Poverty and Banking Exclusion in Mexico: How can remittances and technology contribute to improve access?

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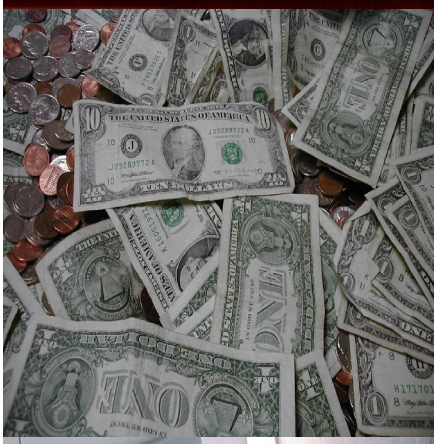

Poverty and Banking Exclusion in Mexico:

How can remittances and technology contribute to improve access?

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"As a great Social Leveler, Information Technology is Second only to Death."
Sam Pitroda, entrepreneur, policy maker and businessman

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1. Executive Summary

The empowerment of the poor through cell phones is this paper's central theme. There already exist a number of cases in the world where such empowerment has already occurred in the financial sector through the usage of cell phones: the cases provided throughout the paper are Kenya, the Philippines and South Africa. There exist many reasons why it is imperative to facilitate access to the financial system for the entire pyramid of the population. To achieve financial inclusion in the remittances industry, the authors suggest an M-banking like solution for remittances transfer. M-banking offers the advantage of having a very low cost structure – making it lucrative for banks to target the rural poor.

Poverty is an insidious problem in Mexico. A large share of the population has to live on less than US$2 a day. In rural areas, and particularly in the Southern states, the issue is even more pressing. High levels of poverty lead to high rates of migration towards the North. Augmented migration in turn results in remittances inflows, which have reached unprecedented levels in Mexico with about US24bn in 2006. But immigrants have not fully capitalized their remittances because they are outside the banking system and pay high costs of transfers. New and cheap channels for transferal are available, but only for the banked. In Mexico between 20 or 30 percent of the population do have a bank account. However, cell phone penetration is about 45 percent – about twice as high as the level of bank account ownership. Consequently, given cell phones' increased processing power and the high penetration rates of cell phones, they are the obvious means to have people take part in the financial sector.

We show in our econometric study that remittances promote savings accounts, but at the same time have an ambiguous effect on them through increased cell phone penetration. By creating virtual mobile bank accounts, banks can leverage the relatively high cell phone penetration across the income pyramid, to bank Mexico's population – while benefiting from additional profitable business. Given remittances' savings increasing nature, starting with remittances' recipients is the logical and most powerful tipping point of the process.

Our study finds that banks ignore the potential of the mobile banking market, including remittances transfers over cell phones. We suggest a number of policies to be implemented to enable the prospering of the mobile financial industry.

2. Glossary

ABM	Asociación de Bancos de México (Association of Mexican Banks)
BANCOMEXT	Banco Nacional del Comercio Exterior (Nacional bank of foreign commerce; a Mexican development bank)
BANXICO	Banco de México (Central Bank of Mexico)
AML	Anti-Money Laundering Law
BANSEFI	Banco del Ahorro Nacional y Servicios Financieros (National Bank of Savings and Financial Services; a national development bank)
BOP	Bottom-of-the-Pyramid
CFT	Counter the Financing of Terror Regulation
CNBV	Comisión Nacional Bancaria y de Valores (National Banking and Securities Commission)
COFETEL	Comisión Federal de Telecomunicaciones (Federal Commission of Telecommunications)
CONAPO	Consejo Nacional de la Población (National Council of Population)
CRA	Community Reinvestment Act
Crowding-Out Effect	Fall in private investment as a consequence of increased interest rates caused by higher public borrowing
FedACH	Automated Clearing House used by the Fed and Banxico to facilitate remittance sending at very low cost
FDI	Foreign Direct Investment
ICT	Information and Communication Technology
INEGI	Instituto Nacional de Estadística, Geografía e Informática (National Institute of Statistics, Geography and Informatics)
M-banking	Mobile Banking: Banking facilitated through cell phones
MFI	Micro Finance Institutions
MTO	Money Transfer Operator
MVNO	Mobile Virtual Network Operators (Network operators that do not have their own telecommunications infrastructure, but us the one of existing providers and reimburses them for the usage)
NAFINSA	Nacional Financiera (a Mexican development bank)
ODA	Official Development Assistance
POS	Point-of-Sale
SME	Small and Medium-Sized Enterprises
SMS	Short Message Service
UNDP	United Nations Development Programme

3. Introduction

Why is financial inclusion so important? There exist many reasons why it is imperative to facilitate access to the financial system for the entire pyramid of the population. Having funds in a bank as compared to at home protects customers of theft while interest is accrued. Credit facilities allow poor customers to smooth consumption in bad times. People who do not have bank accounts tend to be charged significantly higher rates for a similar service (e.g. check cashing businesses or pay-day lenders in the US). The crucial detail is that the poor, who by definition have very little resources, are the ones who are being charged the highest fees. They appreciate an additional unit of a currency the most, as it has the largest impact on their overall standard of living. As Caskey et al (2004: 22) put it thus: "households that must borrow in the alternative financial sector because of impaired credit histories or heavy debt burdens, pay a substantial penalty for their status. When these are lower income households who already struggle economically, this compounds their problems."

With respect to remittances the same point is valid. Bank of America and Citigroup offer remittance sending to Mexico at no charge for instance.[1] However, this service is only available to the banked – at the sending and receiving end people need to have bank accounts. As getting a bank account is rather difficult in the US (illegal immigrants often do not meet the identification or minimum income requirements of banks) as well as expensive in Mexico, using such services is hardly an option for the poor. Furthermore, having lived through numerous financial crises trust in banks is low. Consequently, large parts of the population are forced to use expensive money transmitters such as Western Union or MoneyGram. This paper looks into alternative ways – particularly using technology – how the poor can be integrated into the financial system. More specifically, we evaluate the feasibility and advantages of using M-banking alike technologies for remittances sending.

[1] Even a competitive exchange rate is provided

4. Poverty and Migration in Rural Mexico

Poverty is an insidious problem in Mexico. A large share of the population has to live on less than US$2 a day. In rural areas, and particularly in the Southern states, the issue is even more pressing. High levels of poverty lead to high rates of migration towards the North. This section shall elaborate on the poverty issue in Mexico and then discuss the migration characteristics and patterns of the country.

a. Poverty in Mexico

Since its colonial origins and later independence from Spain in 1821, Mexico has not been able to effectively reduce poverty among its population. The battle has been constant but the obstacles for the country have been significant. Examining a sample of the recent macroeconomic history of the last two decades of the 20th century provides lucid examples of the problems that the country has faced. In the early 1980's Mexico was recuperating from the first devaluation in 22 years. During that decade and the 90's it faced three inflationary crises and continuous devaluations eventually resulting in the 1994 crisis.

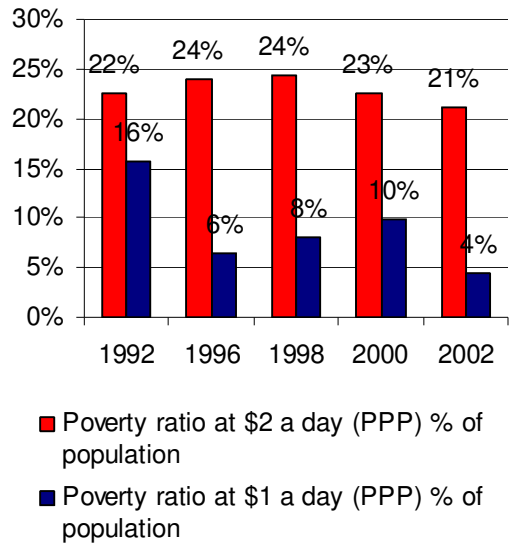

Figure 1: Poverty ratios in Mexico, Source World Bank, WDI Online

Like in many other countries, the poor in Mexico have always been the ones that face the consequences of any economic downturn the hardest. Figure 1 shows that Mexico was able to make advances with regard to the people who live on less than a dollar a day – measured at PPP this percentage was decreased from 16 percent in 1992 to 4 percent of the population in 2002. The principal reasons for the substantial decrease in extreme poverty are thus: firstly, the anti-poverty program *Oportunidades* that supports about five million families or a quarter of the population; and secondly, the increased tendency to move North – either to immigrate to the United States or to work in a richer state close to the Mexican border – and to send home remittances (The Economist 2006). With respect to the 2 dollar a day ratio there has hardly been any advancement during the same period. However, poverty in Mexico is not equally distributed in its territory.

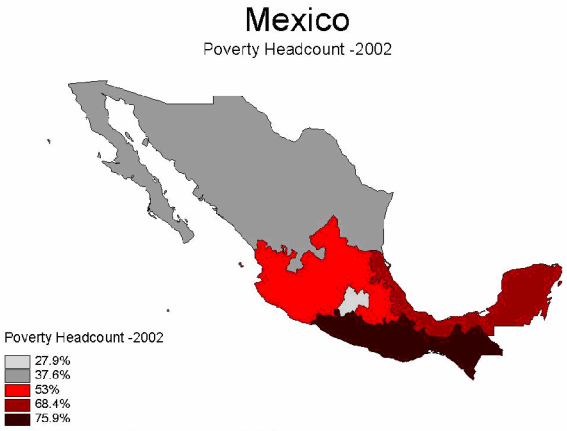

Figure 2: Geography of Poverty in Mexico, Source: World Bank Poverty Assessment 2004.

The poor are concentrated mainly in the south of the country. As the current president, Mr. Calderón, puts it: "There is one Mexico more like North America and another Mexico more like Central America … It is a very clear challenge for me to make them more alike."[2] Figure 2 illustrates the concentration of poverty in the South. According to official figures every second Mexican suffers from some

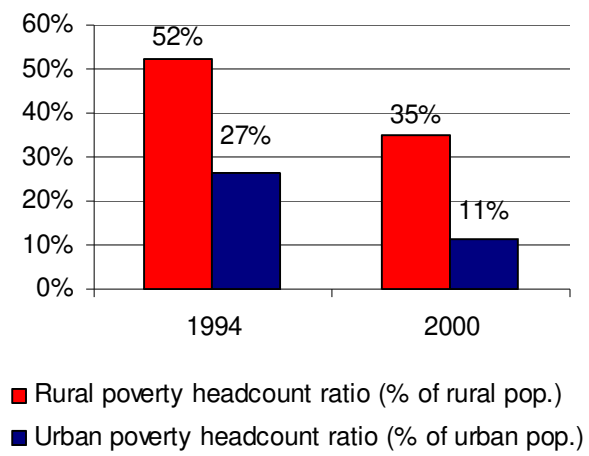

Figure 3: Poverty and Urbanity. Source: World Bank WDI Online.

[2] ibidem

degree of poverty. In the South this number is even higher; there this measure is three out of four. About twice as many people live in rural areas in the South than in the North; twice as many people do not have access to electricity as well as clean, piped water and illiteracy is twice as high.[3]

Poverty levels differ not only with geography, but also in terms of urbanity. People living in rural areas are substantially more likely to be poor than people living in cities. Rural poverty remains much higher than urban poverty – even though both showed a reduced trend. In 2002, 35 percent of the rural population was poor, compared to only 11 percent in urban areas. See figure 3 for an illustration.

b. Migration in Mexico

Not surprisingly, the migration level in the poorer, Southern states is the highest in the nation. Figure 4 illustrates the relationship between urbanity, i.e. the percentage of people living in rural versus urban areas, and the probability to migrate. It is quite startling that there exists a relationship as depicted in the figure. States that have between 33 percent and 39 percent of their population in rural areas[4] have the highest probability of migration. The five states that have the highest probability of migration are Guanajuato, Nayarit, Durango, Michoacán, and Zacatecas. All of them, except for Zacatecas fall into the aforementioned range of rural population. Zacatecas, an "outlier"

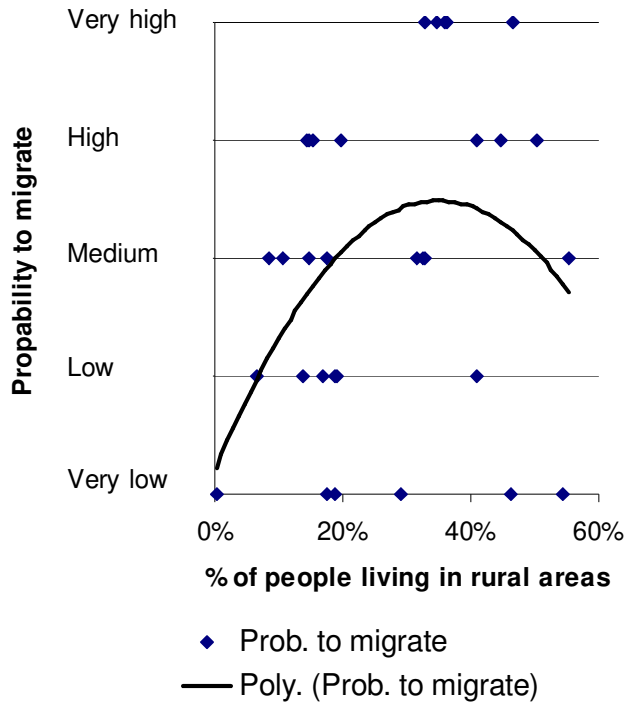

Figure 4: Relationship between urbanity and probability to migrate in 32 Mexican states. Based on data from CONAPO estimates and Tovar, Martha (n.a.).

