PAYMENT SYSTEMS REPORT

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Glossary

ACH: Cámara de compensación automatizada
ACH-Cenit: Compensación electrónica nacional interbancaria administrada por el *Banco de la República*
ACH-Colombia: Cámara de Compensación Automatizada de Colombia S. A.
ATH: A Toda Hora S. A., red de cajeros electrónicos y agilizadores
BIS: Banco de Pagos Internacionales (por su sigla en inglés)
BVC: Bolsa de Valores de Colombia
CCDC: Cámara de Compensación de Divisas de Colombia S. A.
CDT: Certificado de depósito a término
Cedec: Sistema de compensación electrónica de cheques y de otros instrumentos de pago, administrado por el *Banco de la República*
CRCC: Cámara de Riesgo Central de Contraparte de Colombia S. A.
CR5: Índice de concentración construido como la suma de las cinco mayores participaciones
CUD: Sistema de cuentas de depósito, administrado por el *Banco de la República* para liquidación de transferencia de fondos, también denominado sistema de pagos de alto valor.
DANE: Departamento Administrativo Nacional de Estadística
DCV: Depósito Central de Valores, administrado por el *Banco de la República*
Deceval: Depósito Centralizado de Valores de Colombia S. A.
DGCPTN: Dirección General de Crédito Público y del Tesoro Nacional
EcP: Modalidad de entrega contra pago aplicable en la liquidación de Valores (DvP, por su sigla en inglés)
FIC: Fondos de inversión colectiva
Finagro: Fondo para el Financiamiento del Sector Agropecuario
IBR: Indicador bancario de referencia
JDBR: Junta Directiva del *Banco de la República*
MEC: Mercado Electrónico Colombiano de propiedad de la Bolsa de Valores de Colombia S. A.
NDF: *Forward* de cumplimiento financiero (*non-delivery forward*)
PIB: Producto interno bruto
PSE: Pagos seguros en línea
SEN: Sistema electrónico de negociación administrado por el *Banco de la República*
SET-ICAP-FX: Sistema electrónico de transacción en moneda extranjera, administrado por Servicios Integrados en Mercado Cambiario S. A., con el respaldo de la Bolsa de Valores de Colombia S. A. y SIF-ICAP de México
SET-ICAP Securities: Sistema electrónico y de voz para la negociación y registro de instrumentos financieros, y proveedor de información financiera.
TES: Títulos de deuda pública emitidos por el Gobierno y administrados por el *Banco de la República*
TRM: Tasa representativa de mercado
TTV: Transferencia temporal de Valores

As used in English

ACH: Automated Clearing House
ACH-Cenit: National Interbank Electronic Settlement System, managed by *Banco de la República*
ACH-Colombia: Automated Clearing House of Colombia
ATH: A Toda Hora S.A.: ATM network and accelerators
BIS: Bank for International Settlements
BVC: Colombian Stock Exchange
CCDC: Foreign Exchange Clearing House of Colombia
CDT: Term deposit certificate
CEDEC: Electronic clearing system for checks and other payment instruments, managed by *Banco de la República*
CRCC: Central Counterparty Risk of Colombia) S.A.
CR5: Concentration index constructed as the sum of the five largest participations
CUD: Deposit Accounts System, managed by *Banco de la República* and used to settle large-value money transfers. It is also known as the large-value payment system.
DANE: National Administrative Department of Statistics
DCV: Central Securities Depository, managed by *Banco de la República*
DECEVAL: Centralized Securities Depository of Colombia
DGCPTN: General Directorate of Public Credit and the National Treasury - Ministry of Finance and Public Credit
DvP: Delivery versus payment method applicable to securities settlement
FIC: Collective Investment Funds (CIF)
FINAGRO: Fund for the Financing of the Agricultural Sector
IBR: Benchmark Reference Index
JDBR: *Banco de la República*'s Board of Directors
MEC: Colombian Electronic Market, owned by the Colombian Stock Exchange
NDF: Non-delivery forwards
PIB: Gross domestic product (GDP)
PSE: Secure online payments (SOP)
SEN: Electronic trading system, managed by *Banco de la República*
SET-ICAP-FX: Foreign exchange electronic transaction system, managed by Servicios Integrados en Mercado Cambiario S.A. and backed by the Colombian Stock Exchange and SIF-ICAP of Mexico
SET-ICAP Securities: Electronic and voice system for trading and registering financial instruments; is also a financial information provider
TES: Bonds issued by the Colombian government and managed by *Banco de la República*
TRM: Representative market exchange rate
TTV: Temporary transfer of securities (TTS)

Introduction

The Payment Systems Report: 2019

For the last decade, *Banco de la República* has provided oversight of the local financial infrastructure as an additional contribution to support the country's financial stability. This is a function performed by most central banks the world over, because they recognize infrastructure as being an essential component of financial markets. Infrastructure that functions properly helps to maintain and promote financial stability, being that it plays a fundamental role in the financial system and in the economy. In the Colombian case, the oversight of the country's financial infrastructures began formally a decade ago, when External Resolution 5/2009 was issued and the authority to oversight that infrastructures was given to *Banco de la República* by its Board of Directors. Since then, the oversight has been formal and systematic. To commemorate publication of the tenth edition of the *Payment Systems Report*, which is one of the products of financial infrastructure oversight, a section describing this function is included herein, explaining its need, responsibilities, scope, and activities.

On this occasion, in addition to the traditional section providing figures on the local financial infrastructure and describing its behavior (Section One), we have included several highlights that underscore the more relevant aspects of how infrastructure for clearing and settling financial assets has evolved in the last decade. Special emphasis is afforded to the Colombian Central Counterparty Clearing House (CRCC), marking its ten years of operation. There also is a box describing how the company has increased its supply of products for clearing and settlement, and how, as a result, the open positions of its settlement members have performed likewise. At the same time, its risk management model has evolved structurally in response to regulatory adjustments, compliance with international standards, or decisions taken unilaterally by the CRCC, the idea being to have the necessary resources to mitigate exposure to counterparty and liquidity risk. In this way, the CRCC has become a fundamentally important player in the Colombian financial market. Therefore, it is appropriate that the CRCC continue to be monitored by the country's financial authorities.

Another box included in this report offers an analysis of the advantages and disadvantages of lengthening the cash market settlement period in Colombia, which is another topic of interest. Currently, the clearing and settlement time for a cash transaction in most international markets is two business days (t + 2). In Colombia, nearly all peso/dollar and government and private debt transactions on the spot market are cleared and settled on the same trading day (t + 0). This box analyzes the possible implications of Colombia approximating the international standard.

Retail-value payment systems (understood as operations carried out within the circuit of private individuals and companies), such as the use of payment instruments (cash, debit and credit cards, checks and electronic funds transfers), also must be monitored to identify their availability and the public's preferences for these instruments and their acceptance by commercial establishments. With that in mind, three surveys have been conducted in the last decade to gauge how the use of payment instruments is perceived. A comparison of the findings of these three measurements is presented in a section of this report, and an analysis of that comparison indicates the use of payment instruments other than cash for daily payments is still low. Although their ownership and use by the general public is increasing, their acceptance by some commercial establishments remains limited.

In keeping with efforts to oversight innovations in payment processes, the report also includes a box that explores the participation of large, global technology companies in the retail-value payment market. The payment services they offer are associated with innovative payment methods, such as "non-contact" or indirect technology, or by means of devices such as mobile phones, the use of debit and credit cards via applications, and channels such as the mobile network, POS terminals, and the Internet. In other words, these innovations are concentrated in the first stage of the payment process, without altering the other stages, such as traditional payment instruments, channels and systems.

Finally, with respect to work in the area of applied research, the fourth section of this report describes how the cryptoasset system operates. It has two fundamental elements. The first is comprised of the agents who participate in the system; namely, cryptoasset users, and the agents who provide them with services. The second includes the digital asset and the underlying technology platform; together they support interaction between the agents in the crypto asset system. As explained in the respective box, the cryptoasset system is not isolated entirely from the financial system, which it pretends do without. In other words, users cannot extract themselves from the traditional financial system as long as cryptoassets have yet to be adopted on a mass scale, which so far assumes there is a connection between both systems.

Juan José Echavarría
Governor

01

Payment Systems in Colombia

1.1 General Overview of Colombia's Financial Infrastructure

The Bank for International Settlements (BIS) defines financial market infrastructures as multilateral systems in which participating entities clear, settle and record payments, securities, derivatives and other financial assets.[1] These include payment systems (PS), securities depositories (SD), central counterparties (CC) and transaction recording systems,[2] as well as the other clearing and settlement infrastructures that exist.

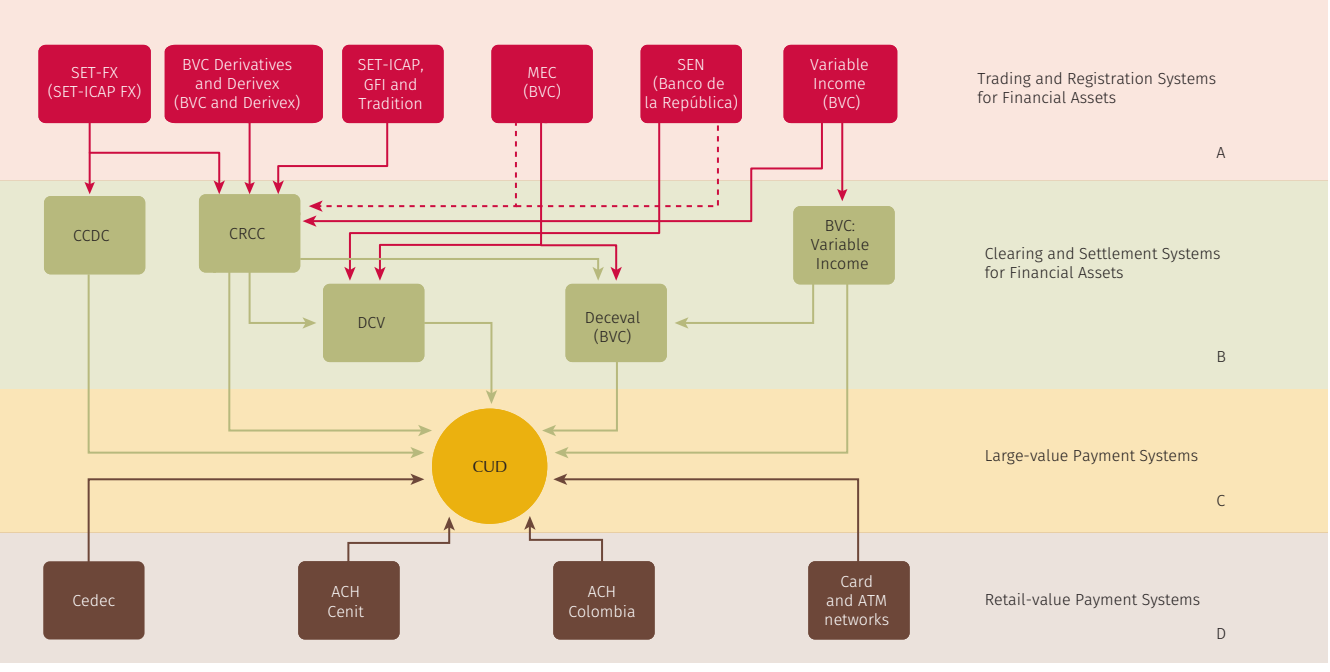
Diagram 1.1 shows the infrastructures that participate, together, in the clearing and settlement of securities and other financial assets in Colombia. It also depicts the main platforms for trading and recording these assets, so as to present a comprehensive overview of the entire value chain. The core role of the large-value payment system managed by *Banco de la República*, known as the Deposit Account System (CUD), is emphasized. As the central axis and underpinning of the entire infrastructure, it is where the cash legs of operations with local financial assets and bank payment instruments are settled.

Band A at the top of Diagram 1.1 shows the trading and recording systems for both securities and currencies. The former includes the Electronic Trading System (SEN), managed by *Banco de la República*, where transactions with government debt securities are traded and recorded, and the Colombian Electronic Market (MEC), managed by the Colombian Stock Exchange (BVC), where government and private debt is traded and recorded. The BVC also manages the equity

1 The Committee on Payment and Settlement Systems, and the Technical Committee of the International Organization of Securities Commissions (2012). Principles for Financial Market Infrastructures, July; available at: https://www.bis.org/cpmi/publ/d94_es.pdf

2 The recording systems report information on over-the-counter market operations by member financial brokers, in both their own name and in the name of third parties.

Diagram 1.1
Global Overview of Financial Market Infrastructures (FMIs) and Other Participants[a/] (2018)



a/ The dotted lines refer to the fact that the CRCC manages the risks in TES sell/buy-back transactions sent from SEN and MEC, while gross settlement is done concurrently in the DCV-CUD.
Source: *Banco de la República* (DSIF).

market and standardized financial derivatives with underlying assets other than energy-related commodities.

There is the Derivex system, which manages the market for standardized derivatives where the underlying assets are energy-related commodities, as well as other trading and recording systems [3] that allow for trading and recording transactions between participants through hybrid mechanisms (voice and data).

In terms of foreign currency, the Forex Market Electronic Transaction and Information system (SET-FX), managed by SET-ICAP FX S. A.,[4] provides trading and recording infrastructure, as do the platforms of some trading and recording systems.[5]

Band B in the diagram shows the clearing and settlement systems. Institutions use to these infrastructures to settle security, foreign currency and derivative legs resulting from the obligations they contract on those markets. Among the systems concerned with securities, the diagram includes the Central Securities Depository (DCV), managed

3 These are ICAP Securities Colombia, GFI Securities Colombia and Tradition Securities Colombia.

4 As of 2012, SET-ICAP FX S.A. replaced Integrated FX as the manager of the SET-FX system. This change was the result of a corporate agreement between ICAP Colombia Holdings SAS, ICAP Latin America Holdings B.V. and the BVC, which is intended to jointly supply Colombia's capital markets with mixed system management services for forex and securities trading and recording.

5 GFI Exchange Colombia and Tradition Colombia.

by *Banco de la República* and used solely for government debt securities; the Centralized Securities Depository of Colombia (Deceval), which is for all types of securities, both government and private; the Central Counterparty Risk of Colombia S.A. (CRCC), which handles term operations, standardized derivatives, both financial and energy commodities, and non-standardized derivatives, such as interest rate forwards (OIS); and the Colombian Stock Exchange (BVC), which is for equities.

Infrastructure with respect to foreign currency includes the Foreign Exchange Clearing House of Colombia (CCDC), where exchange operations are settled in cash, and the CRCC, where standardized derivatives are cleared and settled at the representative market rate of exchange (TRM), as are non-standardized non-deliverable forwards (COP/USD).

Band C shows the large-value payment system (CUD) – the core of the financial infrastructure - is where the cash legs of operations converged to be settled, including those of operations in financial asset clearing and settlement systems, as well as those of operations in retail-value payment systems.

The retail-value payment systems are grouped into Band D. They include the clearing and settlement of multilateral positions generated by the use of debit and credit cards, checks and electronic funds transfers.

Annex 1 offers a description that helps to identify and understand the role financial infrastructures play, according to the markets they support.

In Table 1.1 there is a detailed description of the type of transactions channeled through each system, and the daily average value and quantity of transactions conducted over the last two years. These figures reflect the magnitude of the resources mobilized on a gross basis. However, the value does not necessarily coincide with the flow of money used to cash settle the obligations contracted there by the agents, either because they do not imply the movement of money or because the systems use net settlement mechanisms.

As already mentioned, the settlement of obligations from the other external systems[6] for transactions conducted by financial intermediaries and all other agents in the securities, forex, derivatives and domestic currency markets, both in large and retail values, converges in the large-value payment system (CUD). The daily average value of transactions settled there in 2018 was COP 54.9 billion (b), which is equivalent to

6 External Resolution 5, issued in 2009 by the Board of Directors of *Banco de la República* (JDBR), defines an "external system" as any payment system other than a determined large-value payment system, as well as any securities clearing and settlement system, currency clearing and settlement system, or system to clear and settle futures, options and other financial assets, including central counterparty clearing houses, all duly authorized for operation in Colombia by the competent authority.

Table 1.1
Financial Market Infrastructures in Colombia
(Principal transactions, in quantity and value)

	Daily averages [a/]				Principal transactions
	Number of transactions		Value (thousand million pesos)		
	2017	2018	2017	2018	
Large-value Payment System					
Large value:					
CUD	7,921	8,007	55,305	54,977	- Settlement of the cash leg of transactions cleared by the DCV, Deceval, BVC, CCDC, CRCC and retail-value payment systems. -Payment of the cash leg of monetary transactions, monetary policy repos and remunerative deposits. -Transfers of funds ordered directly by the participants. -Debits to accounts for items such as interbank clearing, sales tax, financial transaction tax and fees, among others.
Clearing and Settlement Systems for Financial Assets					
Securities Depositories					
DCV[b/]	2,989	3,290	31,307	35,863	-Transactions on the primary market with government bonds (trusteeship), on the secondary market, and *Banco de la República* monetary transactions.
Deceval[c/]	4,335	4,849	3,662	3,778	-Transactions with government bonds, corporate bonds, and stocks on the primary and secondary market. They include cash collateral.
Other Securities Clearing and Settlement Systems					
BVC: variable income	2,166	2,311	170	183	-Transactions with common and preferred stocks and subscription rights. -Stock repos are cleared and settled through the CRCC as of August 2017.
Central Counterparty Clearing Houses					
CRCC S.A.	430	466	3,244	3,898	-Clearing and settlement of standardized financial and energy Derivatives. -Clearing and settlement of non-standardized forex and interest rate derivatives. -Clearing and settlement of repos on equities. -Term operations (TES sell/buy-backs) are sent by the SEN and MEC systems to the Central Counterparty Clearing House (CRCC) for respective risk management, while gross clearing and settlement are done in the DCV-CUD. A daily average of 681 transactions at a value of COP 13.3 billion were processed in 2018.
Forex Clearing and Settlement Systems					
CCDC[d/]	1,673	1,741	3,398	3,844	-Purchases and sales of dollars between forex market brokers in the spot market (t + 0, t + 1, t + 2, and t + 3).
Retail-value Payment Systems					
ACH Colombia	721,067	808,832	3,340	3,750	-Recurring payments related to payrolls, pensions, suppliers, social security, dividends and, in general, invoicing for purchases of all kinds of goods and services, as well as automatic payments for these same items.
ACH: Cenit	48,572	48,284	798	833	–Mainly transfers or remittances and payments from the nation to territorial entities.

Table 1.1 (continued)
Financial Market Infrastructures in Colombia
(Principal transactions, in quantity and value)

	Daily averages [a/]				Principal transactions
	Number of transactions		Value (thousand million pesos)		
	2017	2018	2017	2018	
Retail-value payment systems					
Cedec	55,674	47,254	863	777	-Checks for sales and purchases of goods, services, and to settle obligations, etc.
Card and ATM Networks	2,592,115	3,254,002	500	752	-Transactions with credit and debit cards, as well as clearing operations between ATMs

a/ Averages calculated based on the days each infrastructure was in operation.
b/ Corresponds to the settled value of transactions that were cleared and settled in the DCV and originated in the primary, secondary and monetary-transaction markets. These include settled transactions with delivery versus payment and free of payment. The initial and the return transactions are included in the sell/buy-back, repo, and TTS transactions.
c/ Corresponds to the settled value wired by the investor to acquire the security.
d/ Nominal values, Colombian pesos as settled value of the transactions.
Sources: *Banco de la República*, Deceval, BVC, ACH Colombia, CCDC, and CRCC.

5.63% of the country's annual gross domestic product (GDP), followed by transactions in the equities market (COP 39.8 b), which includes the DCV (COP 35.9 b); Deceval, (COP 3.78 b); and equity transactions conducted through the BVC (COP 0.18 b). Next, in order of importance, is the sum of the two ACHs (Cenit and Colombia) (COP 4.6 b); then come settlements of the peso legs of operations carried out by the CCDC (COP 3.84 b); the number of operations with stock derivatives and repos cleared and settled through the CRCC (COP 3.89 b); the amount of interbank clearing of checks settled in the CEDEC system (COP 0.77 b); and, finally, the value of card and ATM clearing (COP 0.75 b).

1.2 The Large-value Payment System

1.2.1 General Aspects and Development

There were 139 direct participants with deposit accounts in *Banco de la República*'s large-value payment system (CUD) by December 2018. Table 2 shows the number of participants for each type of institution.

As for how the figures have evolved, Graph 1.1 and Table 1.3 show the number and value of the transactions processed through the system. The daily average for the number of transactions (8,007) increased 1.09% in 2018 with respect to the year before. However, the nominal value (COP 54.9 b) declined 0.59%, compared to that same year. In real terms, the average daily value was down by 3.65%. In the annual aggregate, the processed value was 13.9 times Colombia's GDP [7] in 2018. This amounts to a daily average equal to 5.63% of GDP, which is less than in 2017, when it came to 6.06%.

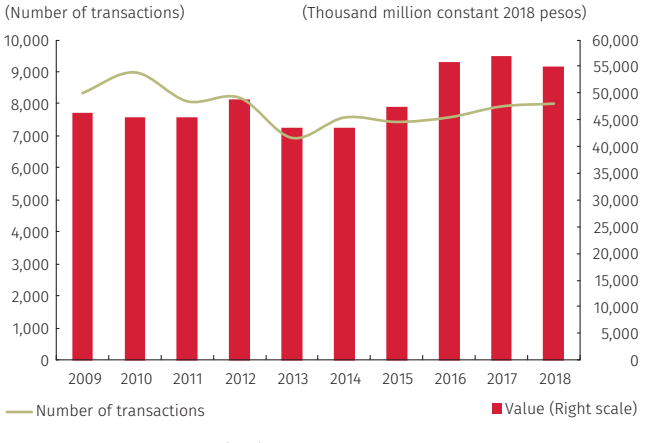
7 The GDP values are official estimates developed by the National Administrative Department of Statistics (DANE), using the new base year for the national accounts, which is 2015. The preliminary GDP estimated by DANE for 2018 comes to COP 976 b and is used as a reference.

Table 1.2
Number of Participants, by Type of Entity

Type of Entity	Number of participants
Banco de la República	1
General Directorate of Public Credit and the National Treasury	1
Ministry of Finance and Public Credit: general system of royalties	1
Banks	25
Commercial finance companies	14
Financial corporations	4
Pension and severance funds	4
Brokerage firms	19
Trust companies	26
Insurance companies	13
Savings and loan companies	2
Public financial entities	10
Financial cooperatives	5
Social security data managers	6
Stock market	1
Central securities depositories	1
Foreign exchange clearing and settlement system	1
Central counterparty clearing houses	1
Retail-value payment system (ACH Colombia and card networks)	4
Total	139

Source: *Banco de la República* (CUD).

Graph 1.1
Statistics on the Number and Value of Transactions in the CUD Large-value Payment System, Daily Averages



Source: *Banco de la República* (CUD).

Table 1.4 provides details on the origin and description of debits to the deposit accounts in the CUD system. As illustrated, settlement of the cash leg of investments, purchase-and-sales, sell/buy-backs and repos on the primary and secondary markets for government debt, through the delivery versus payment (DvP) mechanism in the DCV, accounted for 42.05% of the total value in 2018. Monetary policy operations involving operations to increase money supply (repos), TES definitive purchases, and liquidity operations for the payment system (intraday repos) backed by government bonds accounted for 10.03%. According to the sum of these figures, 52.08% of all operations in the CUD were carried out with government debt securities held in custody by the DCV. Monetary policy operations related to remunerative deposits accounted for 15.23%, out of which 14.84% were remunerative deposits made by the Ministry of Finance and Public Credit and 0.38% by other entities.

Table 1.3
Number and Value of Transactions in the CUD System

Year	Daily Average					Annual value			
	Number of participants	Value		Average transaction value		Number of transactions	(Thousands of millions pesos)	Annual value (Thousand million constant 2018 pesos)	(Number of times the GDP)
		(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Thousand million pesos)	(Thousand million constant 2018 pesos)				
2009	8,343	32,912	46,226	3.9	5.5	2,019,118	7,964,630	11,186,731	15.9
2010	8,998	33,330	45,374	3.7	5.0	2,204,510	8,165,754	11,116,685	15.0
2011	8,083	34,676	45,512	4.3	5.6	1,988,418	8,530,296	11,195,832	13.8
2012	8,196	38,132	48,857	4.7	6.0	2,016,269	9,380,456	12,018,946	14.1
2013	6,925	34,543	43,418	5.0	6.3	1,689,588	8,428,598	10,594,061	11.8
2014	7,570	35,925	43,561	4.7	5.8	1,847,039	8,765,618	10,628,897	11.5
2015	7,430	41,767	47,435	5.6	6.4	1,805,454	10,149,449	11,526,635	12.6
2016	7,574	52,083	55,935	6.9	7.4	1,863,090	12,812,358	13,760,032	14.8
2017	7,921	55,305	57,062	7.0	7.2	1,932,687	13,494,365	13,923,216	14.7
2018	8,007	54,977	54,977	6.9	6.9	1,969,837	13,524,386	13,524,386	13.9

Source: *Banco de la República* (CUD).

As for direct transfers of funds in the CUD,[8] which account for 31.02% of all operations, it is important to note that 9.5% is comprised of transfers (money "uploads") from lending institutions to other depositor account institutions, giving the latter the liquidity needed to meet the cash leg of their operations with securities. On the other hand, 3.57% pertains to multilateral netting in the retail-value payment systems (3.02%. ACH, 0.33%: cards and ATM networks, and 0.22%: checks); 3.2% applies to constitution and retrocession in interbank operations; 2.21% to settlement of the cash leg of investments, purchase-and-sales, and money market transactions backed by corporate bonds (fixed income) and stock (variable income) settled through Deceval; 1.8% pertains to transfers between administrators and custodians to enable the latter to comply with mutual fund transactions; and 1.2% to multilateral netting through the CCDC.

Other direct transfers of funds account for 8.2% of the total value channeled by the CUD. The rest (1.34%) largely pertains to the sum of operations involving the transfer of tax collections to the government by commercial banks, the settlement of forex purchase and sales outside the CCDC, cash provisions through *Banco de la República*'s treasury,

8 This information is generated based on discretional use of the transaction codes each financial entity applies in the CUD system.

Table 1.4
Origin and Type of Transactions for which Deposit Accounts in the CUD System are Debited, Number and Value of Transactions (Daily Averages in Thousand million Pesos)

Government Debt Transactions in the DCV [a/]	Year 2017		Year 2018		Year 2017		Year 2018	
	Number of transactions	Value	Number of transactions	Value	Number of transactions	Value	Number of transactions	Value
					(percentage)			
Primary market								
Issues [b/]	18	202.43	20	216.24	0.2	0.4	0.2	0.4
Payment of capital and returns [c/]	35	165.02	33	145.19	0.4	0.3	0.4	0.3
Secondary Market [d/]								
Purchase and sales	1808	6,231.00	2096	9,202.02	22.8	11.3	26.2	16.7
Money Market [d/]								
Sell/buy-backs	368	5,765.35	387	6,759.61	4.6	10.4	4.8	12.3
Reverse sell/buy-backs	366	5,748.95	387	6,753.04	4.6	10.4	4.8	12.3
Repos between third parties	1	16.42	1	19.51	0.01	0.0	0.01	0.04
Reverse repos between third parties	1	16.43	1	19.51	0.01	0.0	0.01	0.04
Total government debt transactions in the DCV (1)	2,597	18,146	2,925	23,115	32.79	32.81	36.53	42.05
Others in the DCV	25	50.19	23	39.40	0.32	0.1	0.29	0.07
Total (1)+(2)	2,622	18,196	2,949	23,155	33.10	32.9	36.8	42.1
Monetary Policy	**Number of transactions**	**Value**	**Number of transactions**	**Value**	**Number of transactions**	**Value**	**Number of transactions**	**Value**
Repos to increase money supply [f/]	44	5,237.17	40	4,526.78	0.56	9.5	0.5	8.2
Repos to contract money supply [g/]	0	0.00	0	0.00	0.00	0.0	0.0	0.0
Definitive purchase of TES	4	16.11	1	4.38	0.05	0.0	0.0	0.01
Remunerative deposits [h/]	89	14,137.82	70	8,370.96	1.12	25.6	0.9	15.2
Total monetary-policy transactions	137	19,391	111	12,902	1.7	35.1	1.4	23.5
Provision of liquidity in the payment system (*Banco de la República*)	**Number of transactions**	**Value**	**Number of transactions**	**Value**	**Number of transactions**	**Value**	**Number of transactions**	**Value**
Intraday repos [i/]	43	924.62	40	981.28	0.54	1.7	0.5	1.8
Total transactions to provide liquidity	43	924.62	40	981.28	0.54	1.67	0.50	1.78
Direct transfers from funds in the CUD [j/]	**Number of transactions**	**Value**	**Number of transactions**	**Value**	**Number of transactions**	**Value**	**Number of transactions**	**Value**
Securities (money uploads and downloads)[k/]	618	4,690.69	647	5,224.51	7.8	8.5	8.1	9.5
Intraday interbank transactions	30	252.51	24	219.39	0.4	0.5	0.3	0.4
Reverse intraday interbank transactions	14	110.91	14	131.12	0.2	0.2	0.2	0.2
Interbank transactions at one or more days	19	454.94	16	391.25	0.2	0.8	0.2	0.7
Reverse interbank transactions at one or more days	20	448.94	18	389.63	0.2	0.8	0.2	0.7

Table 1.4 (continued)
Origin and Type of Transactions for which Deposit Accounts in the CUD System are Debited, Number and Value of Transactions (Daily Averages in Thousand million Pesos)

Government Debt Transactions in the DCV [a/]	Year 2017		Year 2018		Year 2017		Year 2018	
	Number of transactions	Value	Number of transactions	Value	Number of transactions	Value	Number of transactions	Value
					(percentage)			
Interbank transactions in the IBR	16	320.00	16	320.00	0.2	0.6	0.2	0.6
Reverse interbank transactions in the IBR	16	320.08	16	320.06	0.2	0.6	0.2	0.6
Forex transactions settled outside the clearing house	39	157.20	42	184.20	0.5	0.3	0.5	0.34
Taxes	104	452.21	113	487.26	1.3	0.8	1.4	0.89
Transfers from managers to trustees to comply with CIF transactions	97	937.23	90	969.91	1.2	1.7	1.1	1.8
Other transfers [l/]	2.275	4,181.27	2.116	4,513.68	28.7	7.6	26.4	8.2
Deceval [m/]								
Issues	78	239.98	48	188.10	1.0	0.4	0.6	0.3
Payment of principal and yield	197	268.75	201	254.20	2.5	0.5	2.5	0.5
Purchase and sales	138	330.10	144	369.19	1.7	0.6	1.8	0.7
Sell/buy-backs	57	73.59	61	92.93	0.7	0.1	0.8	0.2
Reverse sell/buy-backs	57	73.09	61	92.68	0.7	0.1	0.8	0.2
Repos	14	6.93	11	8.79	0.2	0.01	0.1	0.02
Reverse repos	14	6.98	11	8.87	0.2	0.01	0.1	0.02
Temporary transfer of securities	12	0.007	11	0.009	0.2	0.00	0.1	0.00
Change of depositor	272	199.71	275	200.61	3.4	0.4	3.4	0.4
Term operations	5	0.28	5	0.25	0.1	0.00	0.1	0.0
Total transactions in Deceval	843	1,199.42	828	1,215.64	10.6	2.17	10.3	2.21
Colombian Stock Exchange (BVC) [n/]	50	46.91	50	55.13	0.6	0.1	0.6	0.1
Central Counterparty Clearing House (CRCC) [o/]	13	13.00	20	28.74	0.2	0.02	0.2	0.05
Foreign Exchange Clearing House (CCDC) [p/]	16	511.42	17	640.45	0.2	0.9	0.2	1.2
Retail-value payment system [q/]								
ACHs	114	1,542.03	129	1,658.83	1.4	2.79	1.6	3.02
Card and ATM networks	41	168.52	44	180.96	0.5	0.30	0.5	0.33
Checks (CEDEC and delegated clearing houses)	43	146.76	38	121.46	0.5	0.27	0.5	0.22
Total retail-value payment systems	198	1,857.31	211	1,961.25	2.5	3.36	2.6	3.57
Total direct transfers of funds in the CUD	4,368	15,954	4,237	17,052	55.1	28.8	52.9	31.0

Table 1.4 (continued)
Origin and Type of Transactions for which Deposit Accounts in the CUD System are Debited, Number and Value of Transactions (Daily Averages in Thousand million Pesos)

Other transactions	Year 2017		Year 2018		Year 2017		Year 2018	
	Number of transactions	Value	Number of transactions	Value	Number of transactions	Value	Number of transactions	Value
					(percentage)			
Total other transactions r/	750	839.17	670	886.90	9.5	1.52	8.4	1.6
Total transactions debited in the CUD	7,921	55,305	8,007	54,977	100	100	100	100

a/ Transfers of funds in the CUD system, originating with securities transactions in the DCV.
b/ Placement of issues that effectively imply outlays of resources. Does not include: reinvestments in TDA, CERT, TES from court rulings, agricultural bonds and those with constant value, etc.
c/ Pertains to money in the CUD that was effectively transferred to pay principal at maturity or yields on securities deposited in the DCV. Excludes payments on *Banco de la República* investments.
d/ Does not include cross transactions; that is, when the originating entity and the receiving entity of the cash leg is the same financial institution.
e/ Deposit account debits due to charges for levies, penalties and DCV fees.
f/ Corresponds to the reversal of repos to increase money supply. In the case of repo chains, it includes only the net value and interest.
g/ Reverse repos.
h/ Remunerative deposits; includes the DGCPTN.
i/ Pertains to the reversal of intraday repos. In the case of repo chains, it includes only the net value and interest.
j/ Clearing and settling transactions from external systems or those handled by account holder entities directly at their CUD stations.
k/ Transfers of funds (money uploads) from leading banks to brokerage firms, trust companies and pension funds (termed "clients"), so the latter will have the necessary liquidity in their deposit accounts to meet the cash leg of their transactions with securities. Banks debit these funds ahead of time from the checking accounts of their clients.
l/ Transfers of funds from Deceval to lenders in securities trading (delivery versus payment mode); initial transfers from entities indebted to Deceval, as discriminated in the concepts that make up item m/; transfers of funds from the ACH account and the clearing systems of the networks to entities with a multilateral credit position in each clearing cycle; initial transfers from entities indebted to the ACH and the networks, as described in item q/; Transactions, number 10, article 879 of the tax statute, transfers between accounts with the same entity; transfers of funds from the Foreign Exchange Clearing House account to foreign exchange market brokers (IMC in Spanish) with a peso-denominated multilateral credit position (payment versus payment mode); initial transfers to the Foreign Exchange Clearing House from IMCs with a debit position, as per item p/; credit disbursements, payment from securities issuers, transfer of funds from the Central Counterparty Clearing House account to entities with a peso-denominated multilateral credit position; initial transfers from entities with a debit position to the clearing house, as per item o/; and constitution-return of collateral.
m/ Payment of principal and yield and transfers of funds from debtor entities to Deceval, so it can guarantee the settlement of transactions with delivery against payment, including purchase and sales, sell/buy-backs, repos and change of depositor of securities deposited with Deceval, among other transactions.
n/ Net multilateral clearing and settlement of the money leg in stock purchases and sales.
o/ Transfers of funds from entities with a peso-denominated position in their favor to the Central Counterparty Clearing House, so it can guarantee the settlement of cleared derivatives (daily settlement and at contract maturity).
p/ Transfers of funds from forex market brokers (IMCs) with a peso-denominated debit position to the Foreign Exchange Clearing House, so it can guarantee settlement according to the payment versus payment mode.
q/ Transfers of funds from entities with a multilateral debit position to ACH and the Credibanco, Redeban, Servibanca and ATH networks, so they can ensure the settlement of cleared electronic transfers and transactions with debit and credit cards and ATMs. Also includes the clearing and settlement of checks.
r/ Provision of cash from *Banco de la República* to financial entities with a deposit account, payment of services, fees and levies, liens, and financial transaction tax collection.
Source: *Banco de la República* (CUD).

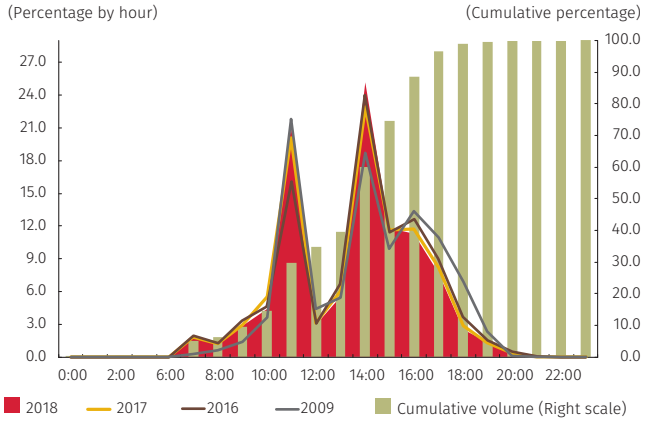
settlements for the purchase and sale of equities in the BVC, and the settlement of derivative contracts in the CRCC, both daily and at maturity.

A comparison of the daily average total values settled in the CUD during 2017 and 2018 (see Table 1.4) shows the main items with the most variability include an increase of COP 2.97 b in the purchase and sale of government securities; COP 1.99b in constitution and retrocession for sell/buy-backs with these same securities; and COP 0.53 b in money uploads/downloads. These increases were offset by a COP 5.7 b decline in remunerative deposits from the General Directorate of Public Credit and the National Treasury (DGCPTN) of the MHCP, and COP 0.71 b in monetary policy repos conducted by *Banco de la República*. Generally speaking, the variation in these items explains the net decline of COP 0.32 b in the amount of funds transferred through the CUD between 2017 and 2018.

1.2.2 Liquidity Indicators in the CUD

The payment systems have a liquidity indicator that is reflected in the concentration of payments occurring at given times during the day. In this respect, it is important to bear in mind that Colombia is one of the few countries in the world where it is common market practice for transactions to be paid and settled the same day, prior to closure of the services provided by these systems (technically known as *t* + 0). This applies to trading in securities (apart from buying and selling stock, which is *t* + 3) and forex trades agreed on during the course of the day.

Graph 1.2
Distribution of Transactions in the CUD System, by Hour Range and in Value



Source: *Banco de la República* (CUD).

Table 1.5
Number and Percentage of Participants in the CUD that Account for 70% of the Value of Payments

Year	Number of Participants	Percentage of Participants
2009	16	10.2
2010	16	10.3
2011	16	10.2
2012	16	10.0
2013	15	9.4
2014	14	9.3
2015	14	9.9
2016	14	9.9
2017	13	9.6
2018	13	9.4

Source: *Banco de la República* (DSIF).

In 2018 (Graph 1.2), 39.82% of the payments accumulated during the day were settled between 7:00 and 13:59 hours. The four hours thereafter (between 14:00 and 17:59 hours) saw a high concentration of payment settlements (55.9% of the daily total), for a total of 95.8% before 18:00 hours.

The steep peaks denoting 24%, 23% and 25% settled by 14:00 hours in 2016, 2017 and 2018, respectively, were due to the liquidity-saving mechanisms the DCV offers for settling securities and cash legs and to retrocession for operations to increase the supply of money.

For 2018, one sees an increase in the settlement of transactions by 11:00 hours with respect to 2016 and 2017, particularly as a result of the DCV's liquidity-saving mechanisms.

1.2.3 Concentration, Operational Efficiency and Other Indicators

Table 1.5 contains estimates of the level of concentration in payments made between the direct participants in the large-value payment system (excluding some payments).[9] Using 70% of total payments as a reference, it is possible to determine how many institutions and what percentage of the total number of participants that reference covers. The result shows the concentration increased between 2009 and 2018: from 16 to 13 institutions and from 10.2% to 9.4% in the total percentage of participants that generated this concentration.

9 The excluded payments are those from the General Directorate of Public Credit and National Treasury (DGCPTN) and *Banco de la República*.

Specifically, while 9.4% of the most active participants (thirteen institutions) originated 70% of the payments made through the CUD in 2018 —nine Banks: 52.6%; two brokerage firms: 9.6%; one trust company: 4.1%, and one financial corporation: 3.9%— the other 90.6% of the participants sent only 30% of the total number of payments.

In terms of operating efficiency in 2018, the CUD offered nonstop service during 99.82% of its normal business hours. In other words, there were occasional interruptions in the provision of service for a period of time equivalent to 0.18% of the total.

