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AMCIS 2001 Proceedings

Americas Conference on Information Systems (AMCIS)

December 2001

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AN EMPIRICAL STUDY OF THE INTERACTION OF ELECTRONIC PAYMENT SYSTEMS IN MEXICO

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Abstract

This work proposes a model to analyze the interrelation that exists in the use of different payments mechanisms. It augments the traditional technology adoption models by defining a set of substitution and complementary effects among wholesale and retail payments. To test the model we use four years of data that include transactions of the most important non-cash payments mechanisms in Mexico. Preliminary results show an increasing importance of electronic transfers and debit card payments.

Introduction

The payment system structure at the international level has recently received increasing attention. Several studies have been carried out by institutions like the Bank for International Settlements and the Federal Reserve System [BIS, 2000, BIS, 1999, Weiner, 1999] attempting to determine the non-cash payment structure for some countries. Such studies have shown the growing importance of electronic payments. However, these studies have two limitations. First, they are mainly descriptive studies of the non-cash payments structure, leaving out the interactions –complementarities or substitutions- that may exist among payment systems. Second, they have concentrated on developed countries for which electronic payments are highly advanced and payment statistics are readily available. This paper attempts to extend the literature in both directions.

We consider it important to asses the structure of the payment systems in Mexico because it is a country where the financial system has limited depth. This lack of depth may represent a constraint for the development of electronic payments. We go a step beyond of the mere description of the structure by developing a model for Mexican non-cash payment systems. This model allows us to analyze the interrelations among selected non-cash payment mechanisms. We hypothesize that the adoption of a particular payment instrument is determined by the stage of technology adoption which this payment mechanism has reached and the existence of alternative means of payment.

Model

The literature on technology adoption has its roots in the traditional model proposed by Bass (1960) and has developed empirical applications along several strands [Mahajan et al, 1990]. One of these strands explains the technology diffusion process by using market level information; that is, adoption is explained by marketing expenses, prices of new products and the like. Another strand looks for consumer characteristics and explains adoption using variables such as individual income and education. For both strands of empirical applications, adoption is consider to be a function of time. The behavior of the time adoption curve can have several stages, ranging from early (slow adoption rate) to mature (no adoption or even negative adoption rate), passing through a dynamic adoption stage that occurs once a critical mass of users has been achieved. We apply this framework by identifying where in its adoption curve each cashless payment system is placed.

As we have mentioned, the actual process of adoption of a particular payment mechanism is affected by the existence of other payment instruments that may be substitutes or complements. For instance, in Mexico debit cards have been adopted very rapidly; however, only those clients that have a banking account –often a checking account- have a debit card. Hence, we expect a positive correlation between the use of debit cards and the use of checks. In this context we expect a positive sign on the regression to

indicate complementarity and a negative sign to indicate substitution. Table 1 describes the expected relationships among payment instruments and includes our entire set of hypotheses. As we can see in the table, in some cases, we do not expect an interaction and therefore the relationship will not be statistically significant.

To control for changes not attributed to the above model, we include some variables that measure economic activity, changes in the regulations and the number of accounts. In particular, we include sales at the retail level, the number of checking accounts and the number of debit and credit cards.

Table 1. Expected Interrelationships Among Payment Mechanisms

	Wire Transfers	ACHs	Checks	Credit Cards	Debit Cards
Wire Transfers		-	-	NR	NR
ACHs	-		-	NR	NR
Checks	-	-		-	+/-
Credit Cards	NR	NR	-		+/-
Debit Cards	NR	NR	-/+	-/+	

- Substitute
+ Complement
NR No Relationship

Data

We use monthly data from two sources. The first is the Mexican Central Bank. This data includes high-value wire-transfers, the Automated Clearing House (ACH), and check information. The second source is a company that operates one of the main credit and debit card switches. It includes credit card and debit card transactions, in both Automated Teller Machines (ATMs) and Points of Sale (POS). For each instrument we analyze data on both value and number of transactions from January 1997 to December 2000. We split the instruments analyzed into high volume and high value. Table 2 presents the cashless payment structure in Mexico for the high volume instruments. In terms of the total number of transactions, there is an important increase registered in the period; such an increase is not matched by an increase in the value of transactions. In terms of the structure of high volume transactions, debit cards and ACHs are rapidly becoming more relevant while checks and credit cards are loosing ground.

Table 3 presents the structure for the high volume cashless Mexican instruments. In terms of total value, the system that performs stock and bonds transactions (SIDV) represents around 60% of the total value, while SPEUA (a system similar to Fedwire) represents around 30% of the total value.

Preliminary Results

Table 4 presents the results of the regressions that test our hypotheses about high volume instruments. In terms of the number of transactions, the coefficient of the time trend indicates that debit cards and ACH are at the expansionary stage of adoption, while checks and credit cards are in a mature stage of adoption. In the case of value of transactions, there is also an indication that ACH and debit cards are in an expansionary stage, credit cards are in a mature stage and checks are in the process of disadoption. In addition, debit cards seem to complement the use of checks in terms of number of transactions, while in terms of value, none of the relationships are statistically significant.

