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Credit vs. Payment Services: Financial Development and Economic Activity Revisited

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Credit vs. Payment Services: Financial Development and Economic Activity Revisited (*)

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Abstract

The purpose of this paper is to assess whether the banking system, over and beyond its credit function, has a significant impact on per capita GDP by providing means of payment. An annual database of 85 countries spanning the 1980-2008 period is exploited to this end. On the descriptive front, we find that richer economies exhibit higher and increasing levels of demand deposits and lower levels of currency than poor countries. While this was to be expected, more surprising is the fact that the currency to GDP ratio did not decrease much over time, regardless of income level differences. In turn, our regressions confidently support the hypothesis that banks contribute to economic development not only as credit suppliers but also by facilitating transactions. Specifically, along with the ratio of private credit to GDP, the ratio of demand deposits to currency seems to exert a positive influence on per capita GDP. The results are robust for different model specifications. These findings have valuable implications for a better understanding of the channels through which the banking system affects the economy.

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(*) Comments welcome at ricardo.bebczuk@gmail.com, tburdisso@bcra.gov.ar and maximo.sangiacomo@bcra.gov.ar. Useful suggestions from Santiago Carbó, Jim Cunha, David Humphrey, Robert Hunt and Scott Schuh are greatly appreciated. We thank Ronald Smith, Hashem Pesaran and Takashi Yamagata for their generous advice in implementing new statistical tests for our unbalanced panel. This work does not necessarily reflect the opinion of the Central Bank of Argentina or its authorities.

Table of Contents

1. Introduction

In the last 20 years, the finance literature has emphasized the importance of financial development for long-term economic growth. This hypothesis is grounded on the ability of banks (and other intermediaries) to: (i) choose the most productive projects; (ii) monitor and control borrowers until the maturity of the project and the subsequent loan repayment; (iii) diversify risks, and (iv) minimize the cost of mobilizing savings.

It is striking, however, the little attention that researchers have paid so far to the role of the banking system in creating means of payment. For instance, in his comprehensive survey of the finance and growth literature, Levine (2004) briefly mentions that the financial system eases specialization by facilitating exchange via lower transaction costs, and cites Greenwood and Smith (1997) for theoretical support but without offering any empirical evidence. An apparent indication of the prevalent credit-based view is that the ratio of private credit to GDP, and no variable measuring payment services, is overwhelmingly used in growth regressions as a proxy for financial sector development.

A similar omission is found in the analysis of the effects of financial crises on economic activity. When stressing the need for an efficient payment system and how to preserve it in the midst of a financial crisis, Flannery (1996) asserts that "*A developed economy's basic infrastructure must include a cheap, reliable payment system to facilitate the mutually profitable exchanges required for agents to exploit economies of specialization…Because the payment system is so crucial to a modern economy's functioning, its potential failure elicits great concern*". On a more anecdotal note, Taylor (2007) takes stock of the 2002 Uruguayan crisis, and notices that "*The immediate need was to stop the bank run and prevent a breakdown in the payments system, which would compound the damage already done to Uruguay's economy*". However, in measuring the real costs of financial crises, Cecchetti, Kohler and Upper (2009) identify the availability and cost of credit as a major

channel of transmission to the real sector, but make no reference to the disruption of the payment system. Likewise, Claessens, Kose and Terrones (2008) highlight the changes in credit as a key determinant of recessions, yet once again neglect a specific role for the payment system.

The reasons why the bank-based payments system improves a country´s economic performance vis-à-vis the direct use of cash are not difficult to pinpoint. First, the use of physical currency is costly, as it implies onerous distribution, insurance and other management costs for commercial and central banks.[1] Second, switching payments from a cash-based to a secure electronic-based platform brings about sizable time savings to entrepreneurs, coming from more efficient accounting and financial planning systems. Third, non-cash vehicles reduce the risk of theft and the pecuniary costs of paper invoicing and payments, which are much more labor-intensive and less expedite than electronic processing. Finally, as all payments get recorded in an electronic environment, transaction transparency enhances internal auditing within firms and the access to credit by third parties –once the documentation of all borrower revenues and expenses alleviates informational asymmetries- as well as a better detection of tax evasion and illegal activities at macroeconomic level.

It is well-known that the technological revolution beginning in the 1970s has favored the massive adoption of inexpensive and secure electronic payment products that have become a close substitute for cash holdings. The rising preference for non-cash payments is illustrated by Schuh (2007) with actual data for the US. In 1995, the share of cash in total payments was 21%; a decade later, in 2005, it was already 14%. Debit and credit cards grew in the same period from 19% to 32%, while checks fell from 53% to 37%. Summarizing the preceding discussion about credit, payments and financial crises, it is only

[1] For example, Humphrey et al. (2003) report that bank payment costs in Norway are about four times higher with cash than with debit cards. Obviously, this difference varies across countries. Our paper is especially concerned with the contrast between cash and bank means of payments but, within the latter, another central issue is the transition from checks (which are still a paper-based instrument) to purely electronic instruments.

natural to think that, as cash is gradually replaced by bank-based payment instruments, bank crashes may critically impact the level of activity through a disruption in the payments network that connects million of buyers and sellers across the economy through the banking system.

The purpose of this paper is to assess whether the banking system, over and beyond its credit function, has a significant impact on per capita GDP by providing means of payment. Also, as a by-product of our research, we will take the opportunity to look at the long-term trends in the usage of cash versus non-cash payment instruments. Our work will be based on an annual panel dataset covering 85 countries over the 1980-2008 period.

In addition to the assessment of the productive impact of a well-functioning payments system, two compelling motivations drive this research work. One has to do with the role of the financial system in the real economy in times of crisis. A spirited debate around the causes and consequences of recurrent financial crises all over the world has unraveled in the last 15 years or so, and even more fiercely with the advent of the US financial crisis in 2007. The underlying question revolves around the net contribution of the financial system after putting on the table two well-documented facts: (i) credit seems to be growth-promoting in the long-run but destabilizing in the short-run, as forcefully demonstrated by Loayza and Ranciere (2005) in the context of international panel growth regressions and IPES (2005) in discussing the probability of a financial crisis, and (ii) the flow of credit is not a major source of finance for the private sector, in particular when compared to self-finance (see Bebczuk et al. (2010)). These facts make the high value that societies place on the financial system as credit provider all the more controversial. As the credit function of the banking system is being put under such a stern scrutiny, it is of interest to quantify the effect of the usually disregarded payment function.

The other motivation is that the way transactions are settled has profound implications for monetary policy. A long-standing topic of analysis in monetary economics is how financial innovations have affected the demand for money, complicating the job of central banks in their quest for keeping inflation under control (see Simpson and Blinder (1984)).[2] In a related vein, the degree of substitution between currency and non-cash instruments is bound to have a direct bearing on seniorage revenue.

The paper is structured in five sections; the next is devoted to the presentation of the data and the discussion of some major trends and methodological issues; the third section discusses the paper's econometric innovations, and the fourth presents our empirical findings. Some conclusions and policy implications will appear in the closing section.