The CUD timeline is illustrated in Table 1.6. It shows the accumulated settlement percentages of transactions involving the most relevant items that affect deposit-account balances,[10] according to one-hour slots, from the time the transfer service opens until it closes.

The transactions that were settled with the benefit of the liquidity-saving and transaction optimization facilities of the DCV are highlighted in the shaded sections.

10 Earlier versions of this report contain examples for interpreting this timeline accurately. Refer to: http://www.banrep.gov.co/es/reporte-sistemas-pago

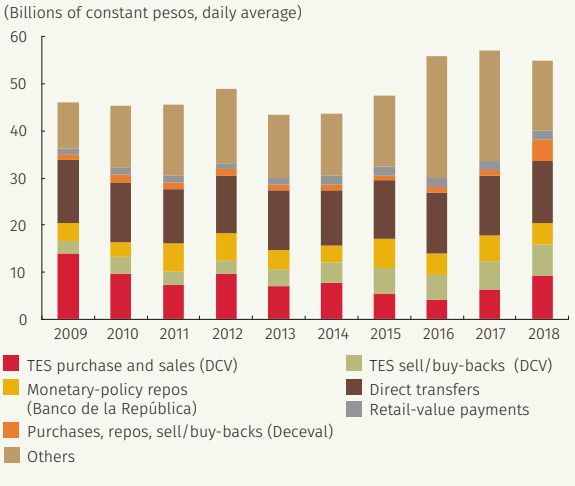
Evolution of Colombia's Large-value Payments System in the Last Decade

As mentioned, all the cash legs of transactions in the securities market, the money market (including central bank monetary-policy operations), the interbank loan, foreign exchange and derivatives markets, and the multilateral clearing of payments in the circuit of companies and private individuals, among others, flow into the large-value payment system for settlement. Managed by *Banco de la República*, it is the only infrastructure of its kind in Colombia.

Graph A shows how the main operational concepts that are part of cash settlement in the CUD have evolved during the last ten years.

The steady growth in secured TES sell/buy-backs is a high point. Financial institutions use this instrument to obtain liquidity, both in money and government debt securities. COP 2.59 b in TES sell/buy-backs were constituted daily in 2009,

Graph A.
The CUD System, a Decade of Evolution: Total Payments and Main Concepts



Source: *Banco de la República* (CUD).

on average, and amounted to COP 6.75 b in 2018. This implies 11.21% compound annual growth. The graph also shows the largest record of TES purchase-and-sales was in 2009. Included under the heading "Others" in the series are mainly remunerative deposits from the DGCPTN and the retrocession in TES sell/buy-backs.

One relevant aspect in the emergence of a new type of transaction in the last ten years is Decree 1498, which was issued by the Colombian government on July 15, 2013 to regulate custody. The latter is defined as a securities-market activity whereby the custodian exercises care and surveillance over the client's (investor's) securities and monetary resources to comply with transactions involving those securities. In fulfilling this function, the custodian must, at the very least, ensure the securities are protected, the transactions are cleared and settled, and the equity rights derived from the securities in question are managed appropriately.

Decree 1498 took effect in July 2015, causing changes in the flow of processing to clear and settle the transactions of collective investment funds (CIFs). Basically, trust companies are now responsible for confirming, clearing and settling CIF transactions. Consequently, CIF managers must, in principle, supply money directly to the custodians, in their CUD accounts, so the securities depositories (DCV and Deceval) can then settle the cash leg and the securities leg in the accounts of the respective custodians.

The custodians who receive the cash leg from a CIF sale or equity right, subsequently deliver these resources to the respective manager, doing so through a direct transfer in the CUD.

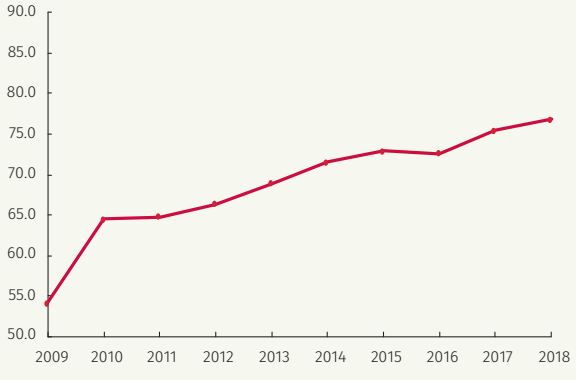
In 2015, the average daily amount settled through the CUD for funds transferred by CIF managers to custodians came to COP 0.74 b. By 2018 the daily average was COP 0.96 b. This type of operation is included under the heading "Direct Transfers" in Graph A.

On the other hand, the same ten years saw progress in the early intraday settlement of transactions, for which 15:00 hours (3:00 p.m.) was taken as a reference point in each of the years analyzed. Therefore, by that hour, it is possible to visualize how the cumulative settlement share of the day's total transactions had evolved (Graph B).

Also, on a daily average for 2018 and by the appointed time (15:00), 76.8% of the sum of intraday transactions had been settled already, unlike in 2009, when the cumulative settlement share was 54.11%.

Graph B
Early Settlement of Transactions in the CUD

(Percentage of cumulative settlement at 15:00 hours)



Source: *Banco de la República* (CUD).

Finally, it is important to point out that *Banco de la República* launched a new large-value payment system (CUD) in June 2014. Its services include, among others: 1) the transmission of operations to the system through web services, thus, facilitating straight through processing (STP); 2) the inclusion of a digital signature when approving online transfers of funds; 3) distribution of an amount from a single source account (debit account) to several destination accounts (credit accounts), via a one-step procedure; 4) the transfer of funds with a value date; and 5) reports in different formats for the entities participating in the system.

Table 1.6
Timeline for the Settlement of Transactions in the CUD (daily averages for 2018)

	0:00	7:00	8:00	9:00	10:00	11:00
Origin and Type of Transactions						
Government debt transactions in the DCV						
Primary market				Percentage of settlement in each time slot		
Issues	0.00	0.00	0.00	0.63	1.94	18.14
Payment of principal and yield	10.65	11.70	12.58	12.65	12.68	13.65
Secondary market						
Purchase and sales	0.00	0.00	0.01	0.19	1.19	26.63
Money market						
Sell/buy-backs and repos between third parties	0.00	0.00	0.00	0.22	0.99	37.19
Reverse sell/buy-backs and repos between third parties	0.00	0.56	2.65	4.75	6.44	62.27
Monetary policy						
Repos to increase money supply	0.00	0.00	0.00	0.00	0.00	0.00
Reverse repos to increase money supply	0.00	0.09	1.17	2.62	4.56	8.51
Provision of liquidity from the payments system (Banco de la República)						
Intraday repos	0.00	1.34	5.30	13.18	23.47	31.58
Reverse intraday repos	0.01	0.01	0.09	1.61	5.45	7.76
Direct transfers of funds in the CUD						
Securities (money uploads/downloads)	0.05	5.20	8.14	13.92	18.28	22.60
Intraday interbank loans	2.02	2.02	10.01	29.89	33.07	35.86
Reverse Intraday interbank loans	0.00	0.13	0.25	0.25	0.47	1.57
Interbank loans at one day or more	0.00	0.00	0.00	0.00	0.00	0.00
Reverse Interbank loans at one day or more	0.00	0.00	0.03	0.23	1.48	3.32
Interbank loans: IBR	0.00	0.00	0.00	0.00	0.00	96.81
Reverse Interbank loans: IBR	0.00	0.21	2.26	3.91	6.71	12.58
Taxes	0.00	0.22	6.99	47.78	98.04	99.94
Custodians	0.00	0.00	0.15	3.93	10.44	15.79
Foreign exchange settled outside the clearing house	0.00	0.97	1.32	1.48	4.02	8.06
Deceval						
Primary market						
Issues	0.00	0.00	0.00	0.25	3.27	8.38
Payment of principal and yield	0.04	0.04	0.70	0.88	1.06	1.89
Secondary market						
Purchase and sales	0.00	0.00	0.02	0.15	1.07	3.83
Money market						
Sell/buy-backs	0.00	0.00	0.00	0.11	1.04	5.30
Reverse sell/buy-backs	0.00	0.00	4.69	12.64	23.00	36.32
Repos	0.00	0.00	0.00	0.56	4.01	13.54
Reverse repos	0.00	0.00	0.08	0.34	73.90	87.21
Temporary transfer of securities	0.00	0.00	0.00	0.00	4.69	11.87
Others						
Change of depositor	0.00	0.00	1.04	4.85	9.75	18.68

Neutral liquidity effect
Neutral effect of transactions settled with liquidity saving
Liquidity drainage effect
Liquidity injection effect
Source: *Banco de la República* (DSIF).

12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Average total value settled daily (Thousand of million)
Percentage of settlement in each time slot										
28.07	41.66	56.59	75.46	91.88	99.29	99.90	100.00			COP 216.24
14.68	14.98	15.59	15.73	15.73	15.73	15.73	15.73	33.24	100.00	COP 145.19
27.65	30.08	69.36	84.99	96.53	99.59	99.95	100.00			COP 9,202.02
38.28	41.57	80.45	89.91	97.67	99.73	99.99	100.00			COP 6,779.12
63.29	65.10	87.39	94.83	99.10	99.91	99.99	100.00			COP 6,772.55
0.00	21.21	50.25	81.28	96.12	99.57	99.98	100.00			COP 4,577.70
12.31	33.85	81.20	94.05	99.11	99.95	99.96	100.00			COP 4,545.48
43.86	55.00	75.29	86.99	94.74	98.15	98.99	100.00			COP 981.26
10.19	12.24	15.00	22.44	43.18	86.40	97.70	99.99	100.00		COP 981.27
25.83	28.07	34.11	45.87	61.94	81.14	91.85	99.81	99.96	100.00	COP 5,224.51
44.52	50.21	63.06	67.59	68.73	69.10	69.32	69.48	95.92	100.00	COP 219.39
9.25	16.37	18.49	21.01	55.65	87.91	99.36	100.00			COP 131.12
0.20	0.33	2.79	16.83	62.15	96.41	99.71	100.00			COP 391.25
3.78	7.47	24.34	56.45	83.67	98.71	99.69	100.00			COP 389.63
97.63	98.35	100.00								COP 320.00
15.95	20.27	84.36	97.40	99.67	99.95	100.00				COP 320.06
99.97	99.98	99.99	100.00							COP 487.26
22.14	28.51	40.40	53.27	74.00	93.65	99.34	100.00			COP 969.91
14.87	22.71	37.02	57.51	76.67	92.50	99.49	100.00			COP 184.20
11.71	14.35	18.60	37.44	69.46	95.30	99.87	100.00			COP 188.10
3.89	5.29	8.70	28.41	81.20	97.87	99.55	100.00			COP 254.20
7.57	13.76	28.45	53.39	82.21	97.66	99.86	100.00			COP 369.19
13.85	24.24	42.05	70.61	91.99	98.99	99.96	100.00			COP 92.93
48.05	60.73	77.96	93.86	98.97	99.81	99.91	100.00			COP 92.68
40.34	61.38	76.87	89.99	96.82	99.74	99.88	99.94	99.98	100.00	COP 8.79
97.59	98.84	99.01	99.50	99.91	100.00					COP 8.87
20.46	28.54	44.64	64.28	88.19	98.10	99.24	99.98	100.00		COP 0.01
25.53	30.46	36.11	47.80	74.92	96.56	99.83	99.96	100.00		COP 200.61

Table 1.6 (continued)
Timeline for the Settlement of Transactions in the CUD (daily averages for 2018)

	0:00	7:00	8:00	9:00	10:00	11:00	
Colombian Stock Exchange (BVC)							
Secondary market: equities purchases and sales							
Entities pay debit position to BVC	0.00	0.64	0.65	12.22	26.30	38.22	
BVC pays credit position to entities	0.00	0.00	0.00	18.95	29.44	40.69	
Central Counterparty Clearing House (CRCC)							
Entities pay debit position to CRCC	0.00	85.05	86.07	86.08	86.20	86.66	
CRCC pays credit positions to institutions	0.00	76.06	91.14	91.61	91.91	93.28	
Colombian Foreign Exchange Clearing House (CCDC)							
Entities pay debit position to CCDC	0.53	2.52	14.28	22.39	29.03	33.71	
CCDC pays credit positions to institutions	0.00	0.00	0.00	0.41	0.41	0.41	
Small-value payment systems							
ACH	0.06	0.83	1.98	4.70	8.85	27.95	
Card and ATM networks	3.77	5.13	6.49	9.50	14.25	29.37	
Checks (CEDEC and delegated clearing houses)	0.00	0.00	0.00	0.00	0.00	96.54	
Aggregate timeline for the entire CUD system	0.27	0.75	1.50	3.42	6.92	18.61	
Percentage of the number of transactions processed per hour (not cumulative)	0.05	1.18	1.46	3.55	6.05	13.70	

Neutral liquidity effect
Neutral effect of transactions settled with liquidity saving
Liquidity drainage effect
Liquidity injection effect
Source: *Banco de la República* (DSIF).

1.3 Clearing and Settlement of Securities and Financial Derivatives

As of this point and up to Section 1.4, the focus is on other components of the financial infrastructure for clearing and settling transactions with financial assets, such as securities, financial derivatives and foreign currencies. These components, in turn, must interact with the large-value payment system in order to settle the cash leg of the respective transaction. They include the central securities depositories (DCV and Deceval), the BVC, the CRCC and the CCDC. Seeing as these infrastructures are responsible for clearing, settling or recording transactions in the bond, equity, derivatives and forex markets, this version of the *Payment Systems Report* includes a brief description of the economic variables that influenced the performance of international and domestic financial markets during 2018, so as to lend context to the clearing and settlement activity recorded in these systems.

The Macroeconomic Context

The performance of international financial markets in 2018 was determined largely by less global growth, with differences among the major developed economies, by trade tensions between the United States and its principal trading partners, by Brexit in Europe, and by the macroeconomic vulnerability of emerging economies in a context of less global liquidity. At this economic juncture, the markets were quite volatile and there were several episodes of sharp declines.

	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	Average total value settled daily (mm)
	54.45	57.70	74.28	97.96	99.52	99.99	99.99	99.99	100.00		COP 55.13
	55.08	58.10	74.01	87.22	95.84	99.24	99.80	99.90	99.90	100.00	COP 58.88
	87.26	87.97	88.50	93.04	97.54	99.79	99.97	100.00			COP 28.74
	94.69	95.75	96.93	97.73	99.63	99.96	99.96	99.99	100.00		COP 25.44
	37.13	90.90	95.70	95.70	95.71	95.71	95.71	95.71	99.49	100.00	COP 640.45
	0.41	0.41	97.24	99.62	100.00						COP 640.45
	30.77	37.84	63.87	77.31	88.72	95.86	98.19	99.47	99.78	100.00	COP 1,658.83
	34.34	39.05	60.72	74.89	88.53	96.50	98.98	99.69	99.89	100.00	COP 180.96
	100.00										COP 121.46
	20.45	24.94	40.71	49.07	56.28	60.89	62.40	81.33	91.14	99.36	
	5.20	5.07	19.00	13.97	13.16	7.68	2.36	1.94	1.41	1.09	

Activity in the developed economies was mixed during the year. While growth in the United States remained solid, reinforced by fiscal stimulus, activity in Europe was somewhat weaker than anticipated, mainly due to the slowdown in EU exports.

In the United States, positive figures on output growth, low unemployment and inflation above target for most of the year prompted the Federal Reserve (Fed) to adopt a more contractionary stance on monetary policy and to raise its benchmark rate from a range of 1.25% to 1.50% at the beginning of the year to a range of 2.25% to 2.50% at the end of 2018.

Trade tensions between the United States and China sparked concerns about a slowdown in the global economy. These weighed on investor perceptions and contributed to dips in global markets.

In this context, the dollar gained strength against its peers and against the currencies of emerging market economies. There were sharp currency devaluations, particularly in countries with fragile fundamentals and political instability (Turkey, Argentina, and South Africa). Currencies depreciated in Latin America as well, influenced by electoral and political uncertainty in the region and by the drop in raw material prices.

The price of oil rose during the first three quarters of 2018 in response to several factors; namely, the production cuts ruled by the Organization of Petroleum Exporting

Countries (OPEC), the expectation of a global increase in the demand for crude oil, and the sanctions imposed by the United States on Iran. However, oil prices declined sharply in the final months of the year, given the growth in U.S. production and the reduced forecast for demand. On the other hand, industrial metals and agricultural products were devaluated by the trade tensions between the United States and China, while prices for precious metals fell marginally, due to the generalized build-up in the dollar throughout the year.

As for financial markets, the major stock indices in Europe and the United States posted valuations throughout most of the year, supported by announcements of positive corporate earnings. In Europe, in particular, higher prices for crude boosted the valuation of companies in the oil sector. However, the international situation affected stock indices during the fourth quarter and the valuations were reversed, posting their worst performance since 2008. The composite indexes in Asia and in some emerging countries also devalued during the year, impacted by the international situation. However, those in Latin America gained value, thanks to the performance of the Brazilian market, which offset the poor performance of other countries in the region. Consequently, stock exchanges in some emerging markets devaluated during the year (-14.6%), as they did in Asia (-14.58%), Europe (-13.2%) and the United States (-6.24%), while those in Latin America gained value (0.8%).[11]

Continued liquidity withdrawal by the central banks in developed economies, coupled with sagging world trade, a stronger dollar, lower raw material prices and the increase in volatility on financial markets, intensified capital outflows and created a less dynamic environment in emerging markets.

On the domestic front, economic activity performed positively, with 2.7% growth during the year to date, which is higher than in 2017 (1.4%) and reversed the downward trend of the last three years. In this case, better performance was driven by a revival in domestic demand due to the build-up in both public and private consumption, a rebound in investment, and a better average price for oil.

In terms of monetary policy, domestic inflation was 3.18% by the end of the year, which is slightly above the target (3%). Coupled with the aforementioned improvement in economic performance, this allowed the Board of Directors of *Banco de la República* (JDBR) to reduce its policy interest rate on two occasions during the first half of the year and to keep it stable for the rest of 2018. Consequently, by the end of 2018, the benchmark rate was 4.25%; that is, 50 basis points (bps) below the record of a year ago.

11 *Banco de la República* (2019). *Reporte de Mercados Financieros (Report on Financial Markets),* IV Quarter of 2018.

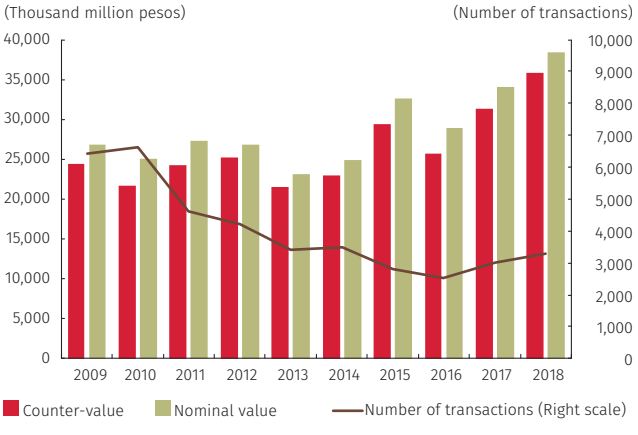
1.3.1 The Central Securities Depository (DCV)

The government debt market in Colombia was influenced throughout the year by a number of external events, such as the increase in the pace of the Fed's rate hikes, the tensions sparked by trade policy decisions in the United States, and the added perception of risk toward emerging economies (purchasing in the market by foreign agents was less dynamic). Local events; namely, the country's fiscal policy, the uncertainty generated by the presidential election, and the decline in *Banco de la República*'s benchmark interest rate were contributing factors as well.

In this situation, Colombia's internal government debt devaluated, mainly during the second and third quarters. By the end of the year, however, the Coltes index had gained 5.8% in value, which was nevertheless lower with respect to 2017 (9.9%) and 2016 (15.1%).

Graph 1.3 shows how the transactions settled by the DCV have evolved, highlighting the increase in the nominal value and the counter-value (market value) during 2018. In effect, the daily averages for the nominal value (COP 38.4 b) and the settled value (COP 35.9 b) represent increases of 12.9% and 14.6%, respectively, compared to the previous year. The variation in the number of transactions was also positive by 10.1%, having gone from 2,989 in 2017 to 3,290 in 2018.

Graph 1.3
Central Securities Depository (DCV), Processed Transactions
(Daily averages) a/



a/ Pertains to the nominal value of the debt.
Source: *Banco de la República* (DCV).

Table 1.7 offers a breakdown of the transactions handed through the DCV, according to their origin. In terms of the primary market, which includes the sale of securities in different categories (mandatory, agreed and auctioned), as well as payment of yield and amortization to principal by the issuers, the daily averages in 2018 for the nominal value (COP 445.9 tm), the number of transactions (77) and the settled value (COP 453 tm) saw positive variations of 12.6%, 2.3% and 7.3%, respectively, compared to the year before.

In the secondary market,[12] the nominal value and the settled value increased with respect to the year before. For 2018, in particular, the nominal value of the transactions settled through the DCV (COP 25.6 b) and the settled value (COP 22.8 b) represented 21.8% and 27.3% growth, in that order, compared to 2017. The number of transactions was up by 11.1%, having gone from 2,738 to 3,042.

12 Includes purchase and sale with delivery versus payment between participants, TES B definitive purchase and sale corresponding to monetary policy, free transfer of payment, transfers between deposit accounts, as well as repos and sell/buy-backs, with their respective retrocession.

Table 1.7
Daily Average Transactions Processed in the DCV, by Service
(Values in Thousand million pesos)

Year	Primary market				Secondary Market Monetary				Monetary Transactions			
	Quantity	Nominal Value	Settled Value		Quantity	Nominal Value	Settled Value		Quantity	Nominal Value	Settled Value	
			Current	Constant			Current	Constant			Current	Constant
2009	278	368.9	355.8	499.7	5,925	18,568.2	16,172.8	22,715.5	219	7,891.4	7,888.7	11,080.1
2010	206	312.9	330.8	450.3	6,213	16,804.0	13,361.0	18,189.4	215	7,907.5	7,922.5	10,785.5
2011	172	342.6	367.0	481.7	4,197	14,250.7	10,927.0	14,341.4	263	12,702.3	12,979.7	17,035.6
2012	143	249.2	285.7	366.1	3,803	15,305.9	12,927.0	16,563.0	262	11,189.0	11,999.2	15,374.3
2013	128	346.1	370.7	465.9	3,048	14,152.6	12,120.1	15,234.0	229	8,548.8	8,962.6	11,265.3
2014	113	439.7	412.4	500.1	3,170	16,576.4	14,285.1	17,321.7	210	7,884.0	8,212.9	9,958.7
2015	99	338.0	363.1	412.3	2,516	18,902.5	15,013.4	17,050.6	207	13,292.5	13,942.6	15,834.4
2016	82	399.0	407.2	437.3	2,253	17,685.1	14,238.9	15,292.1	180	10,747.5	10,971.1	11,782.6
2017	76	395.9	422.3	435.7	2,738	20,981.4	17,953.5	18,524.1	175	12,631.9	12,931.0	13,341.9
2018	77	445.9	453.0	453.0	3,042	25,561.1	22,846.4	22,846.4	171	12,388.4	12,564.0	12,564.0

Source: *Banco de la República* (DCV).

When it comes to the services the DCV provides to *Banco de la República*, which involve open market operations (OMO) and liquidity provision to the large-value payment system, negative variations were reported by the close of 2018. With respect to the previous year, the amounts for the nominal value (COP 12.4 b), and the settled value (COP 12.6 b), represent respective reductions of 1.9% and 2.8%. The number of transactions also declined from a daily average of 175 to 171, which is 2.4% less.

Regarding the function of the DCV as a depository, Table 1.8 shows the total value of the securities in custody at the close of each year since 2009, at current and constant prices. The balance in custody, in current pesos, rose 14.5% during 2018, with 96.9% of this amount pertaining securities issued by the national government. The remainder (3.1%) is comprised of securities issued by the Fund for the Financing of the Agricultural Sector (Finagro).

Out of all current issues managed by the DCV, Class B TES continued to be particularly relevant, accounting for 96.4% of the total balance and 99.5% with respect to internal debt issued by the national government (Table 1.9).

Table 1.8
Total Value of Securities Held by the DCV at Year-end
(Thousand million pesos)

Year	Current	Constant
2009	125,739	176,608
2010	142,327	193,761
2011	155,818	204,507
2012	160,443	205,572
2013	183,580	230,745
2014	202,604	245,671
2015	207,943	236,159
2016	239,717	257,448
2017	265,680	274,123
2018	304,235	304,235

Source: *Banco de la República* (DCV).

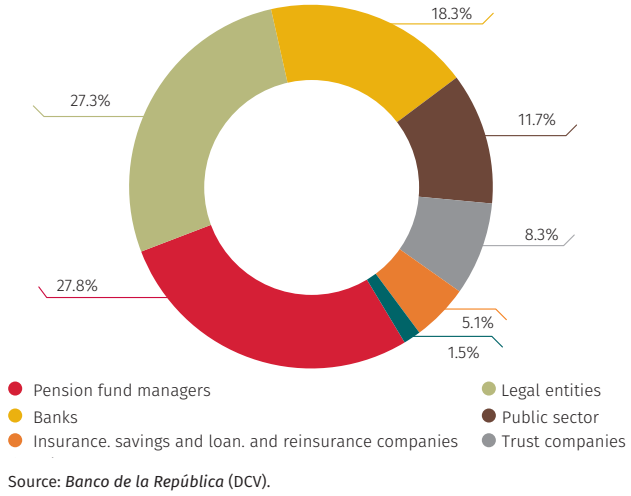
Table 1.9
Balance of Securities Held in Custody by the DCV at the Close of 2018, by Issuer
(Millions of pesos)

Issuer	Balance	Percentage
National government		
TES –Class B	293,408,636	96.4
Constant Value Bonds, series A	63,987	0.02
Constant Value Bonds, series B	1,383,207	0.45
Solidarity for Peace Bonds	1,152	0.00
Security Bonds	15	0.00
CERT	189	0.00
National Government Total	294,857,184	96.9
Finagro		
Agricultural development bonds- Class A	6,195,531	2.04
Agricultural development bonds - Class B	3,182,448	1.05
Finagro Total	9,377,979	3.1
General Total	304,235,163	100.0

Source: *Banco de la República* (DCV).

A distribution of the balance in custody, by type of institution (Graph 1.4), shows pension and severance fund management companies,[13] together with legal entities,[14] account for most of the holdings, with nearly 55% (COP 167.6 b). In third and fourth place are the banks, with 18% (COP 55.7 b), and the consolidated public sector, which includes both the financial and non-financial sectors and companies of a special nature, with 12% (COP 35.6 b). Then there are the trust companies,[15] with 8% (COP 25.2 b). The remaining 7% is made up mostly of securities held by insurance, reinsurance and capitalization companies, with 5% (COP 15.4 b).

Graph 1.4
Total Balance Held by the DCV, per Type of Entity
(At December 2018)



Source: *Banco de la República* (DCV).

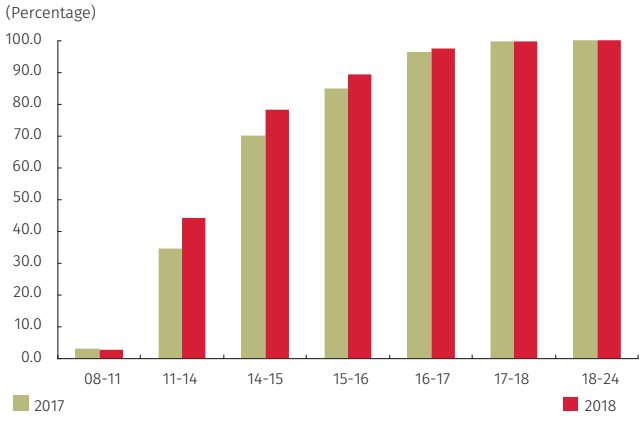
As far as the DCV operational indicators are concerned, the system was available to participants 99.99% of the time scheduled for its services in 2018. With respect to timing in the settlement of transfer orders, Graph 1.5 shows that about 97.6% of all transactions were settled prior to 17:00 hours.

13 Includes pension liabilities.

14 Includes foreigners, among others.

15 Includes trust companies and collective investment funds.

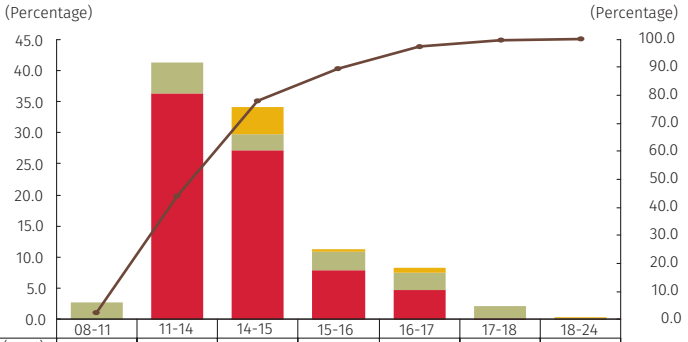
Graph 1.5
Timing in the Settlement of Transfer Orders Received by the DCV



Source: Banco de la República (DCV).

Graph 1.6 contains a breakdown of the activation mechanisms used to settle transactions received by the DCV during the past year. For example, between 8:00 a.m. and 10:59 a.m., all participants activated their operations manually. Between 11 a.m. and 1:59 p.m., the liquidity-saving mechanism was used as well, and automatic retry was added in the subsequent time slots. The peak contribution from the liquidity saving mechanism, which is the one that contributes the most to transaction settlement, is during the 11:00-14:00 cycle. Consequently, 81.9% of all transactions received by the DCV in 2018 were activated automatically (via automatic retry of funds and the liquidity-saving mechanism) and 18.1% by direct instruction from the participants.

Graph 1.6
Distribution of the Transaction Activation Mechanism, by Type (2018)



	08-11	11-14	14-15	15-16	16-17	17-18	18-24
Automatic retry of funds (5.5%)	0.0	0.0	4.3	0.4	0.7	0.0	0.0
Manual activation (18.1%)	2.7	4.9	2.7	3.0	2.8	1.9	0.2
Liquidity saving (76.4%)	0.0	36.4	27.2	7.9	4.8	0.2	0.0
Cumulative percentage settled (Right scale)	2.7	44.0	78.1	89.4	97.6	99.7	100.0

Source: Banco de la República (DCV).

Information on Operation of the DCV in the Last Decade

The DCV developed a margin-call mechanism in February 2015 to comply with decrees 2555/2010 and 2878/2013 issued the Ministry of Finance and Public Credit (MHCP). The objective is to prevent the risk to fixed-term operations posed by market-price variations. Essentially, these include TES sell/buy-backs and fixed term purchase-and-sales settled through SEN; repos made by Banco de la República, in its capacity as the country's monetary authority; and temporary transfers of securities that originate with the DCV's securities lending service.

In September 2015, the DCV made it mandatory to typify investors who hold sub-accounts, the idea being to identify foreign investors who take

part in the local government debt market. This is done the field entitled "Type of Investor," and the foreign investor category is assigned when appropriate.

In the second half of 2015, pursuant to the Ministry of Finance's (MHCP) market maker program for government debt securities, *Banco de la República* signed an agreement calling on the Central Counterparty Clearing House of Colombia (CRCC) to intervene in sell/buy-backs carried out on SEN-tier one. The agreement also requires the CRCC to use the DCV's services for end securities settlement. The scheme is scheduled to begin operating in October.

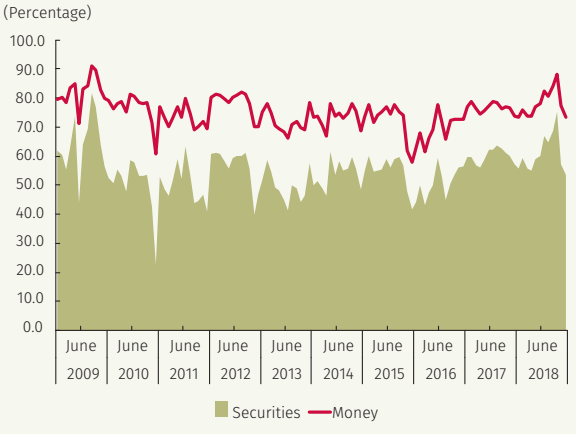
In May 2016, the regulation on *Banco de la República's* operations to increase the money supply was modified to enable the DCV to require placement agents for OMO collateral to conduct repo operations to mitigate the risk of repossession or replacement. Functionally speaking, what stands out is the constitution of basic collateral when the operation is performed (in this case, the haircut), and a variation margin or margin calls. When required, these stem from daily valuation of the securities transferred in the operation and the collateral delivered to *Banco de la República*.

The DCV's liquidity-saving facility simulates a multilateral clearing process by minimizing liquidity needs in both pesos and securities. Liquidity savings in securities continued to average between 50% and 65% monthly in the last decade, reducing dispersion of the percentage of savings by 2018. Cash savings stayed between 70% and 83%, with less dispersion in 2017 (Graph A).

In the last ten years, the daily average value of transactions conducted in the DCV, at constant prices, behaved positively, with a compound annual growth rate of 0.5%. In terms of origin, the secondary market grew 0.1% and monetary operations (OMO and liquidity provisions) increased 1.4%; in contrast, the primary market experienced a compound annual decline of 1.1% (Graph B).

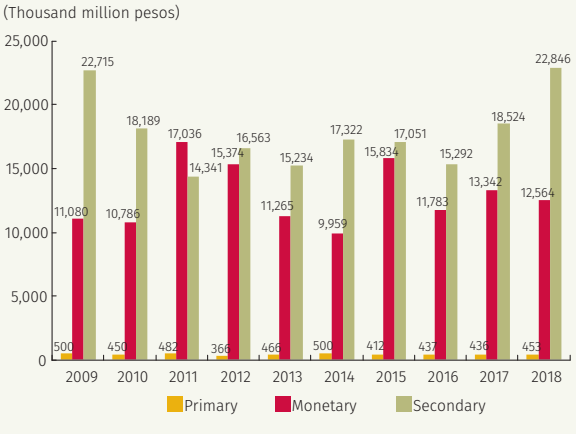
The number of securities held in custody by the DCV in the last decade, in constant values, rose at a compound annual rate of 6.2%, going from COP 177 b in 2009 to COP 304 b by the end of 2018 (Graph C).

Graph A
Liquidity Saving Mechanisms Applied to Securities Leg in the DCV and Money in the CUD



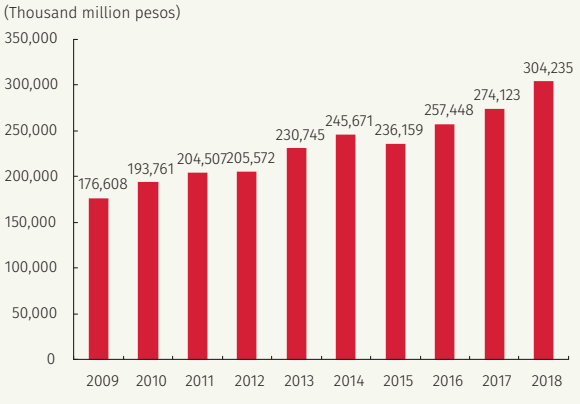
Source: *Banco de la República* (DCV).

Graph B
Growth in Transactions Processed in the DCV, by Service. Daily average in constant values



Source: *Banco de la República* (DCV).

Graph C
Total Amounts Held in Custody in the DCV, at Constant Value



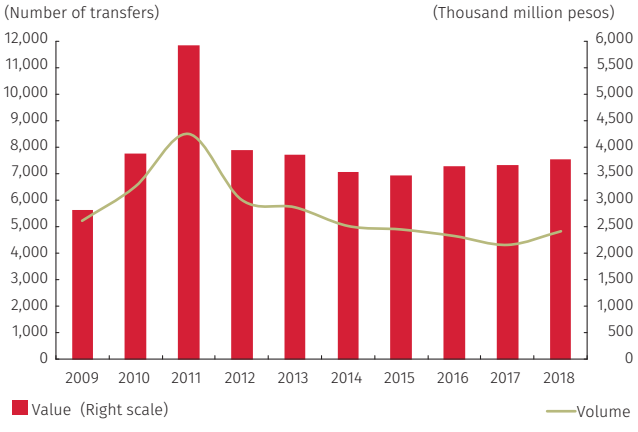
Source: *Banco de la República* (DCV).

1.3.2 The Centralized Securities Depository (Deceval)

The total volume of private debt products traded in 2018 (purchase and sales, and sell/buy-backs) came to COP 128 b, with a 10% increase over the previous year (COP 117 b). A breakdown, by type of operation, shows the volume of sales and purchases rose 5% compared to 2017 (COP 97 b), reaching COP 103 b, while the volume of sell/buy-backs increased 38.4% to COP 25 b.

During 2018, COP 9.5 b in corporate bonds were issued, which is 21.7% less than in the year before. However, primary issues of CDTs increased 13.6% over the previous year. At COP 67.7 b, this is the second largest amount issued in the last five years.

Graph 1.7
Statistics on Deceval Value and Volume
(Daily averages)



Source: Deceval.

Bearing in mind that Deceval also settles equities (variable income), the evolution of this market is outlined in the following section (1.3.3 BVC).

Graph 1.7 and Table 1.10 show how the transactions carried out in Deceval have evolved. They include primary market operations (placement of fixed-income and variable-income securities); secondary market operations for private fixed income and variable income (purchase-and-sales between depositors and free payment transfers), and money market transactions (repos, sell/buy-backs and temporary

Table 1.10
Deceval Statistics

Year	Processed transfers								
	Daily Average					Annual Value			
	Volume	Value		Average transfer value					
	(Number of transfers)	(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Number of transfers)	(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Number of times GDP)
2009	5,244	2,816	3,955	537	754	1,269,071	681,427	957,099	1.36
2010	6,536	3,881	5,283	594	808	1,601,310	950,766	1,294,352	1.75
2011	8,520	5,932	7,785	696	914	2,095,997	1,459,175	1,915,136	2.36
2012	6,032	3,944	5,053	654	838	1,471,831	962,331	1,233,011	1.45
2013	5,752	3,867	4,860	672	845	1,403,374	943,534	1,185,946	1.32
2014	5,046	3,539	4,291	701	850	1,231,272	863,508	1,047,062	1.13
2015	4,915	3,478	3,950	708	804	1,199,378	848,744	963,911	1.05
2016	4,668	3,652	3,923	782	840	1,143,678	894,841	961,029	1.04
2017	4,335	3,662	3,778	845	872	1,049,081	886,131	914,292	0.96
2018	4,849	3,778	3,778	779	779	1,178,228	917,961	917,961	0.94

Source: Deceval.

Table 1.11
Total Securities Held by Deceval at Year-end[a/]
(Thousand million pesos)

Year	Current	Constant
2009	204,058	286,610
2010	281,767	383,592
2011	299,041	392,485
2012	362,513	464,479
2013	387,405	486,937
2014	421,697	511,336
2015	381,310	433,050
2016	440,282	472,848
2017	486,555	502,017
2018	470,519	470,519

a/ Balances valued on the last working day of each year. In the case of variable-income, the valuation price of each share of stock is multiplied by the number of shares in custody.
Source: Deceval.

transfers of securities [TTS]), with their respective retrocession and cash collateral. The average daily volume of transactions went from 4,335 in 2017 to 4,849 in 2018, which is a positive variation of 11.85%. By the end of the year, the average daily value of transfers had increased from COP 3.66 b in 2017 to COP 3.78 b in 2018 (a variation equivalent to 3.17%).

In terms of Deceval's function as a depository, Table 1.11 shows the total amount of securities held in custody at the close of each year since 2009, at current and constant prices. During 2018, the balance in custody, in current pesos, declined by 3.3%, mainly due to the devaluation in variable income.

As illustrated in Table 1.12, stocks (ordinary and preferred) are the securities that account for the

Table 1.12
Details on the Balance of Securities Held in Custody by Deceval at the Close of 2018, by Type
(Millions of pesos)

Type	Balance	Percentage
Common stock	220,951,727.88	47.0
Time certificates of deposit	123,112,796.53	26.2
Ordinary bonds	52,347,215.14	11.1
Preferred stock	33,869,462.69	7.2
Corporate securities	21,449,542.02	4.6
Local government bonds	10,491,006.26	2.2
Mortgage credit securities	3,523,419.84	0.7
Pension bonds	1,688,030.62	0.4
Tax refund securities (TIDI in Spanish)	837,646.93	0.2
Commercial paper	550,000.00	0.1
Treasury bonds (TES)	391,372.67	0.1
Non-mortgage credit securities	345,624.96	0.1
Real estate securities	294,993.90	0.1
Structured mortgage bonds	282,495.90	0.1
Debt reduction securities	223,900.00	0.0
Colombian foreign debt securities	159,433.00	0.0
Bank acceptances	30.00	0.0
General Total	470,518,698.35	

Source: Deceval.

