0	0.00			
MALAWI	0	0.00			
MALAYSIA	0	0.04		0.00	0.83
MALDIVES	0	0.00			
MALI	0	0.00			
MALTA	0	0.03	0.14	0.00	0.85

Table A1-Cont.

	HC	W_HC	FHC	FHC_OW	CR_HC
MAURITANIA	0	0.00	0.01	-0.05	
MAURITIUS	0	0.00			
MEXICO	0	0.00	0.00	0.00	0.71
MOLDOVA	0	0.00			
MONGOLIA	0	0.00			
MOROCCO	0	0.00	0.02	0.00	0.80
MOZAMBIQUE	0	0.01		0.00	
MYANMAR	0	0.00	0.00	0.00	
NAMIBIA	0	0.00			
NEPAL	0	0.00			
NETHERLANDS	1	0.17			1.00
NETHERLANDS ANTILLES	0	0.07			
NEW ZEALAND	0	0.07			0.91
NICARAGUA	0	0.00			
NIGER	0	0.00	0.00	0.00	
NIGERIA	0	0.00	0.00	0.00	
NORWAY	0	0.23			1.00
OMAN	0	0.00			
PAKISTAN	0	0.00	0.04	0.00	
PANAMA	0	0.00			1.00
PAPUA NEW GUINEA	0	0.00	0.00	-0.34	
PARAGUAY	0	0.00	0.00	0.00	1.00
PERU	0	0.00	0.00	0.00	1.09
PHILIPPINES	0	0.00	0.02	0.00	0.75
POLAND	0	0.00	0.00	0.00	0.79
PORTUGAL	0	0.00			0.87
QATAR	0	0.02			
ROMANIA	0	0.01			0.79
RUSSIA	0	0.00			
RWANDA	0	0.00			
SAMOA	0	0.01			
SAUDI ARABIA	0	0.01			
SENEGAL	0	0.00			
SEYCHELLES	0	0.00			
SIERRA LEONE	0	0.00			
SINGAPORE	0	0.10			0.97
SLOVAK REPUBLIC	0	0.00			0.75
SLOVENIA	0	0.00			0.86
SOLOMON ISLANDS	0	0.00			
SOUTH AFRICA	0	0.00			0.80
SPAIN	0	0.01			0.92
SRI LANKA	0	0.00			
ST. KITTS AND NEVIS	0	0.00			
ST. LUCIA	0	0.00	0.03	0.00	
ST. VINCENT & GRENS.	0	0.00	0.01	0.00	
SUDAN	0	0.01			
SURINAME	0	0.00			
SWAZILAND	0	0.00			
SWEDEN	0	0.00			0.97

Table A1 – Cont.

	HC	W_HC	FHC	FHC_OW	CR_HC
SWITZERLAND	1	0.99			1.00
SYRIAN ARAB REPUBLIC	0	0.01			
TANZANIA	0	0.00			
THAILAND	0	0.03			0.90
TOGO	0	0.00			
TONGA	0	0.00			
TRINIDAD AND TOBAGO	0	0.00	0.02	0.00	0.81
TUNISIA	0	0.07		0.00	0.78
TURKEY	0	0.01	0.03	0.00	
UGANDA	0	0.00			
UKRAINE	0	0.00	0.00	0.00	
UNITED ARAB EMIRATES	0	0.02			
UNITED KINGDOM	1	0.28			1.00
UNITED STATES	1	0.97			1.00
URUGUAY	0	0.00			0.86
VANUATU	0	0.00			
VENEZUELA	0	0.00			
YEMEN, REPUBLIC OF	0	0.00			
ZAMBIA	0	0.00	0.00	0.00	
ZIMBABWE	0	0.00	0.00	0.00	