[3] ibidem
[4] As rural areas count villages with less than 2,500 inhabitants (as adopted by *INEGI*)

has even a higher percentage of its population living in rural areas, which makes it the fourth most rural state in the country. Naturally, the probability to migrate and the percentage of people receiving remittances are highly correlated. The 5 states also have the highest share of households receiving remittances in the country. Zacatecas has the highest share of households receiving remittances, namely 13 percent of all households living in the state.[5] At the other end of the spectrum are states like Baja California Sur, Campeche, Quintana Roo, Chiapas and Tabasco (in the order of decreasing share of families receiving remittances). Tabasco, the state that has least households receiving remittances, has a share of only 0.58 percent of all households getting remittances. Chiapas, a highly rural state with 54.5 percent of its population living in settlements that are smaller than 2,500 people, is a bit of a puzzle. It hardly sends migrants towards the North even though poverty is wide spread and urbanity is low. We explain this phenomenon with language barriers: many people living in Chiapas do not speak Spanish but an indigenous language and hence, encounter significant problems when trying to work in a Northern state of Mexico or the United States.

5. Remittances

Remittances inflows have been globally increasing in amount and importance – Mexico is not an exception. But immigrants have not fully capitalized their remittances because they are outside the banking system and pay high costs of transfers. Financial authorities have provided new and cheaper channels, but only for the banked, with such a large market the challenge remains in the unbanked.

a. Global Transfers and Trends

In recent years, remittances flows from industrialized to developing countries have been rising and became a very important source of income for many

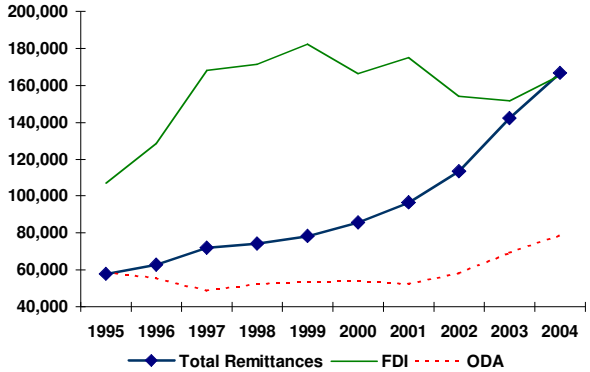

Figure 5: World Remittances, FDI and ODA in millions of dollars. Source: World Bank, Global Economic Prospects 2006

[5] CONAPO estimates based on a 10% simple of the *XII Censo General de Población y Vivienda 2000*

countries. See figures 5. In an increasing number of cases remittances' flows have surpassed the amounts of foreign direct investment and some other of the most important components of the balance of payments.

Figure 6 shows the Mexican case. It can be noticed that remittances inflows have surpassed foreign direct investment and tourism and are just below the level of oil exports, which have benefited lately from increased oil prices and have been traditionally the most important sources of foreign currency.

At a household level, remittances have increased in importance as well. Remittances represented 1.3 percent of the poor's income in 1992. By 2002 the share increased to 3.8 percent. For non-poor households the respective shares were 3 percent in 1992 and 6.2 percent in 2002. See Table 1 (World Bank 2004b: 224).

With the market for remittances evolving the sending methods have changed as well. The population has changed its preference of sending through informal to formal channels. Figure 7 depicts how cash transfers have

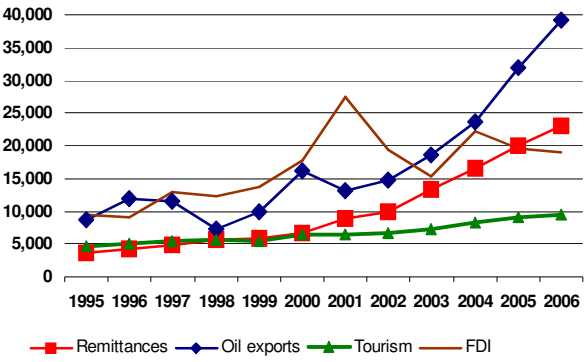

Figure 6: US-Mexico Remittances in Millions of US Dollars, Source: Central Bank of Mexico.

	Poor (1) (2)		Non-Poor (1) (2)	
	1992	**2002**	**1992**	**2002**
Non-Agricultural Income				
Non-farm labor	15.90%	17.20%	21.30%	39.20%
Enterprise income	4.80%	6.80%	8.80%	5.50%
Remittances	**1.30%**	**3.80%**	**3.00%**	**6.20%**
Other private transfers	3.90%	5.50%	4.20%	4.20%
Public transfers	0.40%	16.10%	0.20%	4.50%
Other	15.90%	11.80%	13.10%	18.80%
Sub Total	42.20%	61.20%	50.60%	78.40%
(1) Poverty defined in terms of food-based poverty line (extreme poverty)				
(2) Percentages are with respect to total income				

Table 1: Composition of the Rural Income between 1992 and 2002 Source: World Bank (2004).

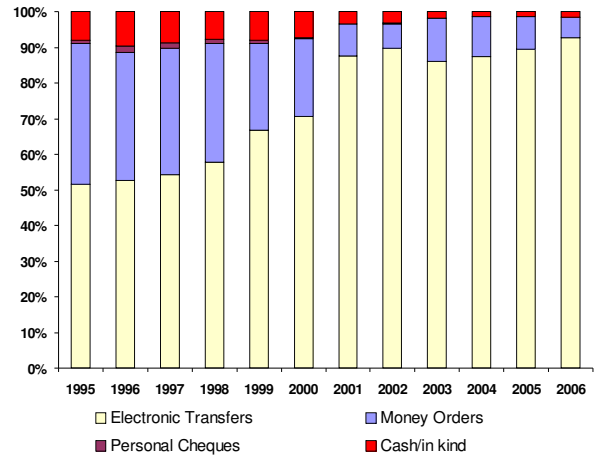

Figure 7: Evolution of Transfer Mechanisms in Mexico. Source: Central Bank of Mexico.

gone from 8.1 percent to 1.5 percent in 2006 while electronic transfers went from 51.5 percent in 1995 to 92.6 percent in 2006.

However, Mexican immigrants and their families have not been able to take full advantage of their additional income. It did not translate into credit, saving or additional investment opportunities. This is due to several reasons. We will elaborate on these reasons in the following paragraphs.

b. Economic Factors Affecting Supply and Demand of Banking Sectors

The first reason that impedes translating the households' additional income into greater integration in the financial markets is the very low degree of "bancarization". Only 31 percent of the population has a bank account in Mexico according to the World Bank.[6] Low bancarization is due to problems in demand as well as supply. It is a known fact that immigrants do not trust banks. Considering that the average age for Mexican immigrants in the US is 42 years, it is not surprising that they are distrustful of banks since they have witnessed three economic recessions in their lives where credit card holders and borrowers felt the pain of interest rates that reached up to almost 160 percent (The Latino Coalition 2002). Please see figure 8. Moreover, many people who held deposits with financial institutions lost them.

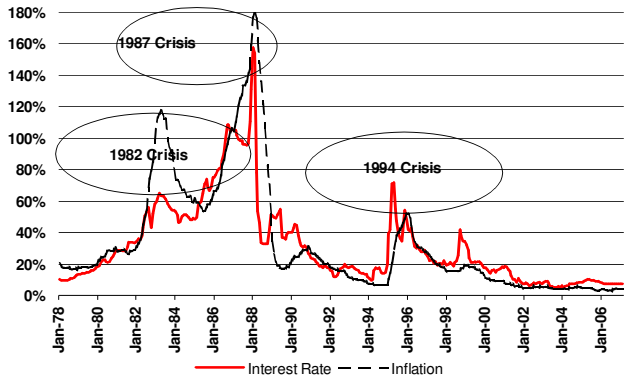

Figure 8: Mexican 90-day annual Interest Rate and Annual Inflation. Source: Central Bank of Mexico.

On the supply side, banks have not paid much attention to customer acquisition since the last economic crisis in 1995. CEPAL (2006: 30) claims that for the year 1999 profits of the nine major banks went up by about 74 percent, while the total credit supplied by the banking sector fell by 13 percent in the same year. Possible changes in the banks' revenue model may have been based in increasing banking fees to their already captive

[6] World Development Indicators Online for the year 2004

customer base. Those fees are charged for ATM withdrawal or account and credit management for instance.

Furthermore, Calderon Villarreal and Roa Dueñas (2006) claim that there has been, at least in the last 9 years, a *crowding out effect* taking place in Mexico as the government and the Central Bank have increased substantially their debt issues. So banks prefer to invest in bonds instead of giving credit to the private sector. In Mexico credit as a percentage of GDP is very low. Please see section 7 for an international comparison of credit to the private sector as a percentage of GDP.

At a micro level, according to Arriola (2006) immigrants' families use the remittances' money primarily for consumption, specifically on durables, healthcare and housing. Therefore, retail stores have leveraged this pattern and became money transfer operators. These stores entice immigrants' families by offering them credit for in-store durable products upon picking up their remittances. However, such forms of credit are very expensive.

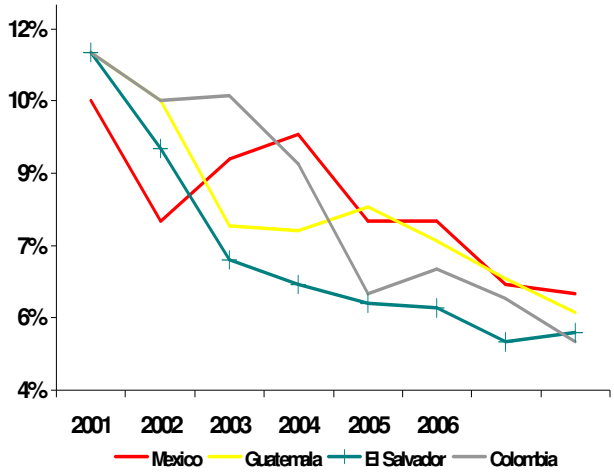

Figure 9: Percentage Cost of sending $200. Source: Manuel Orozco (2002) and (2006a).

At the same time, money transfer operators have charged their clients very high commissions for the transferal of the money for a long period of time. Figure 9 shows that although there have been reductions in these fees, they have only occurred after exploiting very high commissions for years.

c. The Role of the Authorities

Realizing the importance of remittances as a source of income and its high transfer cost, in 2003, in an attempt to decrease the cost of transfers, the Central Bank of Mexico and the Fed enabled a system that allows any account holder in the US to send remittances

through the automated clearinghouses in both countries.[7] The system works for sending money from account to account and transfers cost a nominal price of approximately 67 cents of a dollar (Schultz 2005). However, since this system is only for those who have a bank account the amount of transfers that take place through that system have not met the expectations and very few people have been favored by it.

Figure 10 shows the amount of transactions since October 2003 and the volume operated. In February 2007 this volume roughly amounted to a 0.71 percent of the aggregate amount for all transfers between the two countries and its growth seems to be slowing down.

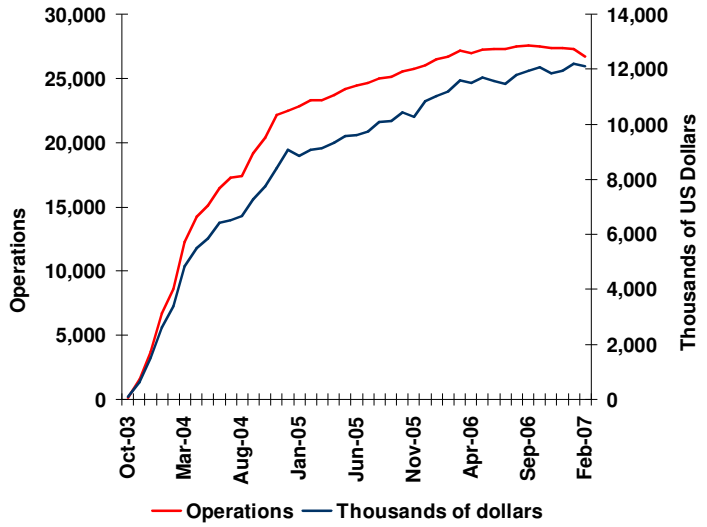

Figure 10: Thousands of dollars and Number of Operations through the FED ACH system. Source: Central Bank of Mexico.

The reasons for its low usage vary but according to Manuel Violante[8] of Banamex immigrants have a strong preference for immediate cash. He also suggested that when being faced with two methods of transfer, such as Western Union's *Money in Minutes* and *Economy* products – differing only in time and price – immigrants go for the fastest delivery method even when it is substantially more expensive; and even when the time difference of delivery is only about 3 days. Violante pointed out what is also mentioned in many surveys: Immigrants are distrustful when it comes to services related to their money and prefer to know that it is delivered immediately. This preference for high speed may also be a reflection that remittances are sent for immediate usage at the receiving country, which points to an important policy consideration: system speed matters when it comes to sending money.

[7] This system is called *Federal Reserve Automated Clearing House* (FedACH)
[8] Violante Macias, Manuel *Vice President Mexican Representation Office of Citibank*. Interviewed by the authors in January 2007.

Given the very low level of bancarization and potential improvements for the population that receives remittances, authorities and banks should look for new and creative solutions to provide incentives for the opening of accounts and conducting transfers trough the banking sector.