[2] It should be noted, though, that there are three levels of substitution between money stock components: (i) between *M*1 and other money aggregates, which was at the center of the missing money debate in the 1970s and 1980s; (ii) between all money aggregates and electronic money (see for example Laster and Wenninger (1995)), and (iii) between currency and demand deposits within the *M*1 aggregate (as discussed in Drehmann, Goodhart and Krueger (2002)). Our paper focuses only on (iii).

2. Data

Economic transactions can be carried out in cash outside the banking system or by using bank substitutes, which include checks, ATMs, and debit and credit cards. These alternative instruments are accepted by sellers because they are backed by cash balances maintained in the banking system mostly as demand deposits (as opposed to savings accounts, which are kept for store of value rather than for transactional uses).

The most popular measure of the use of cash, and the one we will adopt for our work, is the stock of currency in circulation to GDP, also referred to as the inverse of the velocity of money. In turn, our proxy for the use of non-cash bank payment instruments will be the stock of demand deposits to GDP. Both series were obtained from the IMF's International Financial Statistics.

An invaluable advantage of the variables chosen is that they are available for a large number of countries (85) and years (1980 through 2008). But one should be aware, though, that the cash stock issued in a given country may not coincide with the cash stock actually used in registered domestic transactions. First, part of the existing cash may be hoarded by residents, although it is most likely that savings in the form of cash are marginal as a proportion of total stock. Second, some national currencies may be demanded by foreign residents (as a financial asset or even for transaction purposes) and governments (for building international reserves). Finally, cash is normally the vehicle to conduct illegal or informal transactions to avoid official controls that can be more effectively applied on financial intermediaries. This has two amplifying effects on the currency to GDP ratio: on one hand, countries with a large fraction of underground activities will be likely to display a more intensive use of cash vis-à-vis bank payment instruments; on the other hand, since the currency stock is fully recorded but total GDP is underreported, the observed cash to (official) GDP ratio will overestimate the use of cash in economies with a larger shadow

economy, in particular developing economies.[3] As the amount of cash actually used in domestic transactions cannot be directly observed, we will try to control in different ways for these potential drawbacks when running our regressions.

Similarly, it may be the case that some deposits classified as savings be used for transaction purposes, and hence the ratio of demand deposits to GDP would underestimate the role of non-cash payment instruments. A more direct indicator is the value and number of transactions made with checks, debit and credit cards, and related instruments. The problem here is that statistics of this kind exist for a limited number of advanced countries and for a much shorter period of time. Nevertheless, the available data suggest that we are on the right track when adopting the above-mentioned empirical variables. Firstly, work by Snellman, Vesala and Humphrey (2000) and by Snellman and Viren (2006) shows that the ratio of cash to GDP moves negatively with different measures of bank-created means of payment, such as the number of POS terminals and of ATMs per capita, implying that cash and non-cash are substitutes. Secondly, Graph 1 reveals that the ratio of currency to demand deposits –our proxy for the weight of cash vis-à-vis non-cash transactions- holds a negative correlation with the number of debit cards per capita –a good indicator of the use of non-cash instruments- in 31 countries (with 2006 data from national and multilateral sources). Similarly, the overall accuracy of the demand deposits as a proxy for non-cash payments is demonstrated in Graph 2 by confirming its positive correlation with debit cards per capita.

Table 1 displays the ratio of currency in circulation and demand deposits to GDP, as well as the ratio between both for our 85 countries and for different country groups classified by per capita income.[4] A first glance at the data uncovers quite interesting trends. To begin with, currency in circulation has not

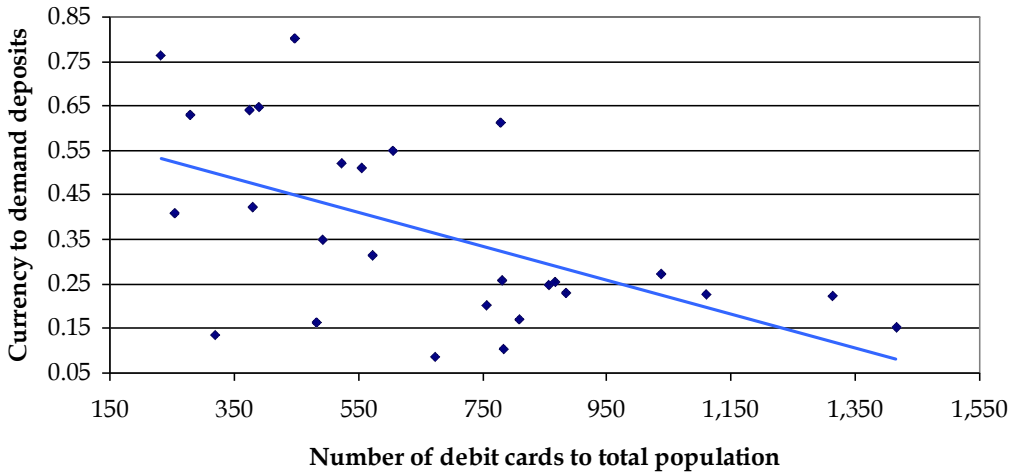
[3] Schneider (2007) estimates that the shadow economy represents, on average, for the period 1999-2005, 36.7% in 96 developing economies and 14.8% in 21 OECD countries.
[4] Descriptive tables span the 1980-2007 period, leaving year 2008 outside because the number of countries drops from 85 to 27, blurring group comparisons over time. However, 2008 data is used in the regression analysis.

evidenced any change in the last three decades, remaining at a level close to 6% of GDP. This contrasts with the downward path driven by the adoption of new cash-saving payment technologies. It is curious that the demand for currency has remained relatively stable over time despite the emergence of technological, more efficient competitors. An answer to this puzzle is offered by Drehmann, Goodhart and Krueger (2002), who contend that currency has the irreplaceable advantage of preserving anonymity, an asset for people conducting illegal or immoral activities. If anything, electronic means of payments may be a substitute for small and legal transactions.

Looking at differences across country groups in 2007, based on GDP-weighted averages, low income countries (8.6%) and lower middle income economies (9.1%) have larger levels of currency to GDP than richer ones (between 5% and 6%). A different situation is found when inspecting the evolution of demand deposits over time, whose world average jumped to 23.2% of GDP in 2007, up from 10.2% in 1980. This ratio shows substantial increases in all country groups, save for low income economies. However, for 2007, OECD countries stand out by their stock of demand deposits (32.5%) against ratios of 12%-13% in the other country groups.

The ratio of Currency to Demand Deposits –which, as said before, is a summary indicator of the relative usage of cash to non-cash payments- declined markedly from 1980 to 2007 for the whole sample (from 62.2% to 41.5%) and for all country groups except for the lower middle income nations. Here the wedge between richer and poorer countries becomes much more conspicuous. Graphs 3 through 5 portrait the trajectory of the three variables on a yearly basis over 1980-2007, showing that in the intervening years the behavior of the series was generally smooth and differences across groups stayed roughly the same as those commented in the previous paragraph.