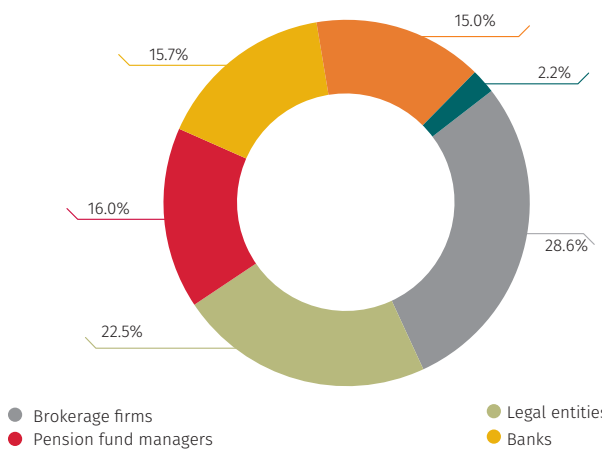
largest proportion (54.2%) of all current issues managed by Deceval, followed by term deposit certificates (CDT), with 26.2%, and ordinary bonds, with 11.1%. The other instruments, such as commercial paper and acceptances, among others, account for 8.6%.

When the balance in custody is grouped according to the type of securities and the type of depositing institution, in terms of variable-income securities (COP 254.8 b), brokerage firms rank first, with 28.6% (COP 72.9 b), followed by legal entities, with 22.5% (COP 57.4 b), and pension and severance fund managers, with 16% (COP 40.8 b). Then come the banks, with 15.7% (COP 40.1 b), and trust companies, with 15% (COP 38.2 b). The remaining 2.2% (COP 5.5 b) is made up of institutions such as: financial corporations, insurance companies and public entities, among others (Graph 1.8, Panel A). In all, 99.8% of the balance in the custody of brokerage firms is in a non-proprietary position and only 0.2%, in proprietary position. Moreover, dematerialized issues accounted for 93.7% of all securities in this market and physical issues, 6.3%.

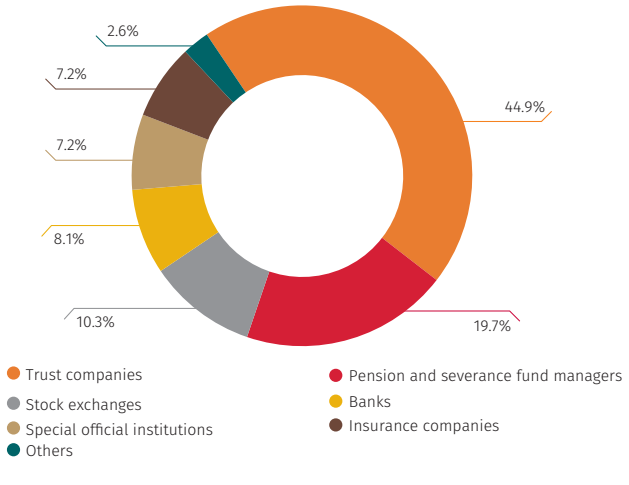
With respect to fixed-income securities (COP 215.7 b), which include CDTs (57%), bonds (30.2%) and other securities (12.7%), the entities accounting for the largest share are trust companies, with 44.8% (COP 96.5 b., out of which 99.6% is in a non-proprietary position and 0.4%, in proprietary position), followed by pension and severance fund managers, with 19.7% (COP 42.4 b), and brokerage firms, with 10.3% (COP 22.2 b). Then come the banks, with 8.1% (COP 17.5 b); the insurance companies and special official institutions, with 7.1% (COP 15.4 b) each; and, finally, the others, with 2.5% (COP 5.5 b), of which legal entities, finance companies, capitalization companies and financial corporations are the most representative (Graph 1.8, Panel B). In all, 99.5% of this market pertains to dematerialized issues, 0.3% to foreign deposits, and 0.2% to physical issues.

Graph 1.8
Total Balance Held by Deceval, by Type of Entity
(December 2018)

A. Variable Income



B. Fixed Income



Source: Deceval.

As for the time it takes to settle transfer orders in the large-value payment system, nearly 83% of all transactions in 2018 were settled before 17:00 hours.

Information on the Operation of Deceval in the Last Decade

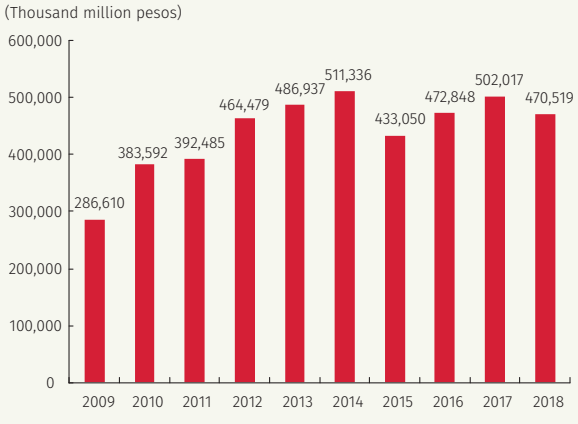
In November 2010, Deceval implemented an automatic debit mechanism for funds in *Banco de la República's* CUD deposit accounts to settle delivery versus payment (DvP) transactions. This process allowed for transactions to be cleared and settled faster and more efficiently, avoiding postponing liquidity until the end of the cycle and freezing securities for long periods.

In 2018, Deceval became part of the Colombian Stock Exchange (BVC), a process that resulted in a single company by the end of the year.

The average value of transactions conducted daily through Deceval in the last ten years increased from COP 2.82 b in 2009 to COP 3.78 b in 2018. This represents 3.3% compound annual growth.

The number of securities Deceval held in custody during the last decade years increased, in constant value, at an annual compound rate of 5.7%, having gone from COP 287 b in 2009 to COP 471 b at the close of 2018 (Graph A).

Graph A
Total Amounts Held in Custody by Deceval, in Constant Values



Source: Deceval; calculations by *Banco de la República.*

1.3.3 The Colombian Stock Exchange (BVC)

The local equity market was affected during the year by tighter international financial conditions and added risk aversion towards emerging markets. As mentioned in the macroeconomic summary, this was due mainly to monetary policy normalization and to trade tensions in the United States. Appreciation of the dollar and the strong downward correction in the price of oil at the end of the year also had a hand in the negative performance of the Colombian stock market.

Accordingly, the Colcap index registered a negative variation of 12.4% during the year, largely because of weak stock performance in the materials and retail sectors, among others.

As for trading volumes in the variable-income market, COP 44.4 b in equities were traded during the year, of which COP 35.9 b pertained to spot buying and selling, COP 7.2 b to repo transactions, COP 1.3 b to TTS operations, and COP 0.018 b to Colombian global market (GMO) operations. In contrast with 2017, this volume represents an increase of 6.9% in the spot market, 15.8% in the repo market, and a decline of 6.4% in the TTS market.

The BVC provides and manages electronic platforms that allow its participants to make purchase and sale bids in a number of markets. The fixed-income market is the one with the highest number of participants (106), followed by the standardized-derivatives market, with 33, and the variable-income market, with 20. While different types of institutions participated in the fixed-income and standardized-derivatives markets (e.g., banks, trust companies, etc.), the stock market is comprised exclusively of brokerage firms.

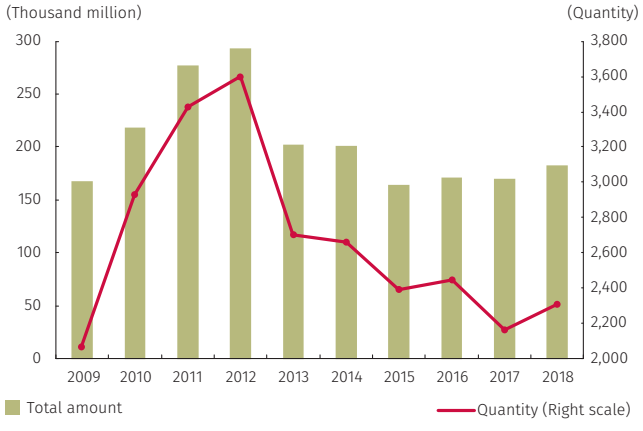
In the equity market, the BVC manages clearing and settlement on the spot market (buying and selling), doing so with a combination of its own developments and the services provided by other infrastructures. These include Deceval (gross settlement of the securities leg) and *Banco de la República*'s large-value payment system (net multilateral cash leg settlements), which are particularly important. The interaction between and among these financial entities, as a whole, constitutes the financial infrastructure of the equity market.

When it comes to the cash leg of these operations, the BVC does multilateral netting. In this case, unlike gross clearing, there is a single position associated with all purchase and sale transactions. Consequently, once the participants who are responsible for a multilateral net position learn of it, they transfer the resources through the large-value payment system to the BVC's deposit account, which then pays the participants who have a net multilateral position in their favor.

With respect to the securities leg, because Deceval has centralized custody of variable-income securities, the BVC constantly sends instructions to that infrastructure throughout the day, once the respective cash leg has been cleared, so Deceval can make the respective book entry.

As for term operations, Decree 2219 issued in 2017 by the Finance Ministry to amend Decree 2555/ 2010 establishes that repos, sell/ buy-backs and TTS transactions traded or registered on stock exchanges and in authorized trading and registration systems must be cleared and settled using the DvP mechanism in approved clearing and settlement systems. It also says stock exchanges must specify, in their regulations, whether clearing and settlement of the securities traded in their systems are to be done through their own system, or through a system managed by another entity and authorized by the Office of the Financial Superintendent of Colombia. Accordingly, the regulations of the BVC indicate repo transactions conducted in its

Graph 1.9
Transactions Processed by the BVC
(Daily averages)



Source: Colombian Stock Exchange.

system are to be cleared and settled at a central counterparty clearing house authorized by the stock exchange itself. As a result, repos on equities traded on the BVC have been cleared and settled through the CRCC ever since August 2017.

Transactions conducted on the equity market[16] during 2018 increased with respect to the previous year. The daily averages in terms of value (COP 182.9 thousand of millions (tm)) and the number of transactions (2,311) represent positive variations of 7.4% and 6.7% compared to those achieved the year before (Graph 1.9).

Table 1.13 contains a breakdown of the variable-income transactions conducted on the BVC, according to the different types of transactions. In terms of the spot market (i.e., purchase and sales), it shows the average amount traded daily in 2018 (COP 147.6 tm) and the daily average number of operations (2,251) increased compared to the previous year, by 6.5% and 6.9%, respectively. The equity repo market also performed well, posting an increase of 15.3% in the average daily amount (COP 29.7 tm), and a higher daily average for the number of transaction (49), which meant an increase of 2.2%. The equities lending market (i.e., TTS), which has been operating since 2011, performed negatively, reversing the trend observed in recent years, given a daily average of COP 5.51 tm for 2018. Compared to the daily average in 2017 (COP 5.91 tm), this implies a decline of 6.8%.

Graph 1.10 shows the momentum in the cash the BVC received and delivered to clear and settle spot transactions. In 2018, this monetary exchange took place throughout the day, with the BCV delivering 32% of these resources before 12:00 p.m. and 65% between 12:00 p.m. and 5:00 p.m.

Compared to the amount traded on the spot market, the amounts the BVC requires as a result of the multilateral clearing process represent a savings of around 69.9% in the liquidity needs of its participants.

The BVC handled clearing and settlement of transactions in the other equity markets (repos and TTS) until August 2017. However, security and cash legs were settled on a gross basis (transaction-by-transaction) in Deceval, which debited the money in the large-value payment system. Graph 1.11 shows how the momentum in repo and TTS transactions processed through the large-value payment system evolved in 2018.

During 2018, the average amount of outstanding repurchase obligations managed by the BVC came to COP 631 tm. This represents an

16 It includes cash, repo and TTS transactions.

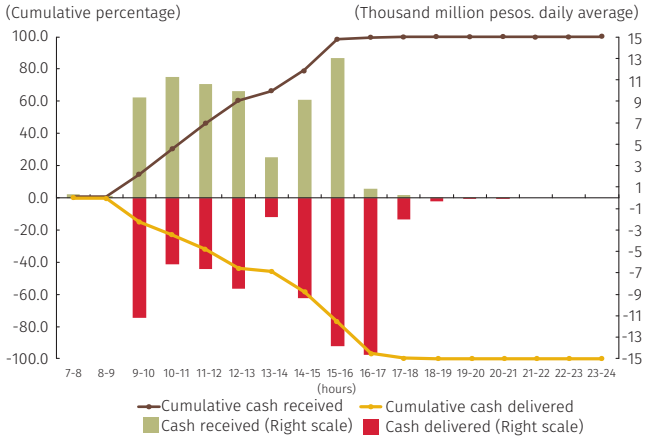
Table 1.13
BVC Statistics

Year	Stock Purchase and Sales					Repos on Equities				
	Daily Average			Annual Value		Daily Average			Value anual	
	Quantity	Amount (Thousand million of pesos)		Amount (Thousand million Pesos)		Quantity	Amount (Thousand million of pesos)		Amount (Thousand million Pesos)	
		Current	Constant	Current	Constant		Current	Constant	Current	Constant
2009	1,815	114.4	160.7	27,680.0	38,878.0	267	53.2	74.7	12,872.8	18,080.5
2010	2,640	151.6	206.4	37,151.8	50,577.7	291	66.8	90.9	16,354.4	22,264.6
2011	2,947	166.6	218.7	40,989.0	53,797.2	478	110.5	145.0	27,181.4	35,675.0
2012	3,199	188.2	241.2	45,923.8	58,841.1	396	104.3	133.6	25,440.4	32,596.2
2013	2,550	167.5	210.6	40,879.4	51,382.1	145	34.2	43.0	8,352.1	10,497.9
2014	2,536	165.4	200.5	40,353.1	48,930.8	121	33.6	40.7	8,193.2	9,934.7
2015	2,294	134.3	152.5	32,489.0	36,897.5	88	27.9	31.7	6,754.3	7,670.8
2016	2,380	144.4	155.0	35,369.9	37,986.1	59	22.3	23.9	5,461.6	5,865.6
2017	2,106	138.6	143.0	33,548.9	34,615.1	48	25.8	26.6	6,241.4	6,439.8
2018	2,251	147.6	147.6	35,875.5	35,875.5	49	29.7	29.7	7,227.6	7,227.6

Year	TTS - Equities					Total				
	Daily Average			Annual Value		Daily Average			Value anual	
	Quantity	Amount (Thousand million of pesos)		Amount (Thousand million Pesos)		Quantity	Amount (Thousand million of pesos)		Amount (Thousand million Pesos)	
		Current	Constant	Current	Constant		Current	Constant	Current	Constant
2009	n.a.	n.a.	n.a.	n.a.	n.a.	2,081	168	235.4	40,552.8	56,958
2010	n.a.	n.a.	n.a.	n.a.	n.a.	2,931	218	297.3	53,506.2	72,842
2011	1	0.20	0.26	43.6	57.2	3,426	277	364.0	68,214.1	89,529.5
2012	1	0.20	0.26	57.0	73.0	3,596	293	375.0	71,421.3	91,510.3
2013	2	0.35	0.43	84.2	105.8	2,697	202	254.0	49,315.7	61,985.8
2014	7	2.03	2.46	494.4	599.5	2,663	201	243.7	49,040.6	59,465.0
2015	7	1.96	2.23	475.22	539.7	2,389	164	186.4	39,718.58	45,108.0
2016	10	4.91	5.28	1,203.40	1,292.4	2,449	172	184.3	42,034.95	45,144.1
2017	12	5.91	6.10	1,431.19	1,476.7	2,166	170	175.8	41,221.54	42,531.6
2018	11	5.51	5.51	1,339.1	1,339.1	2,311	183	182.9	44,442.2	44,442.2

n.a. Not available
Source: Colombian Stock Exchange (BVC).

Graph 1.10
Spot Market Equity Payments in the Large-value Payment System
(Daily averages, 2018)

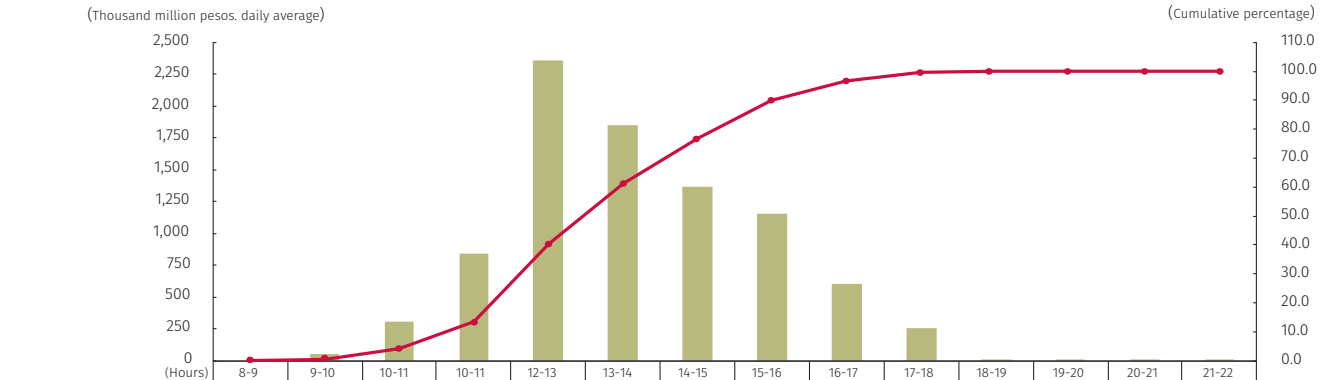


Source: *Banco de la República* (CUD).

increase of 13.4% compared to the year before, when the value of these obligations came to COP 556 tm (Graph 1.12).

Graph 1.13 groups the share of the daily average amount of outstanding repurchase obligations, according to the agreed term. The pattern in 2018 showed that nearly 56% of the brokerage firms were concentrated on financing for more than 60 days, 38% between sixteen and sixty days, and only 6% for a period less than or equal to 15 days.

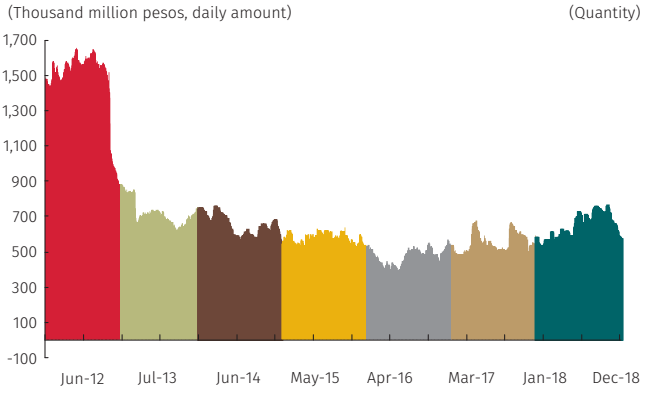
Graph 1.11
Transactions Settled throughout the Day by Deceval for the BVC Repo and TTS Markets [a/]



(Hours)	8-9	9-10	10-11	10-11	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22
Amount processed (millions)		COP 49.1	COP 303.7	COP 838.1	COP 2.356.7	COP 1.849.6	COP 1.363.4	COP 1.154.3	COP 601.7	COP 256.9	COP 12.3	COP 5.6	COP 3.0	COP 2.2
Cumulative Percentage (Right scale)	0	1	4	14	40	61	77	90	97	100	100	100	100	100

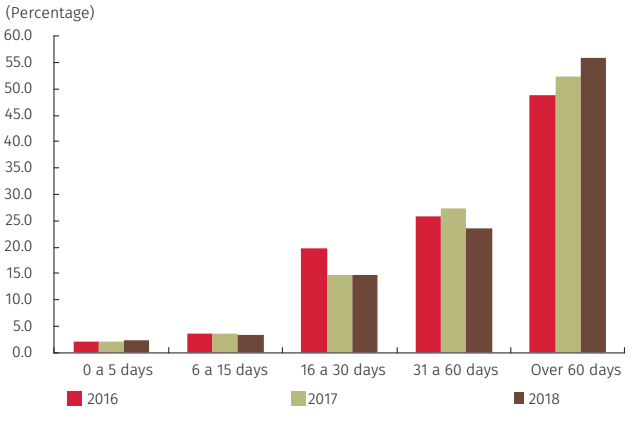
a/ Includes only the initial transaction. Transactions registered up to August 14, 2017. Since that date, stock repos are cleared and settled through the CRCC.
Source: *Banco de la República* (CUD).

Graph 1.12
Stock Repos



Source: Colombian Stock Exchange.

Graph 1.13
Stock Repos by Maturity: 2016-2018



Source: Colombian Stock Exchange.

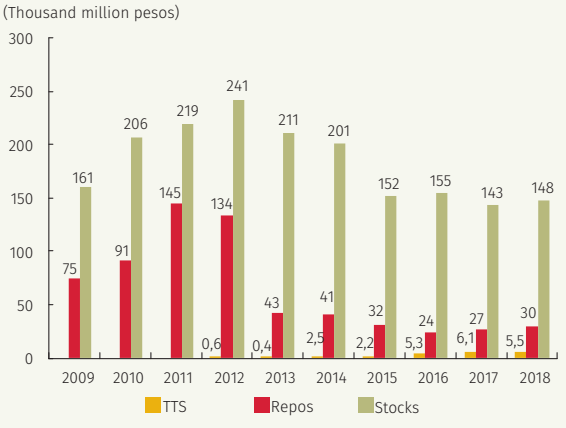
Information on Operation of the BVC in the Last Decade

In May 2011, the BVC launched the Latin American Integrated Market (MILA), allowing investors and intermediaries from Chile, Colombia, and Peru to buy and sell shares on three stock exchanges, using a local broker. The Mexican Stock Exchange (BMV) had been incorporated into the group by December 2014. The number of transactions conducted through MILA totaled USD 47.5 million by the close of 2018.

In August 2017, as authorized in MHCP Decree 2219/2017, the BVC amended its regulations to allow equity repos to be cleared and settled through the CRCC. By 2018, as mentioned in the previous section, the balances of these operations had increased 13.4%.

The daily average amount of transactions on the BVC during the last decade, in constant values, declined at a compound annual rate of 2.8%. A breakdown, by product, shows a compound annual decline of 0.9% in the spot market for stocks and 9.7% in the market for equity repos. In contrast, the TTS market, which has developed considerably since 2012, posted a compound annual growth rate of 22.4% (Graph A).

Graph A.
Conducted through the BVC, at Constant Values, Daily Average



Source: Colombian Stock Exchange (BVC).

1.3.4 The Central Counterparty Risk of Colombia S.A. (CRCC)

A look at the local derivatives market, according to the type of underlying assets, shows the performance of contracts involving the TRM (the underlying asset most traded in 2018) responded to the increase in exchange rate volatility throughout 2018. This was due largely to the volatility in oil prices, the adjustment in U.S. monetary policy, the tensions in world trade, and the heightened perception of risk with respect to emerging economies.

Interest rate futures performed positively in the first half of the year, given the interest-rate volatility generated by the reduction in *Banco de la República*'s benchmark rate. However, the appetite for these instruments eventually dampened in response to the sharp decline in the volatility of rates during the remainder of the year.

Finally, when it comes to equity futures, negative stock market performance reduced the demand for derivatives of this type.

The pattern we see relates to the particular performance of the local futures market, which reacts positively to underlying market valuations, without necessarily doing the same when the underlying market is devalued. In other words, it has more momentum in upward than downward markets.

Cleared and settled transactions[17] involving products in the financial derivatives segment came to COP 909.8 b in 2018. This implies 21.1% growth compared to the number of transactions in 2017. The share of the sum of these transactions, according to the type of product, was 32.8% (COP 298.4 b) for standardized financial derivatives, and 67.2% (COP 611.4 b) for non-standardized derivatives. This represents increases of 13.8% and 25.1%, respectively, compared to the previous year. Among the standardized derivatives, TRM futures were the product with the most growth, registering an increase of 104.3%, having gone from COP 89.9 b to COP 183.8 b, while non-deliverable forwards (pesos/dollars) were the non-standardized product that increased the most (30.1%), having gone from COP 418.03 b to COP 543.9 b.

The proportion, according to type of standardized forward contracts in the sum of such products, was 34.71% (COP 103.58 b) for specific-reference TES futures, 61.58% (COP 183.77 b) for TRM futures, 3.12% (COP 9.3 b) for OIS futures, and 0.6% (COP 1.77 b) for other products, which include stock, index and electricity futures, among others. The proportion of non-standardized products was 88.96% (COP 543.9 b) in the case of non-deliverable forwards (pesos/dollars) and 11.04% (COP 67.48 b) for OIS-IBR and overnight OIS-IBR.

On the other hand, the total value of transactions in the fixed-income segment represented by TES sell/buy-back operations handled by the CRCC, for subsequent gross settlement through the DCV, increased by 20.9% to COP 3,158.02 b.[18]

With respect to the variable-income segment, stock repo transactions were up by 234.5%, posting a total value of COP 14.53 b during 2018 (Graph 1.14).

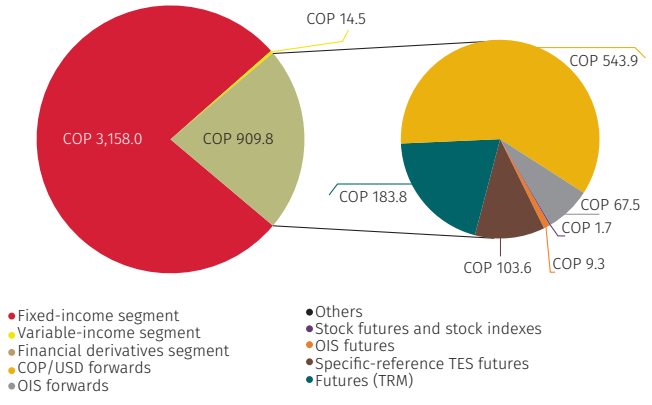
The number of futures contracts[19] cleared and settled through the CRCC declined. The daily average was 10,845 contracts in 2017 and

17 As a result of novation by the CRCC, a negotiated transaction is accounted for as two transactions cleared and settled in the CRCC, since the original counterparty link disappears and, in its place, two links appear in which the clearing house becomes the buyer and the seller of the initial counterparties.

18 This amount takes into account flows for constitution and retrocession in sell/buy-back transactions.

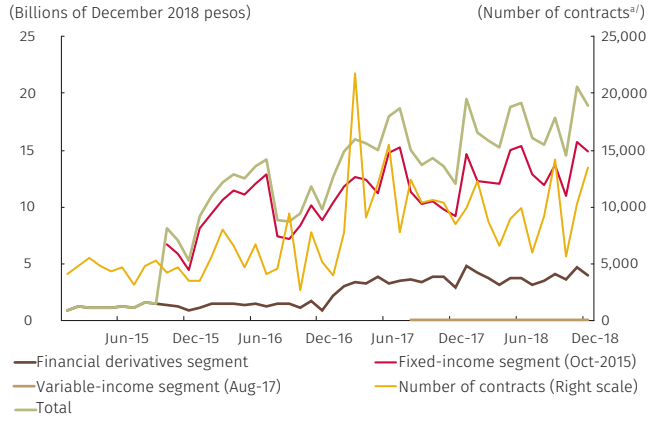
19 Only standardized products are included. Therefore, this number does not take into account exchange rate forwards or transactions in the equity and fixed-income segments.

Graph 1.14
Central Counterparty Clearing House
Share in Billion Pesos, by Product
(Total value of transactions in 2018)



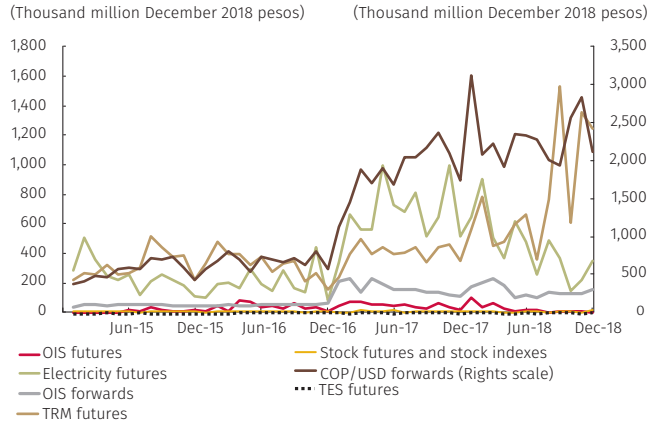
Sources: CRCC and *Banco de la República* (DSIF).

Graph 1.15
Value of Transactions Accepted by CRCC S.A.
(Daily average)



a/ Financial-derivatives segment. Does not include forex or interest rate forwards.
Sources: CRCC and *Banco de la República* (DSIF).

Graph 1.16
Transactions Involving Products in the Financial Derivatives Segment
(Daily average)



Sources: CRCC and *Banco de la República* (DSIF).

9,598 in 2018. The total value of transactions accepted for net clearing in the financial-derivatives segment went from a daily average of COP 3.2 b in 2017 to COP 3.8 b (current pesos) in 2018. On the other hand, the daily average value of gross clearing in the fixed-income segment (TES sell/buy-backs) went from COP 11.1 b in 2017 to COP 13.3 b in 2018. The daily average value of gross clearing in the variable-income segment (stock repo transactions) went from COP 48.26 tm in 2017 to COP 61 tm in 2018 (Graph 1.15).

A detailed look at how the products in each segment evolved during 2018 shows the highest daily average value accepted in November was for TES sell/buy-backs, with COP 15.7 b. In October, it was for repos on equities, with COP 76.39 tm. On the other hand, it is important to point out that the highest daily averages in the financial- derivatives segment were for specific-reference TES futures in February, with COP 906.81 tm; TRM futures in September, with COP 1.5 b; OIS futures in March, with COP 121.3 tm; NDF forwards (pesos/dollars) in January, with COP 3.1 b; and OIS-IBR in March, with COP 436 tm (Graphs 1.15 and 1.16).

The value of gross open positions[20] came to COP 97.70 b by the end of 2018, which amounts to an increase of 13.18% with respect to the open position at the close of 2017. As for participation by the segments and gross open position values, the segment comprised of financial derivatives had an open position of COP 68.97 b (70.59%), as opposed to COP 27.18 b (27.82%) for the fixed-income segment and COP 1.55 b (1.59%) for variable income (Graph 1.17).

For 2017, Graph 1.18 shows the most representative products with declining open positions[21] were OIS futures (-67%), specific-reference TES futures (-55%) and electricity futures (-23%). On

20 Both the buy and sell position generated by the same transaction are taken into account. For example, when intervening in a transaction for the purchase of a TES forward contract, the open position for the CRCC will be two contracts, because one participant has a long open position, while the other has a short open position.

21 The comparison takes into account the open position on the last day of November 2017 and the last day of November 2018. December is not considered, since it is a month marked by seasonal performance.

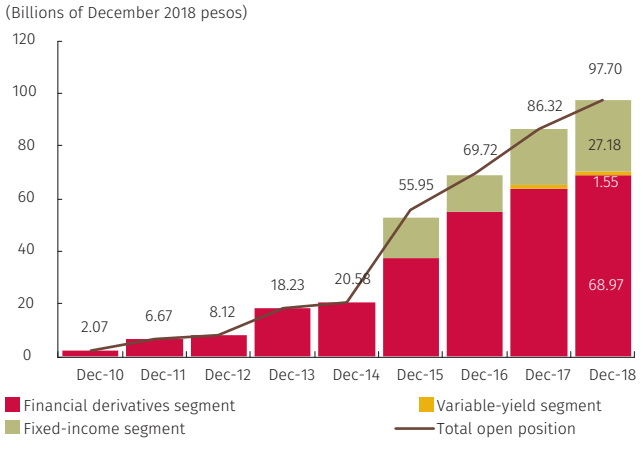
the other hand, the products with increases in open positions were TRM futures (237%) and NDF forwards (pesos/dollars) (46%).

Non-standardized derivative transactions during 2018 were received entirely from the registration systems. Out of the transactions with standardized derivatives, 7.8% were incorporated through the BVC[22] and Derivex trading systems, and 92.2% through their respective registration systems (Graph 1.19). In 2017, this last proportion was 87.4%. With respect to TES sell/buy-backs, 15.3% came from the MEC system and 84.7% from the SEN trading system.

According to the BVC, the trend towards an increase in transactions that are agreed bilaterally and subsequently recorded in its system continued. One factor that explains this behavior is the change in the type of participants in TES futures trading. Also, banks, as market makers, were the most active participants in the market for notional TES futures (currently, trading in these products is non-existent) and, in recent years, brokerage firms have acted as intermediaries in specific-reference TES futures trading. Transactions with this type of brokerage are typically conducted outside the trading system.

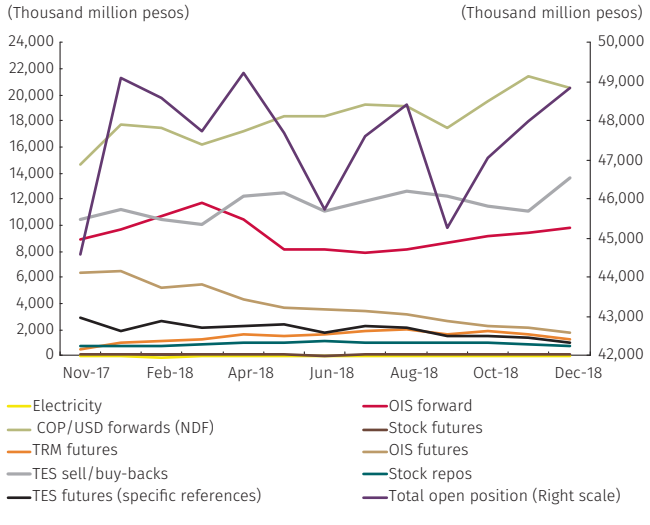
Another factor is the limited liquidity on the TES and TRM futures trading platform. Participants use the liquid market, the TES spot market and the foreign exchange market as a reference to define their strategies in the futures market. Initially, they go to the futures trading platforms for these assets and, if they do not obtain enough liquidity there, they go to the over-the-counter market to carry out the transaction.

Graph 1.17
Evolution of the Open Position at the Close of Each Year, by Segment
(Gross open position, both legs)



Sources: CRCC and *Banco de la República* (DSIF).

Graph 1.18
Open Position in 2018, by Product Group
(Only one leg)



Sources: CRCC and *Banco de la República* (DSIF).

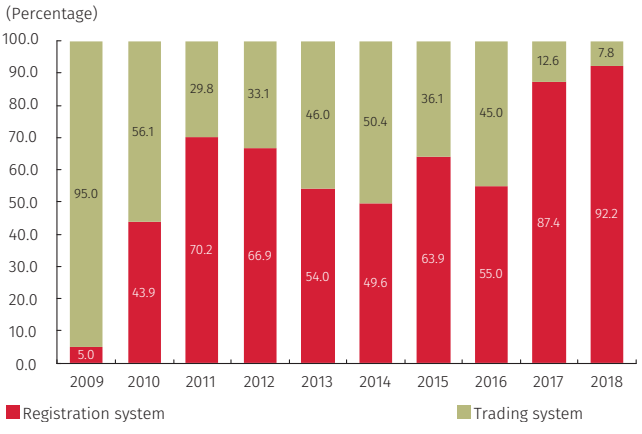
Graph 1.19 shows how the share in the number of standardized derivative contracts handled through the electronic trading system and registration systems has evolved.

Lastly, efficiencies in collateral are generated thanks to risk clearing processes by maturity and instrument, and, thus, can result in lower liquidity requirement for the CRCC's members. On a daily average during 2018, the collateral requirements for the most representative

22 The regulations for the electronic trading and registration system managed by the BVC allow trading to be carried out directly in the system, or the transaction may be registered once it has been conducted in the over-the-counter market.

products were reduced as follows: 17.16% for specific-reference TES futures; 18.5% for TRM futures; 47.8% for OIS futures; 34.63% for NDF forwards (pesos/dollars), and 54.85% for OIS-IBR. Liquidity savings are presented as lower cash or security requirements (collateral to support a position) in the event of purchases or sales of the same product at different maturities (for example, purchases of specific-reference TES futures with different durations), or when there are different positions in various instruments with correlated underlying assets: for example, purchases of TRM futures and sales of NDF forwards (pesos/dollars).

Graph 1.19
Number of Standardized Derivative Contracts Received from Registration or Trading Systems



Sources: CRCC and *Banco de la República.*

The CRCC experienced eight delays during 2018. However, none had an impact on the provision of its services, nor was it necessary to execute collateral.

In terms of operational efficiency in the delivery of service, the CRCC's systems were available to participants during 99.54% of the time, in keeping with the schedules established for 2018.

Some of the major changes introduced by the CRCC during 2018 include: 1) higher percentages of collateral required for large open positions; 2) the possibility of the CRCC establishing default management committees; and 3) creation of the swap segment for operations involving non-standardized financial derivatives used in interest rate swaps (IRS). In such cases, the parties agree to exchange, between themselves and at pre-established dates, interest rate payments that result from applying a fixed rate and a floating rate to a nominal amount for a given period. The swap segment also includes OIS-IBR, where the floating rate of interest is determined based on the average of the rates quoted by the eight banks participating in IBR calculation at one day. Both products have a maximum term of fifteen years. The procedure for calculating collateral is based on historical VaR and probable maximum loss.

As to the requirement for more collateral to support large open positions, a large position is one where the value of the net open position of an account, in a given asset, exceeds a certain percentage of the average daily volume traded. It is, therefore, understood that the time horizon (days) required to close a position of this type increases. Consequently, the parameters for calculating the collateral to support a position and the stress risk will be raised according to the levels set by the CRCC.

With respect to the second point, the committees will be comprised of non-defaulting members who participate in the segment affected by the default. These committees will support and advise the CRCC on managing defaults; however, their recommendations will not be binding. On the other hand, how these committees are set up, the way their members are elected, and their functions will be determined in each segment, and

the CRCC may to decide whether or not the participation of those members is mandatory. Likewise, the CRCC could establish special and segment-specific procedures for default management that make it possible to close positions in an orderly way, pursuant to market conditions. It also may invite one or more experts to serve as advisors on how to manage default.

1.4 The Central Counterparty Clearing House of Colombia (CCDC)

The Colombian peso showed mixed performance in 2018. Up to April, there were valuations explained by the behavior of the U.S. dollar worldwide and the rise in oil prices. However, the peso depreciated throughout the rest of the year, mainly due to the positive economic data and monetary-policy rate hike in the United States, the generalized increase in risk perception with regard to emerging economies, and the collapse of oil prices in the final quarter of the year. As a result, the peso depreciated 8.4% against the US dollar during the course of 2018.

The daily average number of transactions settled among the 33 direct participants in the CCDC who were active in 2018 came to 1,741. This represents 4.1% growth with respect to the daily average the year before. In terms of the gross value cleared and settled, the daily average was USD 1,297.8 m (COP 3,844.1 tm)[23], which implies an increase of 12.85% in dollars and 13.14% in current pesos compared to 2017 (Table 1.14 and Graph 1.20).

Daily average liquidity savings, as a result of multilateral net clearing, came to 86.0%. This is one percentage point (pp) more than the year before. In 2018, the gross value of transactions averaged USD 1,297.8 m daily, while the net daily average was USD 180.2 m (COP 533.21 tm).

From the standpoint of risk mitigation mechanisms, the CCDC maintained the required degree of collateral during 2018; that is, 6.5% of each participant's net selling position for transactions cleared and settled within $t + 0$ and $t + 1$, and 8% for transactions cleared and settled in $t + 2$ and $t + 3$. The daily average amount of collateral provided to the CCDC by the direct participants came to USD 74.26 m and COP 97.64 tm.