6. Information and Communication Technologies in Mexico

Goal 8, target 18 of the Millennium Development Goals states "in cooperation with the private sector, make available the benefits of new technologies, especially information and communications technologies". With regard to this target rapid progress was made. Phone networks in the developing world tripled during the decade between 1993 and 2002. In 2002 the number of cell phone subscribers surpassed that of fixed lines. Africa showed particularly strong growth in mobile phone subscribers (Juma and Yee-Cheong 2005: 51).

Mexico needs to catch up as it is lagging behind many other nations in terms of ICT. Nonetheless, information and communication technologies growth was strong in Mexico in recent years too. Possibilities to buy a computer by installments and the arrival of cell phones helped to support the fast growth in recent years.

Today about 92 percent of Mexican households have a television. In 2006 45.3 percent of the population had cell phones.[9] More than 90 percent of all subscribers use prepaid card plans (COFETEL 2004: 14). In the fixed line segment growth was sluggish – in 2006 there were only 19.1 fixed lines per 100 people in Mexico. In 2005 17.4 percent of the Mexicans were Internet users. Figure 11 illustrates these three indicators of ICT development.[10] It is interesting to see how strong growth was in cell phones – relatively low equipment costs, high convenience and coverage in rural areas makes this technology superior to landlines as well as Internet as an information and communication technology for the poor.

[9] http://www.cofetel.gob.mx/wb2/COFETEL/COFE_Estadisticas_de_telecomunicaciones_2
[10] http://www.cofetel.gob.mx/wb2/COFETEL/COFE_Estadisticas_de_telecomunicaciones_2

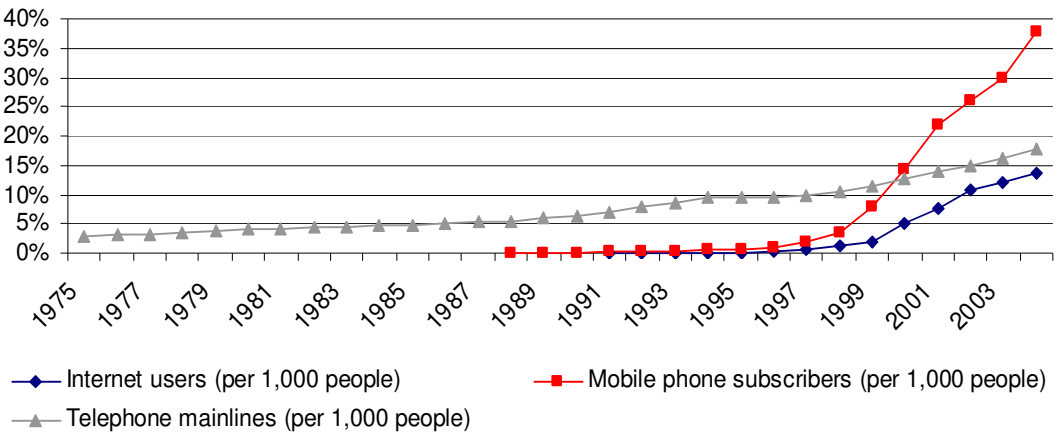

Figure 11: The usage of ICT in Mexico. Source: World Bank WDI Online.

When comparing Mexico regionally across Latin America, it is placed around the average in terms of mobile phone penetration. Not surprisingly, Chile has the highest cell phone penetration with 67.8 percent, followed by Argentina. Mexico with its 45.3 percent penetration is about on a level with Brazil (46.3%), Colombia (47.8%) and Venezuela (46.7%). At the lower end of the spectrum is Peru with 19.9 percent.

Mexico is a country with very low investment in information and communication technologies. In terms of ICT expenditure as percentage of GDP[11] Mexico lags significantly behind other Latin American countries. In 2005 Mexico spent only 3.3 percent of GDP on ICT (the regional average for Latin America and the Caribbean was 5.9%), where countries such as Peru (6.7%) or Argentina (7.1%) spent about twice as much as Mexico. Also in comparison to the other OECD members Mexico spends significantly less. The United States for instance spent 8.8 percent of GDP on ICT in 2005 (World Bank WDI Online).

[11] Information and communications technology expenditures include computer hardware (computers, storage devices, printers, and other peripherals); computer software (operating systems, programming tools, utilities, applications, and internal software development); computer services (information technology consulting, computer and network systems integration, Web hosting, data processing services, and other services); and communications services (voice and data communications services) and wired and wireless communications equipment.

The low investment in ICT has translated into relatively slow growth in fixed lines and an increasing digital divide between rural and urban areas. Figure 12 shows that the Southern regions 7 and 8 have a significantly lower cell phone penetration than in other regions. The figure shows that cell phone penetration ranges from 35 percent in region 7 (Veracruz-Llave, Puebla, Oaxaca, Guerrero, Tlaxcala) to 72 percent in Baja California.

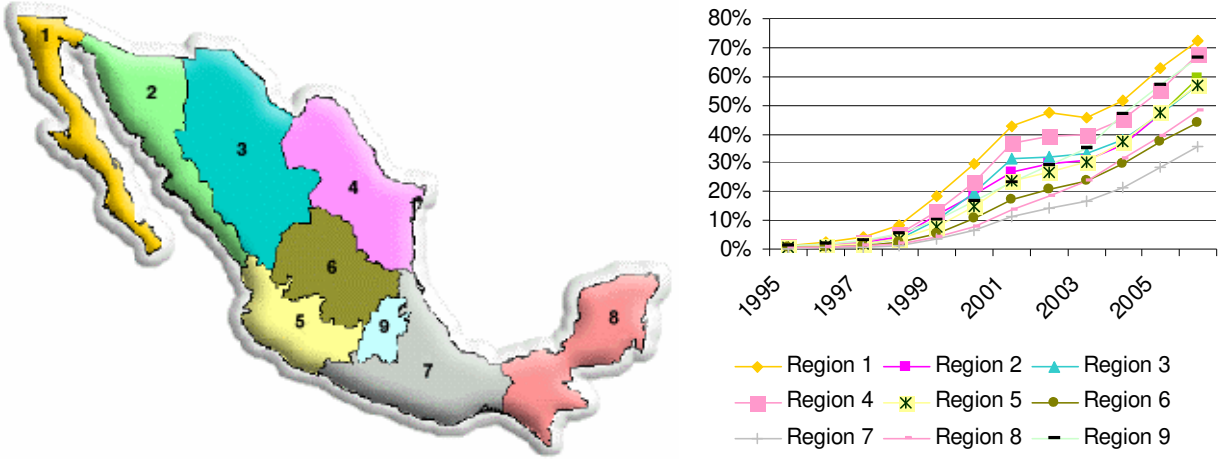

Figure 12: Cell phone penetration on a regional level. Source: Figure based on data from COFETEL accessible under http://www.cofetel.gob.mx/wb2/COFETEL/COFE_Estadisticas_de_telecomunicaciones_2

In telecommunications, major firms have substantial market power. Telmex has a dominant position in long distance, local and mobile markets. In the cell phone market for instance, its market share is 80 percent of the total market (Guevara 2006: 10). This strong market power results in massive profit margins: Telmex's profit margins are more than twice the ones of its closest competitors. The significant concentration of market power leads to high prices charged in Mexico compared to other Latin American countries. Businesses phone charges (factoring installation costs, monthly fees, and per minute rates) are more than 3 times higher in Mexico than in Argentina and 4 times greater than in Brazil (Guerrero et al. 2006: 41). But not only businesses are charged higher prices: the price basket for fixed lines in Mexico amounted to US$15.5 a month in 2004, whereas in the Latin American and the Caribbean region the same basket cost US$9.0. The situation is similar in the cell phone segment, although slightly less discrepant. The price basket for mobile phones amounted to US$11.4 in Mexico and

US$9.0 in the region. With respect to Internet Mexico is actually cheaper than the regional average, US$22.6 and US$31.5 respectively.[12]

In Mexico, the realization of financial transactions over the Internet is still underdeveloped. In 2005 merely 5.8 percent of the Mexican population had ever conducted electronic payments. Nonetheless the Internet is gaining in importance and with increased trust in the means of payment in combination with higher family income electronic transactions will increasingly be conducted (INEGI 2005: 17-18).

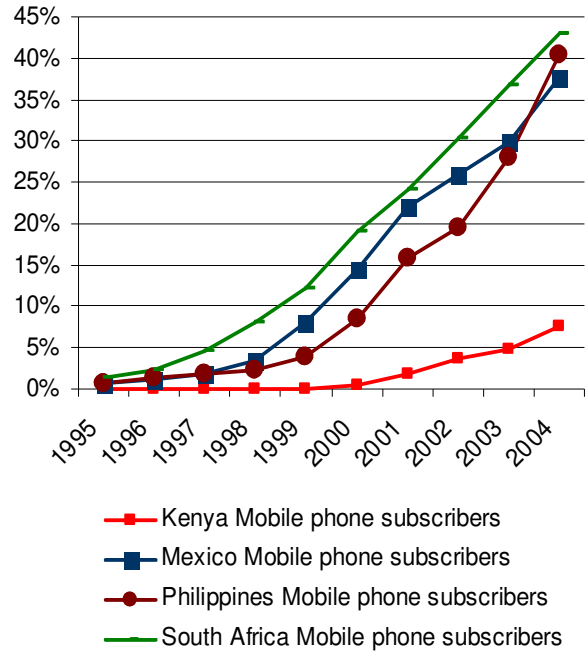

Figure 13: Mobile phone subscribers in various countries % of population. Source: World Bank WDI Online.

As will be argued in section 8 of this paper, in a number of developing countries mobile phones are already used as a means of payment. The section provides the reader with the examples of Kenya, the Philippines and South Africa. As illustrated in figure 13 the cell phone penetration rates are quite comparable in Mexico, the Philippines and South Africa. Kenya on the other hand is lagging far behind. Nevertheless, even though Kenya's penetration rate is low compared to other countries, effective accessibility is much higher. The Vodafone Policy Paper Series (2005) argues that "the way in which mobiles are informally shared between people, the formation of private resellers of mobile services and the provision of mobile phones for public use, all increase accessibility, even in rural communities. The impact of mobile extends well beyond what might be suggested by the number of subscriptions alone." So although official penetration rates are not as high as in developed countries they are still much higher than Internet usage or landline penetration and significantly higher than the percentage of the population that is banked, i.e. people who have a bank

[12] http://devdata.worldbank.org/ict/mex_ict.pdf

account. Consequently, given cell phones' increased processing power they would be the obvious means to have people take part in the financial sector.

7. Financial Exclusion in Mexico

According to the World Bank's World Development Indicators about 31 percent of the population has a bank account in Mexico. However, estimates on bank account ownership vary widely – 20 percent is probably a more likely value. Klaehn et al. (2006: 3) state for instance "between 15 and 25 percent of the urban population, and as low as 6 percent of the rural population, has access to accounts in financial institutions." It continues to state that there exists "strong latent demand for small deposit services in Mexico, and a high level of consensus about the need for a more inclusive financial system."

Caskey et al (2004: 5-6) argue that there are three major reasons why access to bank accounts is not as available as in developed countries: firstly, the Mexican financial and banking market is highly concentrated. The five largest banks hold 82 percent of all deposits in Mexico City for example (In New York, one of the most highly concentrated urban markets in the US the five largest banks hold merely 54 percent). In rural setting competition is much lower, so concentration is even higher. Most of the poor live in rural areas, where banking coverage is very low. Secondly, credit bureaus are little developed and "there can be little meaningfully predictive automated credit risk assessments for most lower- income Mexican households" (Caskey et al: 6). Thirdly, low labor costs in Mexico lead to financial institutions having little incentive to implement labor-displacing financial services technologies, which would augment efficiencies and financial institutions' ability to evaluate poor people's credit risk.

The World Bank (2004a) shows the types of financial instruments that the poor use and how these evolve as people move up to higher deciles. Only starting at the 6th decile people start using formal banking mechanisms in Mexico (see table 2).

Type of Financial Instruments	**Income Group of Median User (Decile)**
Informal banking instruments	
Tandas*	5th
Savings at home	6th
Coop of "Caja Popular"**	6th
Overall Unbanked	*5th*
Formal banking instruments	
Savings, debit card or "AFORE"*** account	7th
Checking account	9th
Investment account	9th
Overall banked	*8th*
* Tandas are informal rotating savings clubs ** Coop and Cajas Populares are savings and loan cooperatives *** AFORE are personal retirement funds	

Table 2: The Use of Financial Instruments among the Mexican Poor. Source: World Bank (2004a).

Especially in rural areas the financial sector's outreach is very low. The following table 3 compares Mexico's financial sector with the countries discussed in the case studies in section 8 of this report. Mexico, South Africa and the Philippines are very similar in terms of financial infrastructure (as was the case for mobile penetration). However, Kenya lags behind – only 7 percent of the Kenyan population is banked.

	Mexico	**South Africa**	**Philippines**	**Kenya**
Bank branches per 100,000 people (2004)	7.6	6.0	7.8	1.4
Financial Information Infrastructure[13], 0 = little, 10 is well developed (2005)	8	6	6	3.5
Bank Deposit Accounts per 100 people (2004)	31%	--	30%	7%

Table 3: The financial sector in selected countries. Source: World Bank, WDI Online

Given Mexico's level of per capita GDP its financial infrastructure is underdeveloped. Figure 14 depicts this – according to the graph one would expect about 50-55 percent of households to have a bank account.

[13] Financial information infrastructure index is based on 10 measures, 6 covering the scope, quality, and availability of credit reporting data (in private and public registries) and the existence of a basic legal framework for credit reporting, and 4 covering the availability of public registry data for collateral (fixed and moveable) and corporate registries and court records.