Graph 1
Currency to Demand Deposits and Debit Cards Per Capita
Data for 31 countries in 2006



Graph 2
Demand Deposits to GDP and Debit Cards Per Capita
Data for 31 countries in 2006

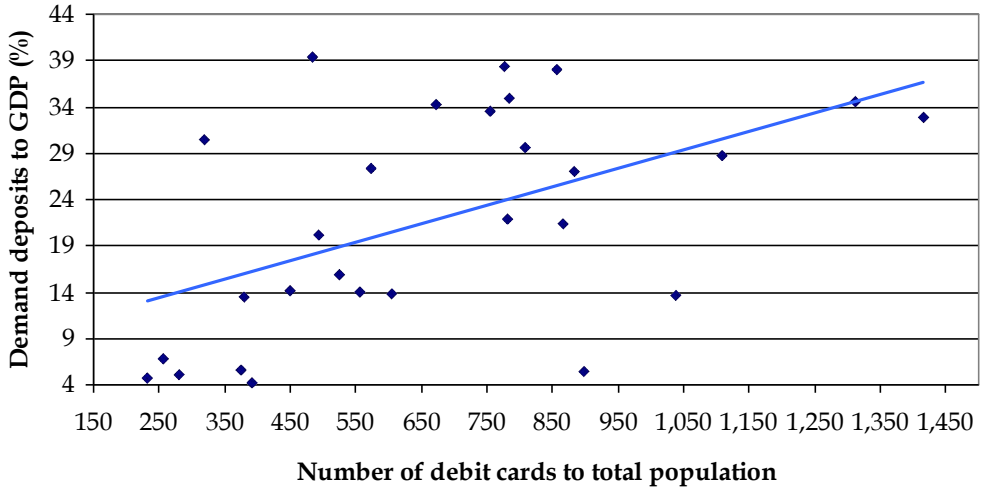
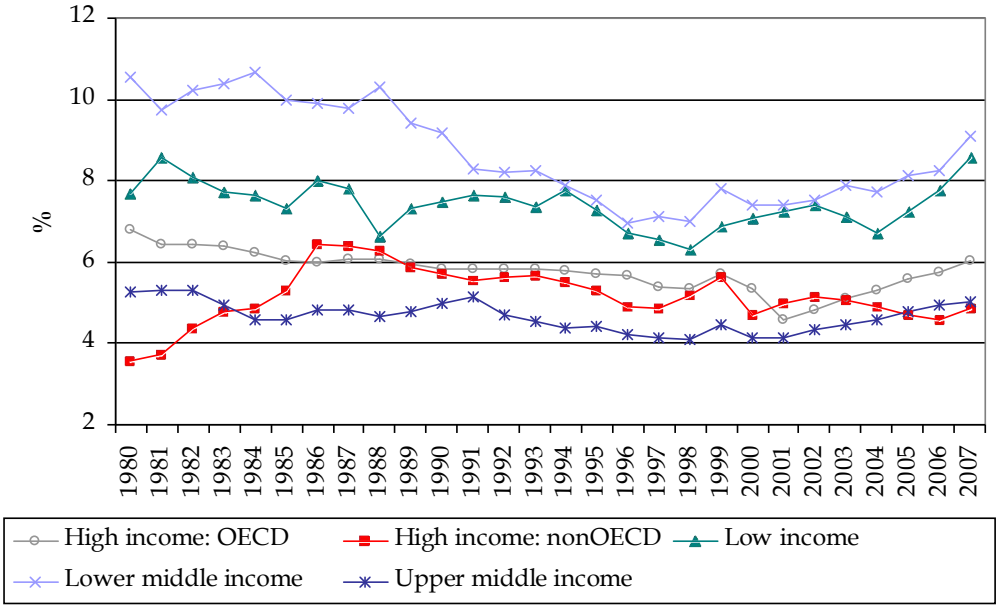


Table 1
Currency in Circulation and Demand Deposits in 1980 and 2007
Per capita GDP-Weighted Values

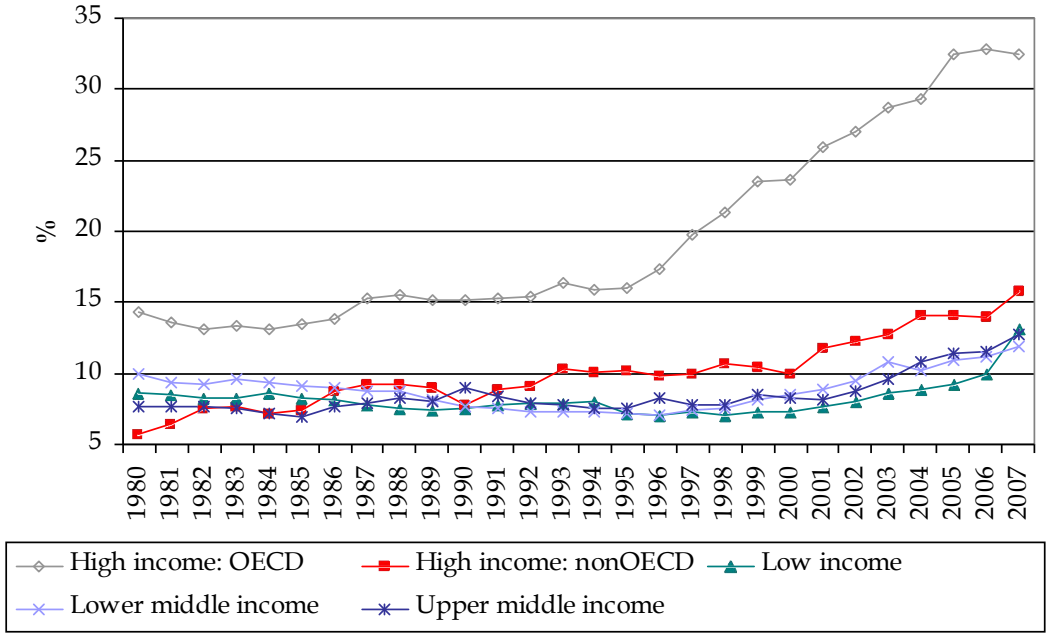
Country Group/Period &Variable	Currency in Circulation (% of GDP)			Demand Deposits (% of GDP)			Currency to Demand Deposits		
	1980	2007	*Change (%)*	1980	2007	*Change (%)*	1980	2007	*Change (%)*
World	5.9	5.9	*0.6*	10.2	23.2	*128.0*	62.2	41.5	*-33.3*
High Income OECD	6.8	6.0	*-11.0*	14.4	32.5	*125.9*	51.4	28.7	*-44.0*
High Income Non-OECD	3.6	4.9	*35.6*	5.7	15.8	*179.0*	59.5	32.6	*-45.2*
Upper Middle Income	5.3	5.0	*-4.7*	7.6	12.8	*67.7*	72.0	48.6	*-32.5*
Lower Middle Income	10.5	9.1	*-13.7*	10.0	11.9	*19.5*	101.8	109.7	*7.7*
Low Income	7.7	8.6	*11.5*	8.7	13.1	*50.8*	99.6	74.8	*-24.9*

Source: Own elaboration based on IMF International Financial Statistics.