Graph 1.21 shows the peso value of the sum of the collateral deposited by participants and the values when applying the foregoing percentages to the multilateral net values. The collateral they deposit allows participants to operate during the day with net selling positions up to the short position limit defined by the CCDC. The values obtained by applying the required percentage of collateral to the multilateral net payments would tally with the collateral necessary to cover exchange-rate volatility in the event of default in the

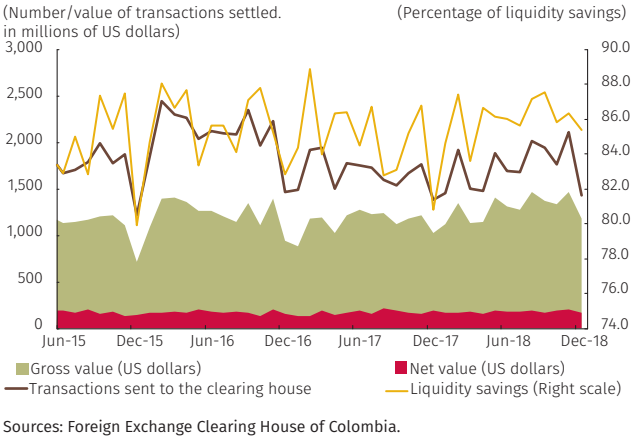
23 The amount is expressed in current pesos.

Table 1.14
Statistics on the Foreign Exchange Clearing House of Colombia [a/]

	Daily Average			
	Number of transactions (Transactions sent to the CCDC)	Gross value		Liquidity savings (Percentage)
		(Millions of dollars)	(Thousand million December 2018 pesos [b/])	
Average 2008	1,414	979.2	2,761.1	86.1
Average 2009	1,886	1,181.0	3,559.8	87.6
Average 2010	1,825	1,274.0	3,297.6	88.2
Average 2011	1,544	1,088.0	2,638.5	84.0
Average 2012	1,399	1,037.7	2,391.1	81.6
Average 2013	1,388	1,125.7	2,649.4	81.8
Average 2014	1,482	1,179.2	2,856.1	80.4
Average 2015	1,823	1,163.9	3,597.0	84.3
Average 2016	2,102	1,243.4	4,086.9	85.7
Average 2017	1,673	1,150.0	3,505.5	85.0
Average 2018	1,741	1,297.8	3,844.1	86.0
Jan-18	1,459	1,116.8	3,187.6	84.6
Feb-18	1,916	1,343.1	3,845.3	87.4
Mar-18	1,502	1,131.8	3,224.2	83.6
Apr-18	1,484	1,148.3	3,177.6	86.7
May-18	1,887	1,406.9	4,033.4	86.1
Jun-18	1,697	1,316.8	3,810.5	86.0
Jul-18	1,678	1,278.4	3,684.9	85.7
Aug-18	2,012	1,468.7	4,367.1	87.2
Sept-18	1,948	1,374.5	4,172.4	87.6
Oct-18	1,766	1,333.6	4,133.1	85.9
Nov-18	2,111	1,469.3	4,698.6	86.4
Dec-18	1,434	1,185.2	3,794.4	85.4

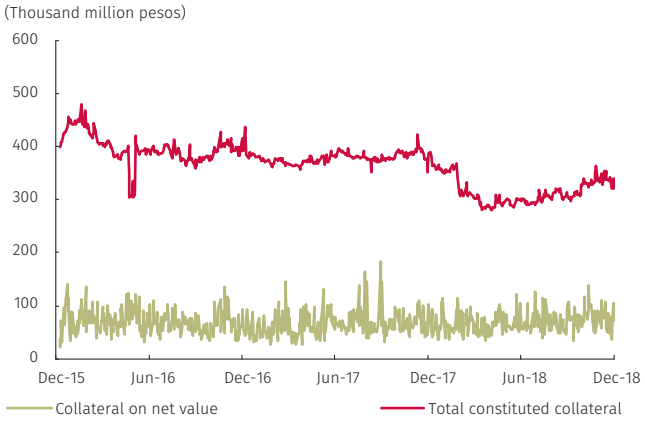
a/ Includes transactions on the spot and next day markets t + 1, t + 2, and t + 3 that reach the maturity date.
b/ The 2018 monthly values in pesos correspond to current pesos.
Source: CCDC S.A.

Graph 1.20
Value, Volume and Liquidity Savings in Transactions Processed by the Foreign Exchange Clearing House of Colombia
(Daily averages)



Sources: Foreign Exchange Clearing House of Colombia.

Graph 1.21
Collateral Received in Relation to Required Collateral on Net Values



Sources: Foreign Exchange Clearing House of Colombia and *Banco de la República.*

payment of multilateral net obligations. Although the collateral that has been provided could be greater by the end of the day than what is required to manage defaults, it reduces the operational risk generated by possible additional collateral requirements during the day.

The peso quotas committed with their liquidity providers (LP) were maintained at COP 350 tm with six banks. The dollar quotas were kept at USD 115 m, committed with seven banks. By the close of 2018, the largest dollar-denominated liquidity provider accounted for 34.78% (USD 40.0 m) of all lines of credit in dollars.

On the other hand, the CCDC experienced six delays[24] in paying the multilateral obligations of some of its direct participants. All the delays were in dollars, for a total of USD 184.92 m. Liquidity providers had to be used on three occasions, for a total of USD 149.07 m (Table 1.15). There were no events involving default.

Table 1.15
Foreign Exchange Clearing House of Colombia: Delays and Defaults by CCDC Participants in 2018

	Number of Delays	Value of Delays	Number of LP Uses	Total Value of LP Use	Defaults	Value of Defaults
Dollars	6	USD 184,924,000.00	3	USD 149,070,000.00	0	USD 0.00
Pesos	0	COP 0.00	0	COP 0.00	0	COP 0.00

Source: CCDC S.A.

As for operational efficiency in the delivery of service, the CCDC's systems were available to participants for 99.97% of the time, in keeping with the schedule set for 2018.

In 2018 the CCDC changed the way it calculates one of its main elements for risk mitigation: the maximum short position (MSP). This change involved eliminating the exchange-rate risk sensitivity factor defined by the Office of the Financial Superintendent of Colombia as an estimation parameter and introducing, instead, the minimum percentage of collateral applicable to multilateral obligations. There is a relevant change, because the new parameter is updated more frequently and, therefore, includes variations in the exchange rate that reflect the recent performance of the FX spot market. Accordingly, the instances where the CCDC can lower the MSP in dollars, due to significant changes in the exchange rate, were modified as well. This adjustment gives the clearing house more flexibility to calibrate its risk model. The CCDC reduced the MSP for dollars at the beginning of the year and, in doing so, was able to obtain more cover for pre-approved lines of credit with its dollar-denominated liquidity providers.

24 CCDC regulations define "delay" as paying an obligation, resulting from the multilateral net balance, after the deadline stipulated in the CCDC regulations (2:30 p.m. for 2014 and provided it does not go past 8:00 a.m. the day after the compliance date).

Last but not least, in 2018, the CCDC gave the Collateral Fund for Financial Institutions (Fogafin) access to its foreign exchange clearing and settlement services under special conditions, considering the unique and particular nature of that fund.

Information on Operation of the CCDC in the Last Decade

The volumes traded in terms of the number of transactions and the gross value of purchase-and-sales in dollars have remained relatively stable after a decade of service. When comparing the daily average number of transactions cleared and settled through the CCDC in 2008 with those in 2018, the increase comes to 23.16%. Similarly, gross dollar values are up by 32.53%. The percentage of liquidity savings, as a benefit of the multilateral clearing service offered by the CCDC, has stayed at around 86%.

Clearing, settlement and risk management in next-day operations, as of the trade date, and the acceptance of TES as collateral to comply with these operations are among the most important changes introduced by the CCDC during this period.

From a regulatory standpoint, *Banco de la República* granted forex clearing and settlement systems the possibility of acquiring liquidity in dollars, through FX-swap transactions, under certain market conditions. It also allowed these systems to conduct transactions with other forex market brokers (apart from liquidity providers) in situations of default and market stress. Moreover, a limit was set on the sum of all pre-approved lines of credit with dollar-denominated liquidity providers that can be concentrated in a single entity (35%).

1.5 Retail-value Payment Systems and Payment Instruments

The function of retail-value payment systems is to clear and settle transactions conducted by means of the various payment instruments that are available in Colombia. The main ones are checks, credit and debit transfers through ACHs (electronic payments in the circuit of companies and individuals), credit cards and debit cards. This section describes their principal characteristics, value and number of operations.

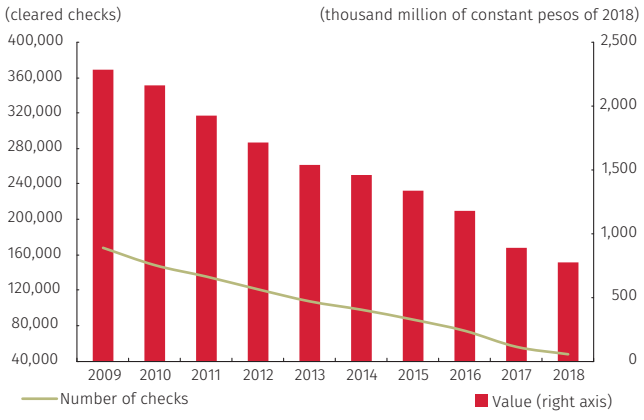
1.5.1 Electronic Clearing System for Checks and Other Payment Instruments (CEDEC), Managed by *Banco de la República*

1.5.1.1 *Electronic Clearing System for Checks – CEDEC*

In all, 11.5 million checks (an average of 47,254 per day) valued at 0.19 times the country's GDP (a daily average of COP 0.77 b)[25] were cleared

25 The figures on the use of checks only take into account interbank payments; that is, payments between the customers of different financial institutions. Therefore, they do not include intrabank checks, which are settled within each institution

Graph 1.22
Value and Number of Checks Cleared through CEDEC
(Checks cleared)



Source: *Banco de la República.*

during 2018. These figures are less than the 40.6 million checks valued at 0.78 times GDP that were registered in 2009 (Graph 1.22 and Table 1.16).

With regard to liquidity needs, Table 1.16 shows COP 777 tm in gross clearing, on a daily average, in 2018. However, as a result of multilateral netting, COP 121.46 tm was required to settle obligations between financial institutions (Table 1.4). Consequently, the liquidity savings came to 84.4%.

According to the information reported by commercial banks, intrabank checks accounted for 38.5% of the value and 61% of the number of all interbank checks that were cleared in 2018. These figures represent a decline of 18.8% in value and 12.3% in the number of checks, compared to 2017 (Table 1.17). In the case of intrabank checks, the drawer and the drawee share the same financial

Table 1.16
Statistics on Check Clearing through CEDEC

	Daily Average					Annual Value			
	Number of Checks	Value		Average transaction value					
	(Number of transactions)	(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Millions of checks)	(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Number of times GDP)
2009	167,967	1,625	2,282	9.7	13.6	40.6	393,212	552,287	0.78
2010	148,342	1,591	2,166	10.7	14.6	36.0	389,769	530,623	0.72
2011	135,334	1,467	1,926	10.8	14.2	33.3	360,922	473,703	0.58
2012	120,857	1,336	1,712	11.1	14.2	29.5	326,056	417,767	0.49
2013	107,239	1,226	1,541	11.4	14.4	26.2	299,225	376,101	0.42
2014	97,762	1,201	1,456	12.3	14.9	23.9	293,048	355,340	0.38
2015	86,537	1,179	1,339	13.6	15.5	20.9	285,374	324,097	0.35
2016	73,852	1,094	1,175	14.8	15.9	18.1	268,009	287,832	0.31
2017	55,674	863	891	15.5	16.0	13.5	208,944	215,584	0.23
2018	47,254	777	777	16.4	16.4	11.5	188,771	188,771	0.19

Source: *Banco de la República* (CEDEC).

and do not go through the check clearing house. Statistics on intrabank payments are provided at the end of this section.

institution. So, the checks are not sent to CEDEC, or to the central bank's physical clearing houses or to its delegates.

Table 1.17
Comparison of the Value and Number of Interbank Checks vs. Intrabank Checks

Year	Interbank Checks Cleared [a/]		Intrabank checks [b/]			
	Number	Value	Number		Value	
	(Number of checks)	(Thousand million pesos)	(Number of checks)	(As a percentage of interbank checks)	(Thousand million pesos)	(As a percentage of interbank checks)
2009	40,647,982.0	393,212.3	14,992,443	36.9	159,169.7	40.5
2010	36,343,795.0	389,768.8	13,992,620	38.5	164,547.8	42.2
2011	33,292,130.0	360,922.2	15,721,623	47.2	104,215.6	28.9
2012	29,489,131.0	326,056.0	13,362,676	45.3	98,033.5	30.1
2013	26,166,386.0	299,225.0	11,894,023	45.5	88,791.3	29.7
2014	23,853,920.0	293,047.9	13,745,083	57.6	109,281.5	37.3
2015	20,900,000.0	285,374.0	11,207,337	53.6	106,209.0	37.2
2016	18,093,721.0	268,008.5	9,530,565	52.7	88,672.4	33.1
2017	13,472,000.0	208,944.0	7,990,110	59.3	89,618.7	42.9
2018	11,482,000.0	188,771.0	7,004,212	61.0	72,738.3	38.5

a/ Corresponds to the number and value of the checks cleared through CEDEC.
b/ These are checks that are settled within each financial institution and do not go through the check clearing house.
Sources: commercial banks and *Banco de la República*.

1.5.1.2 Concentration and Operational Efficiency Indicators

There were 25 entities involved in the check clearing process (Table 1.18) by December 31, 2018; that is, seven more than in 2009. However, the trend towards a concentration of transactions continued as it has for some time, as the CR5 indicator shows, with the five major participants accounting for 70% of the amount cleared.

In terms of operational efficiency, CEDEC's availability 2018 was 99.52%. In other words, there were occasional suspensions that affected the provision of its services for an amount of time equivalent to 0.48% of the total.

1.5.2 Automated Clearing Houses (ACH)

There are two automated clearing houses in Colombia: ACH-Cenit (managed by *Banco de la República*) and ACH-Colombia, which is owned by the commercial banks. Together, they cleared more than 208.2 million transactions during 2018; that is, 11.8% more than in 2017. In terms of the daily average, this comes to 857,117 payment orders (48,284 were processed through ACH-Cenit and 808,832 through ACH-Colombia), for a value equivalent to COP 4.58 b (COP 0.83 b in ACH-Cenit and COP 3.75 b in ACH-Colombia). During 2018, the total gross amount cleared jointly by these ACHs was COP 1,113.6 b, or

Table 1.18
CEDEC
(Participants and concentration)

	Total Participants	CR5 Indicator (Percentage)	Number of participants that clear 70% of the value
2009	18	68.8	6.0
2010	23	70.7	5.0
2011	24	70.8	5.0
2012	24	70.3	5.0
2013	25	69.7	5.0
2014	25	72.1	5.0
2015	27	72.1	5.0
2016	25	72.2	5.0
2017	25	73.3	5.0
2018	25	71.3	5.0

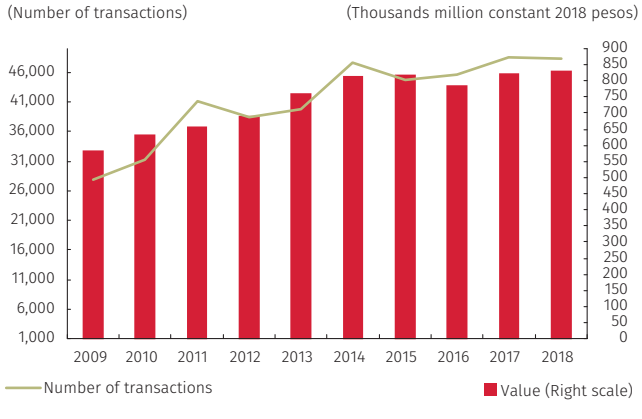
Source: *Banco de la República* (DSIF).

11.22% more than in 2017 and 1.14 times the nominal GDP in 2018. The total net amount settled through these systems in 2018 was COP 403 b (a daily average of COP 1.65 b). This is equivalent to 36.1% of the gross value, which represents a liquidity savings of 63.8%.

1.5.2.1 ACH-Cenit

As Illustrated in Graph 1.23 and Table 1.19, more than 11.7 million transactions (48,284 daily, on average) were processed through ACH-Cenit during 2018, including both credit and debit operations, for a gross value in excess of COP 202.3 b (COP 832.8 tm daily, on average). These figures imply a decline of 0.2% in the number of transactions and an increase of 4.8% in their value with respect to 2017. The limited savings in liquidity (1.44% in 2018) resulting from the net amounts cleared through ACH-Cenit is due to the preponderance of payments sent by the DGCPTN and the General System of Royalties, which accounted for 88.1%.

Graph 1.23
Value and Number of Transactions in ACH Cenit
(Daily averages)



Source: *Banco de la República.*

The large share of credit operations, both in number (98.6%) and value (99.75%), was a high point in terms of total transactions. Debits were down by 19.27% in number and 11.08% in value with respect to 2017 (Table 1.19).

As for operational efficiency, ACH-Cenit was available 99.64% of the time in 2018. In other words, there were occasional suspensions that affected the provision of its services for a period equivalent to 0.36% of its entire schedule.

Table 1.19
ACH Cenit Clearing House Statistics [a/]

Year	Daily Average				
		Value		Average Transaction Value	
	(Number of transactions)	(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Millions of pesos)	(Millions of constant 2018 pesos)
2009	27,967	415.6	583.7	14.9	20.9
2010	31,150	464.4	632.2	14.9	20.3
2011	41,005	500.4	656.8	12.2	16.0
2012	38,504	539.2	690.8	14.0	17.9
2013	39,852	607.0	763.0	15.2	19.1
2014	47,586	670.8	813.3	14.1	17.1
2015	44,743	722.8	820.9	16.2	18.3
2016	45,697	733.8	788.1	16.1	17.2
2017	48,572	797.7	823.0	16.4	16.9
2018	48,284	832.8	832.8	17.2	17.2

Year	Annual Total							
	Number of transactions			Value of transactions (Thousand million pesos)			Value anual (Thousand million constant 2018 pesos)	Number of times GDP
	Credit	Debit	Total	Credit	Debit	Total		
2009	6,725,741	42,272	6,768,013	100,277	291.3	100,568	141,253	0.20
2010	7,587,763	43,912	7,631,675	111,993	1.781.5	113,775	154,890	0.21
2011	10,042,726	44,405	10,087,131	122,829	268.0	123,097	161,562	0.20
2012	9,378,640	93,385	9,472,025	132,504	129.0	132,633	169,939	0.20
2013	9,522,192	201,586	9,723,778	147,926	188.5	148,114	186,167	0.21
2014	11,035,981	574,941	11,610,922	163,238	429.0	163,667	198,457	0.21
2015	10,410,511	417,239	10,827,750	174,408	505.5	174,914	198,648	0.22
2016	10,909,837	285,842	11,195,679	179,164	617.7	179,782	193,079	0.21
2017	11,549,242	205,292	11,754,534	192,463	574.9	193,038	199,173	0.21
2018	11,567,335	165,728	11,733,063	201,849	511.2	202,360	202,360	0.21

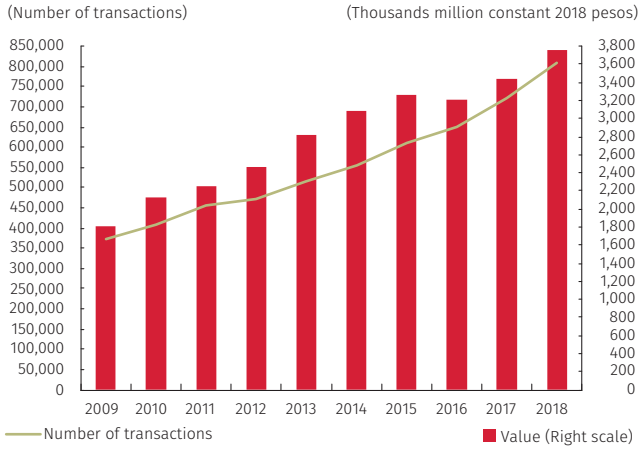
a/ Includes credit and debit transfers.
Source: *Banco de la República* (Cenit).

1.5.2.2 ACH-Colombia

ACH-Colombia conducted 196.5 million transactions in 2018, including both credit and debit operations, for a gross value in excess of COP 911.3 b. These figures imply an increase of 12.64% in the number of transactions and 12.75% in value with respect to 2017 (Graph 1.24 and Table 1.20).

ACH-Colombia settles the net values resulting from clearing in five intraday operational cycles. Once net positions are calculated,

Graph 1.24
Value and Number of Transactions in ACH Colombia
(Daily averages)



Source: ACH Colombia.

participants with net debt positions transfer funds to ACH-Colombia's account, so it can then distribute the resources from its deposit account to participants with net credit positions. The COP 203.5 b in net value settled in 2018 as a whole (COP 837.5 tm daily, on average) was equivalent to 22.3% of the gross value, which represents a liquidity saving of 77.7%.

Table 1.21 shows the CR5 concentration index, which is constructed as the sum of the five largest shares of the value of the transactions. It was 74.32% for credit operations in 2018, which is 0.7% more than in 2017. It also indicates that debit operations rose 2.09%, from 91% in 2017 to 92.91% in 2018.

Table 1.20
ACH Colombia Statistics

Year	Daily Average					Value anual			
		Value		Average Transaction Value					
	(Number of transactions)	(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Millions of pesos)	(Millions of constant 2018 pesos)	(Number of transactions)	(Thousand million pesos)	(Thousand million constant 2018 pesos)	(Number of times GDP)
2009	371,325	1,283.2	1,802.4	3.5	4.9	89,860,749	310,546	436,178	0.62
2010	407,587	1,558.2	2,121.3	3.8	5.2	99,858,818	381,754	519,713	0.70
2011	455,086	1,710.6	2,245.1	3.8	4.9	111,951,241	420,796	552,285	0.68
2012	471,629	1,920.7	2,461.0	4.1	5.2	116,020,691	472,495	605,396	0.71
2013	516,603	2,238.1	2,813.2	4.3	5.4	126,051,206	546,108	686,413	0.77
2014	556,449	2,535.9	3,074.9	4.6	5.5	135,773,574	618,750	750,276	0.81
2015	611,228	2,876.5	3,266.9	4.7	5.3	147,917,150	696,124	790,582	0.87
2016	648,858	2,994.8	3,216.4	4.6	5.0	158,970,262	733,736	788,007	0.85
2017	721,067	3,340.1	3,446.2	4.6	4.8	174,498,262	808,298	833,986	0.88
2018	808,832	3,750.3	3,750.3	4.6	4.6	196,546,261	911,333	911,333	0.93

Source: ACH Colombia.

Table 1.21
ACH Colombia
(Participants and concentration in the value of payments sent)

Year	Transactions Credit			Transactions Debit		
	Number of participants	CR5 indicator (percentage)	Number of participants that clear 70% of the value	Number of participants	CR5 indicator (percentage)	Number of participants that clear 70% of the value
2009	19	69.6	5	15	75.5	4
2010	19	70.1	5	15	72.6	5
2011	21	68.0	6	21	77.8	5
2012	20	76.1	6	20	71.2	5
2013	21	68.5	5	21	93.5	5
2014	20	70.24	5	20	92.1	5
2015	20	70.22	5	20	88.1	5
2016	20	73.50	5	20	85.3	5
2017	23	73.80	5	23	91.00	5
2018	25	74.32	5	25	92.91	5

Source: ACH Colombia.

SOP Service in the Last Decade

One of the most relevant functionalities used by private individuals and companies in the acquisition of goods and services from 2008 to 2018 is the so-called "secure online payment button," better known as the SOP, which was implemented by ACH-Colombia.

This functionality allows companies to offer their customers (private individuals or other companies) the possibility of making payments or purchases on the Internet, by debiting the resources from the client's financial institution and depositing them in the account of the financial institution defined by the company or merchant.

The benefits of this service are:

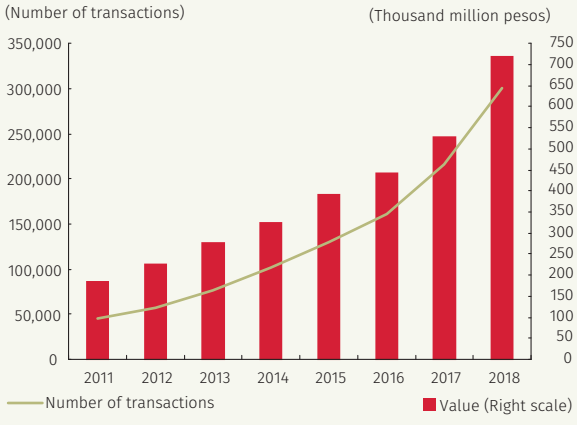
1. Speed and efficiency in the sale or collection process.
2. Ease in operational processes and in reconciling information.
3. Security in managing information and financial resources.
4. Reductions in costs and processing time.[1]

Graph A illustrates how use of the SOP button has evolved. In 2011, the daily average was 185.3 tm. It rose to 720 tm in 2018, which implies a compound annual growth rate of 21.4%. Similarly, the increase in the average number of transactions per day was 31.33% for the same years.

To supplement the statistics on the use of electronic funds transfers as a payment instrument, and with the information submitted by commercial banks from 2010 to 2018, Table A shows the

1 Source: ACH Colombia.

Graph A
Value and Number of Transactions SOP service (ACH Colombia)
(Daily averages)



Source: ACH Colombia.

figures for intrabank transfers,[2] in which both the originator and the recipient of the funds belong to the same banking entity. Therefore, these transfers are not cleared through the ACHs.

Intrabank transfers during 2018, with regard to the number of transactions, accounted for 146.2% of interbank operations. In other words, this is an increase of 70% over 2017. As for value, intrabank transactions came to 2.7 times more than the number of interbank operations.

Table A
Comparison between Interbank and Intrabank Transactions in Value and Number

Year	Interbank transactions cleared [a/]		Intrabank transactions [b/]			
		Value	Number of transactions		Value	
	(Number of transactions)	(Thousand million pesos)	(Number of transactions)	(As a percentage of interbank transactions)	(Thousand million pesos)	(Number of times GDP)
2010	107,490,493	495,529.2	74,964,949	69.7	1,436,046	2.9
2011	122,038,372	543,892.5	82,950,682	68.0	1,347,365	2.5
2012	125,492,716	605,127.9	70,701,523	56.3	1,005,437	1.7
2013	135,774,984	694,221.8	96,171,547	70.8	1,050,129	1.5
2014	147,384,496	782,417.0	112,103,184	76.1	1,025,864	1.3
2015	158,744,900	871,037.9	145,895,871	91.9	1,581,650	1.8
2016	186,252,796	1,001,336.4	189,358,265	101.7	2,393,927	2.4
2017	186,252,796	1,001,336.4	179,104,744	96.2	2,138,592	2.1
2018	208,279,324	1,113,692.7	304,602,311	146.2	2,965,085	2.7

a/ Corresponds to the number and value of the transactions cleared through ACH Cenit and ACH Colombia.
b/ These are that are settled within each financial institution and do not go through the ACH.
Sources: commercial banks and ACH.

2 Includes transfers via Internet, interactive voice recognition (IVR), and offices.

1.5.3 Payment Instruments

Cash, cards (debit and credit), checks and electronic funds transfers (debit and credit) are among the main payment instruments used in the Colombian economy to discharge monetary obligations in the market for goods and services.

Cash and cards are the payment instruments used most often by private individuals, while legal entities tend to rely more on transfers and checks (Table 1.22).

These instruments, other than cash (banknotes and coins), are characterized by the fact that they involve an electronic process or have an electronic format at some point in the payment processing cycle (e.g., checks). They are used to convey orders for the transfer of funds from the payer's account with a financial institution to a payment beneficiary for a variety of reasons, such as to pay for goods and services provided by the beneficiary or to transfer resources as such, or all of the above.

Table 1.22
Main Payment Instruments in the Colombian Economy

Market	Instrument	Greatest Use by Type of Person or Entity	
		Private individuals	Legal entities
Goods and Services	Cash	X	
	Debit cards	X	
	Credit cards	X	
	Checks		X
	Electronic Funds Transfers		X

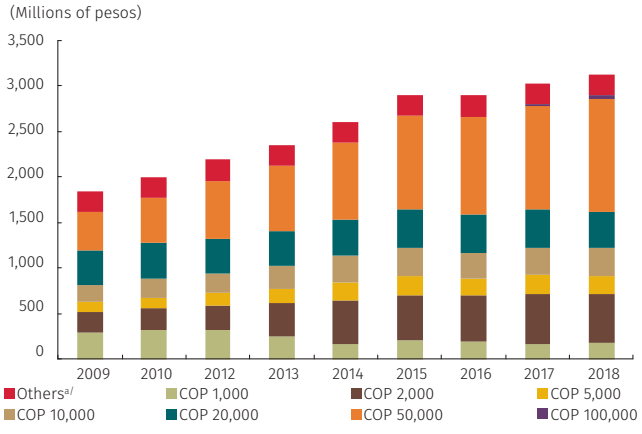
Source: *Banco de la República* (DSIF).

1.5.3.1 Cash

Banco de la República conducts a survey to monitor the use of cash as a payment instrument.[26] Another way to track the use of cash is to analyze the circulation of banknotes and coins. This variable is understood as an approximation to the potential use of cash in the economy, not as a direct reference to payments made in cash.

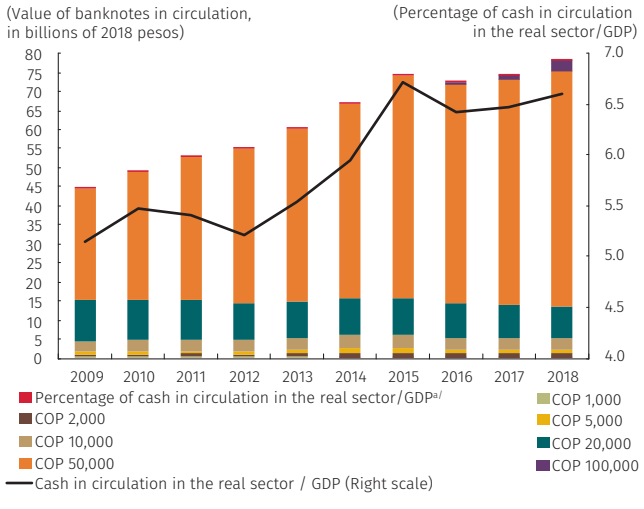
26 The latest survey covers the first half of 2017. It indicates cash is used in most routine monthly payments for food, beverages, clothing, transportation, housing and public utilities, among other items (with respect to the number and value of these transactions, 92% and 90% involve cash, in that order). Similarly, businesses ratify the public's response and say that cash is the instrument of payment its customers prefer. The findings of this survey are described, in detail, in Chapter II of *Reporte de Sistemas de Pago de 2017* (www.banrep.gov.co/es/publicaciones/reporte_de_sistemas_de_pago_2017).

Graph 1.25
Banknotes in Circulation



a/ Pertains to the following denominations: COP500, COP200, COP100, COP50, COP20, COP10, COP5 COP2 COP1
Source: Calculations by *Banco de la República.*

Graph 1.26
Value of Banknotes in Circulation and Cash/GDP



a/ Pertains to the following denominations: COP500, COP200, COP100, COP50, COP20, COP10, COP5 COP2 COP1
Source: Calculations by *Banco de la República.*

With respect to how banknotes in circulation evolved up to 2018, Graph 1.25[27] shows the number of notes increased annually between 2009 and 2018 by 6%, on average, reaching 3,124 million units by 2018.

As to the number of banknotes, by denomination, the high denominations - one hundred thousand pesos (COP 100,000), fifty thousand pesos (COP 50,000), twenty thousand pesos (COP 20,000) and ten thousand pesos (COP 10,000) - accounted for around 63%. The other 37% was comprised of low denominations: five thousand pesos (COP 5,000), two thousand pesos (COP 2,000), and the remaining denominations.[28]

Graph 1.26 shows how the total value of banknotes in circulation evolved during 2009-2018. The average growth in real value during that period was around 7%, representing nearly COP 78.3 b. in 2018.

As to the total value in circulation in 2018, by denomination, the fifty thousand peso note (COP 50,000) accounted for 79%; the twenty thousand peso note (COP 20,000), 10%; and the ten thousand peso note (COP 10,000), 4%. The other denominations were under 4% each.

During the same period, the amount of cash in circulation in the real sector, as a share of GDP, averaged 5.89% and has exhibited a growing trend in recent years. In 2018, that share was 6.60%.

1.5.3.2 Cards

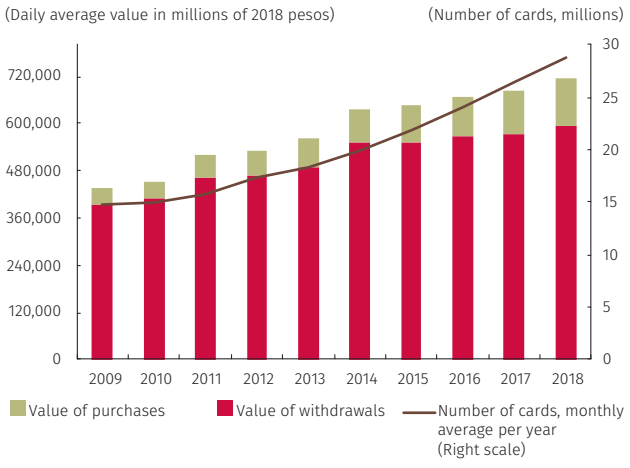
The use of debit and credit cards has grown steadily in the last decade (Graph 1.27). The number of debit cards averaged 28.7 m per month in 2018, for a daily average value of COP 714.9 tm, with withdrawals accounting for 83% and purchases, the remaining 17%.

27 Only the growth in banknotes is discussed, since these accounted for 98% of the cash in circulation during 2009-2018, on average. Coins made up the other 2%.

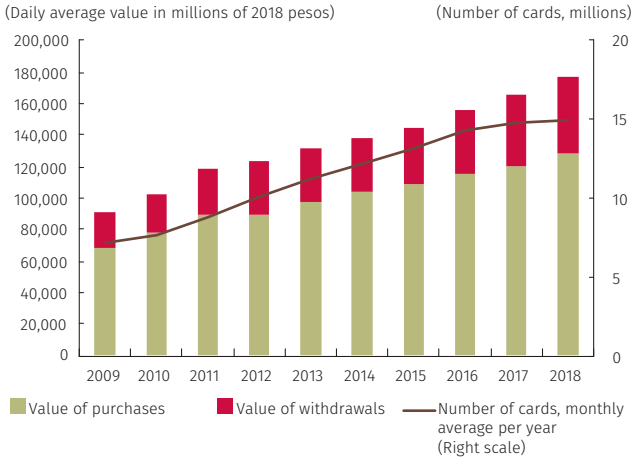
28 The fifty thousand peso banknote (COP 50,000) represents the largest share, with 40%, followed by the twenty thousand peso note (COP 2,000) with 17%.

Graph 1.27

A. Debit cards

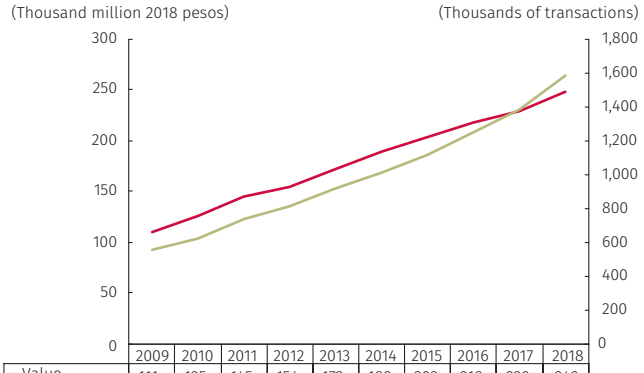


B. Credit cards



Sources: Office of the Financial Superintendent of Colombia; calculations by *Banco de la República.*

Graph 1.28
Debit and Credit Card Purchases
(Daily average)



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Value	111	125	145	154	172	189	203	218	229	249
Number of transactions	558	626	735	811	916	1,015	1,117	1,248	1,382	1,581

Source: Office of the Financial Superintendent of Colombia.

The average number of credit cards per month was 15.0 m in 2018. Daily credit-card use during that period averaged COP 176.3 tm, with purchases accounting for around 73% and cash advances, 27%.

In the last decade, debit and credit card purchases trended upward in both value and number of transactions. By 2018, the daily average value was COP 249 tm and the number had risen to 1.5 m transactions (Graph 1.28).

Given the information on purchases reported by commercial banks, Graph 1.29 shows that 94% of the value of debit card purchases and 88% of the value of credit card purchases originate with private individuals. The majority of their transactions involve individual operations for amounts up to COP 1 m (74% with debit cards and 60% with credit cards).

1.5.3.3 Checks

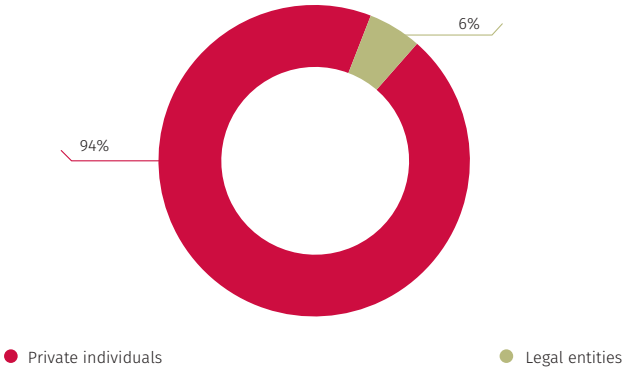
Although the use of checks has declined in the last decade, inter and intra-bank checks together accounted for COP 1.07 b in daily average gross payments during 2018. This is a representative amount of all payments in the market for goods and services.

A similar trend also is evident in the series for interbank checks. One sees an annual decline in both the value and number of transactions, with a daily average of COP 777 tm and 47,000 transactions in 2018 (Graph 1.30).

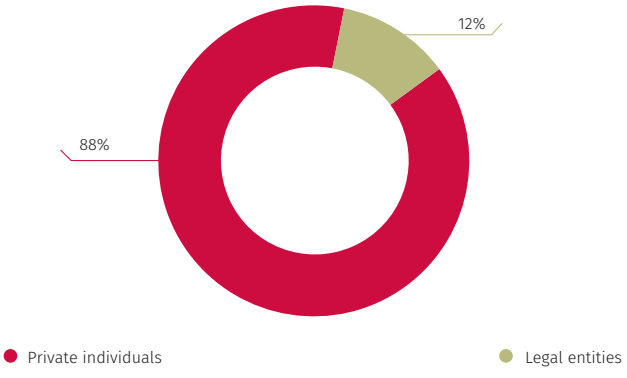
Based on data reported by commercial banks with respect to value, Graph 1.31 shows that 82% of all checks are written by companies and the other 18%, by private individuals. The majority of checks written by companies (43%) are checks for up to COP 50 million each; 55% of the checks written by private individuals are also for amounts up to COP 50 million.