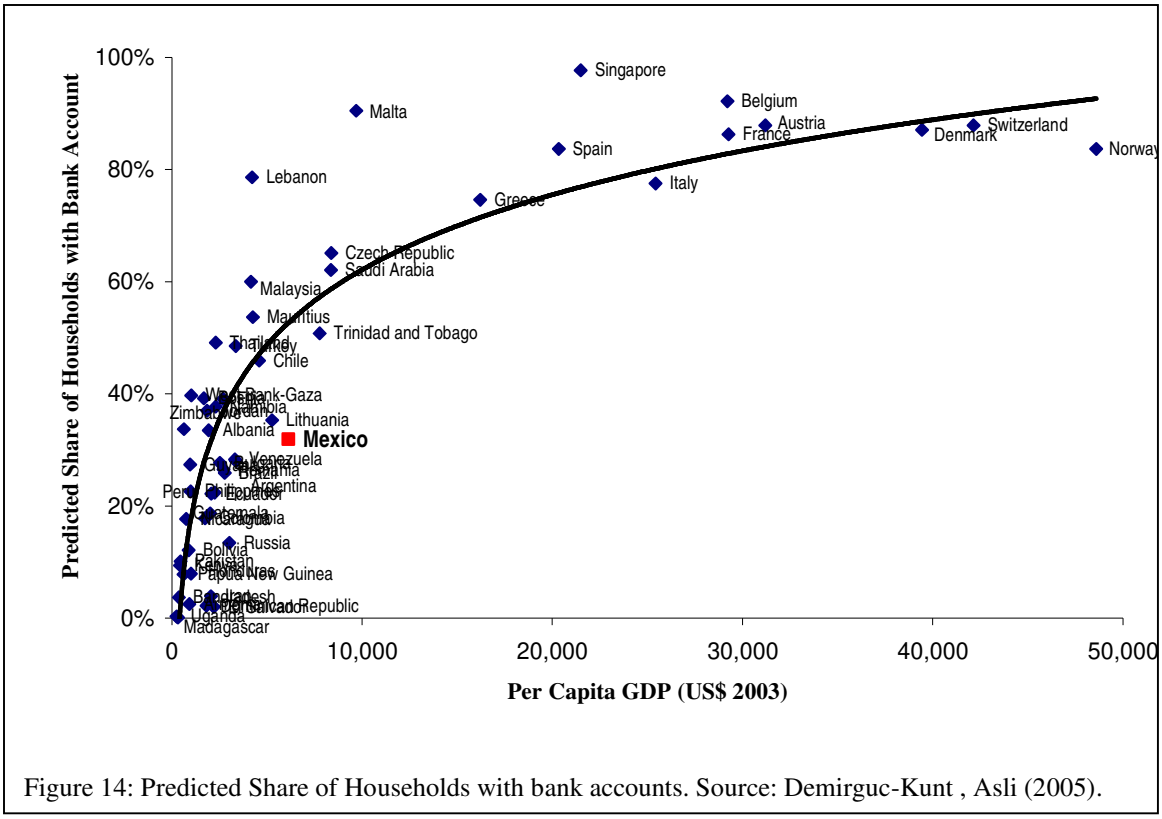

Figure 14: Predicted Share of Households with bank accounts. Source: Demirguc-Kunt , Asli (2005).

Nonetheless, recent developments such as the agreement of all major Mexican banks to implement *PagoMóvil,* a payment mechanism that facilitates paying at Point-of-Sale (POS) in shops with cell phones or the rapid expansion of ATMs across the country could assist to include more people in the financial system in the near future. The usage and availability of ATMs has greatly increased. On a national level, during the first quarter of 2005, there were 67,596 ATMs and in 2006 they reached 76,050.[14] This means that during one year 8,454 more ATMs (+12.5 percent) were installed in Mexico. Additionally, the Mexican government is trying to improve the regulatory framework for financial intermediaries, especially the institutions that offer services to the unbanked. In 2001, the Congress passed the Popular Savings and Credit Law, which regulates institutions that provide financial services to the poor.[15] Prior to that, little protection was provided to customers of non-regulated financial intermediaries.

[14] Source: Central Bank of Mexico
[15] *Ley de Ahorro y Crédito Popular*

Another problem is access to finance in Mexico. While close to 70 percent of the moderate poor own their houses, merely 5 percent pay interests for their houses. The low level of interest payments paid by the poor is an indicator for the predominantly self-financed process of house acquisition and construction (World Bank 2004a). Figure 15 compares Mexico's credit provided by banks as a percentage of GDP with the other three countries of the case studies treated in section 8.

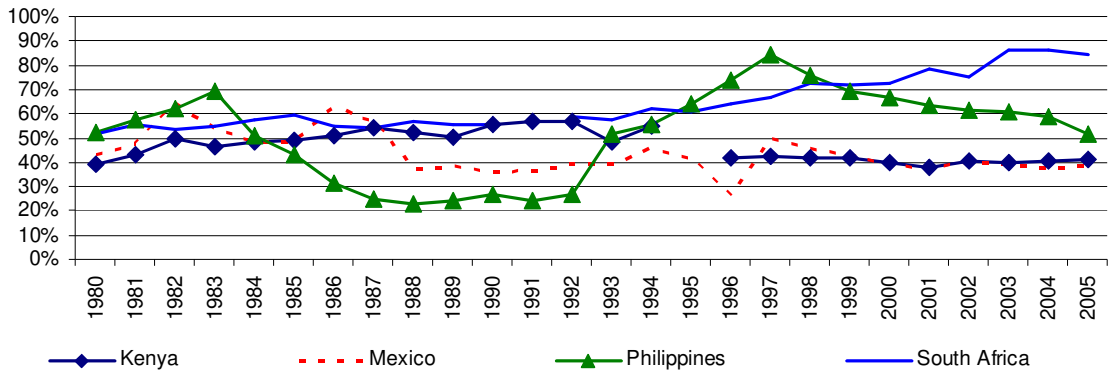

Figure 15: Domestic credit provided by banking sector as percentage of GDP. Source: World Bank, WDI Online.

Even though it can be seen above that Mexico's financial infrastructure is significantly more developed than Kenya's, in terms of credit provided by the banking sector as percentage of GDP it is on the same level. The lack of financing for Small and Medium Sized Enterprises (SMEs) and new entrants is a significant problem. As Guerrero et al (2006: 41) state "while Mexico's financial system appears to now have escaped from the long history of concentrated control by the domestic economic elite, private credit remains extremely low by international standards. Foreign control undoubtedly helped solve the problem of low asset quality and connected lending, but has left Mexico with an unusually risk-averse banking system."

8. International Experiences Using Cell Phones for Financial Inclusion

Technology has a huge potential to promote financial development in the developing world. Access to finance and financial markets in general is considered to be one of the key constraints for private sector development in developing countries. Micro and small

enterprises – often the backbone of a country's economy – are usually most affected by such lack of financial infrastructure provision. In Mexico it is estimated that there exist about 4.5 million small and medium sized enterprises (SMEs), which absorb 64 percent of the Mexican labor force and contribute 40 percent to GDP.[16]

a. The Digital Divide

International experience shows that Information and Communication Technologies (ICT) can contribute substantially to a country's economic and social development. As Sam Pitroda, an Indian entrepreneur, ICT expert and policymaker puts it: "As a great social leveler, information technology is second only to death" (Pitroda 1993: 66). The *Consultative Group to Assist the Poor* (CGAP) reports in Africa alone, the number of mobile phone subscribers has reached 155 million. This represents having grown a remarkable 360 percent in three years.[17]

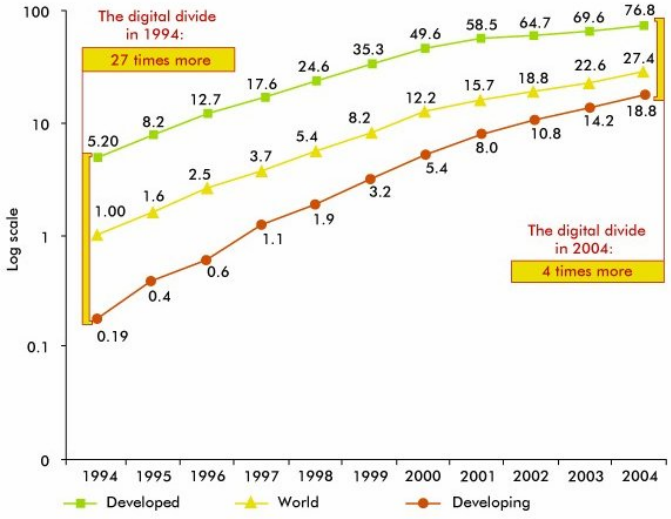

Figure 16: Mobile phone subscribers per 100 inhabitants. Source: http://www.itu.int/ITU-D/ict/statistics/ict/graphs/mobile.jpg

We know from classical growth theory that there exists divergence in economic growth across countries. However, on the technological side, we can find convergence (see figure 16).[18] So why not leverage on this finding to have technology bridge the gap?

In 2005 the *Global Digital Solidarity Fund was launched* to finance infrastructure projects that close the digital divide in developing countries. However, the availability of

[16] http://www.eluniversal.com.mx/articulos/27540.html
[17] http://cgap.org/portal/site/portfolio/Feb2007Lead1/
[18] The situation is comparable for other information and communication technologies such as Internet or fixed line phones.

a computer is only productivity increasing if obstacles such as education and lack of food or electricity can be overcome. *The Economist* states that "rather than trying to close the divide for the sake of it, the more sensible goal is to determine how best to use technology to promote bottom-up development. And the answer to that question turns out to be remarkably clear: by promoting the spread not of PCs and the Internet, but of mobile phones" (The Economist 1995).

b. Mobile Phones, Productivity and Banking Inclusion

Research showed that cell phones enhance productivity. Roller and Wavermann (2001) showed that there exists a causal link between the existence of telecommunications infrastructure (fixed lines) and economic growth in the developed world using data for the OECD from 1970 to 1990 – once a critical level of service of fixed lines is provided. In a later study Waverman et al (2005) looked at 92 countries over 23 years from 1980 to 2003. This time emphasis was put on mobile phones and their impact on economic growth. The authors of the study use an endogenous-growth model to find that the rollout of mobile phones had a significant effect on economic growth in both, developed and developing countries. The interesting finding however is that the impact in the developing world is about twice as big as in the developed world, which makes it similar to the rollout of fixed line phones in the developed world in the 1970s. The authors find that a 10 percent increase in mobile phone penetration causes a 0.6 percent increase in economic growth for the average developing country.

A good example for productivity increases through the usage of cell phones would be fishermen who can check prices in several markets before they decide at which market they are going to sell their fish. So demand and supply can be balanced through the usage of cell phones.[19]

Another exceptional example is *Grameen Phone*. Grameen Phone's founder is Iqbal Quadir, a former lecturer at Harvard's Kennedy School of Government. Grameen Phone is the epitome of a new breed of businesses in Bangladesh: for-profit companies

[19] See Prof. Robert Jensen's research on fishermen in Kerala who use mobile phones to find out at which market they can get the highest price for their fish for example.

leveraging on ICT that engage in inclusive capitalism. Grameen Phone works thus: a female Bangladeshi entrepreneur takes out a loan from *Grameen Bank* to finance the acquisition of a cell phone. These phones are then leased out to village dwellers for a small charge. The so-called *phone ladies* in turn can use the revenues from leasing out the phone to pay back the loan. They earn on average US$750 a year, which is about twice the average Bangladeshi annual income. Today Grameen Phone provides *access to communication and information* to more than a hundred million of people. Grameen Phone started its service in 1997. Not even ten years later Grameen Phone has more than ten million subscribers with revenues above US$1bn and annual profits surpassing US$200 million (Sullivan 2007: xvii-xviii). Grameen Phone is a remarkable story – it shows how private sector profit making notions and development can perfectly be combined.

Cell phones can increase productivity in a number of areas – as Eggleston, Jensen and Zeckhauser (2002: 71) put it – "ICTs are the gift that keep on giving; once in place, they can be used to transmit information for a variety of uses, at little additional cost." These areas include but are not limited to healthcare (*Tracnet,* Syncing data from all HIV treatment clinics in Rwanda), agriculture (*Manobi*, Agricultural information and marketplace through SMS in Senegal), education (*OneWorld,* Health and job information via SMS in Kenya), government (*Rakan,* Community/ Police Relations via SMS in Malaysia) or banking (*Wizzit,* Financial Services for unbanked South Africans).

This paper focuses on the application of mobile phones to achieve financial inclusion. Poor people, so they can benefit from financial markets, need to have access to the financial system where they are living – usually in small villages and slums. But banks do not consider setting up a branch network as economically viable in such places, so in the past rural and very poor areas have historically been financially underserved. Low levels of education and a lack of trust in the banking system pose additional obstacles to financial integration of the poor. Traditional branch based banking systems may be impossible to replicate in the developing world. But a number of devices and technologies such as point-of-sale devices and mobile phones combined with banking agents, automatic teller machines (ATMs) and shared information system platforms make

the outreach to undeserved segments of the population more viable. Dan Schatt, Celent Senior Analyst and advisor to CGAP on technology argues that "the growth of Internet and mobile usage, along with advances in biometric technologies, will begin to have a particularly profound impact on how individuals and households live their lives in the remotest of regions. Payment authentication and identity verification capabilities along with other core payment and banking technologies can now be leveraged to empower unbanked individuals to conduct their basic financial affairs and create a systemic contribution to emerging economies."[20] Such new technologies make transactions much cheaper (see figure 17). Even though the costs shown in the figure are from the United States, the same holds for the costs incurred by banks in developing countries. Consequently, it becomes more attractive for financial companies to provide services to undeserved segments to achieve sales growth.