Table 2. Cashless High-Volume Payment Structure in Mexico

		Year	Checks	ACH	Credit Card	Debit Card	Total
Number of Transactions	Millions of Transactions	1997	182	0.3	123	234	540
		1998	196	0.7	123	446	766
		1999	198	1.6	139	574	913
		2000	196	4.5	155	667	1,022
		Annual Growth (%)	2.4	137.6	8.1	41.7	23.7
	Market Share (in percentage)	1997	33.8	0.1	22.8	43.4	100
		1998	25.5	0.1	16.1	58.3	100
		1999	21.7	0.2	15.2	62.8	100
		2000	19.1	0.4	15.2	65.2	100
		Annual Growth (%)	-17.3	92.1	-12.6	14.6	
Value of Transactions	Billions of Pesos*	1997	2,798	29	83	230	3,139
		1998	2,783	88	81	289	3,241
		1999	2,688	102	86	359	3,235
		2000	2,724	170	104	407	3,405
		Annual Growth (%)	-0.9	80.9	8.2	20.9	2.7
	Market Share (in percentage)	1997	89.1	0.9	2.6	7.3	100
		1998	85.8	2.7	2.5	8.9	100
		1999	83.1	3.1	2.7	11.1	100
		2000	80.0	5.0	3.1	11.9	100
		Annual Growth (%)	-3.5	76.0	5.3	17.7	

* Figures in constant pesos of December 2000.
Source: Banco de Mexico and Prosa.

Table 3. Cashless High-Value Payment Structure in Mexico

		Year	SPEUA	SIAC	SIDV	Total
Number of Transactions	Millions of Transactions	1997	2.27	0.25	n.a.	2.53
		1998	2.90	0.22	n.a.	3.12
		1999	3.22	0.15	n.a.	3.37
		2000	3.65	0.15	n.a.	3.80
		Annual Growth (%)	17.0	-15.7	n.a.	14.6
	Market Share (in percentage)	1997	90.04	9.96	n.a.	100.00
		1998	93.04	6.96	n.a.	100.00
		1999	95.50	4.50	n.a.	100.00
		2000	96.03	3.97	n.a.	100.00
		Annual Growth (%)	2.2	-26.4	n.a.	
Value of Transactions	Billions of Pesos*	1997	76,226	21,293	149,204	246,723
		1998	90,130	24,304	146,353	260,787
		1999	74,410	27,354	151,175	252,939
		2000	77,684	21,785	161,628	261,097
		Annual Growth (%)	0.6	0.8	2.7	1.9
	Market Share (in percentage)	1997	30.90	8.63	60.47	100.00
		1998	34.56	9.32	56.12	100.00
		1999	29.42	10.81	59.77	100.00
		2000	29.75	8.34	61.90	100.00
		Annual Growth (%)	-1.2	-1.1	0.8	

* Figures in constant pesos of December 2000.
Source: Banco de Mexico and INDEVAL.

Table 4.

HIGH VOLUME								
	Number of Transactions				**Transactions Value**			
	interbank payment	**check**	**credit card**	**debit card**	**interbank payment**	**check**	**credit card**	**debit card**
(Intercept)	63.627	6658.322 ***	1057.763	-14318.732	-7.213	75.076 ***	-6.254 **	-3.415
	(49.232)	(2422.712)	(4388.803)	(9128.740)	(6.813)	(18.300)	(2.555)	(4.481)
time	6.308 ***	-30.168	33.372	1013.102 ***	0.260 **	-1.244 **	-0.002	0.282 ***
	(0.696)	(87.478)	(33.342)	(85.686)	(0.108)	(0.555)	(0.013)	(0.046)
interbank payment		-6.254				0.414		
		(9.084)				(0.715)		
check	-0.004		0.175	1.403 *	0.018		0.008	-0.003
	(0.004)		(0.119)	(0.737)	(0.057)		(0.007)	(0.040)
credit card		0.532 *		-0.219		6.421		0.509
		(0.307)		(1.151)		(4.624)		(0.888)
debit card		0.026	-0.006			-0.277	0.052	
		(0.052)	(0.028)			(0.906)	(0.036)	
atm		-0.040				-1.040		
		(0.069)				(3.244)		
retail	1.274 ***	29.475	52.920 ***	92.692	0.019	0.928 *	0.040 ***	0.173 **
	(0.356)	(25.329)	(11.193)	(91.695)	(0.078)	(0.467)	(0.013)	(0.071)
checking accounts	-11.853 ***	172.727			0.141	2.678		
	(3.385)	(189.092)			(0.431)	(1.874)		
credit card number			0.168				0.001 **	
			(0.599)				(0.000)	
R^2	0.871	0.631	0.755	0.909	0.595	0.792	0.856	0.873

*** 1% significance, ** 5% significance, * 10% significance

References

Bank for International Settlements. Clearing and Settlement arrangements for Retail Payments in Selected Countries, Basle, Switzerland, September 2000.

Bank for International Settlements. Retail Payments in Selected Countries: A Comparative Study, Basle, Switzerland, September 1999.

Bank for International Settlements. Statistics on Payments Systems in a Group of Ten Countries, Basle, Switzerland, December 1998.

Belton, Terrence M. "Daylight Overdrafts and the Payment System Risk", *Federal Reserve Bulletin*, November 1998.

VanHoose, David D.;Sellon, Gordon H. "Daylight Overdrafts, Payments System Risk, and Public Policy", *Economic Review*, September-October 1989.

Vijay, M., E. Muller and F.M. Bass. "New Product Diffusion Models in Marketing: a Review and Directions for Research", *Journal of Marketing*, V. 54, 1990, pp.1-26.

Weiner, Stuart "Electronic Payments in the U.S. Economy: An Overview", *Economic Review, Federal Reserve Bank of Kansas City*, Fourth Quarter 1999, pp.1-12.