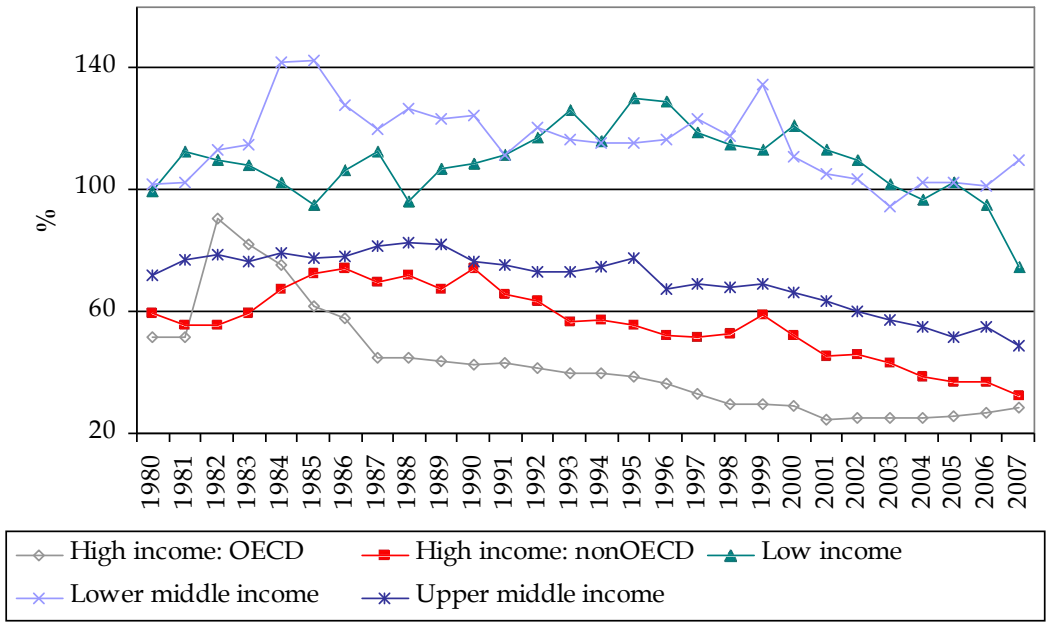
Graph 3
Currency in Circulation to GDP by Country Group
Per Capita GDP-Weighted Average for 85 Countries, 1980-2007



Graph 4
Demand Deposits to GDP by Country Group
Per Capita GDP-Weighted Average for 85 Countries, 1980-2007



Graph 5
Ratio of Currency to Demand Deposits by Country Group
Per Capita GDP-Weighted Average for 85 Countries, 1980-2007



The hypothesis under study admits two possible immediate criticisms: one is that deposits are just the reflection of credit on the liabilities side of the banking system balance sheet, and thus the researcher would be unable to disentangle the independent effect of each other –or, alternatively, a positive loading on demand deposits may in practice be picking up the beneficial impact of credit. The other criticism, in turn, is that any correlation between per capita GDP and financial variables casts the usual doubt about whether the latter explains the former or the other way around. Responding the first issue, Graph 6 shows that in 2007 private credit (106.9% of GDP) was about 4.6 times demand deposits (23.2% of GDP), meaning that they can hardly be considered the mirror of each other. Table 2 reinforces this statement by displaying the Credit to Demand Deposits ratio for each income country group, where it can be confirmed that, in the World at large, this ratio has been 5% at the initial year and 7% at the ending sample year. Also it can be seen that its value is much larger in higher income countries, although it has grown in all groups except for the High Income Non-OECD and Low Income. The lack of proportion between credit and demand deposits is of course linked to the omission of other deposits –the same Table illustrates the ratio of Credit to Total Deposits, which goes from 1.1 in 1980 to 1.2 in 2007 for the whole sample.[5]

Regarding the endogeneity issue, Graph 7 renders a close correlation between per capita GDP and demand deposits, while currency seems to meander around a rather constant level, as noticed earlier. Nevertheless, the analysis leads to reject the idea that the drop in the currency-to-demand deposits ratio is just a side effect of economic development. A preliminary procedure to address this endogeneity is based upon an external instrumental variable for our variable of interest. To this end, we can exploit the fact that the boom in the

[5] The Credit to Total Deposits ratio is larger in high income compared to middle to low income countries. Possible reasons for this are, first, that liquid reserves tend to be larger in poorer and more unstable economies and, second, that banks in well-developed economies are more likely to tap capital markets to increase their funding above their deposits stock. Table 2 also shows that the proportion of Demand to Saving Deposits is generally higher in low income countries, which may be related to the preference for shorter-term, more liquid assets in response to macroeconomic volatility.

usage of non-cash payment instruments since the 1980s and 1990s was largely triggered by technological breakthroughs (such as low-cost telecommunications, secure and real-time point-of-service verification, and massive Internet access, among others) that are independent from the level of activity and instead rely on the effort, creativity, and random luck of engineers and scientists (see Rosenberg (1982) and Aghion and Howitt (1998) for compelling accounts about uncertainty and randomness of technological advances). These periodical shifts in the technological frontier dramatically reduced the costs of electronic transactions over time.[6] We have taken as our instrument for the ratio of demand deposits to currency the consumer price index for information technology services, elaborated by the US Bureau of Labor Statistics since 1988, combined with the one presented in Jorgenson (2001), Table 1, for 1980-1987. In unreported regressions (but available upon request), we find that our econometric results from the next section generally hold when we run a fixed effects IV regression, implying that endogeneity is not driving our conclusions.[7]

[6] This argument does not deny that, over the course of time, income levels may ease the dissemination of new technologies by supporting an expanding demand and the emergence of economies of scale. But this will come at a later stage and has no direct influence on the inventor's inspiration to create new varieties of technological products. More to the point, demand deposits, as can be seen in Graph 4, were rather flat until the late 1990s, around 10% of GDP, and then they tripled in less than a decade. This evolution is at odds with the increase in per capita GDP all over the whole period, unless an exogenous technological factor is at play.

[7] Unfortunately, our novel estimation technique, presented later on, is not suited to run a IV regression, preventing us from including this endogeneity test as part of our core econometric analysis.