Graph 1.29
Debit and Credit Cards by Issuer:
(Share of the value)

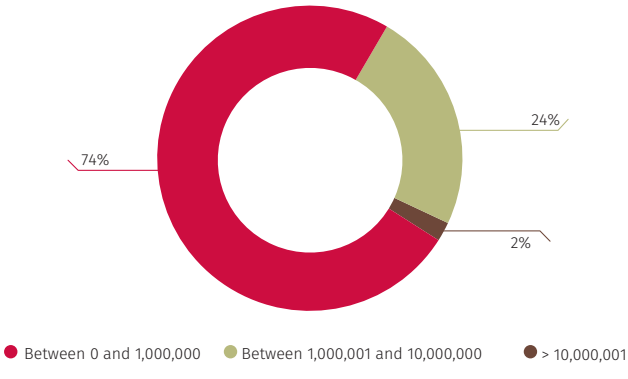
A. Debit cards
i. Total



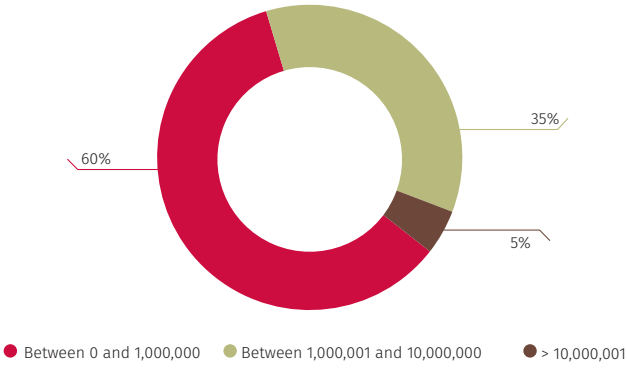
B. Credit cards
ii. Total



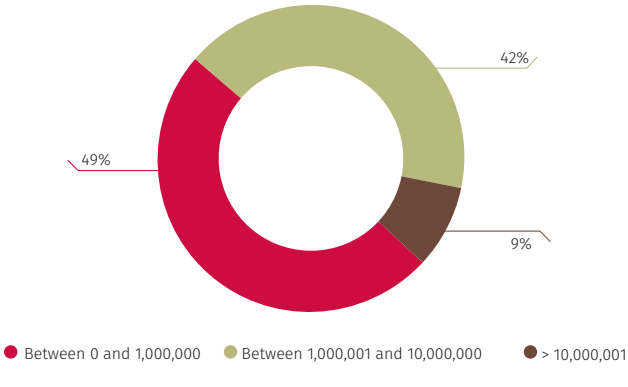
ii. Private individuals



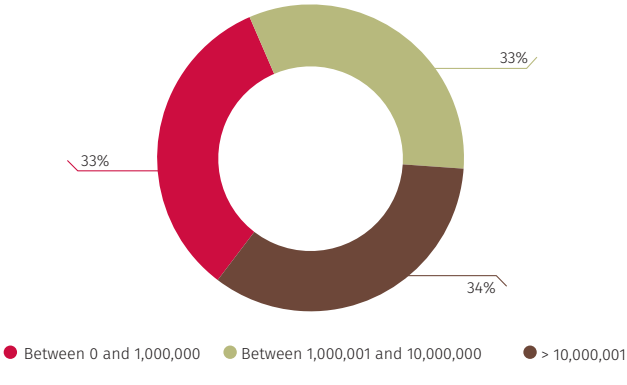
ii. Private individuals



iii. Legal entities



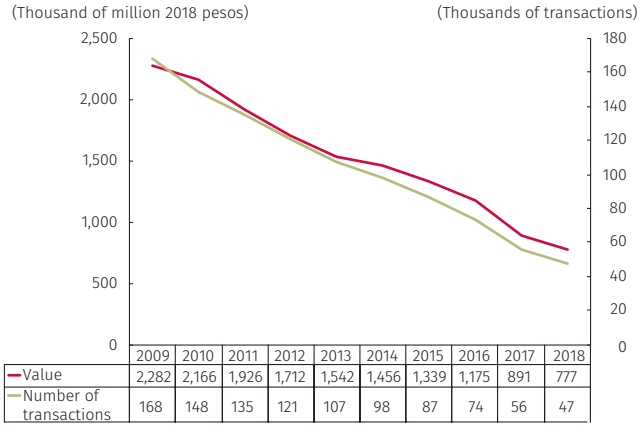
iii. Legal entities



Source: Commercial banks

Source: Commercial banks

Graph 1.30
Interbank Checks
(Daily average)

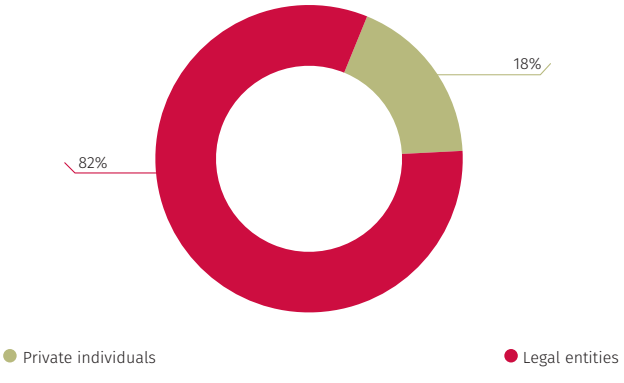


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Value	2,282	2,166	1,926	1,712	1,542	1,456	1,339	1,175	891	777
Number of transactions	168	148	135	121	107	98	87	74	56	47

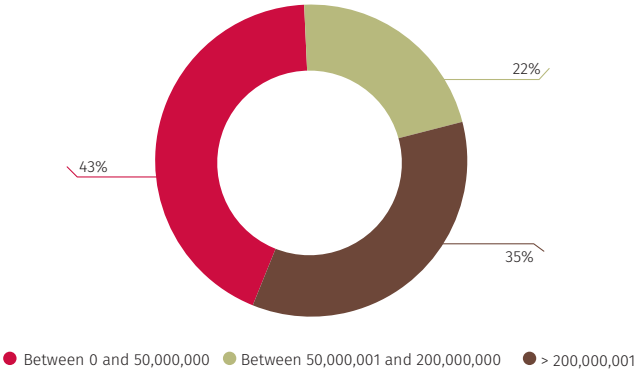
Source: *Banco de la República.*

Graph 1.31
Checks by Issuer, 2018
(Share of the value)

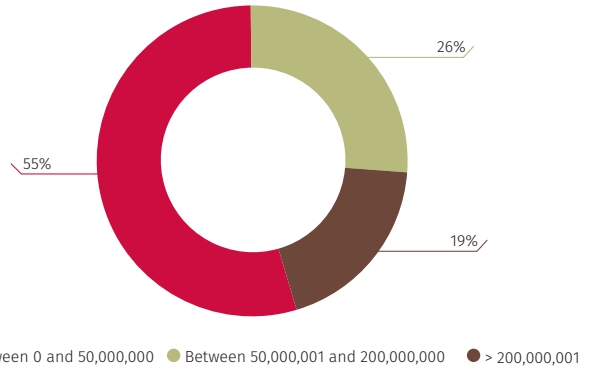
A. Total



B. Legal entities



C. Private individuals



Source: Commercial banks.

1.5.3.4 Electronic Transfers

The use of transfers (debit and credit) has increased in recent years. In 2018, inter and intra bank transfers jointly accounted for COP 16.79 b in average gross daily payments, making transfers the most widely used electronic instrument in Colombia in the market for goods and services.

Interbank transfers (those conducted by ACH Colombia and ACH Cenit) also have exhibited an upward trend, both in value and the number of transactions, posting a daily average of COP 4.6 b and 857,000 transactions in 2018 (Graph 1.32).

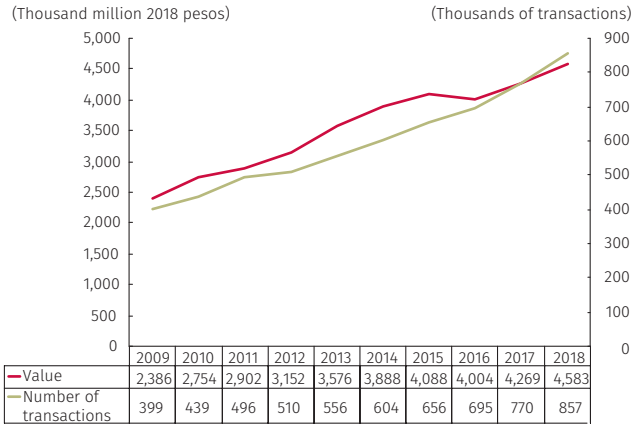
According to data provided by ACH Colombia (COP 3.7 b, daily average), 97% of the transfers are entrepreneurial in origin and only 3% are used by private individuals (Graph 1.33).

Fifty-eight per cent of the transfers made by companies are for more than COP 200 million and 93% made by private individuals are for less than COP 50 million.

1.5.3.5 Comparative Use of Instruments with Electronic Processes: Cards, Checks and Transfers

The information on payment instruments presented in this section is divided between private

Graph 1.32
Interbank Transfers
(Daily average)

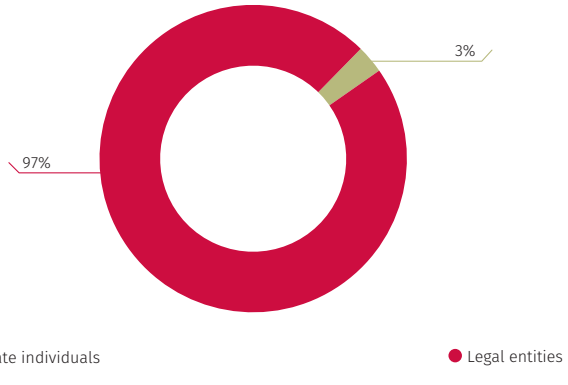


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Value	2,386	2,754	2,902	3,152	3,576	3,888	4,088	4,004	4,269	4,583
Number of transactions	399	439	496	510	556	604	656	695	770	857

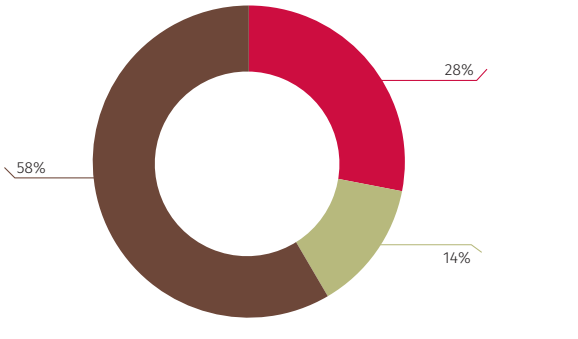
Sources: ACH Colombia and *Banco de la República.*

Graph 1.33
Transfers by Issuer, 2018
(Share of the value)

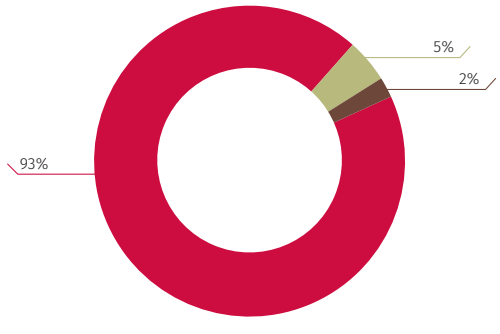
A. Total



B. Legal entities



C. Private individuals



Sources: Commercial banks.

individuals and legal entities. This classification is based on the type of person or institution that initiates the transaction. As mentioned earlier, private individuals use debit and credit cards the most, while transfers are more often used by legal entities.

1.5.3.5.1 The Number of Transactions

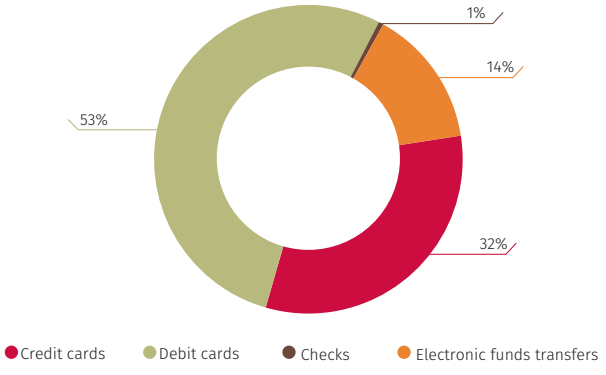
As Graph 1.34 illustrates, 53% of the number of transactions conducted by private individuals in 2018 were with a debit card and 32%, with a credit card. This adds up to a share of 85%. Transfers account for 14% and checks, 1%. In the case of legal entities, transfers constituted the largest share, with 85%, while the use of cards (10%) and checks (5%) was low.

1.5.3.5.2 The Value of Transactions

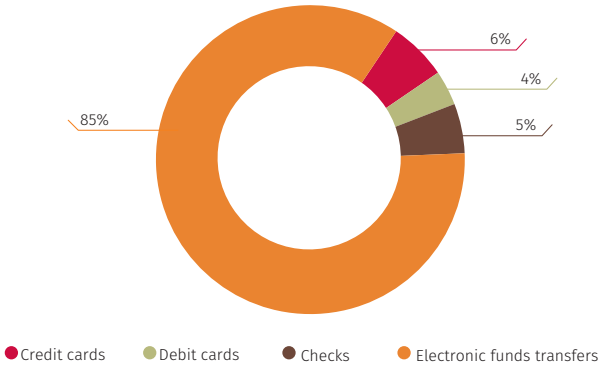
Debit cards made up 24% of the value of transactions originating with private individuals and credit cards, 23%; together they accounted for 47% (Graph 2.15). Checks represented 29% and transfers, 24%. In the case of legal entities, transfers made up 85% of the value and checks, 15% (these entities use cards very little).

Graph 1.34
Share of the Number of Transactions, 2018

A. Private individuals



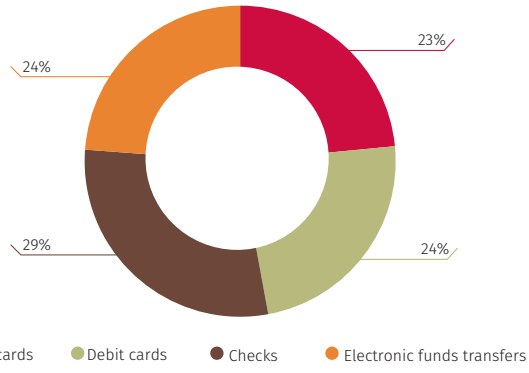
B. Legal entities



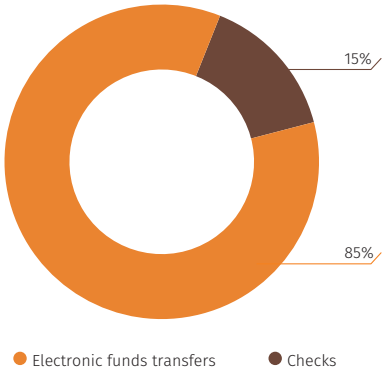
Sources: Office of the Financial Superintendent of Colombia, ACH Colombia, *Banco de la República* and commercial banks; calculations by *Banco de la República*

Graph 1.35
Share of the Value, 2018

A. Private individuals



B. Legal entities



Sources: Office of the Financial Superintendent of Colombia, ACH Colombia, *Banco de la República* and commercial banks; calculations by *Banco de la República.*

Box 1
Payment Channels

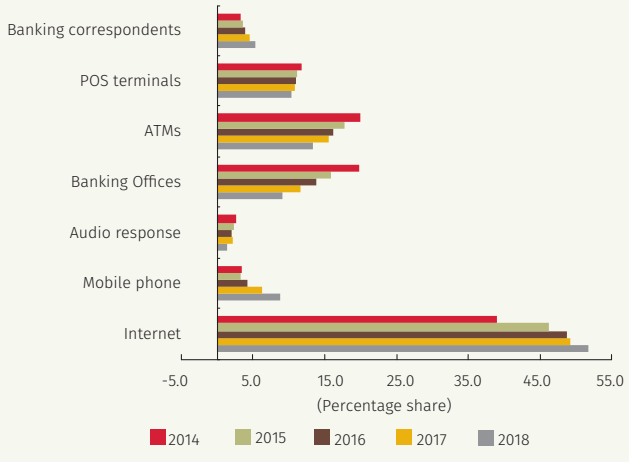
To fulfill their payment obligations, users of banking services (financial consumers) carry out multiple transactions through access channels that connect the payer and the beneficiary with the financial institution that processes the payment. The evolution of transactional channels is analyzed in this section, using figures from the Office of the Financial Superintendent of Colombia (SFC) on the number and value of transactions, failures in transactional channels, and transaction costs. The issue of security in credit and debit card transactions, and in electronic funds transfers is reviewed as well, using data on cybercrime compiled by the Colombian National Police. For the purposes of this section, access channels are classified as face-to-face (bank offices, ATMs, POS terminals, and banking correspondents) and indirect (Internet, mobile phone, and audio response).

1. Access and Transactional Channels

The SFC figures indicate POS terminals were the transactional channel used the most in 2018 (435,836 transactions), followed by banking correspondents (134,318), ATMs (16,192) and banking offices (6,338). However, between 2009 and 2018, the channel with the highest average annual growth rate was that comprised of banking correspondents (47%), followed by POS terminals (14%), ATMs (7%) and banking offices (2%).[1]

Monetary operations (money movement and transfers) and non-monetary operations (balance inquiries) are carried out in transactional channels (face-to-face and indirect), and recent years have seen a rising trend in both these types of operations. According to the SFC figures, approximately 5.88 m transactions were conducted daily in 2009, on average, while this amount was around 16.71 m by 2018. Face-to-face channels accounted for 38.18% of the total number of transactions in 2018; the rest were carried out through indirect channels (61.82%). This last group includes the Internet (51.67%) and mobile phones (8.73%), respectively averaging 8,634,848 and 1,459,110 transactions daily. As illustrated in Graph B1.1, these two channels have increased their share of the total number of transactions since 2014, contrary to what was observed for the audio-response channel (236,732 transactions).

Graph B1.1
Number of Transactions per Channel



Source: Office of the Financial Superintendent of Colombia (*Informe de operaciones*); calculations by *Banco de la República* (DSIF).

There has been a decline in the share of face-to-face channels in the number of transactions. The most representative of these channels in 2018 were the ATMs (13.39%, equivalent to 2,238,304 transactions), POS terminals (10.43%; 1,742,049 transactions), and banking offices (9.03%; 1,508,335 transactions). Banking correspondents are the only channel with a growing share (5.33%, 890,855 transactions).

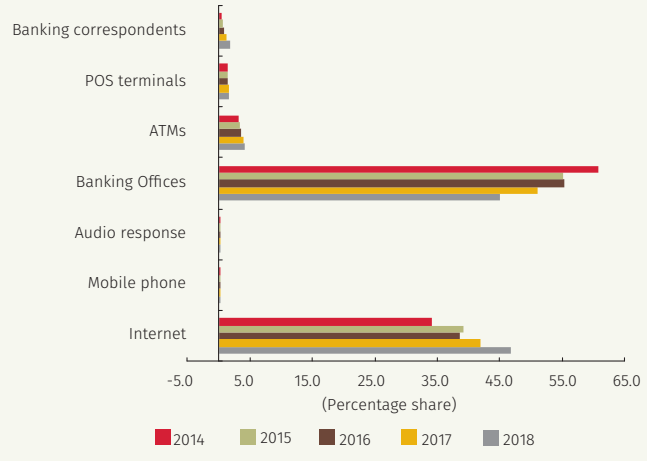
In contrast to what was observed in 2016, most of the channels increased their participation in the number of transactions. The largest growth was in mobile phones (169.89%), the Internet (37.32%), POS terminals (23.08%) and ATMs (7.12%). The proportions for banking offices (-15.20%) and audio response (-12.23%) declined.

The average daily value of transactions (expressed in 2018 prices) has increased as well, from COP 15.1 m in 2009 to COP 16.3 m in 2018. A look at the channels, by type, shows a considerable share for indirect channels (Graph R1.2), both in 2017 (42.15%) and in 2018 (47.16%). In fact, the findings for 2017 are due largely to transactions via the Internet (46.80%), which averaged COP 7.6 b daily. The share of face-to-face channels in the value of transactions depends mainly on banking offices, which accounted for 45% of the total; this implies a daily average of COP 7.3 b in transactions. The channels below COP 700,000 m include ATMs (COP 695,533

1 Banking correspondents provide the population access to financial services in remote areas.

m), banking correspondents (COP 310,686 m), POS terminals (COP 278,721 m), mobile phones (COP 53,662 m), and audio response (COP 5,745 m). The figures on record for 2016 show the value of operations carried out at banking offices declined by 25%, while the value of operations conducted via the Internet was up by 13%.

Graph B1.2
Value of Transactions per Channel



Source: Office of the Financial Superintendent of Colombia (*Informe de Operaciones*); calculations by *Banco de la República* (DSIF).

According to these findings, the Internet was the channel through which more transactions were carried out, both in number and value. Banking offices have lost participation, but continue to be a channel with a significant share.

Considering the channels are supported by a high technological content, two aspects related to the use of technology are considered: failures and security. These are taken into account to better understand the findings. Also included is an approximation of the costs in transactional channels, as another aspect that may explain the changes in their use.

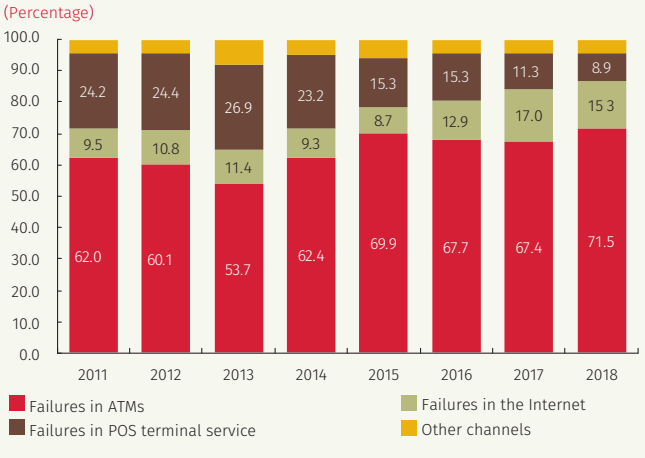
2. Failures in Transactional Channels

The information in the annual report on complaints lodged against the institutions overseen by the SFC includes records of failures in transactional channels. These are related to security aspects (ATMs, Internet and POS terminals) and operational disruptions (office network, mobile devices and audio response).[2] The reasons why the SFC classifies complaints as failures in each of these channels are described briefly, as follows:

- ATM failures, related mostly to: 1) third party assistance resulting in fraud; 2) card cloning; 3) an ATM that debits the deposit account but does not dispense the cash; and 4) double debit.
- Internet failures, owing to: 1) Internet purchases on fraudulent trading platforms, and 2) crashes in Internet connections that do not allow the transaction to be completed, but the deposit account is debited anyway.
- POS terminal failures, consisting of: 1) system problems that generate a double debit of the transaction value, or 2) when the seller introduces a different value into the POS terminals than that of the purchase.
- Failures in the network of banking offices, mainly related to operational issues, such as system downtime.
- Failures in mobile devices (cellular-agenda): these occur when the financial entity's mobile application (app) does not work.
- Failures in audio response, related to the type of transaction, for example: i) cases where the transaction is not carried out (such as mobile phone recharge, or payment of the PIN to process a visa); ii) a call is cut-off, or iii) there is a delay in attending to a call.

Presented below are figures on failures in the aforementioned transactional channels, considering – as a point of reference – that the total number for 2018 (153,478) is comparatively low with respect to the number of registered transactions (6,099,235,462). Even so, their share of the total number of failures, per year, will be taken as a reference to compare the transactions, by channels. Graph B1.3 shows the failures for the most representative channels noted in the

Graph B1.3
Failures Registered by Type of Channel



Source: Office of the Financial Superintendent of Colombia (*Reporte de quejas*); calculations by *Banco de la República* (DSIF).

2 Complaints filed for disagreements or dissent with banking correspondents are not quantified by the SFC as a separate item. Instead, they are entered under savings accounts, office network failures or as complaints per correspondent contract (in cases where the establishment does not recognize the commission charged for the service provided).

complaint report (ATMs, the Internet and POS terminals). The failures recorded for banking offices, mobile devices and audio response are grouped together in the category entitled "other channels".

The higher number and value of transactions conducted through the Internet contrasts with its moderate share in the number of failures. The opposite is true of ATMs, for which participation is lower in both the number and value of transactions; however, ATMs also have an increasing share in the number of failures. These channels offer different services to financial users, since payments and transfers are made via the Internet, while cash can be accessed as well at ATMs.

3. Transaction Costs

The financial price measurements taken by the National Bureau of Statistics (DANE) and the National Association of Financial Institutions (ANIF) are available in aggregate form, and by product. Consequently, this information cannot be applied to study the cost of using each of the channels.[3] The SFC's Financial Consumer Price Index (FCPI) is grouped by product, but also reports disaggregated data that does make it possible to indirectly examine the cost of using transactional channels, by way of spending. Accordingly, this index is reviewed below to examine the effect these costs can have on transactions.

Every six months, the FCPI evaluates the change in the rates credit establishments charge to private individuals for the financial products and services they offer. The index is made up of fixed expenses (management fees for savings accounts and bank cards) and variable expenses (withdrawals, transfers and advances, among others), with this last component being related to some of the transactional channels.

The proportions of the total expense represented by the items contained in the index are grouped as described below in order study what financial consumers spend on transactions. The proportions of expenses pertaining to management fees on savings accounts, debit cards and credit cards are added for the fixed component.

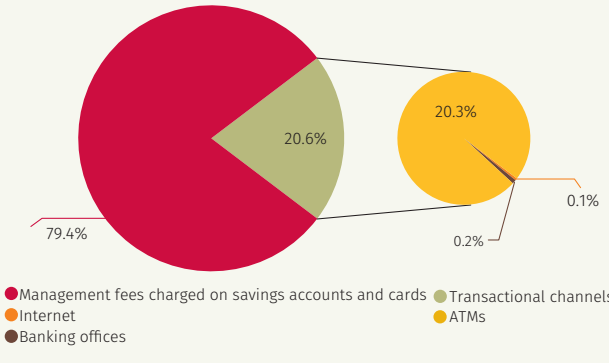
Subgroups are constructed for the variable component to examine two face-to-face transactional channels (ATMs and banking offices) and one indirect channel (the Internet). Added to the ATM subgroup are expenses for balance inquiries using the entity's ATM; cash withdrawals using the entity's ATM; transfers via ATM to a different account holder with the same entity; balance inquiries using the ATM of another entity; cash withdrawals using the ATM of another entity; payments to third parties using the ATM of another entity; cash advances using the entity's own ATM, and cash advances using the ATM of another entity.

The subgroup comprised of banking offices depends solely on the component entitled "in-office cash advances," while the Internet subgroup is made up of expenses for transfers via the Internet from a savings account to accounts held by others with the same entity; payments made to third parties via the Internet, using a savings account; and credit card advances via the Internet.

The FCPI is calculated based on a Fisher index that is defined as the geometric mean between the Laspayres (fixed weighted) and Paasche (variable weighted) indexes. In the latest revision of the index, the fixed weights were established by the SFC, using December 2014 as the base. The findings consist of price variations, with respect to the immediately preceding six-month period, and weights in the total expenditure for financial consumers.

The fixed-costs component calculated with figures for the first half of 2018 shows these expenses represented 79.4% of the total, while variable costs accounted for the remainder (Graph B1.4). This last component can be used to evaluate the relative cost of using transactional channels.

Graph B1.4
Composition of Aggregate Spending by Financial Consumers



Source: Office of the Financial Superintendent of Colombia (*Informe sobre la evolución de las tarifas de los servicios financieros*); calculations by *Banco de la República.*

In contrast with what was observed for the second half of 2017, when variable expenses accounted for 13.24% of the total, the outcome for the first six months of 2018 (20.63%) is attributed mainly to the ATM channel (20.32%) and, in a very small proportion, to banking offices (0.20%) and the Internet (0.11%). The rise in spending on the ATM channel is due to a general increase

3 The DANE index is comprised of the consumer price index (CPI) for banking services and the CPI for other financial services, while the ANIF index includes the bank cost index (ICBA); namely, ICBA - savings accounts, ICBA - credit cards, and ICBA - Internet banking.

in the fees charged for all its components, the highest being for cash withdrawals at the bank's ATMs (36.29%). The findings for banking offices are explained by the increase in fees for in-office cash advances (5.12%), while the findings for the Internet are attributed to an increase in the cost of cash advances on a credit card (8.44%).

As part of the basket of products in the variable-expense component of the FCPI, transactions via the Internet continue to account for the lowest share. This coincides with ANIF's report on banking costs (ANIF, 2018), which indicates most credit establishments reduced or eliminated charges in that channel (for payments to third parties and transfers to other entities). According to Decree 4809/ 2011 (Article 2.35.4.2.5), the fees credit establishments charge to their customers for balance inquiries and Internet transactions may not exceed those charged in other channels. This can be viewed as an incentive for financial consumers to increase their Internet use, which is precisely what was observed in that channel (both in the number of transactions and their value).

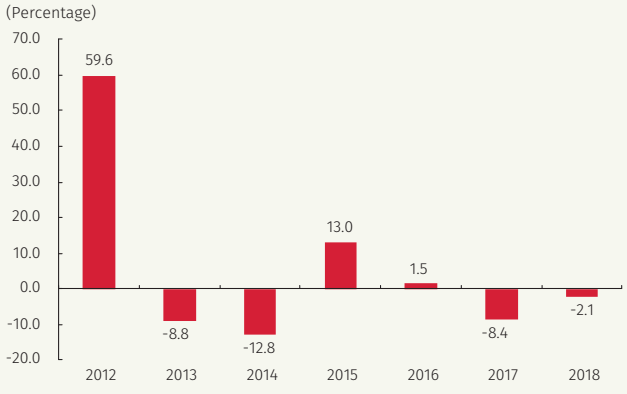
4. Security in Face-to-Face and Indirect Channels

The review of security aspects in face-to-face channels is based on information from the annual report of complaints lodged against institutions that are supervised by the SFC, specifically complaints about security at their facilities. During 2018, 372 complaints were registered, as opposed to 380 in 2017. In contrast to what was observed in 2012 and 2015, the latest findings suggest there are fewer complaints of this type, most notably in 2017 and 2018, as shown in Graph B1.5.

Attacks on security in indirect channels are related to cybercrimes. According to Law 1273/2009 in the Criminal Code, these threaten the protection of information, data and computer systems, and include, among others, crimes that can affect transactions in indirect channels through phishing, smishing, vishing, skimming and the use of malicious software. The definitions afforded to these crimes by the Colombian National Police Cyber Center are summarized below:

- *Phishing*: use of fake websites and emails to obtain confidential information, such as passwords and credit card information.
- *Smishing*: use of social engineering techniques in text messages or chats on WhatsApp to obtain personal information from mobile phone users.
- *Vishing*: phone calls using voice over Internet protocol (VoIP) and social engineering to access financial information that can be used for identity theft.

Graph B1.5
Number of Complaints About Security at Banking Facilities

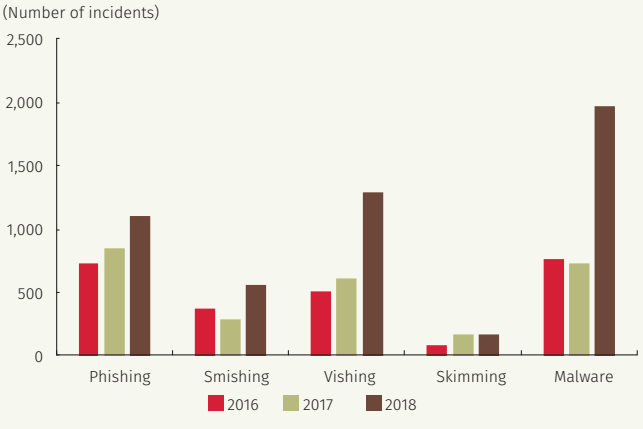


Source: Office of the Financial Superintendent of Colombia (*Informe sobre quejas*); calculations by *Banco de la República.*

- *Skimming:* cloning bank cards (debit and credit) through information extracted for subsequent fraudulent use when the owner uses an ATM.
- Use of malicious software (*malware* or spyware) to access information the user types into his or her computer.

The figures compiled by the Colombian National Police on cybercrime show growing trends in most of its forms (Graph B1.6). Between 2017 and 2018, there were considerable increases in the use of malware (166.94%), vishing (108.59%), smishing (94.52%) and phishing (30.39%). Despite the low number of reported cases, this trend reveals the potential risk cybercrime can pose to those who use mobile banking (Internet and mobile phone communication) and electronic transactional channels (ATMs and POS terminals). The evolution of the payment channels in 2009-2018 is outlined below in graphic form, highlighting the growth in the Internet, both in the number and value of transactions (Graphs B1.7 to B1.12).

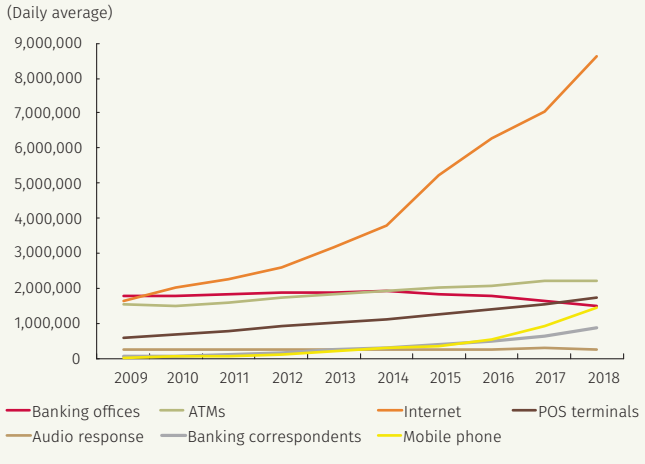
Graph B1.6
Number of Incidents Reported per Type of Cybercrime



Source: Centro Cibernético Policial de la Policía Nacional.

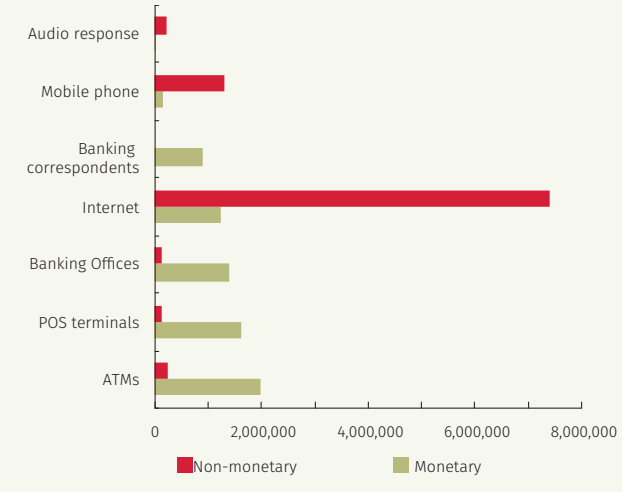
Evolution of the Payment Channels over the last Ten Years

Graph B1.7
Payment Channels
(Number of transactions)



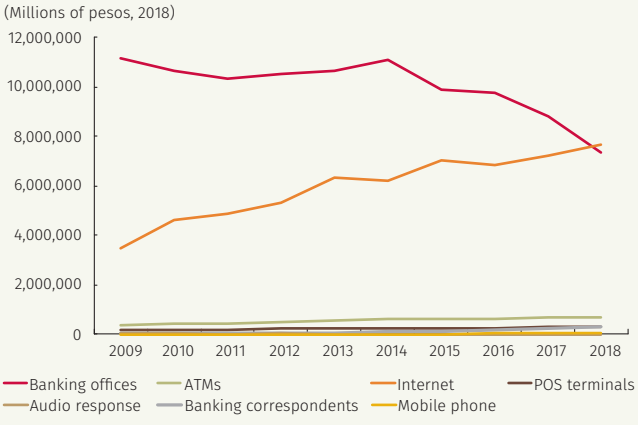
Source: Office of the Financial Superintendent of Colombia (*Informes de operaciones, 2009-2018*); calculations by *Banco de la República* (DSIF).

Graph B1.8
Payment Channels
(Daily average number of transactions in 2018)



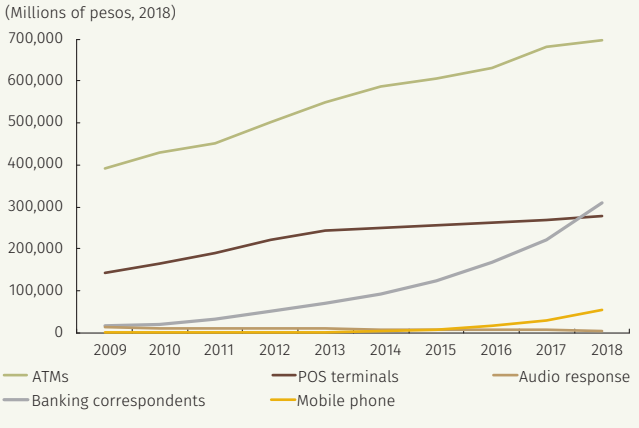
Source: Office of the Financial Superintendent of Colombia (*Informes de operaciones, 2009-2018*); calculations by *Banco de la República* (DSIF).

Graph B1.9
Payment Channels
(Daily average value)



Source: Office of the Financial Superintendent of Colombia (*Informes de operaciones, 2009-2018*); calculations by *Banco de la República* (DSIF).

Graph B1.10
Payment Channels
(Daily average value)
(Below 700,000 million pesos)

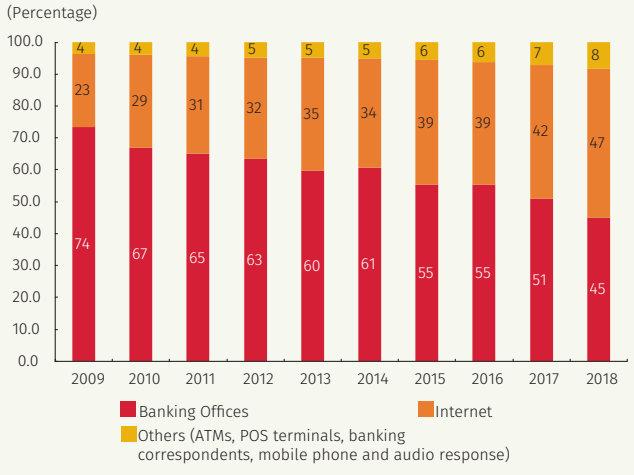


Source: Office of the Financial Superintendent of Colombia (*Informes de operaciones, 2009-2018*); calculations by *Banco de la República* (DSIF).

Graph B1.11
Main Payment Channels
(Share, by the number of transactions)

Source: Office of the Financial Superintendent of Colombia (*Informes de operaciones, 2009-2018*); calculations by *Banco de la República* (DSIF).

Graph B.1.12
Main Payment Channels: Banking Offices and the Internet
(Share, by value of the transactions)



Source: Office of the Financial Superintendent of Colombia (*Informes de operaciones, 2009-2018*); calculations by *Banco de la República* (DSIF).

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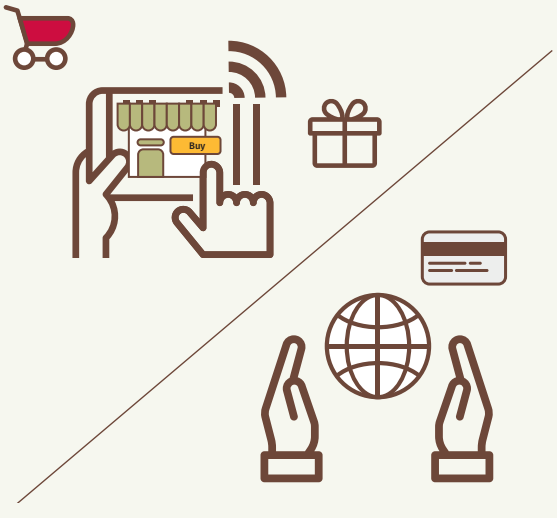
Box 2
Participation of Large Technology Companies in the Market for Retail-Value Payments

The surge in global e-commerce has created a new space for transactions in the market for goods and services. Through different platforms, consumers have gained access to a wide range of products that can be purchased with instruments ranging from cash to traditional electronic alternatives (cards or electronic funds transfers) to new forms of payment created, in most cases, on the basis of those instruments. These new payment instruments have emerged through technological innovations in financial services, as well as acceptance by the consumer (payer), merchants (payment recipients) and in new subsequent regulations (Diagram B2.1).

Large technology companies have played a predominant role in directly giving consumers different alternatives for making purchases 24/7 and from anywhere in the world. In other words, large, well-capitalized firms, such as Alibaba, Amazon, Apple and Google, among others, offer door-to-door delivery of purchases, and payment implies just one step for the consumer in a transaction chain that is fast and integrated. Payment service providers have worked increasingly to respond to changes, seeking greater availability and interoperability in order to provide more benefits to their users.

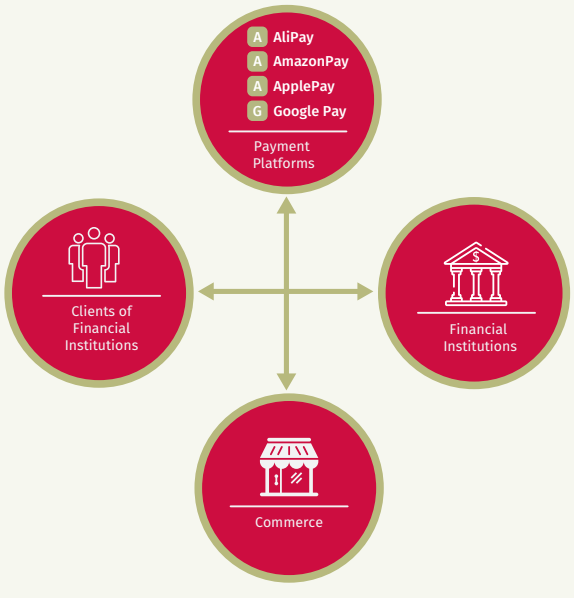
Diagram B2.1
E-commerce and Payment Instruments



Source: *Banco de la República.*

In an effort to make the chain of purchase for goods or services "a single step" for the buyer; that is, to integrate both purchase and payment, some companies, such as the largest technology firms, are situated between the bank and the customer (Diagram B2.2). They offer an infrastructure characterized by data storage and processing capacity (with a high level of automation and agile software development) that now includes virtual payment platforms (Surane, 2019; Basel Committee on Banking Supervision, 2018; Farooqui, 2019). These platforms are offered to electronic and face-to-face retailers for processing payments made by their customers. In turn, customers first must have the respective application in the device of their preference (mobile phone, tablet or computer) and complete a registration process (Diagram B2.3).