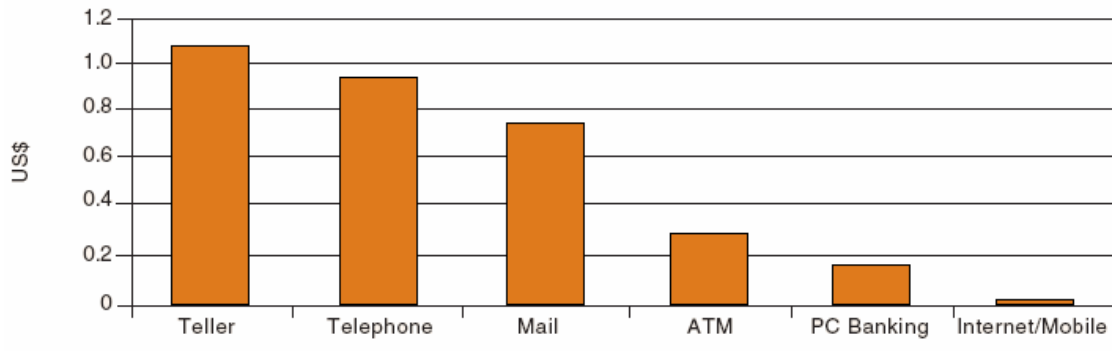

Figure 17: Cost per financial transaction for US banks in US$. Source: Ivatury (2006).

c. M-banking in the International Perspective – Selected Examples

The empowerment of the poor through cell phones is this paper's central theme. There already exist a number of cases in the world where such empowerment has already materialized through the usage of cell phones. The following paragraphs will briefly describe a number of experiences around the world.

[20] http://cgap.org/portal/site/portfolio/Feb2007Lead1/

i. South Africa

In South Africa banks have realized that the unbanked segment of the population represents a large growth potential. Wizzit and MTN Banking both offer financial services to the low income, unbanked segment through cell phones. In South Africa 48 percent of the adult population are unbanked or underbanked. However, cell phone penetration is high with more than 20 million mobile phone subscribers nationwide, of which 80 percent are prepaid customers.

Wizzit is a division of the South African Bank of Athens. Wizzit offers its customers an interest-bearing bank account, which can easily be accessed through cell phones. Further features include money transfers, person-to-person payments and airtime purchases. Moreover, Wizzit customers get issued a Maestro card that enables them to withdraw money at cash machines and to purchase in shops. A survey implemented by CGAP confirmed that the service quality perceived by Wizzit customers is very high: ninety percent of the people asked stated that the service provided was inexpensive (about a third cheaper than a comparable account offered by major South African brick and mortar banks). It was also verified that the service is significantly faster and perceived as safer than branch and ATM channels.

It is quite puzzling that such services can work in a country where the literacy rate among adults is only 82 percent (in Mexico it is 91 percent), as these services are precisely targeted towards the lowest income segment with least education.[21]

Other banks have also realized the potential of the unbanked segment in South Africa. First National Bank as well as Standard Bank also entered M-banking. The latter teamed up with MTN, a telecommunications company, to offer *MTN Banking*. MTN banking is a joint venture between the two firms: cell phone SIM cards are distributed through MTN's dealers, but customers actually hold a bank account with Standard Bank. First National Bank implemented the service itself and offers it as an alternative service (Ivatury 2006: 9).

[21] World Bank, World Development Indicators Online

ii. Philippines

Even though M-banking is quite developed in South Africa, its cradle is the Philippines. Philippines is a country with massive usage of SMS technology – its usage is more prevalent than anywhere in the world and that helped M-banking to be an immediately accepted application. The two incumbent Telecom companies – Globe Telecom and Smart Communications – are both very innovative companies, offering services to the poor and unbanked in the Philippines. *Smart Money* was introduced in 2000 and was the world's first electronic wallet. Smart Money can be used like a debit card where the cash is transferred via SMS technology. Smart realized that it was necessary to offer prepaid cards in tiny denominations to make their usage attractive to the bottom-of-the-pyramid segment. Physical prepaid cards were soon replaced by electronic loading in more than 700,000 outlets nationwide. *Sari Sari* (neighborhood shops) rely on social networks and relationship marketing in the Philippines. Owners of such Sari Saris commonly extend credit for staples to their customers, which they know very well. Now phone credit in the form of minutes could be purchased on credit as well. Even if a person did not have cash it could now get phone credit. Smart virtually converts neighborhood shops into microlenders. The shops do not earn interest on the credits extended, but rather earn a 15 percent commission from Smart. Of the 700,000 outlets Smart counts as its network about 90 percent are Sari Saris. Through very innovative approaches Smart achieved an incredible outreach across the entire country. Six years after it started operations in 1999, Smart counted more than 21 million subscribers, which generated about US$1.4 billion with profit margins of 66 percent. This story also shows that a country's poor population can be empowered through very profitable business. Smart's competitor, Globe Telecom, also offers M-banking to the unbanked. Its products are similar. Remarkable though is the fact that Globe is collaborating with the local Rural Bankers' Association for making loan repayments and with Micro Finance Institutions (MFIs) to advance micro loans.

In the context of remittances both, Globe and Smart are closest to globally offer transfers of remittances through cell phones. They see remittances as an extension to their existing M-banking business. Nevertheless, on the sending side, money needs to be paid in

physically, i.e. the sender needs to go to a branch abroad to be identified for regulatory reasons (AML and CFT) and to get the cash into the system. The recipient of the remittance is immediately notified via SMS that she was credited the amount on her electronic wallet, which can be used in shops or transformed into cash at any Smart of Globe store (Sullivan: 135-140 and InfoDev 2006).

iii. Kenya

In Kenya *Safaricom*, an affiliate of Vodafone, allows clients of the Kenyan MFI called *Faulu* to repay and receive loans through its *M-Pesa* product line. Safaricom allows Faulu to piggyback on its infrastructure, thus reducing the overall costs of distribution and collection of the loan: the credit for the loan can be exchanged for cash at any Safaricom dealer. M-Pesa allows subscribers to transfer or withdraw cash or prepaid minutes and to manage the account over the mobile phone (Ivatury 2006: 4-5). In February 2007 Safaricom announced that it was going to launch a global remittance sending service through collaboration with Citigroup later in the year. The trial will involve people living in the UK being able to send remittances home to Kenya over their cell phone. Allegedly neither sender nor receiver will need a bank account and costs are expected to be half that of the ones charged currently by money transmitters such as Western Union or MoneyGram.[22]

9. Feasibility of Integrating Cell Phones to the Remittance Market in Mexico

The following section seeks to evaluate the relationship between remittances, cell phone penetration and savings accounts, as a proxy for banking services, for the 32 Mexican states. The authors use a fixed effects model to capture this relationship.

a. The Relationship between Banking Accounts, Remittances and Cell Phone Penetration

To understand the relationship among banking accounts, remittances and cell phone penetration we undertook econometric analyses in an attempt to explain the number of savings accounts as a proxy for banking services. This is a good approximation given the

[22] http://money.guardian.co.uk/consumernews/story/0,,2014982,00.html#article_continue

constraints on the data and given that savings accounts are the most basic banking product in Mexico (as opposed to credit accounts which have more requirements). The regressions were estimated utilizing panel data for the 31 Mexican states as well as the Federal District (Mexico City). The structure of the model is similar to that of fixed effects but using the dummy variable method – a method that allows for greater flexibility.[23] We assigned a dummy variable to each State and also took into account the time-structure of the data by including a time trend.

The structure of the model is the following:

$$Bankingsavings = f(celusers, remit\tan ces, income, branches, populationratio, population)$$

Various specifications were calculated to take into account fixed effects through the inclusion of dummy variables and a time trend in the data. At the same time to avoid problems of magnitude, the regressions were run in logs.

The best specification was a fixed effects specification in log form:

$$\log(savingsaccounts)_{ti} = \alpha_0 + \beta_1 \log(celusers) + \beta_2 \log(remesas) + \beta_3 (indiceingreso) + \beta_4 \log(branches) + \beta_5 popruralratio + \beta_6 population + \sum_{i=1}^{i=31} D_i + trend^2 + u_{ti}$$

The results of the regressions and the chosen specification (far left of the table on the next page) are shown on the following page. It was chosen due to the highest permitted flexibility – as a consequence of the squared trend – and comprehensiveness.

[23] The fixed effects methodology allows us to use the information that Panel Data provide and at the same time account for the effects of unobserved variables in the data and trend components. This methodology is superior to that of time series or cross section alone since it minimizes the risk of omitted variable bias and provides greater flexibility to allow for time-variant relationships. For a more detailed treatment of the estimation method, please refer to the appendix and also: Wooldridge (2002) and Hausman et al (1984).

	Specifications						
Dependent Variable	**logsavings**	**logsavings**	**savingspercap**	**savingspercap**	**savingspercap**	**logsavings**	**logsavings**
logcelusers	-2.917	-1.699				-2.9	-2.932
	(5.76)**	(4.17)**				(5.65)**	(5.59)**
logremesas	9.531	14.202				9.524	9.355
	(5.81)**	(9.63)**				(5.84)**	(5.70)**
trend2	-0.147			5.827	24.659	-0.143	-0.163
	(2.29)*			(6.20)**	(11.97)**	(2.33)*	(2.61)*
logbranches	5.925	6.066	145.227	99.732	-34.789	5.899	6.025
	(5.19)**	(7.15)**	(4.93)**	(3.69)**	(-1.52)	(5.31)**	(5.05)**
popruralratio	32.605	4.148	120.114	1022.893	-350.56	34.014	
	(1.33)	(0.25)	(0.2)	(1.36)	(-0.47)	(1.41)	
Índice de ingreso	4.9	-13.206	-274.72	-370.968	-963.284	3.831	0.77
	(0.16)	(-0.61)	(-0.37)	(-0.49)	(-1.26)	(0.13)	(0.02)
population	0	0.001	0.06	0.03	0.021		0.001
	(-0.25)	(1.66)	(1.04)	(0.76)	(0.8)		(0.55)
State Dummy ZACATECAS	-4.028	24.679	373.986	-607.167	-256.471	-8.414	19.251
	(-0.16)	(1.5)	(0.55)	(-0.84)	(-0.47)	(-0.5)	(1.11)
State Dummy YUCATAN	20.017	51.103	318.902	-397.593	-308.843	16.235	34.518
	(1.04)	(4.27)**	(0.6)	(-0.77)	(-0.86)	(1.54)	(2.21)*
State Dummy VERACRUZ	-10.165	1.647	-139.102	-709.473	-399.218	-11.788	4.156
	(-0.7)	(0.16)	(-0.34)	(-1.5)	(-1.06)	(-0.93)	(0.46)
State Dummy TLAXCALA	17.235	42.579	510.47	-230.58	-412.047	13.135	30.258
	(0.84)	(3.40)**	(0.87)	(-0.42)	(-1.12)	(1.22)	(1.68)
State Dummy TAMAULIPAS	14.638	31.51	187.559	-265.803	-315.121	11.674	22.497
	(1.06)	(3.96)**	(0.47)	(-0.77)	(-1.38)	(2.01)	(1.8)
State Dummy TABASCO	12.536	45.513	302.181	-560.584	-302.869	8.579	31.945
	(0.57)	(3.23)**	(0.5)	(-0.89)	(-0.65)	(0.61)	(2.01)
State Dummy SONORA	17.093	40.449	247.614	-312.805	-269.944	13.77	27.939
	(1.08)	(4.25)**	(0.56)	(-0.78)	(-0.98)	(1.85)	(2.06)*
State Dummy SINALOA	2.769	25.914	185.971	-559.788	-285.185	-0.802	20.153
	(0.14)	(2.08)*	(0.35)	(-1.01)	(-0.69)	(-0.07)	(1.44)
State Dummy SAN LUIS POTOSI	0.473	24.229	260.958	-528.9	-289.457	-3.21	18.481
	(0.02)	(1.86)	(0.47)	(-0.92)	(-0.68)	(-0.25)	(1.27)
State Dummy QUINTANA ROO	28.268	54.806	488.607	-125.645	-239.144	24.434	39.235
	(1.59)	(5.22)**	(0.99)	(-0.3)	(-0.87)	(3.18)**	(2.46)*
State Dummy QUERETARO	9.421	33.27	381.689	-320.164	-244.84	5.604	24.058
	(0.51)	(2.90)**	(0.74)	(-0.66)	(-0.72)	(0.59)	(1.61)
State Dummy PUEBLA	-9.755	5.933	28.737	-646.475	-313.112	-12.237	7.19
	(-0.58)	(0.52)	(0.06)	(-1.25)	(-0.77)	(-0.93)	(0.69)
State Dummy OAXACA	-14.601	10.677	173.021	-820.549	-304.121	-18.223	10.841
	(-0.59)	(0.64)	(0.26)	(-1.08)	(-0.51)	(-0.94)	(0.74)
State Dummy NUEVO LEON	15.845	30.354	55.383	-240.994	-273.264	13.58	20.532
	(1.59)	(5.41)**	(0.19)	(-1.07)	(-1.92)	(3.97)**	(2.16)*
State Dummy NAYARIT	8.615	35.942	466.18	-383.342	-331.111	4.312	26.222
	(0.39)	(2.56)*	(0.74)	(-0.62)	(-0.76)	(0.34)	(1.48)
State Dummy MORELOS	10.042	27.254	396.252	-183.858	-335.555	6.403	20.004
	(0.58)	(2.69)*	(0.8)	(-0.42)	(-1.17)	(0.85)	(1.29)
State Dummy MICHOACAN	-18.039	-4.725	233.756	-450.88	-213.605	-21.08	0.023
	(-0.93)	(-0.36)	(0.44)	(-0.78)	(-0.49)	(-1.45)	(0)
State Dummy ESTADO DE MEXICO	-10.287	-14.715	-489.71	-553.988	-515.932	-8.708	-9.118
	(-1.22)	(3.03)**	(-1.64)	(2.35)*	(2.78)**	(-1.46)	(-1.05)
State Dummy JALISCO	0.26	7.565	-161.725	-518.397	-420.597	-1.307	7.857
	(0.02)	(1.03)	(-0.51)	(-1.54)	(-1.61)	(-0.15)	(0.85)
State Dummy HIDALGO	-6.316	14.869	323.593	-533.883	-314.517	-10.151	13.464
	(-0.29)	(1.03)	(0.54)	(-0.84)	(-0.67)	(-0.69)	(0.86)
State Dummy GUERRERO	-14.178	4.537	249.605	-571.265	-258.397	-17.627	6.032
	(-0.68)	(0.33)	(0.45)	(-0.94)	(-0.56)	(-1.2)	(0.44)
State Dummy GUANAJUATO	-8.143	2.175	63.562	-464.105	-327.272	-10.558	3.993
	(-0.56)	(0.23)	(0.16)	(-1.1)	(-1.05)	(-1.04)	(0.37)
State Dummy DURANGO	7.592	33.509	399.396	-367.419	-288.547	3.658	23.644
	(0.38)	(2.66)*	(0.72)	(-0.68)	(-0.75)	(0.33)	(1.49)
State Dummy CHIHUAHUA	13.199	30.826	169.439	-326.297	-305.891	10.238	22.666
	(0.93)	(3.63)**	(0.42)	(-0.87)	(-1.2)	(1.48)	(1.84)
State Dummy CHIAPAS	-11.126	19.074	143.272	-778.659	-154.581	-14.243	13.513
	(-0.52)	(1.3)	(0.26)	(-1.2)	(-0.28)	(-0.83)	(1.31)
State Dummy COLIMA	23.461	49.759	568.85	-57.735	-266.677	19.472	33.673
	(1.28)	(4.61)**	(1.09)	(-0.13)	(-0.96)	(2.68)*	(2)
State Dummy COAHUILA */	22.68	37.661	211.67	-218.453	-483.555	19.428	27.737
	(1.38)	(4.05)**	(0.44)	(-0.52)	(-1.62)	(2.25)*	(1.72)
State Dummy CAMPECHE	22.549	62.501	553.45	-316.597	-152.937	18.311	41.42
	(1.02)	(4.35)**	(0.97)	(-0.56)	(-0.37)	(1.42)	(2.46)*
State Dummy BAJA CALIFORNIA SUR	35.485	73.999	574.265	-204.012	-227.084	31.216	50.452
	(1.68)	(5.57)**	(1.01)	(-0.39)	(-0.63)	(2.80)**	(2.81)**
State Dummy BAJA CALIFORNIA NORTE	21.076	39.555	253.587	-179.148	-279.477	18.031	28.002
	(1.53)	(5.08)**	(0.64)	(-0.55)	(-1.34)	(3.49)**	(2.18)*
State Dummy AGUASCALIENTES	16.679	37.102	526.779	-59.782	-261.199	12.899	26.259
	(0.97)	(3.71)**	(1.06)	(-0.15)	(-0.99)	(1.98)	(1.66)
trend		-2.296	20.981		-103.976		
		(6.49)**	(5.09)**		(10.02)**		
celusers			0		0		
			(-0.16)	(-0.8)	(-1.58)		
Constant	-59.395	-93.742	-996.863	-260.576	1340.061	-54.662	-59.66
	(-1.73)	(4.57)**	(-1.04)	(-0.3)	(1.82)	(2.10)*	(-1.69)
Remittances			-0.064	-0.082	-0.042		
			(3.12)**	(2.56)*	(-1.42)		
Observations	**128**	128	128	128	128	128	128
R-squared	**0.84**	0.90	0.84	0.87	0.93	0.84	0.83