Graph 6
Currency, Demand Deposits and Credit to GDP
Per Capita GDP-Weighted Average for 85 Countries, 1980-2007

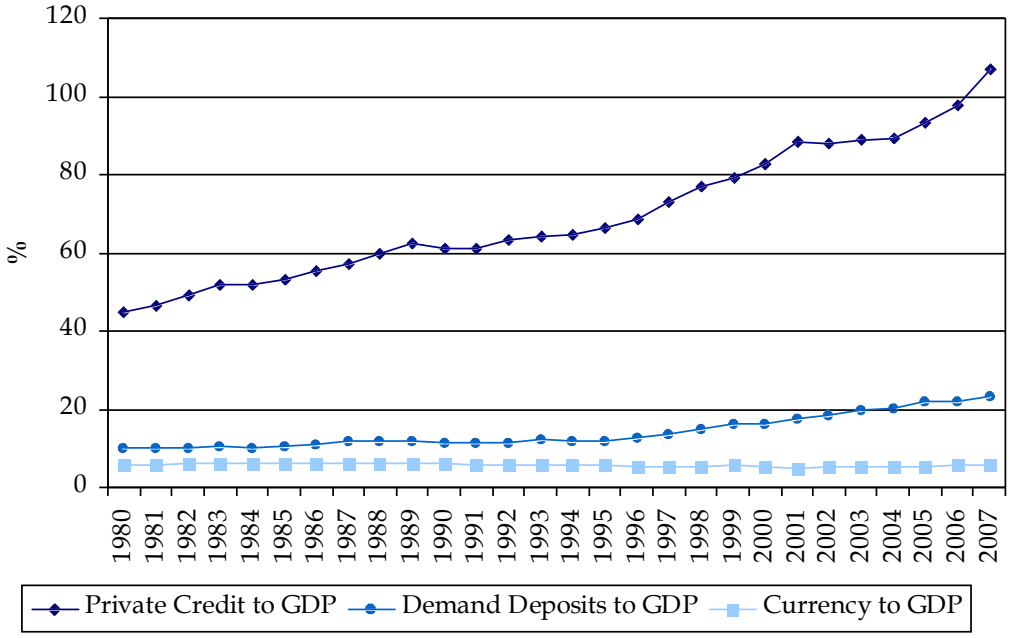
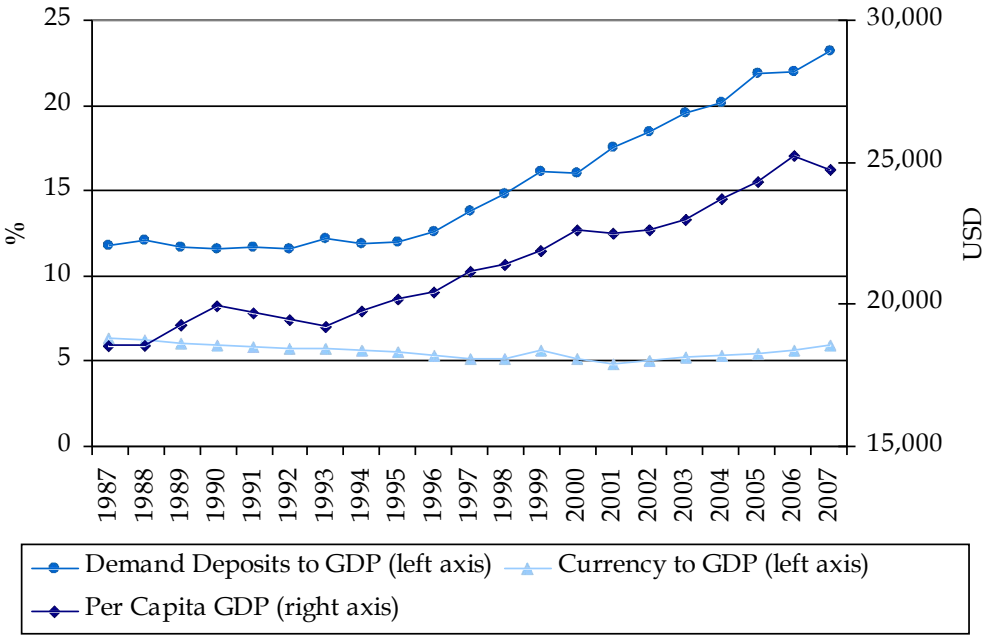


Table 2
Credit, Demand Deposits and Saving Deposits in 1980 and 2007
Per capita GDP-Weighted Values

Country Group/Period &Variable	Credit to Demand Deposits			Credit to Total Deposits			Demand to Saving Deposits		
	1980	2007	*Change (%)*	1980	2007	*Change (%)*	1980	2007	*Change (%)*
World	5.0	7.0	*40.2*	1.1	1.2	*6.0*	0.5	0.4	*-7.8*
High Income OECD	5.3	8.5	*60.5*	1.1	1.5	*37.9*	0.4	0.5	*32.1*
High Income Non-OECD	5.6	5.5	*-2.8*	1.2	0.7	*-37.3*	0.3	0.2	*-31.1*
Upper Middle Income	3.9	4.9	*25.8*	1.0	0.9	*-2.3*	0.5	0.3	*-30.0*
Lower Middle Income	3.4	7.3	*113.6*	1.1	0.8	*-21.9*	0.9	0.3	*-68.8*
Low Income	2.6	2.0	*-23.5*	1.5	0.8	*-42.8*	1.8	1.2	*-35.7*

Source: Own elaboration based on IMF International Financial Statistics.

Graph 7
Demand Deposits, Currency and Per Capita GDP
Per Capita GDP-Weighted Average for 85 Countries, 1980-2007



3. Econometric Approach

As follows, we will explain the nature of our econometric panel analysis and introduce various innovations to the existing empirical literature. Our empirical specification is the following:

$$y_{it} = \alpha_i + \beta_i x_{it} + \gamma_{it} z_{it} + u_{it} \qquad i = 1,2,...,N \;\; and \;\; t = 1,2,...,T$$

where the dependent variable is per capita GDP, x_{it} is the ratio of Demand Deposits to Currency (our core explanatory variable), and z_{it} are additional controls, including the ratio of private credit to GDP.

The growing availability of panel datasets with not only large *N* but also large *T* has driven new developments into the panel literature regarding the choice of a proper estimator and the asymptotic analysis (see Smith and Fuertes (2010)). Moreover, large *N* and large *T* datasets are well-suited for the discussion of three key issues in panel estimation, namely, heterogeneity, dynamics and cross section dependence.

The treatment of *heterogeneity* is probably the central question in panel time-series. Since it is possible to estimate a regression for each unit (country, firm, region), it is natural to consider heterogeneous panel models when the parameters can vary over cross-section units rather than assuming homogeneity across units, as we usually do in small *T* cases. The latter is a testable assumption, which is quite often rejected.[8] Assuming homogeneity when the true model is heterogeneous may lead to inconsistent estimates because the

[8] Of course, the preference for a heterogeneous or homogeneous panel model will depend on the purpose of the exercise. Pesaran and Smith (1995) have questioned the poolability of data across heterogeneous units. Studies about the properties of some panel data estimators (with stationary and non-stationary regressors), that assume that the regression coefficients are homogeneous when they are not, have shown a severe bias in dynamic estimation even for a relatively small parameter variation.

restriction imposed is not valid. Regarding *dynamics*, large T allows for estimating less restrictive dynamic models. Ignoring different dynamic structures for all or some units also implies that estimates might be inconsistent due to the fact of dynamic misspecification. The last topic is *cross-section dependence* (CSD). The standard panel data analysis assumes independence across units. However, as recently shown in the so-called second generation panel literature (see Breitung and Pesaran, 2008), when cross-section dependence is significant and is not dealt with, one may get little improvement in efficiency from panel estimators compared to a single time series. Usually, this cross-section dependence is associated to unobserved common factors, such as global cycle, that cannot be estimated from a single time series. This is an important advantage of panel methods, provided we control for this effect.