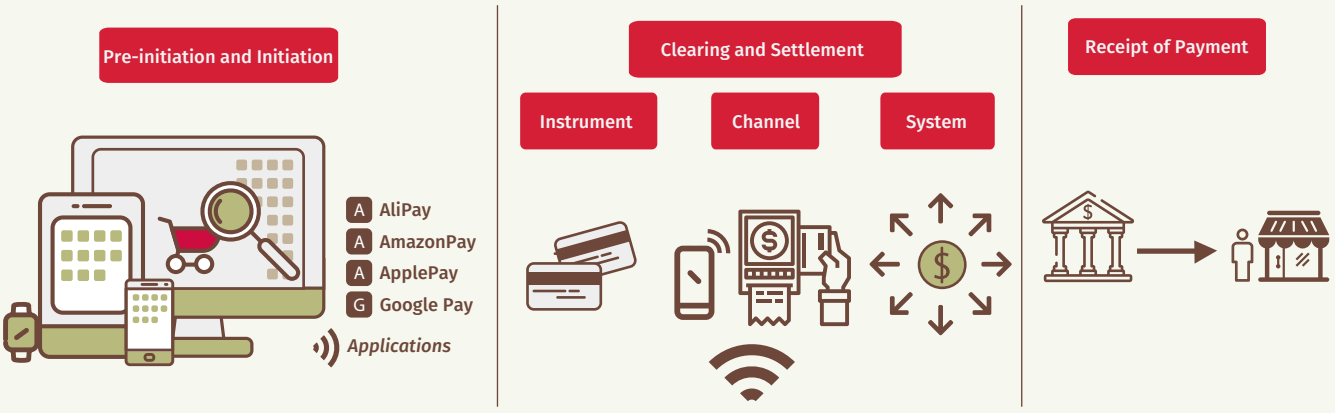
Diagram B2.2
E-commerce and Payment Platforms



Source: *Banco de la República.*

The following is a brief description of the extent to which large technology companies, such as Alipay, Amazon Pay, Apple Pay and Google Pay, take part in these new forms of payment:

Diagram B2.3
Participation of Large Technology Companies in the Payment Chain



Source: *Banco de la República.*

Alipay

Alipay is a virtual payment platform belonging by Alibaba, a company known as the Chinese e-commerce giant. It allows for payment to be initiated through a debit or credit card and made from a computer, tablet or mobile phone, with access mechanisms such as QR codes or facial recognition (Fontdegloria, 2017; BBVA, 2017; El Androide Libre, 2019).

In China, this application gives users the option to make different sorts of retail payments, such as those for taxis or cinema tickets. It occupies approximately half of the electronic wallet market in that country (shared with WeChat Pay). In fact, cash is used very little in many Chinese cities, such as Hangzhou (where the company is headquartered). Alipay can be used in markets such as Hong Kong, India and Southeast Asia, where consumers register on that platform using accounts with their local banks and financial institutions, rather than Chinese accounts. It also is possible for Chinese tourists to use this platform in various countries, such as Canada and Spain, where payments can be made through Alipay. In other words, it allows Chinese tourists to use their accounts in China, without obliging them to exchange their frequent payment method (Alipay) for an international credit card (Chiang, 2019).

Amazon Pay

This is a form of payment made through an application that contains information on the user's Amazon account (credit card and shipping address), thereby making it possible to buy goods and services outside the Amazon trading platform (Amazon, n. d.). Users download an application to make payments from a computer, mobile phone or tablet.

For the near future, Amazon proposes having a physical store where customers select their purchases and are automatically billed for those items via facial recognition and artificial vision (Carstens, 2018).[1 & 2] Payments will be made automatically, through an application. Buyers will be able to select goods or services of interest and leave the store without going to the cash register.

Apple Pay

Apple Pay is a payment option that initiates without contact, through near field communication (NFC) technology, using Apple phones (Nicolaisen, 2018). Payment also can be made on Apple computers, watches and tablets. In each case, payment originates with a debit or credit card (Apple, n.d.).

Google Pay

Google Pay offers payment services from devices such as a mobile phone or tablet, as well as from a computer. Acceptance by banks is required for customers to use Google Pay. Consequently, banks can restrict some or all of their cards for making these payments (El Khour, 2019). With Google Pay, credit or debit cards may be added and, for mobile payment, wireless communication

1 It also makes loans to online venders, selected through the Amazon loan branch (Zachariadis and Ozcan, 2018).

2 Artificial vision "makes it possible to automate the process of gathering information from the physical properties of objects, based on an analysis of the images captured by the cameras. It is a technique that simulates the gist of human vision in which our eyes are sensors that capture information from reality, which is then processed by the brain to make decisions. Artificial vision is used extensively in the agri-food sector to guarantee the quality and safety of processed foods," according to the Ainia Technology Center (El Mundo, 2015).

technology (NFC) enables an exchange of data between the mobile phone and the POS terminals.

The Central Bank of Ireland has authorized Google Pay to operate as a payment institution in Europe.[3] Google's financial activities include transfers, credit card management and foreign exchange, as well as data storage and processing. However, it will have legal restrictions on deposit taking, which is an activity particular to banks (Murgich, 2019). This authorization was granted under recent European Union legislation (Directive 2366/ 2015), which seeks to integrate banks with external providers by allowing access to their systems as a way to improve the supply of payment services and account information (open banking). The regulation is expected to contribute to development of the payments market as a catalyst for future progress, and Google's authorization as a payment institution is the result of the objectives of that directive (Nicolaisen, 2018).

The forms of payment described herein involve innovative methods for access, such as "contactlessness" through devices like mobile phones, the use of debit and credit cards through applications, and channels such as mobile networks, POS terminals, and the Internet (Table B2.1). In other words, these innovations are concentrated in the first stage of the payment process, while the other stages (traditional instruments, channels and payment system) are maintained.

With the incursion of large technology compaes into the payments market, one can conclude that innovations, in general, have emerged mostly with respect to pre-initiation and initiation of the payment value chain. Associated payment services are provided by non-bank entities (virtual payment platform), generally through the use of wireless communication and applications.

Table B2.1
Large Technology Companies: Most Used Payment Instruments and Channels

Company	Payment instrument	Payment channel
Alipay	Debit and credit cards	Mobile phone POS terminals Internet
Amazon Pay		
Apple Pay		
Google Pay		

Source: *Banco de la República* (DSIF)

3 According to Directive 2007/64/EC (Payment Services) issued by the European Parliament and Council, authorization of a payment institution shall be valid in all Member States and shall enable the payment institution in question to provide payment services throughout the Community. It is understood that Ireland, as a Member State of the Union, authorizes Google Pay as a payment institution, thereby allowing it to provide its services in other Member States, subject to additional processing requirements when opening branches.

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Box 3

A Decade of Progress for the Central Counterparty Clearing House of Colombia: More Products for Centralized Clearing and More Sophistication in its Risk Management Model

1. Introduction

During its ten years of operation, The Central Counterparty Clearing House of Colombia (CRCC) has increased its supply of products that are appropriate for clearing and settlement. Consequently, the open positions of its settling members have developed likewise. On the other hand, its risk management model has evolved structurally in response to certain regulatory adjustments, compliance with international standards or unilateral decisions by the CRCC.

The increases in the supply of products for clearing and settlement, the way total open positions have evolved, and the primary changes in the risk management model over the last decade are described chronologically in this box.

Generally speaking, there has been an almost annual increase in the products offered for clearing and settlement. By the end of 2018, asset products were grouped into three segments: 1) financial derivatives, which included all standardized and non-standardized derivatives; 2) fixed income assets, which grouped TES sell/buy-backs negotiated through electronic trading and registration systems; and 3) equities, which included repos on equities. The total open position, on a gross basis, rose nearly ninety percent between the end of 2009 and the close of 2018, going from COP 1.08b to COP 98 b. The risk management model, in terms of the financial resources needed to manage default, went from a structure based on two security rings: individual collateral and the assets of the CRCC, to one that also contemplates loss mutualization mechanisms and tools to recover the extent of financial resources needed to address any possible default on the part of its two main settlement members.

2. Evolution of the CRCC

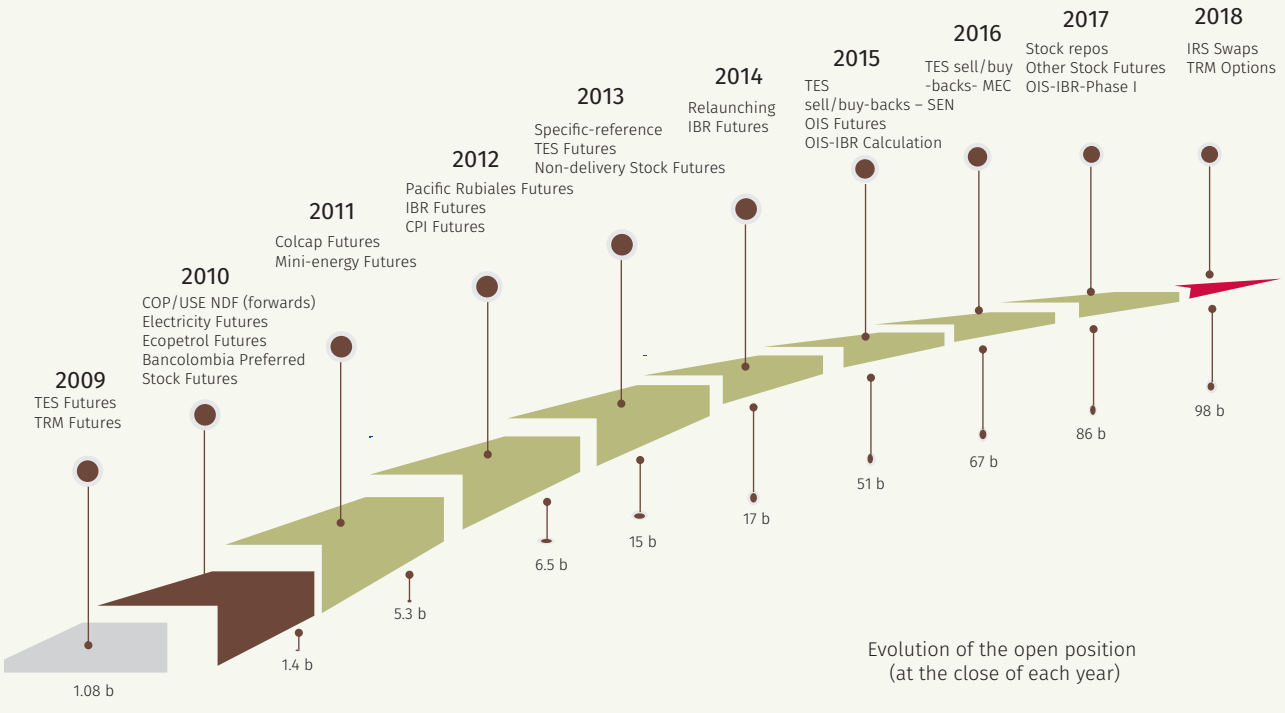
2.1 Products for Clearing and Settlement, and the Gross Open Position

Diagram R3.1 shows how products for clearing and settlement, and the total gross open position have evolved chronologically during the last decade. In the beginning, at the start of its operations, the CRCC cleared and settled standardized products traded on the Colombian Stock Exchange (BVC). Specifically, these included TRM futures and notional short, medium and long-term TES futures. By the end of 2009, the open position in these products was COP 0.28 b and COP 0.8 b, respectively. During 2010, the CRCC increased its portfolio by including one non-standardized product for financial settlement: USD/COP non-deliverable forwards (NDF), and three standardized products: electricity futures, Ecopetrol stock futures and Bancolombia preferred stock futures. By the end of 2010, the open position was COP 1.4 b.

In the two years thereafter, COP/USD non-deliverable forwards (NDF) became the product with the largest open position,[1] which was COP 5.1 b at the close of 2012 and accounted for 80% of the entire open position. The CRCC also included the following standardized products in its supply of services: Colcap and CPI futures, Pacific Rubiales stock futures, bank reference index (IBR) futures and mini-electricity futures.

1 For the purpose of calculating the gross leverage position, *Banco de la República* reduced from 20% to 0% the weight of exchange derivatives that are cleared and settled through a central counterparty clearing house (RE/12/08 JDBR). This is likely one factor that influenced the consolidation of this product.

Diagram B3.1
Products Cleared and Settled by CRCC S.A.



Source: CRCC and *Banco de la República.*

In 2013, the CRCC introduced specific-reference TES futures and stock futures with financial-settlement. By the end of the same year, the open position amounted to COP 15 b (2.3 times what it was at the close of 2012). The former were accepted quickly by the market, with an open position of COP 1.16 b at the end of the year, while short, medium and long-term TES futures closed at COP 0.29 b. After five years of operation, the CRCC reached its break-even point that year.

No new products were created in 2014, and the total open position rose slightly to COP 17 b. In contrast, 2015 was a year of considerable activity. On the one hand, standardized overnight index swaps (OIS) and non-standardized OIS-IBR calculations[2] were introduced during that period. Their underlying asset is the rate resulting from calculation of the overnight IBRs published daily by *Banco de la República* for a definite period. On the other hand, the CRCC, together with *Banco de la República*, implemented the clearing and settlement of TES sell/buy-backs through the Electronic Trading System (SEN). In operations of this type, the CRCC interposes itself between the parties and manages the risks associated with compliance. Novation on sell/buy-back operations by the CRCC represents a contribution to mitigating liquidity and counterparty risks and to strengthening the certainty of compliance. Some of the main features include gross settlement at maturity, collateral management, margin calls, affected operating limits and open positions, and netting collateral by offsetting different maturities. Under normal conditions, gross clearing and settlement of sell/buy-backs continues to be done directly in the central securities depositories, while the securities leg and the cash leg of operations continue to be cleared and settled in the CUD, as was routinely the case. The requirement and daily management of collateral done by the clearing house; however, in the event of default on the obligations of any of the members, the clearing house will be in charge of managing it by executing collateral to cover possible losses in the replacement of assets.

The open position at the end of 2015 was COP 51 b, which is three times what it was in 2014. The products with the highest share were COP/USD NDF forwards,

2 The IBR is a short-term interest rate for the Colombian peso. It reflects expectations of the price at which the agents participating in its calculation are willing to offer or raise resources in the interbank market. The terms for the IBR are one day, one month, three months, and six months.

The OIS-IBR is an interest rate swap wherein the fixed rate for each term is the average resulting from the quotation process and is equivalent to the IBR for the respective maturity, while the floating rate is the compound interest rate of the overnight IBR during the term of the swap. In the overnight term, the banks whose quotes are below the average calculated by *Banco de la República* are suppliers of resources, while those with higher quotes are demanders of resources. For the other terms, the participating banks whose quotes are below the average will be swap sellers, will receive a fixed rate, and will pay a floating rate. In contrast, banks whose quote is above the average will be swap buyers, i.e., they will pay a fixed rate and receive a floating rate.

with 37%; TES sell/buy-backs, with 33%; and OIS-IBR, with 12%.

By 2016, the CRCC had introduced TES sell/buy-backs traded and registered in the BVC trading and recording system (MEC). Generally, these followed to the same parameters as TES sell/buy-backs traded through SEN.[3]

In 2017, the CRCC implemented the second gross settlement product: repos on equities. The main features of this product are: 1) settlement through delivery versus payment. Cash and stock clearing are done bilaterally for gross balances per account holder; 2) definition of volume filters as a requirement or risk-control mechanism for the acceptance of transactions, the individual transaction amount and the intraday consolidated amount per settlement member; and 3) settlement at maturity, with the possibility of clearing and settlement in advance to reduce or eliminate the risk of default or at the request of the members, pursuant to the terms defined by law or in the CRCC regulations. Additionally, the CRCC began to clear and settle the stock futures in the Colcap index, some with settlement on delivery and others with financial settlement (by difference) and TRM options. It also introduced OIS-IBR Phase I, a product that seeks to incorporate additional operations into OIS-IBR calculation. Operations with a maximum term of eighteen months are accepted for this new scheme, with maturities at one, three, six, twelve, and eighteen months. By the end of 2017, the total open position was COP 86 b and the products accounting for the largest share were COP/USD NDF forwards, with 32.55% (COP 28 b); TES sell/buy-backs, with 25% (COP 21 b), and OIS-IBR, with 20% (COP 18 b).

Finally, in 2018, the CRCC created a new segment known as swaps, which will group long-term interest rate swaps (OIS). These are non-standardized interest rate derivatives whereby the parties agree to exchange the payment of amounts that result from applying a fixed interest rate and a floating interest rate to a nominal amount, for an agreed period and on pre-established dates. Initially, OIS-IBR transactions will not be grouped into this segment, because the risk model and system for clearing and settling these long-term swaps is different from the one used for other non-standardized financial derivatives that are grouped in the financial derivatives segment. The open position ended the year at COP 98 b and the share, by product, was: COP/USD NDF forwards, with 42% (COP 41 b); TES sell/buy-backs, with 27.9% (COP 27.2 b); OIS-IBR, with 20% (COP 19.4 b); OIS futures, with 3.6% (COP 3.5 b); TRM futures, with 2.6% (COP 2.6 b); TES futures, with 2.2% (COP 2.1 b); stock repos, with 1.5% (COP 1.5 b); and "other products," with 0.2%.

2.2 The Risk Management Model

The past decade has witnessed changes not only in the supply of products and the balances of open positions, but also in the CRCC's risk management model. Some of these changes or adjustments respond to the specific characteristics of the new products being offered. Others were motivated by modifications or requirements in Colombian regulations, while some address the recommendations or standards of international organizations and, in doing so, secure international certification or membership in groups of central counterparty entities, which allow the CRCC to adopt initiatives from the international context. The main changes to the model are outlined as follows, in chronological order. Diagram B3.2 shows how the CRCC changed its risk management model during 2008-2019.

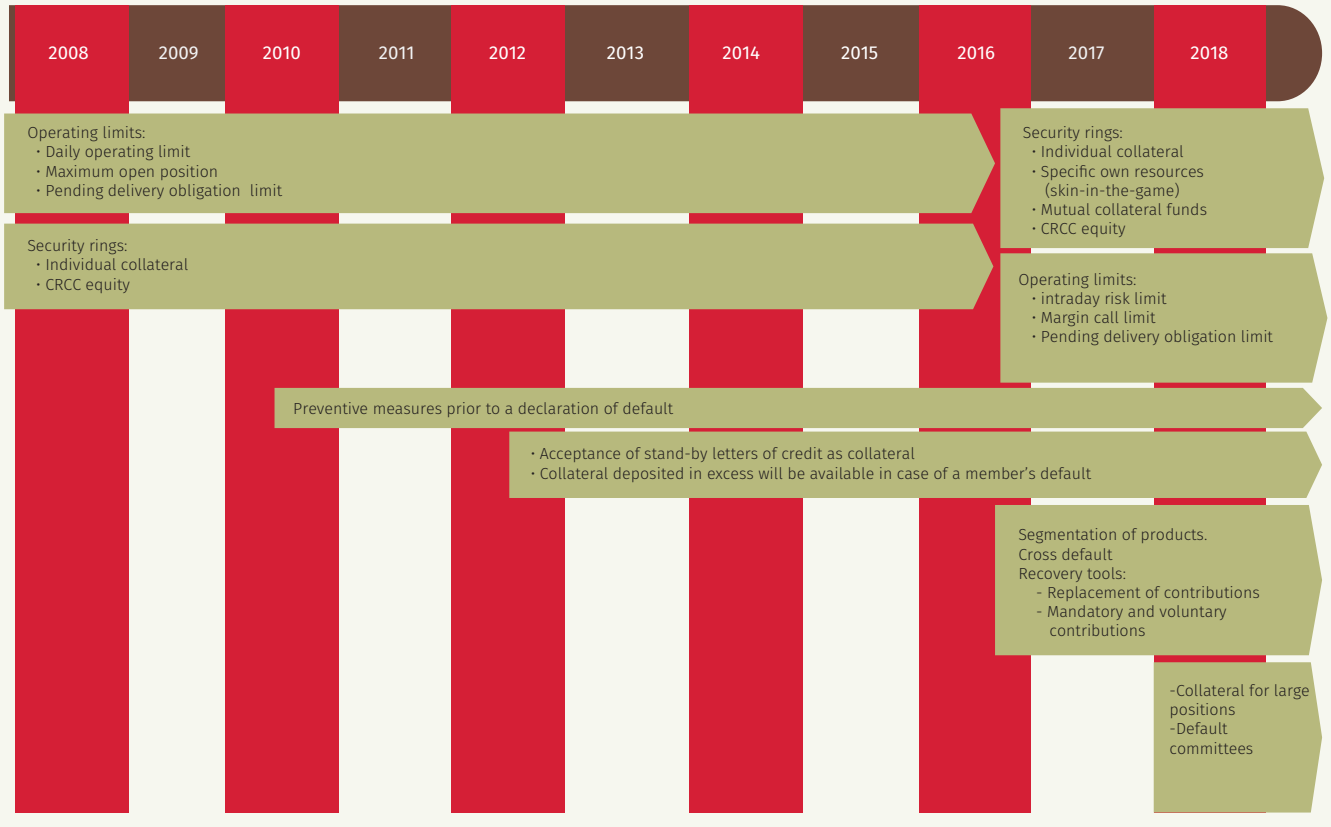
In 2008, the CRCC had a risk management scheme based on three pillars. The first involved the affiliation of robust entities as settlement members, with the understanding that the requirements for affiliation were demanding from a financial, technological and operational perspective. The second pillar was made up of the initial, daily and extraordinary collateral required of each member, while the third concerned the CRCC's assets. This scheme also incorporated tools to avoid a concentration of risk in some of the members, by establishing operating and open position limits indexed to the regulatory capital of the settlement members. Therefore, the daily operating limit was intended to restrict the value of transactions accepted during the day that did not have pre-funded collateral, while the limit on the open position curbed the total open position at the member level,[4] and the limit on the pending obligation to deliver restricted open sale positions in contracts with settlement at maturity by delivery of assets for the account structure of a settlement member.[5] This scheme remained

3 One of the peculiarities in clearing and settling sell/buy-backs through MEC is the minimum prior collateral requirement distinguished from the sell/buy-back operations through SEN. Accordingly, at the close of 2018, the minimum collateral required in advance to support a position on the part of any settlement member participating in SEN was two billion pesos (COP 2,000,000,000) and three hundred million pesos (COP 300,000,000) for members participating only in MEC and not in SEN.

4 It limits the maximum amount generated for the member by an extraordinary or unusual margin call due to possible extreme price variations, including all accounts the member clears and settles.

5 This is the obligation of the settlement member with a sale position in contracts with settlement at maturity, on delivery. It pertains to the

Diagram B3.2
CRCC S.A.: Risk Management Model



Source: CRCC and *Banco de la República.*

in place until 2016; however, measures that strengthened the model were taken during that period.

In 2010 and 2011, the CRCC expanded its regulations to include the power to adopt certain measures to prevent a situation from leading to one or more members being declared in default, or the negative impact extending to other members or the CRCC itself. Therefore, in circumstances where a member is experiencing financial or operational difficulty, if there is a reasonable expectation that the member will not meet its obligations or fail to comply with any of the obligations cited in the regulations, among others, the CRCC could take preventive measures. Mainly, these include restricting the acceptance and registration of new transactions that increase the risk to the member, to its third parties, to the non-settlement member and to its third parties, as the case may be, requesting total or partial closure of the contracts with an open position; reducing the limits granted, or requiring more collateral to be constituted that what is required of the other settlement members. This mechanism allows the CRCC and its members to manage risk situations in a timely and controlled way and helps to reduce potential events involving default and the generation of systemic risk.

In 2012, the CCCR was accepted into CCP12, which is a global association formed by the world's major central counterparty clearing houses. This membership allows the CRCC to cooperate on issues of mutual interest and for the benefit of minimizing global systemic risk and improving the efficiency and effectiveness of international markets. In addition, CCP12 members jointly share information and technical documents, and draft consultation and discussion papers for global industry and regulators to promote the development and adoption of better risk-management standards and practices. On the other hand, the CRCC introduced a new procedure for delivering the assets underlying derivatives. This allows members to make partial deliveries; a mechanism that encourages greater synchronization between the compliance cycles in the spot market and financial derivatives.

sum of the open sale positions of its accounts, those of its third parties or those of its non-settlement members and third parties thereof, as the case may be, multiplied by its nominal value, minus the nominal value of the collateral constituted in favor of the CRCC in the asset to be delivered by each account holder with a sale position.

In 2013, the CRCC added to the assets that can be used as collateral to expand operating limits. Accordingly, it will accept, as admissible collateral, stand-by letters of credit that are payable on first demand and denominated and payable in Colombian pesos. These must be issued by financial institutions that are overseen by the Office of the Financial Superintendent of Colombia. Moreover, they must be legally capable of issuing collateral of this type and be settlement members of the CRCC. This collateral is solely for the purpose of expanding the daily operating limits and the open position of the members. On the other hand, the CRCC decided the collateral subject to the fulfillment of obligations would not only be that which is required, but also that resulting from the sum of excess collateral required and constituted by the settlement member.

During 2014-2015, the CRCC made no changes in its risk management model. However, it did implement certain functional features to promote centralized settlement. For example, it developed an optional service to invest the collateral deposited in cash by its members. These investments would be made with prior authorization from the members and would be framed by the general criteria of security, liquidity and low volatility. Through this mechanism, the CRCC and its members will be able to obtain additional returns, bound by the guidelines and limits defined in the CRCC's regulations. On the other hand, the CRCC may suspend settlement at maturity for a maximum period of ten business days, as of the last trading day, or decide that the respective futures contract will be settled by differences, in the event the asset underlying a stock futures contract to be settled by delivery is suspended in the trading system on the last trading day.

In 2016, the risk management model underwent a structural change. The new security scheme maintained the access requirements for settlement members, and the operating limits of the old scheme were merely rechristened to adopt internationally known names. In addition, the following changes were made: 1) cleared and settled products were grouped into two segments, on the basis of which security rings were defined. The financial-derivatives segment grouped together all standardized and non-standardized derivatives that had been accepted by the CRCC, and TES sell/buy-backs were included in the fixed-income segment. In 2017, the variable-income segment was created, and the various repos on equities were grouped therein. 2) New lines of defense against default scenarios were defined, including:, a) a loss mutualization tool known as the "mutual collateral fund," which is constituted for each segment; b) a requirement for skin-in-the-game, placing the CRCC's capital resources after those of the defaulting member have been used, but prior to using the contributions non-defaulting settlement members have made to the mutual collateral funds of the other members; and c) powers granted to the CRCC to require non-defaulting members to replace contributions to the mutual collateral funds, on a mandatory basis, and to make obligatory and voluntary contributions for the continuity of the service.

As mentioned in the *Payment Systems Report* published in 2018, the following are the general objectives of each security ring:

- Individual collateral: the purpose is to cover the risk posed to the CRCC by its settlement members, who must deposit a minimum amount of collateral for each segment, doing so before the CRCC accepts the first transaction. This collateral also can be used to extend certain limits.
- Collateral to support a position: Collateral of this type is required to hedge or offset the risk changes in market prices posed to the open position in the end beneficiary's account. Collateral to support a position is affected upon the fulfillment of obligations produced by the positions opened in an end account, which is why surplus collateral to support a position in a settlement member's account does not offset these collateral requirements for other accounts cleared and settled by the same member, even if they belong to the same owner. In exceptional market circumstances where the extent of the clearing house's cover is affected by variations in the price of the different instruments it clears and settles, the clearing house may require extraordinary collateral consisting of an amount in addition to the collateral to support a position. In this case, the idea is to recover an adequate and sufficient level of collateral to offset the default risk to which the clearing house would be exposed in a new scenario of price volatility.
- Specific proprietary resources: These are understood as at least 25% of the minimum amount of capital required to establish a central counterparty clearing house. Once their amount has been defined, a proportional value will be allocated to each segment, depending on the value or size of the mutual collateral funds.
- Mutual collateral funds: The purpose of such funds is to cover any balances owed that might arise from default on the part of a settlement member and are not covered by the collateral to support a position, extraordinary collateral, individual collateral and contributions to the mutual collateral funds of the settlement member in default, as well as the clearing house's specific proprietary resources. These funds are constituted for each segment and are calculated according to historic price performance and scenarios based on a historical correlation and projecting a rupture of these correlations.

The following are the main features of mutual collateral funds: 1) they are constituted by segments; 2) the members are jointly and severally liable for losses associated only with the segments in which they participate; and 3) contributions to each fund are made in proportion to the risk each member poses to the CRCC.

Establishment of a mutual collateral or safeguard fund was required by *Banco de la República*, pursuant to the prerequisites central counterparty clearing houses must meet to become open market placement agents (OMPA), and, thus, have access the liquidity provided by the central bank.

This structural change represented progress in the CRCC's risk management scheme, which is aligned with several recommendations for central counterparties put forth by international organizations, such as the Financial Stability Board (FSB),[6] the Payments and Market Infrastructure Committee (CPMI) and The Board of the International Organization of Securities Commissions (IOSCO)[7]. In addition, the structure of the security rings and the recovery tools largely follow the guidelines in EU Regulation 648/2012 of the European Parliament and Council (2012) on over-the-counter derivatives, central counterparties and transaction registries.

Ultimately, the main changes made during 2017 and 2018 include higher percentages of collateral required for large open positions and the possibility of the CRCC being able to establish default management committees.

With respect to the higher margins required for large open positions, a position is regarded as large when the value of the net open position of an account, in a given asset, exceeds a certain percentage of the average volume traded daily. Therefore, it is understood that the time horizon (days) required to close that position increases. Consequently, the parameters for calculating margin or collateral position and stress risk will increase to the levels set by the CRCC.

With respect to the default management committee, which is comprised of non-defaulting members who participate in the segment affected by the default, the committee will support and advise the CRCC on managing defaults in order to close positions in an orderly way that is consistent with market conditions.

3. Final Comments

Between 2008 and 2018, the CRCC increased the supply of products it offered for clearing and settlement. In doing so, it also heightened the risk it assumes as a result of growth in the open positions of its settlement members.

It also made changes in its risk management model during the same period. However, in 2016, a structural change was instituted that largely conforms to the international standards defined for central counterparties. This perhaps will enable the CRCC to achieve positive results when seeking international certification that could give it the power to facilitate market globalization processes. In addition, it is important to point out that the parameters established by the CRCC in its risk model exceed those of Colombia's regulations on central counterparty clearing houses. For example, Decree 2555 issued in 2010 by the Ministry of Finance and Public Credit requires central counterparties to maintain a minimum amount of financial resources to withstand - in extreme but possible market conditions - default by the counterparty with which it holds the largest position. In contrast, the CRCC model contemplates the two main settlement members.

Over the last decade, the CRCC has become very important, due to the growth in volumes and products cleared and settled. This translates into greater exposure to counterparty and liquidity risk. Indeed, it is the only provider of infrastructure services established pursuant to the aforementioned standard. These factors have made the CRCC a player of systemic importance in the Colombian financial market. Therefore, it is crucial that the authorities continue to monitor its operation.

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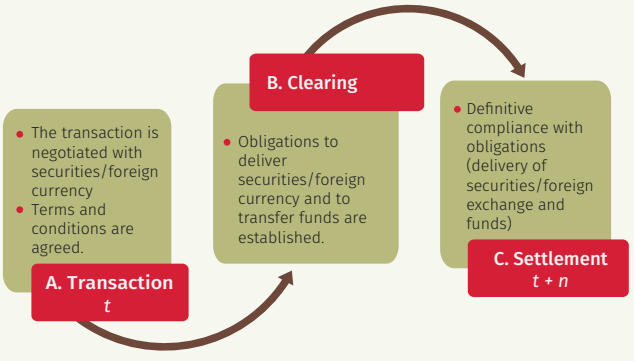
6 *Key Attributes of Effective Resolution Regimes for Financial Institutions* (2014), specifically Appendix II, Annex I, entitled "Resolution of Financial Market Infrastructures (FMIs) and FMI Participants," provides guidelines on implementing attributes involving to resolution regimes for infrastructures considered to be of systemic importance.

7 The principles applicable to financial market infrastructure (2012), from the standpoint of credit risk management, recommend that CCPs hedge their current and potential future exposure with respect to each participant, as a whole and with a high degree of confidence, through margins and other pre-financed financial resources. Moreover, CPIM-IOSCO's *Recovery of Financial Market Infrastructures* (2014) recommends these structures have a comprehensive and effective set of recovery tools that allows them to allocate losses not covered by initial and variation margins to cover liquidity deficits.

Box 4
Settlement Time on the Local Spot Market

Diagram B4.1
Clearing and Settlement Cycle



Source: *Banco de la República.*

Currently, the clearing and settlement time for a spot transaction in most international markets is two business days (t + 2). In Colombia, the majority of spot dollar/peso and government- private debt market transactions are cleared and settled on the same day of trading. The implications of Colombia approximating the international standard are analyzed in this box.

Accordingly, this box begins with an explanation of the settlement cycle for a spot transaction. Then, it describes how the initiatives to establish an international standard evolved and outlines the current situation of the cycle in international markets and in Colombia. It goes on to describes the benefits and disadvantages of lengthening the settlement cycle and shows the findings of a survey of local government debt market participants. Final considerations are presented at the end.

1. Clearing and Settlement Cycles

The clearing and settlement cycle for a transaction is defined as the period between the trade date of a transaction and the day of its completion. The cycle begins with execution of the transaction in time t, when the parties quote and finalize the terms and conditions of the business, doing so through verifiable means. Obligations to deliver securities/currencies or to transfer money between the participants are determined by reconciling purchases and sales of securities/currencies and transfers of funds between entities (bilaterally or multilaterally) and by validating the availability of funds and ensuring the delivery of securities/currencies. Finally, in t + n, the obligations of the transaction are fulfilled definitively; that is, the seller delivers the securities/currencies and the buyer, the funds (Diagram B4.1).

2. Establishment of Clearing and Settlement Cycles in International Markets

There have been several initiatives to determine the optimal number of days to comply definitively with the obligations in a cash transaction.

The first was spearheaded in the late 1980s by the Group of 30 (G30), an international body created to broaden an understanding of global economic and financial problems. It sought to minimize counterparty and market risk (by reducing exposure time) and to standardize the settlement cycle in international markets. The recommendation was that transactions be settled in a maximum of three days: t + 3 (down from t + 5 or more days, in effect at the time). Then, at the beginning of the first decade of the 21st century, the CPSS and IOSCO reaffirmed that recommendation, and even proposed a further reduction the number of days.

Ever since the credit crisis in 2008, the financial industry has become more interested in reducing risk, heightening transparency and improving the efficiency associated with transactions in securities markets. This concern has given rise to a new series of regulations and initiatives[1] that include topics on clearing and settling transactions. In fact, it was even suggested [2] the market standard for clearing and settlement should be two days after trading (t + 2).

A settlement in less time (t + 1 or t + 0) could be established as a standard. However, this was considered unfeasible, because of the impact it would have on foreign counterparties and the time limit it would impose on reconciling transactions and on error management.[3]

1 The Dodd Frank Act (Title VIII: Payment Supervision, Clearing and Settlement) in the United States; the European Market Infrastructure Regulation (EMIR), and the Markets in Financial Instruments Directive (MiFID) in Europe are some examples.

2 Regulation (EU) 909/2014 was adopted by the European Parliament and the Council in July 2014 to improve securities settlement in the European Union and the central securities depositories. In draft since 2012 and applied as of January 2015, it standardized the settlement cycles in the EU at t + 2.

3 Boston Consulting Group (2012) "Cost Benefit Analysis of Shortening the Settlement Cycle".

Consequently, settlement in t+2 became a market standard and was introduced in Hong Kong in 2011, in 23 European Union member states in 2014, in Australia in March 2016, and in the United States and Canada in 2017. In Japan, the time period was changed in 2018 to t + 1 for locals in the case of government debt. A change to t + 2 for stocks is scheduled for 2019 (Table B4.1).

The forex spot market settlement cycle is two days after the transaction (t + 2) for most exchange rates, except for the Canadian dollar (CAD), the Philippine peso (PHP) and the Turkish lira (TRY), which are settled in t + 1.

Although the general trend in the countries in the sample has been to reduce the settlement cycle to t+2 in an effort to strike a balance between the increase in counterparty and market risk and the decline in operational risk, two cases were found where the settlement cycle was lengthened:

1. In 2007 in Mexico, the stock market settlement period was extended from t + 2 to t + 3 to facilitate transactions with the United States, which at the time had a settlement period of t + 3.
2. In Russia, settlement on the stock and bond markets migrated in 2013 from t + 0 to t + 2, enabling the Moscow Stock Exchange to link with securities depositories (Euroclear and Clearstream). This shift also provided access to foreign resources and brought Russia in line with the mandate of the European Commission.

3. Clearing and Settlement Cycles in Colombia

Clearing and settlement cycles in Colombia are carried out routinely in time periods that range from zero to three days (t + 0 to t + 3) on the fixed income, cash and forex spot markets to three days (t + 3) on the market for equities.

Yet, in practice, most transactions on the government debt market in 2018 were settled in t + 0. Longer periods were observed only on the spot market (Graph B4.1).

Nevertheless, in the case of foreigners who participate in spot transactions and accounted for 0.3% of the transaction market and 10.7% of the registration market in 2018, t + 2 and t + 3 were the most relevant periods, with 72.7% in trading in transactional systems and 84.1% in registration of all their operations (Graph B4.2). These longer settlement times respond to the operability of foreign investment, which often occurs in different time zones, requires exchange operations, and generates the need to settle the securities transactions of foreign investors within a timeframe that is broad enough to ensure the resources in currency will be available, thereby avoiding default of any sort.

The t + 1, t + 2 and t + 3 periods were more prevalent in the domestic currency market in 2018 than in the government debt market, but t + 0 was still used the most. (Graph B4.3).

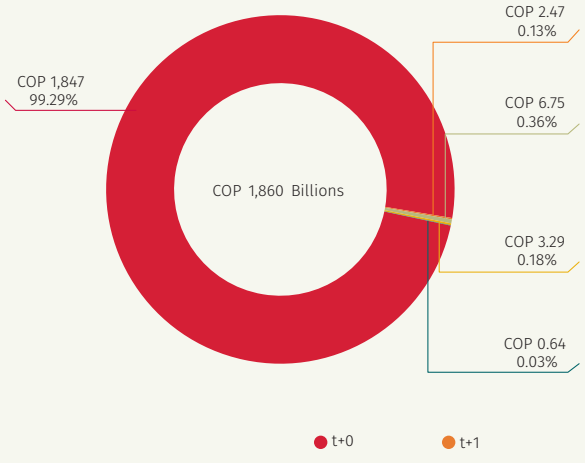
Table B4.1
Settlement Cycles, by Country

Country	Variable Yield	Fixed Income	Updated
Africa			
South Africa	*t*+3	*t+0 to t+3*	10/25/2018
America			
Brazil	*t*+2	*t*+2 *t*+0 or *t*+1 (SELIC) and *t*+0 (CETIP)	2/22/2008
Colombia	*t*+3	*t*+3 *t*+0 *t*+1 to *t*+3 could be proposed	11/29/2018
United States	*t*+2	*t*+0 or *t*+1	9/4/2017
Mexico	*t*+2	*t*+0, *t*+1, *t*+2 or more	12/5/2017
Asia Pacific			
Australia	*t*+2	*t*+2	11/24/2016
South Korea	*t*+2	*t*+1	8/3/2007
Japan	*t*+3	*t*+3 (*t*+1 for locals)	11/24/2016
Europe not T2S			
United Kingdom,	*t*+2	*t*+1	10/8/2018
Turkey	*t*+2	*t*+0 to *t*+90	6/1/2018

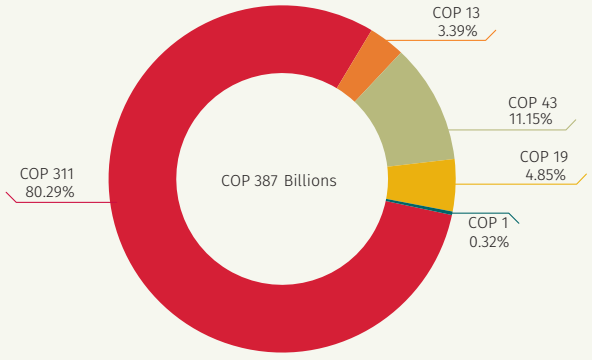
Source: DataStream; prepared by the authors.