Robust t statistics in parentheses
*** significant at 5%; ** significant at 1%**

Throughout the different specifications there is consistency in the signs of the coefficients for the explanatory variables. The first three columns from left to right show that the effect of cell users on savings (even in the savings per capita case in the third column) is always negative and significant even at a 1 percent level. The effect of remittances is always positive for savings, either per capita or in logs, and significant without falling outside the 10 percent significance range. As for the effect of bank branches there is also a positive effect across specifications, however, it does not show significance for the case of savings per capita.

Another robust result is that the level of income is not significant nor is the population level. The trend and state dummies allow for the calculation of fixed effects and are jointly significant in all the cases.

The specification on the far left was chosen given its flexibility due to a squared trend, significance and consistency of the variables. The results on this equation show that there is a strong and statistically significant positive relationship between remittances' inflows and the number of saving accounts. For each increase of 1 percent in remittances there is a 9 percent increase in savings accounts. Previous studies showed ambiguous results, but mostly confirming the positive relationship between remittances and savings. Fajnzylber and López (2007) state for instance that "recipients [of remittances] save more than non-recipients, the only exceptions being Mexico and El Salvador." Orozco (2006b: 5) on the other hand finds that

> "… evidence from Latin America South East Asia and Africa suggests that both senders and recipients tend to increase their savings and investment when remittances flow over a stable period of time, thus providing a space to set up small businesses or invest in real estate. Specifically, remittance flows increase by 25% when the sender has a savings account in his or her home country. When senders have a savings account, they are three times more likely to send money to support a family business. In addition, each year of remitting is associated with a 20% increase in sending money to pay off loans. From the perspective of the beneficiary, recipients with bank accounts receive 27% more. The longer a person has been receiving remittances, the higher the likelihood that they will run a business; what's more, having a bank account while receiving remittances also increases the chances of the beneficiary having a business."

Our results are in line with Orozco's findings, contradicting Fajnzylber and López, for the case of Mexico. We argue that Mexican households that receive remittances have

significantly higher savings. At the same time, although immigrants' families are poor, they have saving capacity.

With respect to the number of branches, the relationship is positive, as previously expected. The presence of this variable is probably rendering insignificant the effect of the income index given that the presence of bank branches can be a good proxy for each state's income. A 1 percent increase in the number of branches is related to a 5 percent increase in the number of saving accounts.

At the same time the regression also shows two important results a) It cannot be rejected that there exists no relationship between the variable proportion of rural population and the number of accounts. This can be the result of the fact that in the construction of the ratio the total population is taken into account and this measure is also considered to calculate the cell users variable. The cell users variable was constructed by multiplying the cell phone penetration by the population (both at state level). And b) that there is a strong relationship between the number of cell phone users and the number of savings accounts. This finding is controversial since a first approach may lead us to believe that the more cell users the higher the savings. Hence, reverse causality might be a problem.

However, to verify that in fact there is a causal relationship between the number of cell phone users and the amount of saving accounts we ran Granger causality tests (Granger 1969). We found that the causality runs only from cell users to saving accounts, eliminating other two possible causal relationships: firstly, that there exists simultaneous causality, i.e. cell users cause savings and vice versa; and secondly, that saving accounts cause cell users, but not the other way around. Table 4 shows the results for the causality tests. It can be seen that the null hypothesis of non-causality between cell phone users and savings accounts can be rejected even at a 99 percent confidence level.

Granger Causality Test	F-value	P-value
H0: Savings accounts do not cause cell users	0.23	0.79
H0: Cell users do not cause savings accounts	6.04	0.01

Table 4: Study Results of Granger Tests for Causality

These results are relevant for the explanation of the negative sign between call phone users and savings found in the regression. We found three theories that may explain that result. **However, all explanations undoubtedly lead to the same conclusion: the opportunity of increasing the mobile banking industry.** Before venturing an explanation it is important to show that there are two effects through which remittances flows are affecting the number of accounts:

a) A direct positive impact on savings accounts and,

b) An indirect negative effect through the number of users of cell phones (remittances increase cell phone users but more cell phone users cause falls on savings accounts).

To clarify the second point, the positive relationship between remittances and cell users is estimated in table 5. As can be noticed in the two specifications presented, the remittances variable (*logremesas*) has a positive relation with

	Specifications	
Dependent Variable	**logcelusers**	**logcelusers**
logpoprural	**3.05**	4.456
	(1.91)	(2.43)*
logremesas	**0.938**	0.983
	(5.66)**	(5.77)**
State Dummy ZACATECAS	**3.382**	1.221
	(1.76)	(0.71)
State Dummy YUCATAN	**6.246**	5.212
	(2.61)*	(2.88)**
State Dummy VERACRUZ	**0.456**	0.691
	(2.53)*	(0.71)
State Dummy TLAXCALA	**6.857**	5.383
	(1.95)	(1.91)
State Dummy TAMAULIPAS	**7.411**	8.038
	(2.60)*	(3.34)**
State Dummy TABASCO	**4.461**	3.034
	(2.72)*	(2.45)*
State Dummy SONORA	**6.967**	6.777
	(2.73)*	(3.46)**
State Dummy SINALOA	**4.155**	3.201
	(2.95)**	(3.68)**
State Dummy SAN LUIS POTOSI	**3.358**	2.243
	(2.25)*	(2.34)*
State Dummy QUINTANA ROO	**10.716**	9.716
	(2.64)*	(2.96)**
State Dummy QUERETARO	**6.212**	4.999
	(2.30)*	(2.45)*
State Dummy PUEBLA	**0.975**	0.718
	(4.10)**	(1.48)
State Dummy OAXACA	**-0.027**	-1.323
	(-0.13)	(2.17)*
State Dummy NUEVO LEON	**9.406**	11.475
	(2.67)*	(3.24)**
State Dummy NAYARIT	**5.948**	3.861
	(1.93)	(1.5)
State Dummy MORELOS	**7.246**	6.777
	(2.10)*	(2.54)*
State Dummy MICHOACAN	**0.653**	0
	(1.03)	(.)
State Dummy ESTADO DE MEXICO	**2.041**	4.758
	(2.36)*	(1.77)
State Dummy JALISCO	**3.87**	4.973
	(3.69)**	(3.29)**
State Dummy HIDALGO	**2.519**	1.176
	(1.85)	(1.3)
State Dummy GUERRERO	**0.973**	-0.09
	(1.15)	(-0.23)
State Dummy GUANAJUATO	**2.167**	2.347
	(2.24)*	(3.07)**
State Dummy DURANGO	**4.961**	3.572
	(1.96)	(1.86)
State Dummy CHIHUAHUA	**6.463**	6.772
	(2.85)**	(3.71)**
State Dummy CHIAPAS	**0**	-0.996
	(.)	(-1.68)
State Dummy COLIMA	**10.906**	9.355
	(2.07)*	(2.13)*
State Dummy COAHUILA */	**9.812**	10.999
	(2.45)*	(3.09)**
State Dummy CAMPECHE	**7.898**	5.511
	(2.32)*	(1.84)
State Dummy BAJA CALIFORNIA SUR	**11.415**	8.973
	(2.48)*	(2.23)*
State Dummy BAJA CALIFORNIA NORTE	**9.069**	9.9
	(2.67)*	(3.36)**
State Dummy AGUASCALIENTES	**8.991**	8.221
	(2.05)*	(2.33)*
trend2	**0.007**	0.01
	(1.21)	(1.75)
logpop		-2.594
		(-1.27)
Constant	-19.608	-8.48
	(-1.55)	(-0.61)
Observations	**186**	186
R-squared	**0.96**	0.97
Robust t statistics in parentheses		
*** significant at 5%; ** significant at 1%**		

Table 5: Cell users estimated as dependent variable.

cell users, and in both cases the variables are statistically significant even at the 1 percent level. The regressions also controls for fixed effects through a quadratic time trend and state dummy variables.

Recalling both points mentioned above, figure 18 summarizes the interrelations of the principal variables:

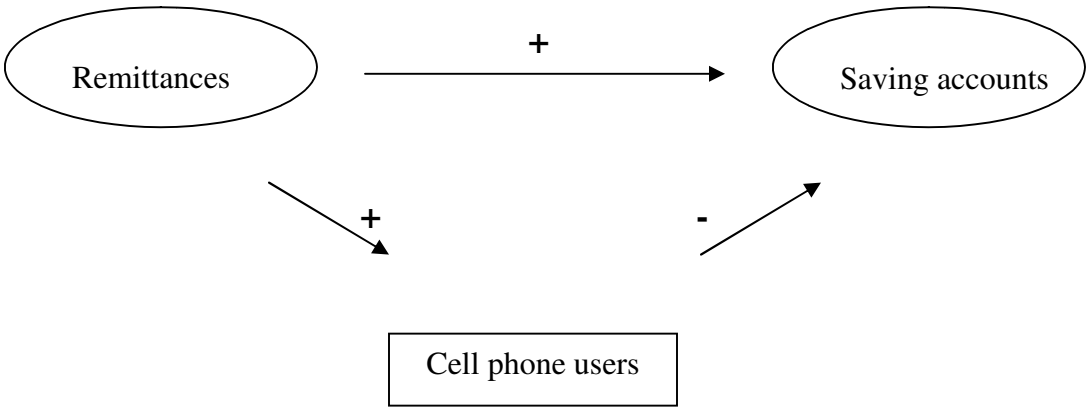

Figure 18: Demonstration of Relationship between Principal Variables of the Study.