As we have shown previously, our panel data with N = 85 and T varying between 20–30 years could be considered as a large N, large T panel. This gives us variability in both dimensions: cross section variation tends to be associated to long run or permanent effects, while time series variation has more to do with short run or transitory effects (Baltagi, 2008; Pesaran and Smith, 1995).

In this context, our parameters of interest are the long-run effects, in line with the belief that the working of the payment system improves resource allocation and economic efficiency over long-time horizons, while short-term changes in the usage of currency and demand deposits should have no influence on such macroeconomic outcomes.[9] One reason to expect the order of integration in time series analysis to be important is the potential danger of spurious

[9] To fix ideas, the likely growth effect of a bank-centered payment system is similar to that of increased education: more education should be expected to enhance growth prospects after, say, 15 or more years, but it is highly unlikely that an increase in enrollment from one year to the next would accelerate second year's growth, the main reason being that any investment in human capital matures after many years. An exception is the disruption of the payments system during a full-fledged banking crisis.

regression if the variables of interest are I(1).[10] Pesaran et. al (1995) note that the problem of spurious regression does not arise in a cross section of the form:

$$\bar{y}_i = \alpha + \beta \bar{x}_i + \bar{u}_i$$

even if x_{it}, y_{it} and u_{it} contain a unit root. Under strong assumptions of random and strictly exogenous x_{it}, the authors show that $\hat{\beta}$ can consistently estimate the long run effects of x_{it} on y_{it} through the between estimator (BE). However, the BE wipes out the time dimension, causing a loss of efficiency. Even more, if the strict exogeneity of the regressors is questioned, the BE estimator is inconsistent. Hence, between estimators need to be interpreted with caution.

Phillips and Moon (1999, 2000) propose new estimators that exploit both dimensions of the panel under weaker assumptions. One of these estimators is mean group estimator (MG), that is, the average long-run regression coefficient estimated by the average across groups of the individual regression coefficients (see Pesaran et al., 1995). This estimator represents the average behavior of the individuals. Notice that the average over *i* attenuates the noise, avoiding the problem of spurious regression and delivering a consistent estimator of β ($T \to \infty$, $N \to \infty$), even when the individual β_i is not consistent. Notice that the MG estimator relaxes the conventional assumption of slope homogeneity.

At the opposite side of β^{MG}, we have the traditional pooled estimator known as the fixed effect (FE) estimator, where the intercept is allowed to differ across groups while all other coefficients and error variances are restricted to be the same. This homogeneity coefficient assumption, though usually adopted, faces

[10] Most economic time series are non-stationary and integrated of order one, i.e., they contain a unit root. However many equilibrium or arbitrage conditions imply that linear combinations of these I(1) variables are stationary, indicating that the variables are cointegrated. Furthermore, the presence of unit roots is at the heart of the spurious regression syndrome, but in panel time series this seems to be less of a problem, as pointed out by Phillips and Moon (1999, 2000) and Kao (1999).

serious limitations on empirical grounds (Pesaran, Shin and Smith, 1999). All three estimators –BE, MG and FE- yield an estimate of the average coefficient; the difference is that in the case of the MG estimator the averaging is explicit while, in the others, it is implicit, (Pesaran et. al, 1995).

Nevertheless, one of the key assumptions behind most of the panel estimators is the lack of correlation across units. Phillips and Sull (2003) observe that the consequences of ignoring CSD can be serious: averaging across units may provide little gain in efficiency over single equation estimation, and correlated error terms may render estimators biased, turning any statistical inference invalid. In recent years, there has been much progress in characterizing and modeling CSD. Pesaran (2006) suggests a new approach by noting that linear combinations of unobserved factors can be well approximated by cross-section averages of the dependent variable and the observable regressors. In order to do this, he suggests including the means across units in each moment of time of the (y_{it}, x_{it}) vector as additional regressors. This gives the Correlated Common Effect Mean Group estimator (MG-CCE). The CCE procedure is applicable to panels with a single or multiple unobserved factors. Kapetanios, Pesaran and Yamagata (2011), in turn, extend Pesaran's (2006) analysis to the case where the unobserved common factors are integrated of order 1.

Our paper innovates by adapting to the context of an unbalanced panel several tests for panels with common correlated effects, which are part of the so-called second generation panel tests. This seemingly simple extension involves a convoluted work aimed at simulating specific critical values. Some of the pioneers of these recent contributions are acknowledged, in particular Prof. Smith, Pesaran and Yamagata, for generously providing guidance in this task.

4. Econometric Results

In order to consistently and efficiently estimate the effect of the means of payments on GDP level, we will use the estimators introduced in the previous section: the Between (BE), the Mean Group (MG), the Fixed Effect (FE), and the Correlated Common Effect Mean Group (MG-CCE) estimators.

A first unavoidable step in the choice of a proper method is to establish the order of integration of the series involved. Many unit roots tests are available for panel data in conventional statistical packages. Here we apply Im, Pesaran and Shin (2003). However, Breitung et. al (2008) distinguish between first generation unit root tests, the traditional ones, and second generation tests, the ones that account for cross-section dependence. Following Pesaran (2007), we implement a panel unit root test in the presence of cross-section dependence.[11] According to Table 3, unlike the first generation test, the second generation test rejects the null hypothesis of a unit root process for the stock of currency in circulation to GDP, the ratio of demand deposits to GDP and the ratio of Demand Deposits to Currency.

Next we present our estimations of the effect on per capita GDP of the ratio of demand deposits to currency, in addition to private credit to GDP. Our sample covers a maximum of 85 countries over 1980-2008. The main novelty vis-à-vis the existing literature on financial development and growth is the inclusion of the demand deposits to currency. Also note that our dependent variable is not the customary GDP growth rate but the level of GDP per capita (in PPP units).

[11] One challenge for the implementation is that, given that we are dealing with an unbalanced panel, critical values for the estimated coefficients need to take into account the structure of each cross-section unit. To do so, we assumed individual unit root processes for each unit and we considered a constant and a trend as exogenous variables. We generated 85 non-stationary series with error terms following a standard normal process. We then computed $CDAF_i$ for each unit and the *t*-bar (the average of $CDAF_i$) according to Pesaran (2007). We repeated this 10,000 times to finally get the sample distribution of the *t*-bar and the corresponding critical values. We thank Prof. Takashi Yamagata for his advice while running these simulations.

Unlike credit, which might boost both the volume and the quality of investments, we do not expect that a variation in the availability of payment instruments accelerate economic growth but have only a scale effect by encouraging a one-time improvement in the efficiency of resource allocation. GDP level regressions have been previously estimated, among others, by Mankiw, Romer and Weil (1992), Hall and Jones (1997) and Bernanke and Gürkaynak (2001).