Graph B4.1
Spot Market for Government Debt, by Settlement Times: 2018

A. Transactional system



B. Registration

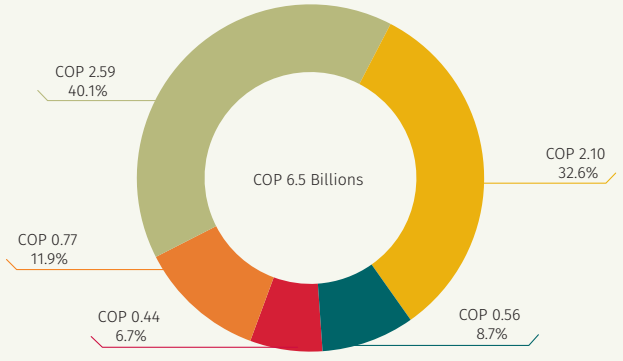


t+0 t+1 t+2 t+3 > t+3

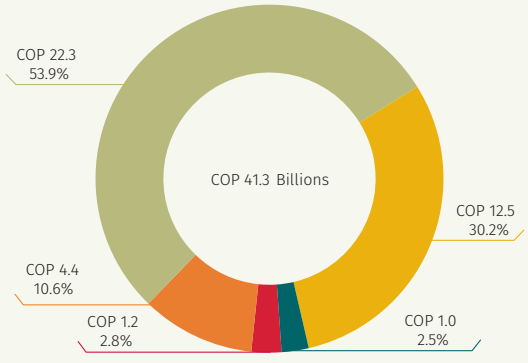
Source: *Banco de la República* (DCV).

Graph B4.2
Spot Market for Government Debt, by Settlement Times for Foreign Participants in 2018

A. Transactional system



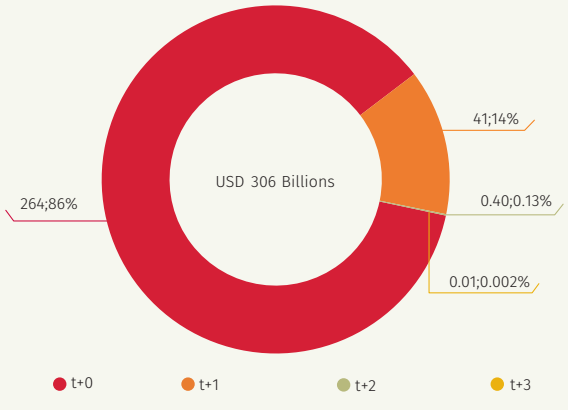
B. Registration



t+0 t+1 t+2 t+3 > t+3

Source: *Banco de la República* (DCV).

Graph B4.3
Equity Market, by Settlement Times in 2018



t+0 t+1 t+2 t+3

Source: Foreign Exchange Clearing House of Colombia.

4. Benefits and Disadvantages of Taking the Settlement Cycle to the t + 2 Standard

In general terms, lengthening the clearing and settlement cycle to equate the standard (t + 2) implies a trade-off between an increase in counterparty risk and a reduction in operational risk. A balance between these two factors could result in market agents managing liquidity more appropriately.

With respect to the advantages, an approximation of this sort would link the domestic market to international settlement cycles, benefitting the foreign investment process, in the midst of initiatives to integrate markets.[4]

4 The Latin American Integrated Market (MILA) and the Pacific Alliance, among others.

In Europe, this feature was one of the pillars of the transition to settlement in t + 2, which was recognized as a solution to problems with double listing securities on the European stock exchanges. In Russia and Mexico, the settlement time was increased to match the European and North American markets, respectively, in an effort to improve the flow of orders to their domestic markets.

It also would lead to harmonizing the settlement cycle between different types of assets. This would make it possible, for example, to connect the settlement cycle for fixed-income products with foreign exchange markets, facilitating efficient product coverage. At an operational level, a longer period would allow for better transaction reconciliation and better error management. Moreover, adapting to the t + 2 international trading standard would make it possible to concentrate market liquidity in a single trading round (currently distributed between the different spot rounds) and would lead to better price formation. Ultimately, it would allow market agents to improve their in short-term liquidity management.

As for the disadvantages, lengthening the local market settlement cycle might imply an increase in the consumption of credit quotas, given that t + 0 transactions normally do not require a quota, while those at *t* + 1 or *t* + 2 might require one.

Moreover, acceptance of a transaction in gross settlement systems[5] occurs only once it is settled (i.e., when money and securities are moved). This being the case, if the settlement cycle is lengthened, trades that have yet to be completed and accepted in the clearing and settlement system could be revoked during the time it takes for the respective entities to intervene, occasioning possible defaults between payment system participants.

On the other hand, in the case of spot TES and forex transactions cleared and settled in a clearing house, a longer settlement cycle would imply higher margin requirements and a higher concentration of risk in the clearing house.

In the end, lengthening the cycle could raise the costs associated with technological (systems and processing), operational and regulatory changes. (Table B4.2).

5. What the Market Thinks

The most important studies carried out in countries that changed the timing of their clearing and settlement cycles suggest a debate with local industry, corroborating the advantages and disadvantages, and identifying the individual impact of a longer settlement time, would round out efforts to arrive at a comprehensive assessment of the possibility of a change in the cycle.

There was a pronouncement to that effect at the first workshop of the Capital Market Mission in 2019. It mentioned eliminating compliance within t + 0 and changing to t + 2, pursuant to the international standard, as one proposal for expanding investor base in the market, and as part of the conditions for foreign investment.

Table B4.2
Main Benefits and Disadvantages of Lengthening the Clearing and Settlement Cycle in the Local Market

Benefits	Disadvantages
• Possible facilitation of the investment process for foreigners. • Possible facilitation of the investment process for foreigners. • Increase in liquidity and better price formation in a single trading round of *t* + 2.	• Increments the counterparty risk.
• Harmonization of the settlement cycle between different types of assets. • Possible improvement in product coverage.	• Increased requirements for operation between counterparties due to added use of bilateral quotas. • Possibility of less liquidity in the market.
• Better transaction reconciliation process.	• Increase in the probability of transactions being revoked during the time it takes for the respective institutions to intervene, since the period between trading and gross settlement of transactions is extended.
• Better error management.	• Increase in the collateral required by clearing houses. • Greater concentration of risk in clearing houses. • Costs associated with changing operational, technological and legal processes.

Source: Prepared by the authors.

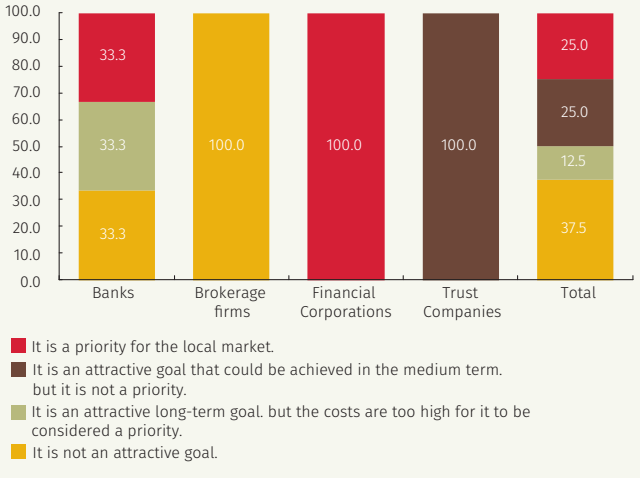
5 DCV, Deceval and BVC stock purchase-and-sales.

To delve further into this issue and gauge the opinion of a representative sample of the market, *Banco de la República* surveyed the participants in the Finance Ministry's (MHCP) market makers program for government debt securities, along with trust companies that act as custodians. This was done in February 2019 and, out of the fifteen entities surveyed, eight gave their opinions (three banks, two brokerage firms, two trust companies and one financial corporation). The following was identified on that basis of that information:

Only 25% of respondents believe lengthening the clearing and settlement cycle is a priority for the market, while 37.5% think it may be an attractive goal, but do not consider it a priority. The other 37.5% do not see it as a goal for the market (Graph B4.4).

Graph B4.4
Opinion on Lengthening the Clearing and Settlement Cycle

(Percentage)



Source: *Banco de la República* (DCV).

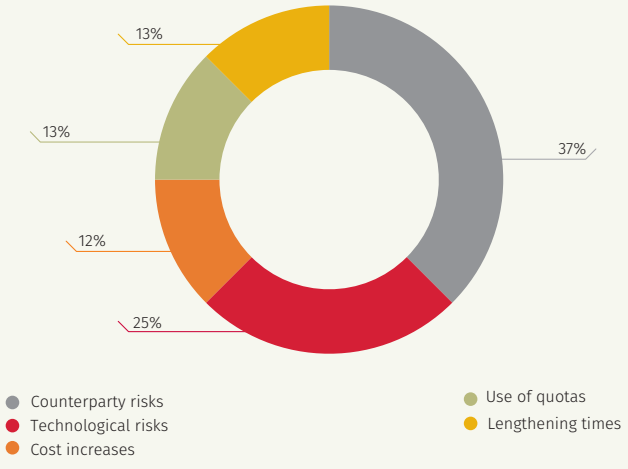
Counterparty risk, technological risk and cost increases are thought to be the main risks posed by lengthening the settlement period (Graph B4.5).

Sixty-three percent of those surveyed do not believe the advantages of lengthening the cycle would offset the possible increase in risk to counterparties and the related market.

As for the entry of foreigners, 62% of those surveyed believe this would be facilitated primarily by an increase in liquidity in the domestic market, while the other 38% believe it would not, particularly because foreign investors already operate within a settlement period of t + 2 and because of the time required in the foreign investment process (Graph B4.6).

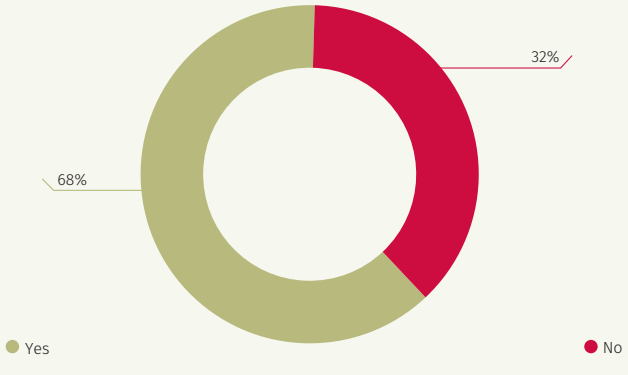
A reduction in operational risk and an approximation to the international standard are main advantages of

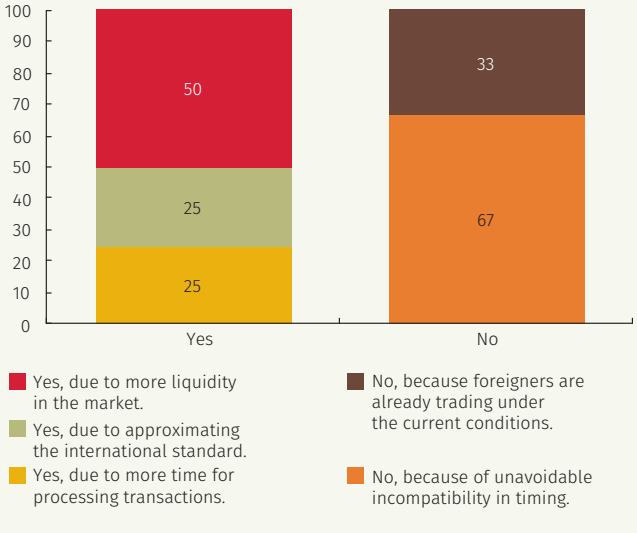
Graph B4.5
Opinion on Lengthening the Clearing and Settlement Cycle



Source: *Banco de la República* (*Encuesta sobre la ampliación ciclo de compensación y liquidación local,* February 2019).

Graph B4.6
Lengthening the Clearing and Settlement Cycle and Access to Foreigners

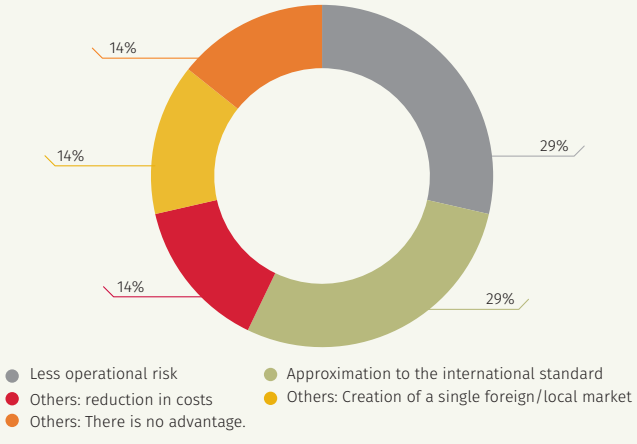




Source: *Banco de la República* (*Encuesta sobre la ampliación ciclo de compensación y liquidación local,* February 2019).

lengthening the cycle, according to those who replied to the survey. A reduction in costs and the creation of a single market for nationals and foreigners also were regarded as advantages. Ultimately, 14% of the respondents believe lengthening the cycle does not constitute an advantage (Graph B4.7).

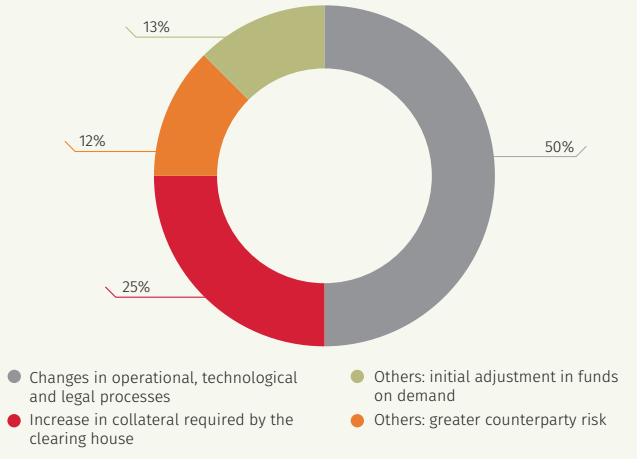
Graph B4.7
Advantages of Lengthening the Clearing and Settlement Cycle



Source: *Banco de la República* (*Encuesta sobre la ampliación ciclo de compensación y liquidación local,* February 2019).

The change in operational, technological and regulatory processes was considered to be the main disadvantage of lengthening the cycle, followed by the increase in collateral that would be required by the clearing house. The initial adjustment in sight deposits and, again, the increase in counterparty risk were noted as well (Graph B4.8).

Graph B4.8
Main Disadvantages of Lengthening the Clearing and Settlement Cycle



Source: *Banco de la República* (*Encuesta sobre la ampliación ciclo de compensación y liquidación local,* February 2019).

Finally, 75% of the respondents do not believe there should be a regulatory mandate to enforce a broader settlement cycle.

6. Final Comments

This box offers arguments for and against lengthening the settlement time in the local spot market. The idea in doing so would be to incorporate various elements into the debate on the issue. Any decision should reflect a good balance between the risks implied in lengthening the cycle and the benefits that would be generated for the market as a whole.

The survey of a group of market participants showed opinions remain divided. For instance, lengthening the clearing and settlement cycle is not unanimously regarded as a priority for the market. By the same token, although aligning with the international standard and reducing operational risk are considered to be the main advantages, the increase in counterparty risk is regarded as the primary problem.

The Ministry of Finance and Public Credit (MHCP), in conjunction with industry, is leading an initiative to evaluate the possibility of a longer settlement cycle in the government debt market and the need to extend it to other markets. This being the case, alternatives to mitigate counterparty risk should be considered. For example, it is possible to explore whether or not the added number of pending transactions would be sent to the CRCC. If so, the concentration of risk in the CRCC would have to be examined and, additionally, it would be important to assess whether those transactions would be cleared and settled entirely by the CRCC, with gross or net settlement (losing the liquidity savings in clearing through the DCV), or if they would follow the TES sell/buy-back model, where the CRCC handles risk management, while gross clearing and settlement are done in the DCV-CUD.

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02

A Decade of Formally Overseeing Colombia's Financial Infrastructures[29]

Central banks have maintained an interest in promoting the safety and efficiency of payment and settlement systems, and financial market infrastructures (FMIs) in general,[30] given their job to ensure public confidence in a country's currency. Making certain that FMI systems are secure and efficient is fundamental to: 1) guaranteeing normal operation of financial markets and the economy, in general; in 2) contributing to financial stability, and 3) facilitating the implementation of monetary policy. For these reasons, central banks predominately oversight these infrastructures.[31]

29 This section was prepared on the bases of "El seguimiento a la infraestructura financiera: una contribución adicional del *Banco de la República* a la estabilidad financiera" (The Oversight of Financial Infrastructures: An Additional Contribution to Financial Stability from *Banco de la República*), which is an editorial note that appeared in the September 2012 edition of *Revista Banco de la República,* No. 1019.

30 CPSS-BIS defines financial market infrastructures as "multilateral systems between participating financial entities, including the operator of the system. They are used to record, clear or settle payments, securities derivatives or other financial transactions."

31 The Bank for International Settlements (BIS) uses the term *oversight* (*vigilancia)* in some of its publications in Spanish to refer to supervision. However, *supervision* is employed more often in Colombia to denote the responsibilities of the Office of the Financial Superintendent, which is the national agency that supervises certain institutions and infrastructures in the financial market.

Oversight FMIs is different from supervising them. The latter involves analyzing and inspecting the individual risk of financial institutions and FMIs, while the former focuses on how payment systems function, as a whole, from a systemic perspective. Because their approaches are different, the methodologies they employ are also different. Supervision is intended to analyze the health of an institution by evaluating its financial performance, solvency, and risk management. Oversight is meant to monitor participants and the connections between or among them, from a comprehensive standpoint, in order to validate the proper functioning of payment systems as a whole, as well as to identify risks with a potential systemic impact and to propose changes to mitigate them.[32]

Although central banks have always been interested in the security and efficiency of payment systems, overseeing was formally adopted as a systemic function in 2005, when "Vigilancia de sistemas de pago y liquidación por el banco central" (Central Bank Oversight of Payment and Settlement Systems) was published. The scope and manner in which each central bank fulfills its overseeing function depend, among other factors, on the institutional and legal arrangements in each jurisdiction.

The lessons and experiences derived from the financial crisis that began in 2008, particularly those concerned with effective risk management - including that of financial infrastructure - led the Bank for International Settlements' Committee on Payment and Settlement Systems (CPSS-BIS) and the International Organization of Securities Commissions (IOSCO) to launch a review in 2010 to update of international standards for FMIs. The review also supported the Financial Stability Board's (FSB) initiative to strengthen financial infrastructures and markets. Highlighted in that initiative is the importance of regulating, supervising and overseeing financial infrastructures, given their role as essential components of financial markets and in helping to maintain and promote financial stability in times of market stress.

In the case of Colombia, the oversight of financial infrastructures function was established formally a decade ago, through External Resolution 5 of 2009, whereby *Banco de la República* was given the authority by its Board of Directors (JDBR) to fulfil this function. It has done so systematically since then, based on the premise that proper operation of the payment system contributes significantly to financial stability and to the prevention of systemic risk.

32 Editorial Note "El seguimiento a la infraestructura financiera: una contribución adicional del *Banco de la República* a la estabilidad financiera" (The Oversight of Financial Infrastructures: An Additional Contribution to Financial Stability by *Banco de la República*), *Revista Banco de la República,* No. 1019.

On occasion of the publication of the tenth edition of the *Payment Systems Report*, this section describes the purpose of oversight FMI in Colombia. Four topics are emphasized in that regard: 1) the need for oversight, 2) the responsibilities involved, 3) the scope of oversight, and 4) the activities it involves.

2.1 The Need for Oversight

According to the CPSS-BIS (2005), central banks are generally in charge of oversight because they are responsible for providing the economy with a liquid means of payment, such as money, as well as the liquidity required to facilitate an orderly execution of operations in the financial system. Also, it is because the implementation of monetary policy by central banks requires safe and efficient payment systems. Accordingly, the World Bank (2018) reports that 100 out of 110 central banks surveyed are entrusted with the task of oversight.

The role of central banks with respect to payment systems has evolved in recent decades. Initially, they acted as services providers for the FMIs they operate. Later, they began to oversight those systems, taking into account factors such as the growing participation of private FMIs; the added complexity, concentration and sophistication of some systems; and the notable increase in the value and volume of the transfers they handle. Similarly, the problems derived from market failures, as well as the presence of negative externalities with potential systemic impact, network externalities and coordination problems, and the concentration of payments are arguments that validate the action of central banks in terms their responsibilities of oversight FMIs.

In their oversight role, central banks focus on FMIs that are of systemic importance, either because of the value of the transactions being settled or because their existence is essential for the proper functioning of financial markets and the economy.

Security and efficiency in payment systems, which are the primary objectives of oversight FMIs in Colombia, are based on the idea of contributing to proper operation and stability of the payment system, in addition to supporting financial stability and the implementation of monetary policy.

2.2 The Responsibilities Involved in Oversight

Before singling out *Banco de la República*'s responsibilities as the authority in charge of comprehensive FMIs oversight, it is important to be clear about Colombia's institutional arrangements for supervision and regulation of infrastructures.

Although the national government is responsible for supervising all financial market infrastructures, which it does through the Office of the Financial Superintendent Colombia, regulation is divided according to the type of systems involved. Large-value payment systems and those clearing and settling foreign exchange and derivatives thereof are regulated by *Banco de la República*, while retail-value payment systems are regulated by the national government, through the Financial Regulation Unit of the Ministry of Finance and Public Credit.

Law 31/1992 is part of the regulatory framework for FMI oversight and refers to the functions of the JDBR. According to Article 16 therein: "[...] it is responsible for studying and adopting monetary, credit and exchange measures to regulate the circulation of currency and, in general, the liquidity of the financial market and the normal functioning of internal and external payments in the economy, ensuring stability in the value of the country's currency."

Similarly, in accordance with the basic statute regulating operation of the financial system, Law 964/2005 establishes that *Banco de la República* shall continue to regulate large-value payment systems, as well as trading, clearing and settlement systems for foreign currency and derivatives thereof. In development of this faculty, the first of these responsibilities is regulated in JDBR External Resolution 5/ 2009 and the latter in external resolutions 7/ 2004, 4 / 2006, 5 / 2007, 12 / 2008 and 4/ 2009, among others.

External Resolution 5, issued in 2009 by the JDBR, gives *Banco de la República* the authority to oversight large-value payment systems in view of how important their adequate functioning is to the stability of the financial system and the implementation of monetary policy. For this reason, and by virtue of that authority, the central bank may require the participants in those systems, as well as the managers of interconnected external systems (which are understood as the country's other financial infrastructures) to provide the information it regards as necessary to ensure the payment systems operate securely and efficiently, given their interaction with external systems and their influence on systemic risk and the stability of the financial system.

With this objective in mind, *Banco de la República* created the Financial Infrastructure Oversight Department (DSIF) in October 2010. It functions - from an organizational standpoint - as part of the Monetary and International Investment Division (SGMII) and is a technical area separate from the direct provision of payment services offered by *Banco de la República*.

2.3 The Scope of Oversight

Resolution 5/ 2009 broadly defines the scope of oversight. It views the potential transmission of risk posed by the interdependence of

FMIs as an argument for oversight to be extended to include all FMIs that converge in the CUD large-value payment system to settle their operations with money from the central bank.

In the case of Colombia, the FMIs that fall within the scope of oversight include the large-value payment system (CUD) managed by *Banco de la República*, as well as the external systems interconnected to the CUD. The latter include the Colombian Foreign Exchange Clearing House and the other securities clearing and settlement systems (DCV, Deceval, and BVC), as well as the Colombian Central Counterparty Clearing House (CRCC), all of which are responsible for clearing and settling financial assets.

Retail-value payment systems, such as ACH Cenit, ACH Colombia, CEDEC and some of the ATM and credit and debit card networks are also part of the financial infrastructure and the external systems connected with the CUD. They are responsible for settling electronic payments made between private individuals and companies within the circuit of goods and services.

In addition, given the importance of retail-value payment systems to the normal flow of the economy, *Banco de la República* also oversights the payment instruments associated with these FMIs, such as checks, debit and credit cards, and electronic funds transfers, as well as the use of cash. Both retail-value payment systems and payment instruments play a fundamental role in the stability of the financial system in general, since consumer confidence and trade in goods and services depend on their proper functioning. In that sense, the risks associated with those systems are extremely important to the economy.

2.4 The Activities Involved in Oversight

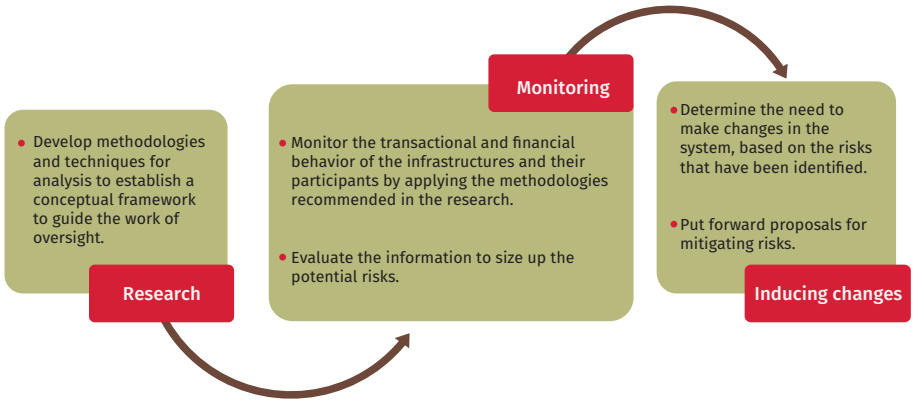
The following section illustrates how DSIF has developed three activities that are crucial for the oversight of FMIs, pursuant to CPSS-BIS (2005). These include monitoring, evaluation and induction to change

Thanks to the faculties granted to *Banco de la República* in Article 19 of Resolution 5/ 2009, it has the authority to request the information it requires from the managers of large-value payment and interconnected external systems to oversight the safe and efficient operation of those systems, their interaction with other external systems, and their influence on systemic risk and the stability of the financial system.

Having this information is crucial to monitoring and enables the DSIF to identify how each FMI functions and how these infrastructures articulate with each other, as important components of the financial system.

In Colombia, the oversight carried out by DSIF involves scrutinizing the financial infrastructure thoroughly, as well as the interconnections between the systems that comprise it and their participants, focusing on risk mitigation and efficiency. Diagram 2.1 summarizes the value chain in the oversight of financial infrastructures.

Diagram 2.1
DSIF Value Chain



Source: *Banco de la República* (DSIF).

With this goal in mind, the DSIF has two operational areas: one for monitoring and information analysis and another for research and development. Both areas complement each other in carrying out the activities required to oversight information on how the FMIs function, evaluating that evidence to identify risks associated with clearing and settling transactions, and putting forth proposals to introduce changes that make it possible to mitigate the risks associated with FMI activity, thereby helping to prevent systemic risk.

Resolution 5/2009 also supports the possibility of *Banco de la República* initiating changes. It authorizes the Bank to encourage adjustments, once it validates the existence of potential risks and by requiring external system managers and the participants in the large-value payment system to adopt ways and means to mitigate risks associated with clearing and settling their own transactions or those of third parties.

At the DSIF the FMI's monitoring activity is executed in two dimensions: one is qualitative and the other, quantitative. Qualitative monitoring focuses on aspects that affect the FMI as a whole, such as regulations, the internal bylaws of the FMIs that define the rules for participation, the risk mitigation mechanisms being applied, and the settlement mechanisms that are used (e.g., RTGS, multilateral netting, hybrid settlement and the savings mechanisms that complement it).

In the quantitative dimension of monitoring, information on the value and volume of transactions and the sequence in which they occur over time are the basis for estimating connectivity metrics that reflect - along with other indicators - the relative importance in the system and the risks to which its participants are exposed in different

markets. Other aspects stemming from an analysis of this dimension involve monitoring developments with respect to FMIs' figures, liquidity sources, the performance of the institutions participating in each infrastructure, as well as a quantification of the magnitude of broader default that could be triggered by default on the part of those participants.

The DSIF receives contributions from its research and development area to perform its monitoring functions. This area is responsible for the design and implementation of techniques and methodologies to identify and quantify the risks associated with clearing and settling transactions. It also analyzes the stability of payment systems as a whole.

Over the course of the last decade of oversight, the DSIF has adopted a vision of payment systems from the standpoint of network analysis. The result is an extremely valuable set of analytical tools. These have made it possible to identify participants who can be regarded as systemically important, due to their role within the structure of the network. This importance is understood as the potential to spark a wider impact on the system.

The combination of network analysis and simulation in payment systems has been a methodological contribution to approximating a measurement of systemic risk. As such, it contributes to a macroprudential vision of systemic risk and, in this way, not only are the size and number of participants in the system assessed, but so are the relationships and interconnections between them.

Thanks to the simulation exercises, it has been possible to measure the capacity of the CUD's participating institutions to deal with the contagion derived from default on the part of other participants, as well as the stability of the system as a whole.

The information on the metrics of the payment system network (such as connectivity and substitutability), coupled with the figures from the balance sheets of financial institutions, constitute valuable input for developing the methodology used to construct the systemic importance index.[33]

Another way research and development have contributed to monitoring is by quantifying the use of the various sources of intraday liquidity that are available in the CUD, either for each individual participant or by type of participant (e.g., credit establishments, brokerage firms, etc.). These sources include the balances in deposit accounts at the central bank, payments received from other participants, intraday repos with the central bank, and interbank money-market resources in the large-value payment system. Quantifying these sources shows their contribution varies, by type of institution,

33 The respective methodology is outlined in Box 5 of the *Financial Stability Report, Banco de la República*, 2013.

and reveals a preference on the part of non-credit establishments for using the payments received from other CUD participants. Therefore, in response to the importance managing intraday liquidity risk in the large-value payment system, several methodological approaches have been designed and developed to study and measure that risk.[34]

Currently, the DSIF is working on the design and implementation of a monitoring and analysis system known as Monitor-A. Using analytical techniques applied to FMI information and indicators to carry out systematic monitoring, the idea is to build early warning signs in response to changes in the performance of FMI participants. These signs make it possible to oversight, in timely way, events that could represent risk and, thus, mitigate their potential systemic impact (see the part in italics at the end of this section). Consequently, as far as the participants are concerned, the aim is to understand how they perform within the FMIs, both individually and jointly. Using modern machine learning techniques, it is possible to construct performance patterns (profiles) that serve as frames of reference to give notice of deviations and to generate early warning signs.

The DSIF has expressed its interest in payment instruments through a continuous effort to oversight the data reported by the Office of the Financial Superintendent of Colombia, given the direct relationship these instruments have on retail-value payment systems. It also has been involved actively in designing a survey conducted by the Treasury Department at *Banco de la República* on the use of cash. In fact, it has added a questionnaire intended to analyze preferences in the use of payment instruments for routine payments made by the public, and their general acceptance by merchants. The findings of the survey on the use and acceptance of payment instruments, as well as the findings outlined in research documents on this subject, are included in the *Payment Systems Report.*

2.5 Cooperation with other Relevant Authorities

The CPSS-BIS (2005) believes cooperation between central banks and other authorities, such as international and local securities regulators and banking supervisors, can be useful under special circumstances. Although each regulator fulfils its own regulatory responsibilities, cooperation will not be exercised to the detriment of those duties, nor to delegate them. In the interest of minimizing the regulatory burden and maximizing efficiency, cooperation in this sense could result in the possibility of coordinating or sharing certain activities, if permitted under national legislation.

In Colombia, as in other countries, cooperation between the oversight authority and the other powers occurs informally or on an *ad hoc*

34 See Martínez and Cepeda (2018), León *et al.* (2018), *Banco de la República* (2015), Cepeda and Ortega (2015), and León (2012).

basis. In that regard, Article 20 of Resolution 5/ 2009 indicates *Banco de la República* may sign inter-administrative agreements or memoranda of understanding with the Office of the Financial Superintendent of Colombia to cooperate in fulfilling its functions and to exchange information on large-value payment systems, external systems, and their respective participants.

When it comes to oversight, cooperation with the Office of the Financial Superintendent of Colombia and the Ministry of Finance - the former as a supervisor and the latter as a regulator - has been smooth. Although there is no defined agenda for meetings, if special circumstances arise that warrant concerns about one or more FMIs or any of their participants, interaction is coordinated to exchange information between or among agencies. Another cooperation mechanism used in Colombia involves regular meetings with other authorities to exchange views and opinions, such as – for example - the Coordination Committee to Oversight the Financial System.

Recent international experience underscores the importance of having a comprehensive view of payment systems as a whole and the interconnections and interdependencies that exist among financial institutions and infrastructures, in addition to the traditional approach focused on individual institutions. Hence, the relevance of *Banco de la República*'s efforts to strengthen its oversight of financial market infrastructures, the idea being to continue to expand what is known about how these infrastructures and their participants operate and interact. The goal is to supplement its analysis of the financial sector, with a view towards financial markets.

The task of overseeing local financial infrastructure has provided new and valuable elements to strengthen the network for financial safety in terms of regulation, supervision and oversight. The resulting analysis will continue to contribute to a macro-prudential approach to systemic risk, which recognizes that relationships and interconnections between and among institutions are as important as their size. It also will continue to give financial authorities new tools to assess the ability of financial infrastructures, their participants, and the system as a whole to resist contagion and mitigate risk, the objective of which is to enhance the country's financial stability.

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The Monitor-A System for Monitoring and Analysis

DSIF currently is implementing a system to monitor and analyze FMIs [1] and their participants. Known as Monitor-A FMI,[2] it is shown in Diagram A and consists of:

A data warehouse that has been developed through business intelligence methods and is centralized at *Banco de la República* to store details on the transactions processed by local FMIs (CUD, DCV, Deceval, CRCC, CCDC, and BVC).

A set of applications, developed *in situ* and provided by the industry, to monitor and analyze the performance of FMI participants, through the use of methods such as complex network analysis, automated learning, neural networks and simulation (among others). In this way, sources of liquidity, counterparties and costs are analyzed continuously, along with the evolution of risk exposure and the balances in deposit accounts and financial assets.

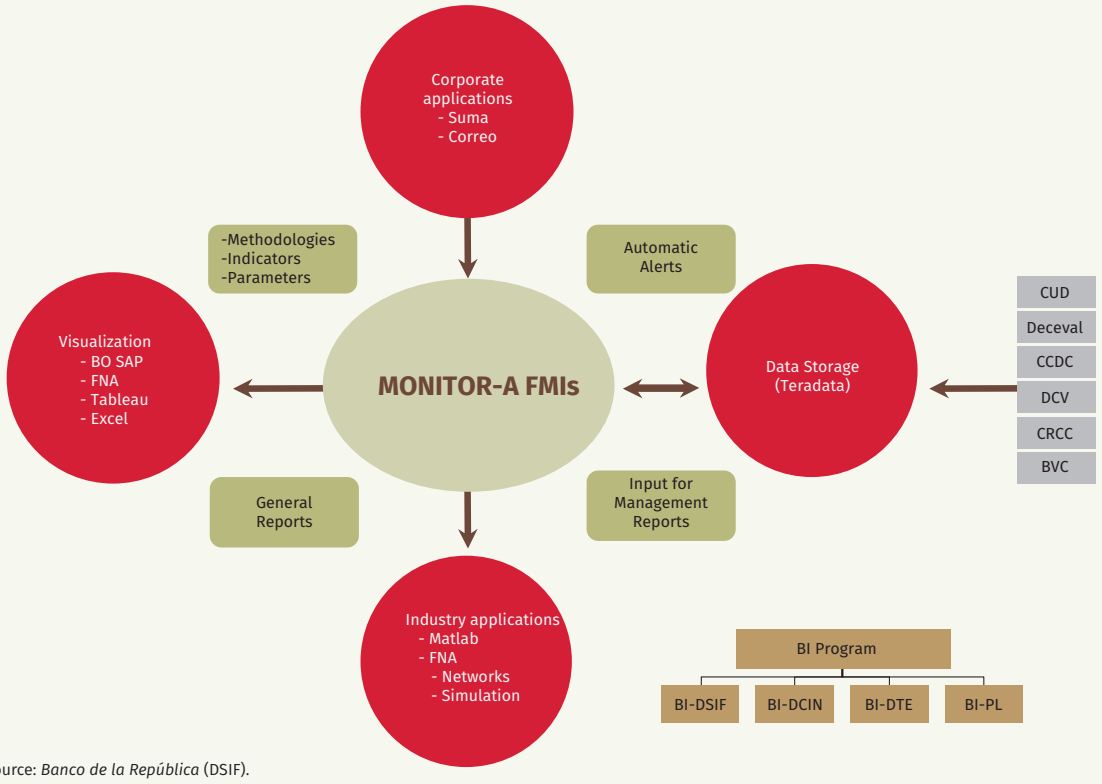
Diagram B illustrates the sequence of steps to be followed at DSIF if a proposed indicator is to be included in the set of those used for monitoring, particularly with regard to Monitor-A. The predesign of an indicator is intended to address some key aspect of the system, such as an analysis of the transfer network structure and the identification of systemically important entities, intraday liquidity risk, exposure to risk from the system's participants, or quantification of the impact of systemic default.

Once the significance and importance of the proposed indicator are recognized in terms of its contribution, and the method to be used is identified, a decision is made on the feasibility of implementing the indicator. Incorporating the indicator already developed in Monitor-A also requires adding it to the monitoring manual, with all the necessary detail.

1 *Banco de la República* selected Teradata and ETL de Informática as the hardware and software used to implement Monitor-A FMI.

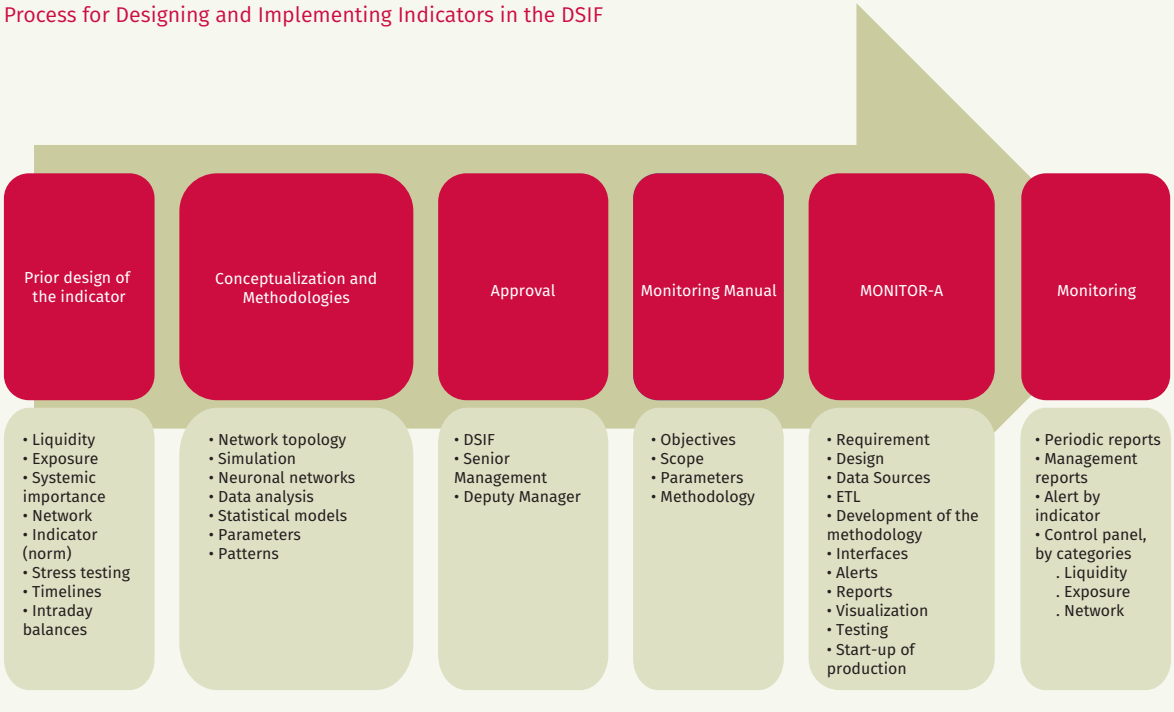
2 In Monitor-A FMI, the data will be centralized in a data warehouse, which will be reconciled, complete and reliable. The analysis will be timely, in an effort to identify risks, and will have an additional scope for other areas of the Office for Monetary Operations and International Transactions and the Office of the Deputy Technical Governor, as well as for the Office of the Financial Superintendent of Colombia.