The first explanation for the negative sign on the cell phone users variable on explaining saving accounts is that there are different subsets of the population at different parts of their budget constraint (as a result of different preferences). When provided with remittances, one subset may increase its savings whereas other subsets increase consumption. Those that save will generate a positive increase in the number of accounts (therefore the positive sign between remittances and saving accounts). Those who consume more, will also buy more cell phones (positive relationship between remittances and cell phone users) and show a substitution effect between cell users and savings (negative sign between savings accounts and cell phones). This does not mean that there is a long term substitution effect, it only means that those that consume more cell phones as a result of remittances may only be deciding to postpone the opening of saving accounts for later.

The second explanation of the negative sign between cell users and savings accounts hinges on the empirical fact that cell phone penetration is higher than fixed line penetration in rural towns. See figures 11 and 12 in section 6, which show that even in the least developed regions in Mexico cell phone penetration is well above 30 percent, whereas fixed lines per a hundred users are only about 20 percent. This is not surprising as purchasing a cell phone is cheaper than the installation of fixed telephone lines. Once said that, it may be the case that banks are neglecting rural towns as a business niche and regard them as not business worthy, because cell phone penetration is not factored into their decision to establish a branch. This may be because these towns fare badly in other indicators of development such as number of fixed lines or income for instance. Naturally, banks may not only fail to open a branch in a town on that basis – even in cases where cell phone penetration is high – but in addition they may not even establish ATMs. This can help explain the negative relationship between cell phone users and saving accounts. For many people it is just too much hassle to open an account, as they would have to go far to withdraw cash or make any other financial transaction. It is easier to spend the money received through remittances on other things.

If this second explanation is taken as a plausible one, the banks should reconsider the increase of cell phone penetration and take advantage of the capacity of the cell phones to provide mobile banking – which offers radically improved cost structures – rather than looking at other indicators such as fixed lines or income to decide whether or not serve the market.

Thirdly, having savings accounts in Mexico is expensive. The remainder between received remittances and consumption, i.e. the amount available for saving, has to be significant to make saving a lucrative option. Banks generally charge very high fees (for bank accounts) and give very little interest (for savings accounts).[24] Additionally, there are very high minimum balance requirements in place. To sum up banks do not provide the right incentives to the population to have bank or savings accounts. Hence, people

[24] There exist exceptions to the rule such as BANORTE, which offers bank accounts at no charge to remittance receivers.

may just decide to spend the entire money on consumption (which includes spending on cell phones). So the unattractive product offering of Mexican banks may disincentivize people to save, which explains the negative sign between cell phone users and savings accounts.

b. Summary of Empirical Results

The authors find a positive relationship between remittances and savings accounts and between remittances and cell phone users in the 32 Mexican states. Nonetheless, cell phone users *cause* less savings. The paper offers three explanations for the negative, causal relationship between cell phone users and savings:

1. Substitution effects between consumption (cell phone usage) and savings
2. Banks' failure to take into account high cell phone penetration rates when calibrating their product mix for rural zones, which leads to inconvenient, inaccessible bank locations and ATMs; this in turn leads to higher preference for consumption (cell phone usage) than for savings.
3. The product mix offered by banks is not geared towards remittances receivers' necessities – low interest rates for savings accounts, high fees for bank accounts and high minimum balance requirements make financial intermediation unattractive and leads to higher preference for consumption (cell phone usage).

10. Recommendations

Throughout the document we have shown that remittances represent an opportunity to serve as a vehicle for deeper bancarization, higher savings and welfare for the poor. The poor's adoption of technology has provided new ways to reach those segments of the population that have always been excluded. Technological solutions that leverage the use of cell phones could be the missing link in the search for means through which remittances can help promote development. This is especially true in light of the deep inefficiencies in the financial services and the high costs that the poor face. Active policies should be instrumented to develop the mobile financial market. Policy makers

should pave the way for a transition that is required to make sure not to further entrench the exploitation of the poor.

We showed in our econometric study that remittances promote savings accounts, but at the same time have an ambiguous effect on them through increased cell phone penetration. By creating virtual mobile bank accounts banks can leverage the relatively high cell phone penetration across the income pyramid, to bank Mexico's population – while benefiting from additional profitable business. Given remittances' savings increasing nature, starting with remittances' recipients is the logical and most powerful tipping point of the process.

Our study finds that banks ignore the potential of the mobile banking market, including remittances transfers over cell phones. We suggest a number of policies to be implemented to enable the prospering of the mobile financial industry. The following paragraphs enlist the suggested policies.

a. Cost and Access

One of the main obstacles that impedes the bancarization of the poor in Mexico is the high cost of financial products such as bank accounts. The maintenance fee and the minimum requirements are very high for those in the bottom of the income pyramid. At the same time, the concept of saving accounts has almost disappeared for the poor for they have to have significant minimum balances to even receive meager interest rates. The financial authorities should work on encouraging the creation of financial instruments and credit, either by incentives or by regulation. Although not perfect, there are examples of incentive initiatives such as the Community Reinvestment Act (CRA) in the US. The CRA's purpose is to "encourage depository institutions to help meet the credit needs of the communities in which they operate, including low- and moderate-income neighborhoods, consistent with safe and sound banking operations"[25]. By

[25] For additional information, visit the Community Reinvestment Act webpage at: http://www.ffiec.gov/cra/history.htm

learning from the experience of those kinds of laws the Mexican authorities can improve access to credit.

b. Encouragement and Access for Non-Bank Financial Institutions

Currently, Money Transfer Operators (MTOs) are not allowed to access the *Federal Reserve Automated Clearing House* (FedACH) system for cheap transferal of funds. They have to conduct the transfer of remittances using banks as points of entry to the financial systems. Although the access to such a sophisticated system is delicate, the Fed and the Central Bank of Mexico could attempt to create an alternative channel of clearing house systems where MTOs could clear their international operations and reduce their costs by not having to pay banks high fees as intermediaries in the process. Although research is poor on the possible colluding behavior of banks, given their strong market power (recall from section 7 that the five largest banks hold 82% of all the deposits only in Mexico City where there is more competition), making them the main funnel for remittance transmissions can lead to collusion and higher prices.

Credit and loan cooperatives and credit unions are restricted from access to the mainstream financial clearinghouses as well as to the FedACH too. As mentioned above, recent governmental action has been taken with in cooperation with BANSEFI, one of the federal development banks. However, more development banks could participate in the process of providing access for Non-Bank Financial Institutions. Those banks may include BANCOMEXT and NAFINSA for instance. At the same time, the government could explore the possibility of using cell phone mechanisms for government assistance transfers such as *Oportunidades.*

c. Regulatory Cooperation and Transparency

Given the latest trends and international concerns with respect to terrorism financing and money laundering, Mexican authorities should push for a coordinated, international agenda – at least with the US (by virtue of being the country with which it conducts almost all its remittance operations) – to homogenize the regulation and disclosure of

compliance procedures in the transmission process of remittances. For many new MTOs regulations they need to abide by is confusing, increasing the barriers of entry and making remittances sending more costly, legal advice needs to be hired from the outset.

d. Clear Operational Frameworks for Credit and Loan Cooperatives

Loan cooperatives and microfinance institutions are organizations that have had a better grasp of the poor through their extensive coverage and dispersion. However, there is no sufficiently comprehensive regulatory body in place. The Popular Savings and Credit Law to further improve transparency and security for customers – especially the ones at the bottom of the pyramid. In the past fraud was common, with dark consequences for the poor in rural areas. A recent initiative by the government in Mexico and BANSEFI, a national development bank, is taking the first steps in registering financial institutions and trying to provide regulatory frameworks for those institutions but more needs to be done. Especially, regulatory bodies should be forward looking and flexible to technological innovations in remittances transmission and other uses such as M-Banking in general.

e. Improve Regulation to Reduce Monopolies in the Telecommunications Sector

High concentration in the telecommunications industry may be the single most important threat for the development of a widespread mobile banking market either for remittances as well as for simple points of sale systems. Legislation and enforcement regarding interconnection rights and their pricing need to be designed carefully in order to avoid monopolistic rents and foster competition. At the same time, rules must be clear to prevent mobile companies from developing controls on the access to Internet content through cell phones.

f. Incentives for ICT Investment

Mexico compares unfavorably on its ICT investment levels against countries that have the same level of GDP. Therefore, ICT investments should be provided with incentives, especially considering that information technology on cell phones has the capacity to reach the poor and help close the financial gap for the poor. On the other hand investments should be encouraged to create more competition in the telecommunications sector. *Mobile Virtual Network Operators* (MVNOs) need to be allowed to use the existing infrastructure of telecommunications companies to increase competition and efficiencies.

g. Efforts to Improve Financial Literacy

The government and organizations should engage in creating programs to promote financial literacy for the poor. Recently, the Central Bank of Mexico inaugurated the *Museum of Economics*[26] in Mexico City. Projects of similar nature could assist in educating the poor about financial services and their advantages.

[26] *Museo de Economía*

11. Bibliography

Arriola, Jim (2006): "On the Use of Remittance Income in Mexico". Working Paper Series, Defense Resources Management Institute, available at: http://www.nps.navy.mil/drmi/WorkingPapers/DRMI%20Working%20Paper%2006-01.pdf

Caskey, John, Ruiz Duran, Clemente and Solo, Tova Maria (2004): "The Unbanked in Mexico and the United Status." April 2004.

CEPAL (2006): "Competencia Bancaria en México." Available at: http://www.eclac.cl/publicaciones/Mexico/1/LCMEXL722Rev1/L722.pdf

COFETEL (2004): "Evolución de Las Tarifas Telefónicas en México."

Demirguc-Kunt, Asli (2005):"Measuring Access to Finance: An Update of Activities." World Bank, Prepared for International Year of Microcredit Advisors Group Meeting, September 26, 2005 Washington, D.C., slide 14.

The Economist (2006): "Mexico's Mezzogiorno." November 16, 2006.

The Economist (1995): "The Real Digital Divide". March 10, 2005.

Eggleston, K., R. Jensen and R. Zeckhauser (2002): "Information and Communication Technologies, Markets, and Economic Development." Working Paper, Tufts University, Department of Economics and Harvard University, Kennedy School of Government.

Fajnzylber, Pablo and López, J. Humberto (2007): "Close to Home: The Development Impact of Remittances in Latin America." World Bank, Conference Edition.

Girmens, Guillaume and Guillard, Michel (2002): "Privatization and Investment: Crowding-Out Effect vs Financial Diversification". Pp 3. Social Science Research Network. Electronic Paper Collection. Available at: http://papers.ssrn.com/abstract_id=363841

Guerrero, Isabel, Lopez-Calva, Luis Felipe and Walton, Michael (2006): "The Inequality Trap and Its Links to Low Growth in Mexico." November 2006. Working Paper No. 298, Stanford Center for International Development.

Granger, C. W..J. (1969): "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods." Econometrica, 37, 424–438.

Guevara, Gustavo (2006): "A Glimpse South of the Border: Business in Mexico." Brew 2006 Conference, Iusacell.

Hausman, Jerry, Hall, Bronwyn H. and Griliches, Zvi (1984): "Econometric Models for Count Data with an Application to the Patents-R & D Relationship", *Econometrica*, Vol. 52, No. 4 pp. 909-93.

Hurlin, Christophe and Venet, Baptiste (2003): "Granger Causality Tests in Panel Data Models with Fixed Coefficients." Available at: http://www.dauphine.fr/eurisco/CH_Recherche/Granger_v1.pdf

INEGI (2005): "Estadisticas sobre Disponibilidad y Uso de Tecnología de Información y Comunicaciones en los Hogares, 2005."

InfoDev (2006): "Micro Payment Systems and Their Application to Mobile Networks." January 2006. GSMA, IFC, InfoDev Report.

Ivatury, Gautam (2006): "Using Technology to Build Inclusive Financial Systems." CGAP, Focus Note, No. 32, January 2006.

Juma, Calestous and Yee-Cheong, Lee (2005): "Innovation: Applying Knowledge in Development." UN Millennium Project, Task Force on Science, Technology, and Innovation.

Klaehn, Janette, Helms, Brigitt and Deshpande, Rani (2006): "Mexico – Country-Level Savings Assessment." Third edition, March 2006. CGAP.

The Latino Coalition (2002): "National Survey of Hispanic Adults." Available at: http://www.thelatinocoalition.com/news/surveysandpolls.htm

Maimbo, Samuel Munzele and Ratha, Dilip (2005): "Remittances: Development Impact and Future Prospects." Editors. The World Bank.

Orozco, Manuel (2002): "Attracting Remittances: Market, Money and Reduced Costs." Report commissioned by the Multilateral Investment Fund of the Inter-American Development Bank. Washington, DC. Available at: www.thedialogue.org/publications/country_studies/remittances/MarketMoney.pdf

Orozco, Manuel (2006a): "Toward a Scorecard on Remittance Transfers: Pricing, Convenience, Competition and Financial Access." Summary of Results. Available at: http://search.iadb.org/search.asp?querymode=basic&language=english&QueryText=o-f&LastQuery=&Page=10

Orozco, Manuel (2006b): "International Flows of Remittances: Cost, Competition and Financial Access in Latin America and the Caribbean — Toward an Industry Scorecard".Inter-American Dialogue, Washington DC.