Just to recall our working hypothesis, we expect that GDP levels should increase with a more intensive use of demand deposits vis-à-vis currency. Core results based on cross-section estimates appear in Table 4. Mean group regressions and fixed effects results are illustrated in Tables 5 and 6, respectively. Table 7 reports the mean group regression after accounting for cross-section dependence.

For robustness, each table includes, besides the full sample regression in the first column, the estimates for several subsamples of interest. The second column excludes the US and the third, the US and Germany. The rationale is that these economies (in particular, the US) are major suppliers of international liquidity and even store of value in some emerging economies, and thus foreign holdings may be sizable. Hence, the level of currency to GDP may not reflect an intensive use of cash in transactions, which is the concept relevant to our empirical model. Next, we exclude the 15 most dollarized economies or the 20 countries with the largest share of shadow economy. The level of deposit dollarization for 1995-2001 is taken from De Nicoló, Honohan and Ize (2003) and the share of underground economy for 1999-2005 from Schneider (2007). Both phenomena are prone to distort the normal use of domestic payment instruments. A dollarization process unmasks a lack of trust in local currency owing to a track record of inflation or deposit expropriation, which might lead to smaller cash and deposit balances. In turn, economic agents operating in the shadow economy tend to conduct their outright and borderline illegal

transactions in cash in order to circumvent government controls, so the use of currency is inflated vis-à-vis other economies.

Reassuringly, all results are strongly supportive of the claim that higher ratios of demand deposits to currency are associated with larger GDP levels. Credit to GDP, as expected, also exerts the expected positive effect. Estimates are highly significant and quite stable across the different samples for each given regression method. It must be noted, nevertheless, that while the FE, MG and MG-CCE estimates are similar, the BE is more than three times larger.[12] This fact gives us a different picture for the phenomenon we are trying to quantify.

The similarity between the FE and both MG estimates might suggest a lack of slope heterogeneity, which in the long run can be a sensible assumption (see Pesaran et al., 1999). However there could be a potential problem in comparing MG and FE. Pesaran et al. (1995) prove that, if the variables are I(1), the FE estimator will not be consistent whereas if there is a single cointegration relationship between y_{it} and x_{it} for each group (country), the simple static cointegrating regression of y_{it} on x_{it} will yield the cointegrating vector θ_i and this could then be averaged over group to obtain the average estimator MG. In Table 3, we have shown that all relevant variables in our problem are I(1). In order to have single cointegration, and in line with Kapetianos et al. (2011), we should check that the integration order of the residual is I(0) following IPS unit root second generation test. Table 8 presents the unit roots test on the residuals from the various econometric techniques. The first row of Table 8 shows these tests for the five subsamples.[13] Most of them are very close to -2, implying that the unit root null hypothesis probably cannot be rejected.

[12] This estimator should be interpreted with caution because of the strong assumptions behind its implementation.

[13] Although we have obtained the critical values for the IPS unit root test second generation for the variables under study, we could not use these critical values for the regression residuals. As with the Dickey-Fuller unit root test, the critical values for these distributions change if the variable analyzed is a residual because of parameter uncertainty.

The fact that the residuals of the regressions for some subsamples present a unit root revealing that they do not cointegrate could be related to the presence of CSD, one of the most harmful problems in panel time series; so we need to improve the MG estimator by applying the CCE procedure. Additionally, as we indicated above, in the presence of unobserved common factors the gains of working with a panel are jeopardized. Pesaran, Ullah and Yamagata (2008) propose a test to evaluate the lack of cross-section independence in panel data models.[14] Table 9 reveals that the null hypothesis of no correlation among the groups for all t is rejected.[15] However, based on Kapetanios et. al (2011), we need to check again the integration order of the residual from the MG-CCE regression as we did for MG residuals. The second row of Table 8 shows that the tests for the residuals for the 5 subsamples are now substantially smaller (below -3) compared with the IPS second generation test for the MG residuals, indicating that the rejection of the null hypothesis of a unit root is now more likely. Therefore, once we have controlled for cross section dependence, we can expect to have single cointegration, supporting the MG-CCE estimator.

In order to evaluate the robustness of the results from Table 7, we ran the regressions with the same subsamples and the additional control variables. The results, which in general remain unchanged, are shown in Table 10 and the residuals of the different regressions are now I(0) (see third row of Table 8, where all the unit root tests are below -4.5), supporting once again the MG-CCE estimation.[16]

[14] The test is a bias-adjusted version of the Breusch and Pagan (1980) Lagrange Multiplier test statistic of error cross section independence, for panel data models with strictly exogenous regressors and normal errors. We once again acknowledge the suggestions of Prof. Takashi Yamagata, which have helped us implement this test for our unbalanced panel.

[15] As Pesaran (2006) pointed out, the MG-CCE estimator yields consistent and asymptotically normal parameter estimates even in the presence of correlated unobserved common effects when T is fixed and $N \rightarrow \infty$ and when $(N, T) \rightarrow \infty$.

[16] Unreported BE, MG and FE results reinforce the robustness of our findings. They are available upon request.

5. Conclusions

In outright contrast to most of the banking literature, which stresses the credit function of banks and neglects their payment function, our paper explores the role of banks on the level of per capita GDP as providers of means of payment. To do so, we employ a dataset of 85 countries spanning the 1980 to 2008 period with annual data. Given the macroeconomic scope of our study, we take the ratio of demand deposits to GDP as our variable of interest. To research the influence of non-bank payment instruments –the alternative to debit and credit cards, checks and other bank-based instruments- we also introduce in our empirical research the currency to GDP ratio, and for the econometric analysis we include the demand deposits to currency ratio as well.

On the descriptive front, we find that richer economies display higher and increasing levels of demand deposits and lower levels of currency than poor countries. While this was to be expected, more surprising is the fact that the currency to GDP ratio did not decrease much over time, regardless of income level differences. In turn, our regressions confidently support the hypothesis that banks contribute to economic development not only as credit suppliers but also by facilitating transactions. In particular, our per capita GDP level regressions yield a positive and significant impact from the ratio of demand deposits to currency. The results are robust for different model specifications.

At a time in which the impact of credit flows on the economy at large is under a heated debate in academic and policy circles, this new evidence suggests that banks are still central to economic development. Nevertheless, it invites to revisit the precise channels through which such beneficial influence takes place.

Table 3
Unit root test: Im, Pesaran and Shin
Annual data 1980-2008
Unbalanced panel
H_0: Unit root (assumes individual unit root process)
Exogenous variables: Constant and linear trend

	First generation test N = 85		Second generation test N = 85			
	Lag length based on SIC: 0 to 5 Assumes asymptotic normality.		Lag length based on F test: 0 to 3	Lag length based on F test: 0 to 5	Simulated critical values*	
	IPS Statistic	p-value	CIPS Statistic	CIPS Statistic	At 5%	At 1%
Per Capita, PPP-Adjusted GDP	21.001	1.000	-2.081	-2.023	-2.643	-2.765
'Private Credit to GDP	3.498	1.000	-2.175	-2.206	-2.644	-2.757
Currency Outside the Banking System to GDP	-1.552	0.060	-2.820	-2.703	-2.650	-2.767
Demand Deposits to GDP	-1.450	0.074	-2.980	-2.918	-2.646	-2.762
Demand Deposits / Currency	-3.311	0.001	-2.904	-2.755	-2.651	-2.764

*The critical values were simulated according to the specific *t* of each country in the sample for each variable.