Pitroda, S. (1993): "Development, Democracy and the Village Telephone". In Harvard Business Review, Nov./Dec. 1993, p.66.

Roller, Lars-Hendrik and Waverman, Leonard (2001): "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach." The American Economic Review, Vol. 91, No. 4. (Sep., 2001), pp. 909-923.

Schulz, Larry J.: (2005): "*Directo a Mexico*." Presentation to Specialized Reporting Conference, Atlanta, GA. www.grady.uga.edu/SRC/Latino/binder/Presentations/latino05Schulz.ppt

Sullivan, Nicholas P. (2007): "You Can Hear Me Now: How Microloans and Cell Phones Are Connecting the World's Poor to the Global Economy." Jossey Bass Books, San Francisco.

Tovar, Martha Patricia (n.a.): "Estudio sobre la Educación para la Población Rural en México." Project between FAO, UNESCO, DGCS Italia, CIDE and REDUC.

Villarreal, Calderon and Dueñas, Roa (2006): "¿Existe un Crowding Out del Financiamiento Privado en México?" Revista Análisis Económico UAM.

The Vodafone Policy Paper Series (2005): "Africa: The Impact of Mobile Phones." Moving the Debate Forward. Number 3, March 2005.

Wooldridge, Jeffrey (2002): "Econometric Analysis of Cross Section and Panel Data." MIT Press, Cambridge, MA.

World Bank (2004a): "Mexico – Poverty in Mexico: An Assessment of Conditions, Trends and Government Strategy." Report No. 28612-ME, June 2004. Colombia and Mexico Country Management Unit, Latin America and the Caribbean Region, Poverty Reduction and Economic Management Division.

World Bank (2004b): "La Pobreza en México, una Evaluación de las Condiciones, las Tendencias y la Estrategia del Gobierno." Pp*: 224.* Available at: http://web.worldbank.org/WBSITE/EXTERNAL/BANCOMUNDIAL/EXTSPPAISES/LACINSPANISHEXT/MEXICOINSPANISHEXT/0,,contentMDK:20835462~menuPK:500926~pagePK:1497618~piPK:217854~theSitePK:500870,00.html

12. Appendix

The function for bank savings is assumed to be as:

$$Bankinsavings = f\left(celusers, remit\tan ces, income, branches, populationratio, population,\right)$$

To take into account the heterogeneity of the data on size at state level, the series of the regression need to be expressed in logs, thus the functional form of the equation is:

$$\log(savingsaccounts)_{ti} = \alpha_0 + \beta_1 \log(celusers) + \beta_2 \log(remesas) + \beta_3 (ndiceingreso)$$
$$+ \beta_4 \log(branches) + \beta_5 popruralratio + \beta_6 population + \sum_{i=1}^{i=31} D_i + trend^2 + u_{ti}$$

Where:

According to Wooldridge (2002: 274) The fixed estimator is consistent and asymptotically normal under the three assumptions below:

1) $E(u_{it} \left| x_i, c_i \right.) = 0, t = 1,2,...T$

2) $Rank\left[\sum_{t=1}^{T} E(\ddot{X}_{it}^{'} \ddot{X}_{it})\right] = Rank\left[E(\ddot{X}_{it}^{'} \ddot{X}_{it})\right] = K$

3) $E(u^{'} u_i^{'} \left| x_i, c_i \right.) = \sigma_u^2 I_T$

However, if assumption 3 is violated the variance of the coefficients below will be an improper variance estimator:

$$A\hat{\text{var}}(\hat{\beta}_{FE}) = \hat{\sigma}_u^2 (\sum_{i=1}^{N} \ddot{X}_i^{'} \hat{u}_i \hat{u} \ddot{X}_i)(\ddot{X}^{'} \ddot{X})^{-1}$$

(where $\ddot{Y}_i = \ddot{X}_i \beta + \ddot{u}$ is simply the equation for all periods)

This inefficiency may arise in case of heteroskedasticity but most importantly in case of autocorrelation. This however happens more frequently when T is large, which is not the case of our sample where T=5, but nonetheless we estimated the robust errors with:

$$A\hat{\text{var}}(\hat{\beta}_{FE}) = (\ddot{X}^{'} \ddot{X})^{-1} (\sum_{i=1}^{N} \ddot{X}_i^{'} \hat{u}_i \hat{u} \ddot{X}_i)(\ddot{X}^{'} \ddot{X})^{-1}$$

to account for any autocorrelation or heteroskedasticity.

Variable Definitions:

savingsaccounts: Number of accounts at time t in state *i.* Source: "Comision Nacional Bancaria y de Valores" (CNBV), *National Banking and Securities Commission*, data available through Asociacion de Banqueros de Mexico (ABM), *Association of Mexican Banks* at: *http://www.abm.org.mx/estadisticas/cn-cnbv.htm*

celusers: State penetration (number of cell phone users per 100 inhabitants) at time t*state population at time *t.* Source: Comision Federal de Telecomunicaciones (COFETEL), *Federal Commission of Telecommunications*, data available at: *http://www.cft.gob.mx/wb2/COFETEL/COFE_Densidad_de_Telefonia_Movil_por_Entidad_Feder*

remesas: This variable measures the amount of dollars (remittances) received by the Mexican state i at time t. Source: Banco de México (Banxico), *Central Bank of Mexico*, data available at: http://www.banxico.gob.mx/tipo/estadisticas/index.html

indiceingreso: Measure of income. Source: income state index used by the *UNDP*, data available at: http://saul.nueve.com.mx/estadisticas/index.html

branches: This is the number of bank branches in state i at time t. Source: "Comision Nacional Bancaria y de Valores" (CNBV), *National Banking and Securities Commission,* data available through Asociación de Banqueros de Mexico (ABM), *Mexican Bankers Association* at: http://www.abm.org.mx/estadisticas/cn-cnbv.htm

popruralratio: Percentage of the population that is rural, this index was calculated taking the rural population and dividing it by the total population. Source: Instituto Nacional De Estadistica Geografia en Informatica (INEGI), *National Institute of Statistics, Geography and Informatics*. Data available through the UNDP at: *http://saul.nueve.com.mx/estadisticas/index.html*

D_i**:** Specific dummy for each state in Mexico

$trend^2$**:** Time-trend variable in quadratic form.

***population*:** Source: Instituto Nacional De Estadistica Geografia e Informatica (INEGI), *National Institute of Statistics, Geography and Informatics*. Data available through the UNDP at: *http://saul.nueve.com.mx/estadisticas/index.html*

The regressions were run using data from 2000 to 2006 at a state level. However, the level of remittances per state was only available for the period 2003-2006 at the Central Bank of Mexico. For the years 2000 to 2002 we obtained the national level of remittances from the Central Bank. Thus, we could estimate the state level using the rates of growth of the national aggregate series doing a backward calculation proportional to the level of remittances in the following year in a particular state.

The pool of specifications tested is listed in section 9 of this paper. The chosen specification was selected due to its highest flexibility and comprehensiveness.

The complete results of the chosen specification are:

Linear regression — **Number of obs = 128**; **R-squared = 0.83**; **Root MSE = .73**

Number of clusters (state) = 32

Dependent Variable: logsavings, Errors: Robust

	Coefficient	Std. Err.	t value	P>|t|	[95% Conf.	Interval]
logcelusers	-2.92	0.51	-5.76	0.00	-3.95	-1.88
logremesas	9.53	1.64	5.81	0.00	6.19	12.88
trend2	-0.15	0.06	-2.29	0.03	-0.28	-0.02
logbranches	5.92	1.14	5.19	0.00	3.60	8.25
popruralratio	32.61	24.44	1.33	0.19	-17.24	82.45
ndicedeingreso	4.90	29.85	0.16	0.87	-55.99	65.79
population	0.00	0.00	0.25	0.81	0.00	0.00
State Dummy ZACATECAS	-4.03	25.03	-0.16	0.87	-55.07	47.01
State Dummy YUCATAN	20.02	19.17	1.04	0.30	-19.07	59.11
State Dummy VERACRUZ	-10.17	14.45	-0.70	0.49	-39.65	19.32
State Dummy TLAXCALA	17.24	20.63	0.84	0.41	-24.84	59.31
State Dummy TAMAULIPAS	14.64	13.76	1.06	0.30	-13.42	42.70
State Dummy TABASCO	12.54	21.85	0.57	0.57	-32.03	57.10
State Dummy SONORA	17.09	15.82	1.08	0.29	-15.17	49.35
State Dummy SINALOA	2.77	19.38	0.14	0.89	-36.75	42.29
State Dummy SAN LUIS POTOSI	0.47	20.16	0.02	0.98	-40.65	41.59
State Dummy QUINTANA ROO	28.27	17.79	1.59	0.12	-8.01	64.55
State Dummy QUERETARO	9.42	18.63	0.51	0.62	-28.57	47.41
State Dummy PUEBLA	-9.75	16.81	-0.58	0.57	-44.03	24.52
State Dummy OAXACA	-14.60	24.66	-0.59	0.56	-64.89	35.69
State Dummy NUEVO LEON	15.84	9.99	1.59	0.12	-4.53	36.22
State Dummy NAYARIT	8.61	22.36	0.39	0.70	-37.00	54.23
State Dummy MORELOS	10.04	17.21	0.58	0.56	-25.06	45.15
State Dummy MICHOACAN	-18.04	19.44	-0.93	0.36	-57.68	21.60
State Dummy ESTADO DE MEXICO	-10.29	8.42	-1.22	0.23	-27.46	6.89
State Dummy JALISCO	0.26	11.01	0.02	0.98	-22.19	22.71
State Dummy HIDALGO	-6.32	21.92	-0.29	0.78	-51.03	38.40
State Dummy GUERRERO	-14.18	20.74	-0.68	0.50	-56.48	28.12
State Dummy GUANAJUATO	-8.14	14.45	-0.56	0.58	-37.62	21.33
State Dummy DURANGO	7.59	20.07	0.38	0.71	-33.35	48.53
State Dummy CHIHUAHUA	13.20	14.24	0.93	0.36	-15.84	42.24
State Dummy CHIAPAS	-11.13	21.49	-0.52	0.61	-54.96	32.71
State Dummy COLIMA	23.46	18.39	1.28	0.21	-14.05	60.97
State Dummy COAHUILA */	22.68	16.38	1.38	0.18	-10.72	56.08
State Dummy CAMPECHE	22.55	22.03	1.02	0.31	-22.39	67.49
State Dummy BAJA CALIFORNIA SUR	35.48	21.17	1.68	0.10	-7.69	78.66
State Dummy BAJA CALIFORNIA NORTE	21.08	13.76	1.53	0.14	-6.98	49.13
State Dummy AGUASCALIENTES	16.68	17.28	0.97	0.34	-18.57	51.92
Constant	-59.40	34.25	-1.73	0.09	-129.25	10.46

Table 6: Complete Output for Chosen Specification.

The Granger procedure mentioned in section 9 was conducted running the regressions:

(1)

$$\log(savingsaccounts)_{ti} = \alpha_0 + \sum_{n=1}^{n=2} \phi_n \log(savingsaccounts)_{t-n,i} + \sum_{n=1}^{n=2} \beta_n \log(celusers)_{t-n,i} + u_{ti}$$

and

(2)

$$\log(celusers)_{ti} = \delta_0 + \sum_{n=1}^{n=2} \gamma_n \log(celusers)_{t-n,i} + \sum_{n=1}^{n=2} \pi_n \log(savingsaccounts)_{t-n,i} + u_{ti}$$

Where Wald tests contrast:

For **(1)** $H_0 : B_1 = B_2 = ... = B_n = 0$ vs. $H_A : B_1 ... B_n \neq 0$, and,

For **(2)** $H_0 : \pi_1 = \pi_2 = ... = \pi_n = 0$ vs. $H_A : \pi_1 ... \pi_n \neq 0$

The results of jointly significant F tests from the regressions below show that the causality runs from cell users to bank accounts.[27]

	Specifications	
Dependent Variable	**logsavings**	**logcelusers**
logsavings (t-1)	0.577	0.204
	(1.3)	(0.66)
logsavings (t-2)	-0.348	-0.187
	(-0.78)	(-0.6)
logcelusers (t-1)	0.565	1.039
	(0.73)	(1.91)
logcelusers (t-2)	-0.131	-0.33
	(-0.17)	(-0.6)
Constant	5.87	4.313
	(5.27)**	(5.54)**
Observations	32	32
R-squared	**0.72**	**0.87**

Value of t statistics in parentheses
* significant at 5%; ** significant at 1%

Where:

$Logsavings_{(t-1)}$= logsavings lagged one period

$logsavings_{(t-2)}$= logsavings lagged two periods

$logcelusers_{(t-1)}$=logcelusers lagged one period

$logcelusers_{(t-2)}$= logcelusers lagged two periods

[27] Results can also be tested following Hurlin and Baptiste (2003) where they propose a new methodology to conduct causality tests in Panel data by separating effects on homogenous non causality, homogenous causality, heterogeneous non causality and heterogeneous non causality.

As shown also in section 9 the granger causality tests show that the causality runs only from cell users to saving accounts and are not simultaneously determined.

Granger Causality Tests	F-value	P-value
H0: Savings accounts do not cause cell users	0.23	0.793
H0: Cell users do not cause savings accounts	6.04	0.006

Table 9: Precise Results for Granger Tests.