Table 4
Cross-Section Estimation (BE)

Dependent Variable: Per Capita, PPP-Adjusted GDP	Baseline	Without USA	Without USA and Germany	Excluding 15 most dollarized economies	Excluding 20 economies with largest share of shadow economy
Private Credit to GDP	0.899***	0.884***	0.874***	0.910***	0.855***
	[0.117]	[0.119]	[0.121]	[0.122]	[0.152]
Demand Deposits / Currency	0.364**	0.370**	0.370**	0.433***	0.287
	[0.141]	[0.142]	[0.143]	[0.158]	[0.183]
Constant	5.272***	5.313***	5.341***	5.116***	5.556***
	[0.380]	[0.388]	[0.392]	[0.395]	[0.522]
Observations	2283	2254	2225	1899	1739
Countries	85	84	83	70	65
R^2	0.526	0.514	0.505	0.574	0.414
Time period	1980-2008	1980-2008	1980-2008	1980-2008	1980-2008

***Significant at 1%, **Significant at 5%, *Significant at 10%.
Standard errors in brackets.

Table 5
Mean Group Estimation (MG)

Dependent Variable: Per Capita, PPP-Adjusted GDP	Baseline	Without USA	Without USA and Germany	Excluding 15 most dollarized economies	Excluding 20 economies with largest share of shadow economy
Private Credit to GDP	0.2139***	0.2079***	0.2004***	0.1722***	0.2369***
	[0.0447]	[0.0448]	[0.0447]	[0.0350]	[0.0529]
Demand Deposits / Currency	0.1309***	0.1321***	0.1324***	0.1108***	0.1415***
	[0.0366]	[0.0370]	[0.0375]	[0.0354]	[0.0447]
Countries	85	84	83	70	65
Time period	1980-2008	1980-2008	1980-2008	1980-2008	1980-2008

***Significant at 1%, **Significant at 5%, *Significant at 10%.
Standard errors in brackets.

Table 6
Fixed Effects Estimation (FE)

Dependent Variable: Per Capita, PPP-Adjusted GDP	Baseline	Without USA	Without USA and Germany	Excluding 15 most dollarized economies	Excluding 20 economies with largest share of shadow economy
Private Credit to GDP	0.188***	0.177***	0.177***	0.202***	0.198***
	[0.0111]	[0.0112]	[0.0113]	[0.0122]	[0.0136]
Demand Deposits / Currency	0.166***	0.183***	0.181***	0.194***	0.193***
	[0.0120]	[0.0123]	[0.0125]	[0.0138]	[0.0139]
Constant	7.782***	7.792***	7.774***	7.681***	7.993***
	[0.0364]	[0.0364]	[0.0364]	[0.0400]	[0.0464]
Observations	2283	2254	2225	1899	1739
Countries	85	84	83	70	65
R^2	0.509	0.491	0.482	0.558	0.387

***Significant at 1%, **Significant at 5%, *Significant at 10%.
Standard errors in brackets.

Table 7
Mean Group Estimation
Controlling for Cross-Section Dependence (MG-CCE)

Dependent Variable: Per Capita, PPP-Adjusted GDP	Baseline	Without USA	Without USA and Germany	Excluding 15 most dollarized economies	Excluding 20 economies with largest share of shadow economy
Private Credit to GDP	0.1363***	0.1291***	0.1229***	0.1241***	0.1207***
	[0.0321]	[0.0317]	[0.0315]	[0.0299]	[0.0413]
Demand Deposits / Currency	0.0420**	0.0421**	0.0431**	0.0351	0.0593**
	[0.0201]	[0.0204]	[0.0204]	[0.0234]	[0.0301]
Countries	85	84	83	70	65
Time period	1980-2008	1980-2008	1980-2008	1980-2008	1980-2008

***Significant at 1%, **Significant at 5%, *Significant at 10%.
Standard errors in brackets.

Table 8
Unit root test: Im, Pesaran and Shin
accounting for cross-section dependence
H_0: Unit root (assumes individual unit root process)
Exogenous variables: constant

	Baseline	Without USA	Without USA and Germany	Excluding 15 most dollarized economies	Excluding 20 economies with largest share of shadow economy
Residual from MG (Table 5)	-2.24	-2.21	-2.24	-2.18	-2.11
Residual from MG-CCE (Table 6)	-3.25	-3.22	-3.20	-3.35	-3.10
Residual from MG-CCE with additional controls (Table 10)	-4.51	-4.53	-4.62	-4.62	-4.77

Table 9
A bias adjusted LM test (Pesaran, Ullah and Yamagata) of cross-section independence
H_0: $\mathrm{Cov}(e_{it},e_{jt}) = 0$ for all t and $i \neq j$

	Baseline	Without USA	Without USA and Germany	Excluding 15 most dollarized economies	Excluding 20 economies with largest share of shadow economy
LM test	92.83	92.54	90.22	74.63	70.96

Table 10
Mean Group Estimation
controlling for Cross-Section Dependence (MG-CCE),
with additional controls

Dependent Variable: Per Capita, PPP-Adjusted GDP	Baseline	Without USA	Without USA and Germany	Excluding 15 most dollarized economies	Excluding 20 economies with largest share of shadow economy
Private Credit to GDP	0.0643***	0.0609***	0.0612***	0.0556**	0.0537**
	[0.0202]	[0.0203]	[0.0206]	[0.0237]	[0.0241]
Demand Deposits / Currency	0.0537**	0.0533**	0.0651**	0.0580**	0.0216
	[0.0236]	[0.0240]	[0.0313]	[0.0237]	[0.0189]
Government Consumption Expenditure to GDP	-0.040	-0.040	-0.027	-0.048	-0.066*
	[0.0358]	[0.0359]	[0.0399]	[0.0360]	[0.0389]
Exports plus Imports to GDP	-0.004	-0.007	-0.032	0.0041	0.0011
	[0.0234]	[0.0235]	[0.0384]	[0.0250]	[0.0243]
Secondary School Enrollment	0.0008	0.0011	0.0009	0.0034*	0.0003
	[0.0018]	[0.0018]	[0.0018]	[0.0020]	[0.0020]
Gross Fixed Capital Investment to GDP	0.0927***	0.0939***	0.1095***	0.1213***	0.1115***
	[0.0322]	[0.0319]	[0.0340]	[0.0255]	[0.0287]
Annual Inflation Rate	-0.001	-0.001	-0.001	-0.002	-0.002
	[0.0011]	[0.0011]	[0.0012]	[0.0013]	[0.0014]
Countries	79	78	77	64	61
Time period	1980-2008	1980-2008	1980-2008	1980-2008	1980-2008

***Significant at 1%, **Significant at 5%, *Significant at 10%.
Standard errors in brackets.

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