Diagram A
The Monitoring and Analysis System for FMIs



Source: *Banco de la República* (DSIF).

Diagram B
Process for Designing and Implementing Indicators in the DSIF



Source: *Banco de la República* (DSIF).

03

A Comparison of the Findings of the Survey on the Use of Instruments for Routine Payments in Colombia

3.1 Introduction

In recent years, modern payment technologies have led to an expansion in the supply of non-cash payment instruments. To observe the effect this has had on the population's payment preferences, the Financial Infrastructure Oversight Department (DSIF) at *Banco de la República* has collected information on the use and acceptance of payment instruments. A set of questions to that effect has been included in the Survey on the Provision of Banknotes and Coins (EPEBM), which is carried out by the Treasury Department at *Banco de la República*, through the National Consulting Center (CNC).[35]

The survey has been conducted on three occasions: the first in November 2012, the second in November 2014, and the latest in February 2017.[36] It is important to note that percentage changes at the level of the surveyed unit

35 The DSIF module of the EPEBM is made up of closed questions. Some are binary (yes/no); the others are multiple choice.

36 Data collection in all three surveys relied on face-to-face interviews with the target population, as defined specifically by the CNC for each side of the market (general public and merchants). In the case of the general public, the company conducting the surveys used random samples of the population (i.e., a stratified multi-stage random sampling of elements), while the DANE list of hypermarkets, service stations and map frames (maps showing the structure, sections, and blocks in a sector) were used in the case of merchants.

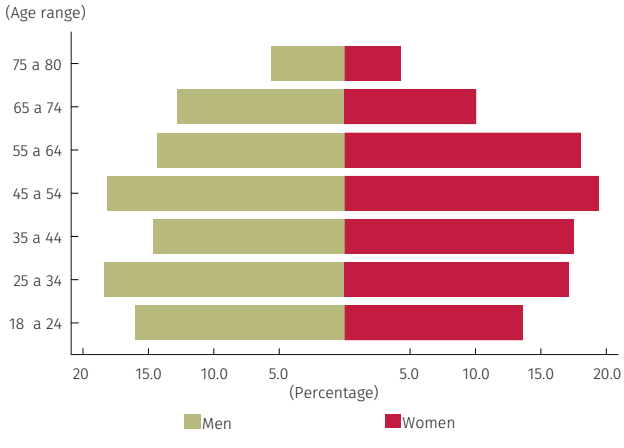
cannot be calculated on the basis of a comparison of the EPEBM findings presented below. On the one hand, this is because the surveys were not repeated in the same month of the year and, on the other, the periods of time separating them are not identical. The findings obtained by processing the information on the 33 cities that appear in all the surveys taken to date[37] are provided in this section. However, they are presented separately, because growth rates cannot be calculated between one survey and another, for the reasons mentioned already.

3.2 The General Public[38]

3.2.1 Demographic Aspects

To study the payment habits and preferences of the general public, the CNC defined the target population as persons between the 18 and 80 years of age who reside in the selected urban areas. The list of dwellings, households and persons in the 2005 National Population Census conducted by DANE is used as a sampling frame. Accordingly, the demographic aspects in all the surveys match a sample design with a total population represented in equal proportions (50%) by men and women. All three surveys show a decline in the population as of age 55, and a high concentration of responses among persons with ages between 18 and 64 years (83.64% for 2017, 83.63% for 2014 and 86.03% for 2012). Graph 3.1 depicts the population pyramid, by age, for the most recent survey. The pyramids for the earlier surveys are very similar, since they are all based on the 2005 census.

Graph 3.1
Population Pyramid, by Age



Source *Banco de la República* (EPEBM, 2017); calculations by *Banco de la República* (DSIF).

37 The survey in 2012 covered 35 cities; the ones in 2014 and 2017 included 43 and 47 cities, respectively. The following cities are included in all three surveys: Apartadó, Arauca, Armenia, Barrancabermeja, Barranquilla, Bogotá, Bucaramanga, Cali, Cartagena, Cúcuta, Espinal, Flandes, Florencia, Guadalajara de Buga, Ibagué, Ipiales, Leticia, Manizales, Medellín, Melgar, Mitú, Neiva, Pasto, Pereira, Popayán, Santa Marta, Sogamoso, Sincelejo, Tuluá, Tunja, Valledupar, Villavicencio, and Yopal.

38 The sample size changed from one survey to another. The number of interviewees in the 33 cities was 3,021 in 2012, 2,339 in 2014 and 2,194 in 2017. Using the expansion factors calculated by the CNC, it is possible to establish that the findings for 2017 represent 15,871,369 persons (those for 2014 represent 15,122,647 and those for 2012, 14,321,628). Taking into account the DANE labor market figures, the findings of all three surveys were determined to be representative of the population employed in the formal sector (participation in the EPEBM by persons with some level of occupation is 72.96% for 2017, 67.90% for 2014 and 67.58% for 2012). However, in addition to persons working fulltime or part-time, the survey includes self-employed workers, retirees, persons engaged in household work, and students. This is an important clarification to bear in mind.

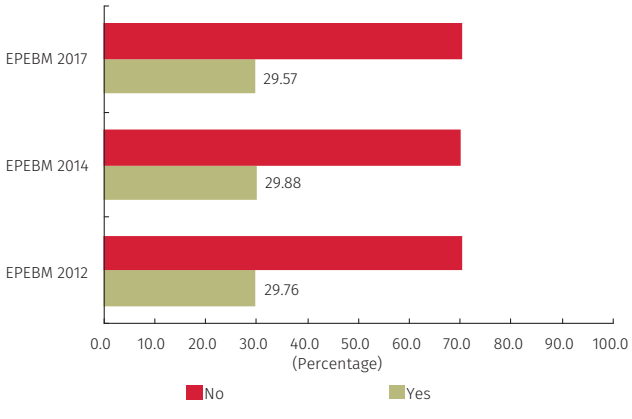
The distribution of the sample in the three surveys shows coincidences in schooling and socioeconomic brackets. With respect to the level of schooling, the highest average proportions (between the surveys) are for those with a secondary education (42.13%), technical and technological schooling (27.84%), and a primary education (19.82%). The lowest are for those with university studies (4.79%), postgraduate studies (3.63%), and no schooling (1.56%). In terms of the second demographic aspect, the highest average proportions are in brackets 2 (33.36%) and 3 (30.03%); the lowest are in brackets 5 and 6 (5.07% and 2.97%, respectively).

Monthly income is one demographic aspect that shows major differences between one survey and another. Only two income thresholds coincide in all the surveys: income below the legal minimum wage (SMLV), and income below or equal to two times the SMLV. For these income thresholds, the average population altogether accounts for 75.24% of the general public.[39]

3.2.2 Possession of Means of Payment and Payment Instruments

The use of non-cash instruments is linked inevitably to the means of payment (deposit and credit accounts) that enable transactions to be carried out. Deposit accounts (checking or savings) give a person the ability to use a debit card and checks (personal and cashier checks), while an available line of credit allows a person to make payments with a credit card. No significant changes in the ownership of means of payment were identified between one survey and another, with the average of these measurements showing 37.50% of the population with savings accounts and 7.19% with checking accounts.

Graph 3.2
Debit Card Ownership



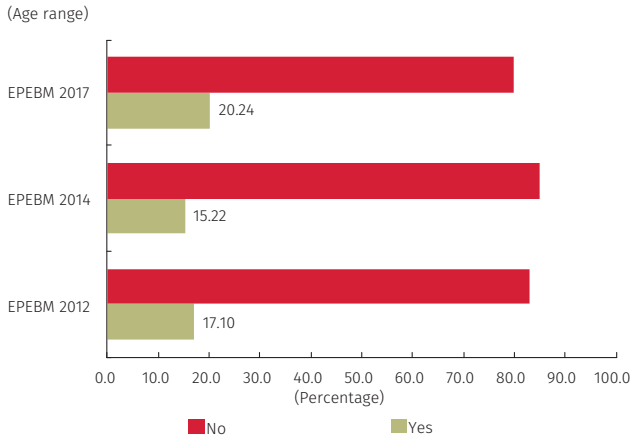
Source *Banco de la República* (EPEBM 2012, 2014 & 2017); calculations by *Banco de la República* (DSIF).

As for payment instruments, moderate changes are apparent in the case of debit cards, with ownership averaging at around 29% for the three surveys in all (Graph 3.2). This group could be represented, for the most part, by a high proportion of wage earners and retirees in the formal sector, who need access to a savings account to receive their income from work (or pensions). The balances in these accounts are accessed largely via debit cards.

As illustrated in Graph 3.3, there is evidence in the number of people with credit cards increased between the survey in 2014 and the one in 2017. This can be attributed to a variety of factors not measured in

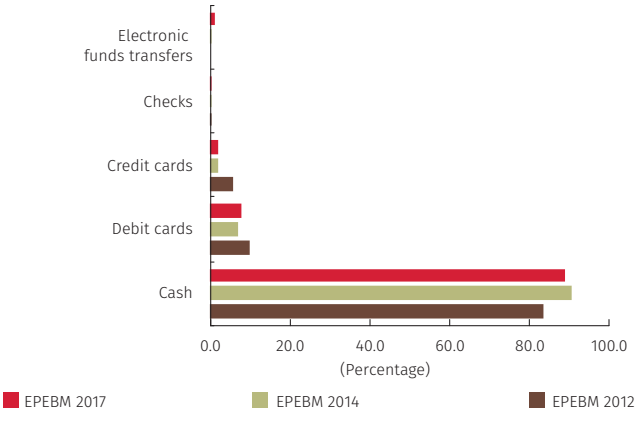
39 In the 2017 EPEBM, the percentage of those with income below the minimum wage was 41.25%. It was 26.21% in the 2014 survey and 27.87% in 2012.

Graph 3.3
Credit Card Ownership



Source *Banco de la República* (EPEBM 2012, 2014 & 2017); calculations by *Banco de la República* (DSIF).

Graph 3.4
Most Used Payment Instrument



Source *Banco de la República* (EPEBM 2012, 2014 & 2017); calculations by *Banco de la República* (DSIF).

the survey, such as those that could result from a larger supply of cards from banks and retail establishments.

These figures, all together, show debit card ownership has remained constant in the last seven years, while the increase in checkbook ownership is barely noticeable. In contrast, there was a sharp rise in credit card ownership between the second and third surveys.

3.2.3 The Preference for Payment Instruments

Two aspects must be considered with respect to the findings presented in this section. First, they pertain to the value of the payments made by the general public. The findings on the number of payments made coincide significantly with the previous findings and, therefore, will not be taken into account. Secondly, the questionnaires for two previous versions of the survey (EPEBM 2014 and 2017) include the possibility of making payments via electronic funds transfers. However, the share of this instrument as a portion of the value of the transactions carried out by the target population remains incipient (0.05% for 2014 and 0.95% for 2017); thus, it is reasonable to assume its share measured in the 2012 survey was close to zero.

As per Graph 3.4, cash is the instrument most commonly used for routine payments: It represents, on average for the three survey, 87.66% of the payments made by the target population, followed by debit cards (8.21%) and credit cards (3.29%), in that order. Similar use of credit cards is observed between the second and third surveys (around 2%), which contrasts with the increase in credit card ownership shown in the last subsection (3.2.2).[40] The situation is the same for checks; their use in retail and low-value payments reveals a downward trend (0.38% in 2012, 0.12% in 2014 and 0.03% in 2017). These findings indicate the population's most preferred instrument for retail-value payments is cash, followed by debit cards, credit cards, electronic funds transfers and checks, in that order.

40 In the 2012 survey, the proportion of payments with a credit card was 5.76%.

3.2.3.1 *By Age Range and Occupational Level*

A breakdown of the findings, by age range, shows the order of preferences remains unchanged, with cash being the most widely used instrument and checks, the least used. In terms of cash, the three surveys show high use in all age groups, but particularly among people over 75 years of age (92.77% on average for the three surveys). This population group is comprised mainly of retirees (46.89%, according to EPEBM 2017) and homemakers (38.74%, according to EPEBM 2017).

The largest preference for credit and debit cards is found in the population between 25 and 54 years and with some level of occupation (formal or self-employment). The average for the surveys shows 9.66% of the people in this age range prefer a debit card, while 3.58% prefer a credit card.[41]

Electronic funds transfers rank fourth. Their highest share (2.13% in 2017) is found among people between 35 and 44 years. This population group is comprised mostly of formally employed workers and the self-employed (81.95%). In fifth and last place are checks, which are the instrument used most commonly by people between 65 and 74 years.

These findings indicate demographic aspects such as age and occupation have a considerable impact on the choice of payment instruments. Cash is the most widely used instrument in all age groups, but mostly by people over 75 years of age. The highest use of credit and debit cards is observed in a population group that could be considered as representative of the economically active population. These findings also show electronic funds transfers are the instrument used to a larger degree by people with some level of occupation (employees and the self-employed workers), while checks are particular to the elderly (retirees).

3.2.3.2 *Education Level*

Among those with little schooling, defined as people with no education or a complete or partial primary education), the average between the surveys is 97.77% for the use of cash. This contrasts with the findings for the intermediate and high levels of education, where there is some preference for payment instruments in addition to cash. For those with an intermediate level of schooling, represented by secondary education and technical and technological studies, cash also accounts for a considerable share (91.95%). Nevertheless, this population group exhibits a moderate preference for debit cards (4.83%) and credit cards (2.48%). In the population group with a high education level (university and postgraduate studies),

41 According to the latest survey, 68.47% of the people in this age group are formally employed or self-employed. That proportion (68.47%) is made up of full-time employees (38.07%), the self-employed (23.42%) and part-time workers (6.98%).

these instruments account for an even greater share: 18.97% for debit cards and 6.24% for credit cards. In summary, the findings suggest the choice of payment instruments is influenced considerably by education level, since the more years of schooling a person has, the greater the preference for electronic payment instruments, such as bank cards.

In contrast, EPEBM measurements on the consumer side suggest there is also a moderate preference for other payment instruments, even though the target population makes intensive use of cash for retail and small-value payments. Sociodemographic aspects such as age, education and occupational level allow for a better understanding of the preferences of the target population, indicating that those in the middle-age range, who are formally employed and have an intermediate level of schooling, prefer to pay by credit or debit card.

3.3 Merchants

The target population of merchants and tradesmen consists of those who are engaged in commercial activities at hypermarkets, supermarkets, mini-markets, neighborhood supermarkets, neighborhood shops, variety stores, restaurants, service stations and on public transportation (taxis and buses).[42] The changes from one survey to another on this side of the market consist of different groupings based on the type of trade. To make the findings comparable between the surveys, this section examines the following groups: 1) hypermarkets, supermarkets, mini-markets and neighborhood supermarkets; 2) restaurants; 3) taxis and buses; 4) service stations; and 5) neighborhood shops, stationary stores, variety stores and drugstores.

3.3.1 Demographic Aspects

In the commercial sector, the average target population for the three surveys is comprised of taxis and buses (64.86%), neighborhood shops, variety stores, stationary stores and drugstores (24.96%), restaurants (8.05%), hypermarkets, supermarkets, mini-markets and neighborhood supermarkets (1.69%), and service stations (0.44%). From the sample of commercial establishments examined in this section, the percentage in the commercial bracket of the survey conducted in 2017 was 10.66%; in the 2014 and 2012 surveys, the proportions were 2.12% and 2.87%, respectively. The findings, by type of trade, are presented separately as follows.

42 When the expansion factors calculated by the CNC are applied, those interviewed accounted for 717,059 of the commercial establishments in 2017, 738,681 in 2014 and 533,768 in 2012.

3.3.2 Acceptance of Non-cash Payment Instruments

The merchants that accept non-cash payment instruments the most are hypermarkets and service stations. In the case of hypermarkets, the average acceptance of credit and debit card payments was high in the last two EPEBMs (90.9% in both cases), followed by electronic funds transfers (49.3%) and checks (68.3%). The findings for service stations are similar, with a high acceptance of payments made via debit cards (87.17%), credit cards (60.03%), electronic funds transfers (45.80%) and checks (21.97%).

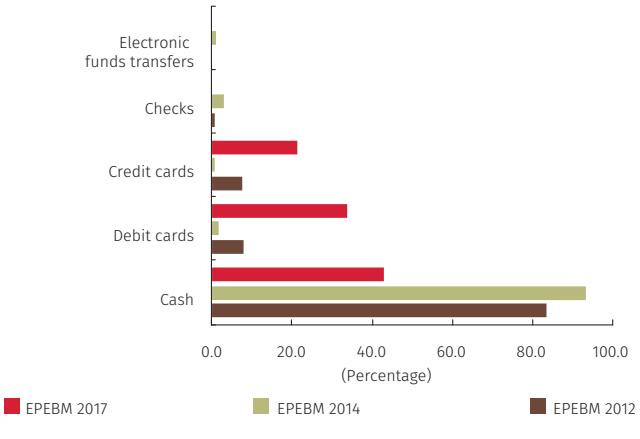
The findings for other types of commerce are very different. At supermarkets, mini-markets and neighborhood supermarkets, average acceptance for the last two surveys is 26% for credit and debit cards, followed by checks (9.72%) and electronic funds transfers (6.74%). In the restaurant group, bank card acceptance is low (6.45%), as is acceptance of electronic funds transfers (1.93%) and checks (1.58%). In last place are the groups comprised of neighborhood shops, variety stores, stationery stores and drugstores, and transportation services. For these groups, the highest percentage of acceptance of non-cash instruments is concentrated in credit and debit cards, with the first group having less than 5% and the second group, less than 2.5%

3.3.3 Customer Use of Payment Instruments

This section looks at the payment preferences of retail customers, according to what merchants say about the payments they receive for their commercial activity. As in the previous section, which focused on the general public, this one shows a substantial coincidence in the findings obtained on the number and value of transactions. Accordingly, there is no individual mention of these criteria. Instead, only the findings calculated for the value of payments are presented.

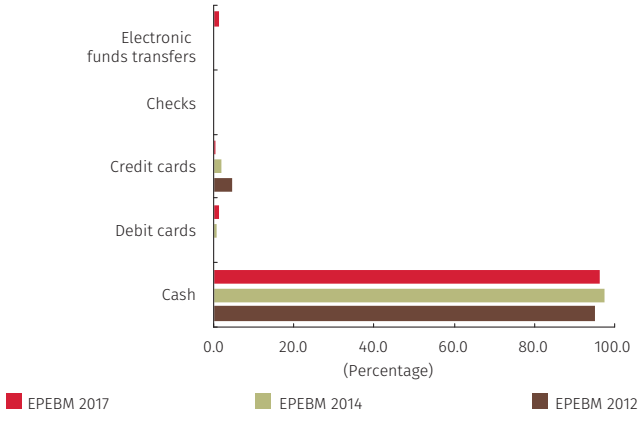
In all the merchant groups, the instrument most used by customers is cash. However, some particularities were identified. For the first group (hypermarkets, supermarkets, mini-markets and neighborhood supermarkets), the latest survey shows the use of cash was much lower (42.99%) than in the previous surveys, when the share exceeded 80% (Graph 3.5). This contrasts with the findings for debit and credit cards for which the proportion of payments increased between the first and last surveys (by 2017, payments with debit cards and credit cards accounted for 33.91% and 21.28%, respectively). Other instruments such as checks and electronic funds transfers account for less

Graph 3.5
Payment Instruments Most Used at Hypermarkets, Supermarkets, Mini-markets and Neighborhood Supermarkets



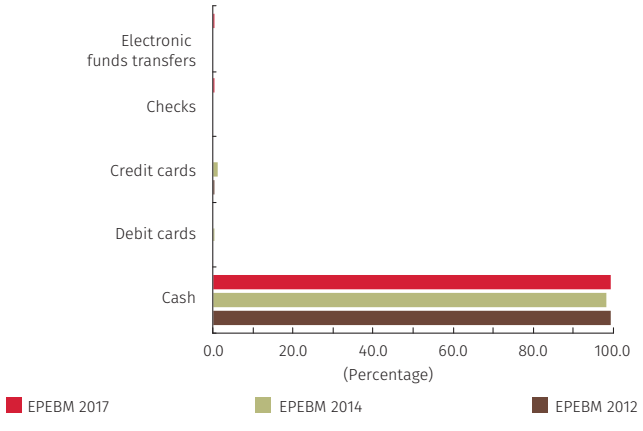
Source *Banco de la República* (EPEBM 2012, 2014 & 2017); calculations by *Banco de la República* (DSIF).

Graph 3.6
Payment Instruments Most Used at Restaurants



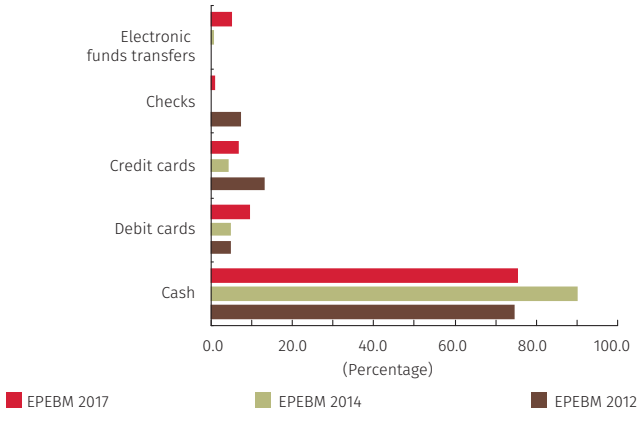
Source *Banco de la República* (EPEBM 2012, 2014 & 2017); calculations by *Banco de la República* (DSIF).

Graph 3.7
Payment Instruments Most Used for Taxis and Buses



Source *Banco de la República* (EPEBM 2012, 2014 & 2017); calculations by *Banco de la República* (DSIF).

Graph 3.8
Payment Instruments Most Used at Service Stations



Source *Banco de la República* (EPEBM 2012, 2014 & 2017); calculations by *Banco de la República* (DSIF).

than 2% of the value of payments received by merchants (average of the three surveys).

As for restaurants, the cash proportion (average of the three surveys) is 96.33% (Graph 3.6), while that of credit and debit cards is 2.21% and 0.88%, respectively. This outcome is explained largely by the proportion of establishments in the middle and low socioeconomic brackets.[43]

With regard to transportation services, the predominant payment instrument is cash (Graph 3.7), averaging 98.98% for the three surveys. The intensive use of this instrument obeys the fact that it is practically the only one accepted by all transport operators. Although some taxis receive credit and debit card payments from their customers, their average for the three surveys is less than 1%.

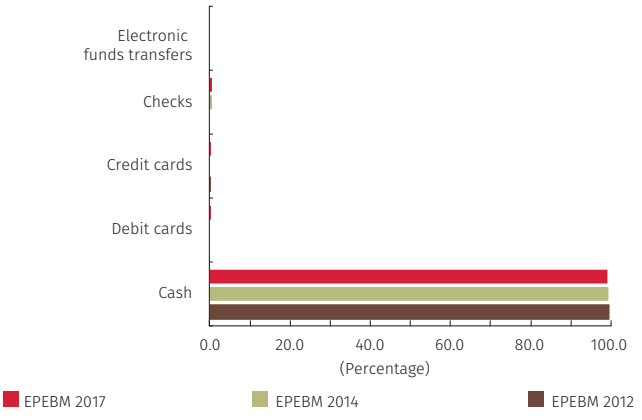
At service stations, cash accounts for 80.01% of the payments received from customers, on average. However, as illustrated in Graph 3.8, a significant proportion of payments at service stations involve credit cards (8.06%), debit cards (6.48%) and checks (4.27%). With regard to electronic funds transfers, the 2014 survey measured these payments at less than 1% (0.62%), but the 2017 survey revealed much more use (5.08%).

At neighborhood shops, stationary stores, variety stores and drugstores, the use of cash averaged 99.46% for the three surveys. As shown in Graph 3.9, payments received via other instruments are practically non-existent.

Merchants say their customers make intensive use of cash payment and moderate use of other instruments, such as credit and debit cards. Although changes were identified in the target population's preferences for instruments that facilitate electronic payments, these are evident only at service stations and hypermarkets, supermarkets, mini-markets and neighborhood supermarkets. In contrast, the use of checks is getting smaller.

43 In the 2017 survey, 74.85% of the restaurants were in brackets 1, 2, 3 and 4; 10.26%, in brackets 5 and 6; and only 7.52%, in the commercial bracket.

Graph 3.9
Payment Instruments Most Used at Neighborhood Stores, Stationary Stores, Variety Stores and Drugstores



Source *Banco de la República* (EPEBM 2012, 2014 & 2017); calculations by *Banco de la República* (DSIF).

In summary, the findings indicate the use of non-cash instruments for routine payments remains low. Although their ownership and use by the general public is on the rise, their acceptance at some retail establishments is still limited. However, some instruments, such as debit cards, have gained share in this payment segment.

04

Interoperability between the Cryptoasset System and the Traditional Financial System[44]

Generally speaking, any system has two fundamental elements: agents and their interactions. The cryptoasset system is no exception.[45] Its agents are those who use cryptoassets, in addition to those who provide services to cryptoasset users. The second component is comprised of the digital asset and the underlying technological platform that supports interaction

44 This section expands on some of the elements presented in "El Sistema de los criptoactivos: una mirada structural" (The Cryptoasset System: A Structural View), which is a chapter in the 93rd edition of *Ensayos sobre Política Económica* (ESPE), a journal devoted to the topic of cryptoasset agents (Arango-Arango et al., 2019). The content in this section is solely descriptive in scope; it should not and cannot be interpreted as a recommendation or technical notion on the relationship between the cryptoasset system and the traditional financial system.

45 The term *cryptoasset* is used instead of *cryptocurrency*, because cryptoassets are representations of value that, in some circumstances, can serve as an alternative to money (ECB, 2015; Arango-Arango et al., 2018). Therefore, they cannot be fully considered as money or currency.

between and among the agents in the system. In the case of the bitcoin system, the digital asset is the bitcoin and the technology platform is the blockchain.[46]

The original purpose of the cryptoasset system (see Nakamoto, 2008 and 2009) is to provide users with a digital asset of limited supply,[47] the value of which depends on free play between supply and demand, based on a technological platform that enables users to interact directly (peer-to-peer), without intervention on the part of agents in the traditional financial system (e.g.: central banks, governments and financial institutions).

However, the cryptoasset system is not isolated entirely from the financial system, which it pretends to do without. As long as cryptoassets do not serve as a payment instrument in the market for goods and services, some users will have to rely on payment instruments in the traditional financial system to buy and sell cryptoassets, which means there is a connection between the two systems.

4.1 How does a user enter the cryptoasset system?

A user is understood as an agent who seeks to use a digital asset and its underlying technological platform to conduct a transaction, without the main corporate objective being linked to the provision of services related to cryptoassets (e.g., custody, intermediation, digital wallets, mining). Users acquire cryptoassets for the purpose of entering the system; that is, in order to use them to purchase goods and services (i.e., as a payment instrument) or to hold a position in a cryptoasset and eventually secure a gain derived from its valorization (i.e., as a value reserve).

In principle, there are four ways to acquire cryptoassets. The first is to receive a payment in cryptoassets in exchange for providing a service or delivering goods. This form is not common, because it is difficult to find private individuals or companies willing to exchange goods and services for cryptoassets (Meiklejohn et al., 2013; Ali et al., 2014; Surowiecki, 2018; JP Morgan, 2018; Cross, 2018; Wood, 2018; Kharif, 2018). According to Armstrong (2018), only 10% of all transactions with cryptoassets involve purchases of goods and services.

The second is to buy cryptoassets with cash. This implies that two users, one who is willing to exchange cryptoassets for cash from the other, meet physically to carry out the transaction. Given the limited

46 This is a technology capable of keeping a distributed, encrypted, permanent and growing ledger that prevents the asset from being spent by users simultaneously, more than once (double spending).

47 For example, the bitcoin supply is limited to 21 million, which will be reached in the year 2140. This does not mean bitcoin, like other cryptoassets, cannot experience forks: events that split an existing cryptocurrency simultaneously into two co-existing versions, thereby multiplying the supply.

adoption of cryptoassets, it is not easy for users to come together for this type of exchange. Consequently, there are services dedicated to providing information on the location of users who are willing to buy or sell cryptoassets (e.g., https://localbitcoins.com/).

The third way is to use electronic tellers where cryptoassets can be sold for cash or purchased with a credit card. However, their number and coverage is still low. Currently, there are about 4,500 cryptoasset ATMs in the world, with bitcoin being the most common cryptoasset. Approximately 58% of these ATMs are in the United States, and there are 33 in Colombia (0.7% of the total), including 19 in Bogotá. Yet, the installation of new cryptoasset ATMs has declined since mid-2018.[48]

Lastly, there are exchange platforms (i.e., exchanges) that offer the user services for buying and selling cryptoassets. They are able to act as intermediaries between buyers and sellers, in addition to being proprietary traders of cryptoassets. It is estimated that proprietary transactions can represent up to 20% of the total on some of the major exchanges (Underwood, 2018).

The difficulty in trading cryptoassets directly with other users, whether in exchange for goods, services or cash, has led to exchange platforms becoming the primary means whereby users buy and sell these assets. Although there are no exact or verifiable figures, it is estimated that most transactions in the cryptoasset system pertain to purchases and sales in which an exchange platform is involved. Wood (2018) and Roubini (2018) say the proportion is 99%, while Armstrong (2018) estimates it to be 90%.[49]

The first two ways of acquiring cryptoassets do not involve the financial system. However, it is included in the third and fourth, through exchange platforms.[50] Unless cash is used to buy cryptoassets at an electronic teller, the traditional financial system is involved in these two forms of acquisition. A user looking to acquire cryptoassets must transfer the funds to an exchange platform, through an electronic payment instrument in the traditional financial system (e.g., electronic transfers, credit cards). The respective seller and the exchange platform will receive the funds in the products they

48 With information from Coin ATM Radar (consulted on March 28, 2019, https://coinatmradar.com/charts/geo-distribution/) and Bitcoin.com (consulted on March 29, 2019, https://www.bitcoin.com/bitcoin-atm/).

49 The origin of transactions in the cryptoasset system has been called into question recently. A study done by Bitwise Asset Management, and reported to the U.S. Securities Exchange Commission (SEC), found that nearly 95% of the transactions (according to value) are created artificially by some exchange platforms. The study is available at https://www.sec.gov/comments/sr-nysearca-2019-01/srnysearca201901-5164833-183434.pdf (consulted on March 30, 2019).

50 Purchases and sales through electronic tellers should be considered as part of those made via an exchange platform, which is the user's counterparty in the transaction. Not all ATMs are two-way. In other words, all ATMs allow users to purchase cryptoassets, but not all allow them to sell cryptoassets.

hold with the traditional financial system (e.g., savings accounts), through payment instruments used in that system. In both cases, infrastructure in the traditional financial system will participate (e.g., clearing houses, card networks). For that reason, exchange platforms provide interoperability between the cryptoasset system and the traditional financial system. In other words, they serve as a connection between the two.

4.2 The Exchange Platforms and Interoperability

Given the difficulty in exchanging cryptoassets directly, users must interact with various agents in the cryptoasset system and the traditional financial system. In terms of the cryptoasset system, the user must set up a digital wallet and open an account on an exchange platform.

Digital wallets allow users to store and use their keys and authentication codes easily, as well as to initiate a transaction or view previous ones.[51] The exchange platforms, as mentioned already, offer users a range of services for the purchase and sale of cryptoassets, either in proprietary positions or on behalf of third parties.[52]

As for the traditional financial system, the user needs to have a bank account from which funds can be send (received) electronically to (or from) the exchange platform on which the cryptoassets will be purchased (sold). One alternative is to use a credit card, which normally requires a relationship between the user and a financial institution (e.g., a bank). With that instrument, cryptoassets can be purchased either directly, through an exchange platform, or via an ATM. Exchange platforms charge a commission for receiving or sending payments via payment instruments in the financial system. The commission varies from one platform to another (Underwood, 2018; BTC Makers, 2018).

As soon as the user has one of these payment instruments (i.e., electronic funds transfer, credit card), plus a digital wallet and an account with an exchange platform, he can carry out transactions with cryptoassets. Diagram 4.1 shows a typical transaction for the purchase and sale of cryptoassets. As highlighted by Böhme et al. (2015), this type of transaction involves one or up to two currency conversions.

In this case there are two users: A and B. They want to buy and sell bitcoins, respectively, through an exchange platform. User A must

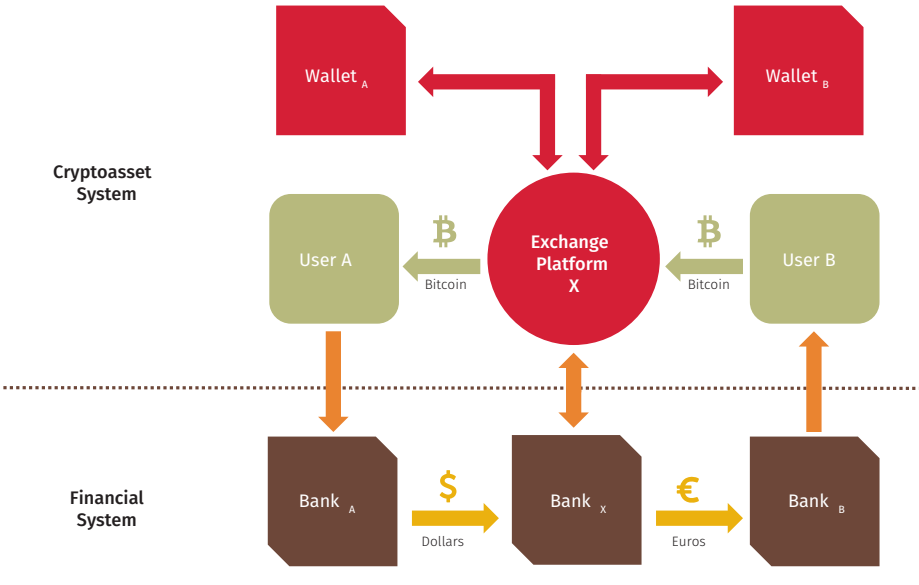
51 Generally speaking, they are classified as online (hot storage) or offline (cold storage) wallets, depending on how they can be accessed. The user can do without a digital wallet, but this requires more technical knowledge and implies greater risk in handling the keys and codes required to safeguard and use cryptoassets.

52 They also issue cryptoassets, offer bid and ask-price quoting services, statistics, margin accounts, automated trading, cryptoasset custody, and digital wallets.

make a payment to the exchange platform. For this to happen, both the user and the exchange must employ one of the payment instruments that is available in the traditional financial system. Diagram 4.1 shows this payment as a transfer from user A's bank (Bank A) to the exchange platform's bank (Bank X). In the meantime, user B must transfer his bitcoin to the exchange platform. To do so, he uses his digital wallet (Wallet B), which uses the blockchain platform to verify, conduct and register the transaction.[53]

In this instance, the job of the exchange platform is to bring the buyer and seller together, charging a commission for this service (e.g., taking the bid-ask spread as a fee) or for receiving and sending payments from and to users. Then, the exchange platform delivers the agreed amount to the seller, doing so through one of the payment instruments used in the financial system. This delivery is represented in Diagram 4.1 as a transfer in euros from the exchange platform's bank (Bank X) to user B's bank (Bank B). At the same time, the exchange platform delivers to the buyer the amount of bitcoins agreed to in the cryptoasset system. The result is the registration of a bitcoin balance on the bitcoin blockchain platform, which the user can manage through his digital wallet (Wallet $_A$).

Diagram 4.1
Interoperability of the Cryptoasset and Financial Systems



Source: *Banco de la República* (DSIF).

53 Orders are verified and transactions are subsequently recorded by agents known as miners, who are responsible for applying complex mathematical processes (i.e., cryptography). Miners receive bitcoins either in exchange for new bitcoins generated by their verification work or through commissions offered by users. The verification work done by miners is the only source of bitcoins (see ECB, 2012 and 2015).

Clearly, this type of cryptoasset transaction, which is the most frequent, given the difficulty in exchanging cryptoassets directly, cannot be considered as peer-to-peer between the users. Nor can it be regarded as independent of the financial system, since it requires payment instruments (e.g., electronic funds transfers, credit cards) and other services (e.g., bank accounts) that are provided or supported by financial institutions (e.g., banks) and traditional financial infrastructures (e.g., electronic clearing houses and card networks). Underlying this type of transaction is the exchange platform, which links the financial system to the cryptoasset system; in other words, it provides interoperability to both systems.

4.3 Prospects for Interoperability between the Cryptoasset System and the Financial System

The work of exchange platforms is very important to the cryptoasset system. As described in Arango-Arango *et al*. (2019), this is because they are highly central agents in the cryptoasset system, which is meant to be a distributed or entirely decentralized system.

According to Armstrong (2018) and Grossman (2019), the process towards mass adoption of cryptoassets implies interoperability with the traditional financial system. In other words, the eventual adoption of cryptoassets on a mass scale might make exchange platforms irrelevant, along with their work in providing interoperability between the cryptoasset system and the financial system.

Given that mass adoption of cryptoassets is uncertain, as is the possible irrelevance of exchange platforms once that adoption is achieved, the interoperability between both systems must be monitored, so as to determine the challenges and difficulties involved in the interconnection between the financial system and the cryptoasset system.

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Annex 1
Infrastructure and Financial Markets

The following description makes it possible to identify and understand the role infrastructures play in the markets they support and the relationships among them. For that reason, they have been grouped into markets for fixed-income securities, equities, foreign exchange and standardized derivatives. Aspects related to the retail-value payment systems are expanded upon as well.

Fixed Income

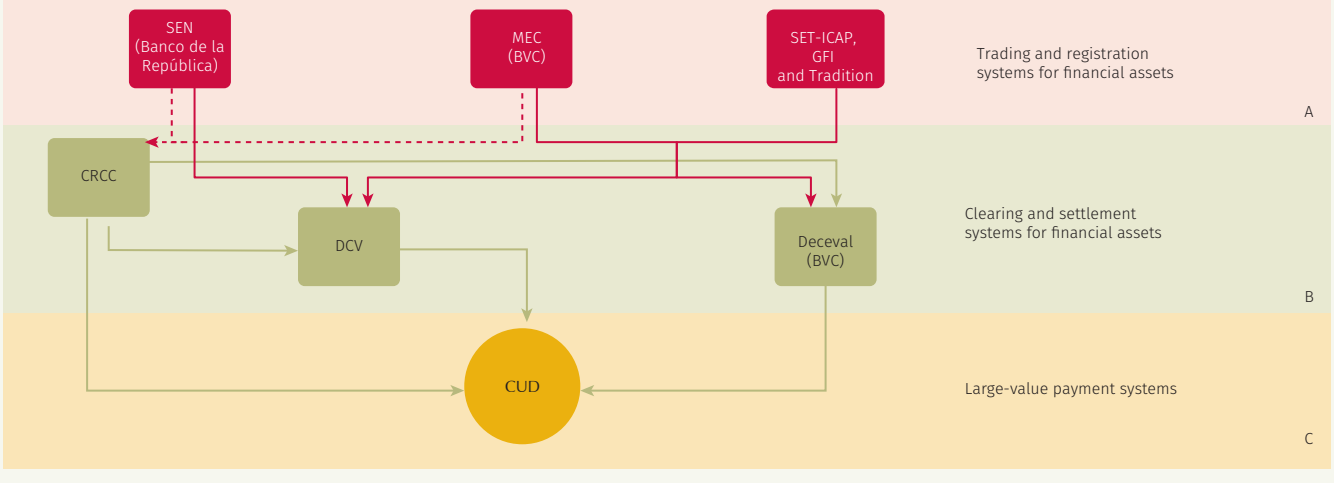
Diagram A1.1 shows the infrastructures that provide trading, clearing and settlement services for operations in this market. The flow begins at the top, with the trading and registration systems, where participants conduct their transactions through the use of automatic matching mechanisms (SEN and MEC) and hybrid voice and data systems (SET-ICAP Securities, GFI and Tradition). In each of these, the seller must inform the system manager of the deposit where the securities to be delivered are kept, so the manager can send them in order to complete the process and settlement. The securities leg is fulfilled with an annotation in the securities deposit referring to the change in ownership in favor of the buyer, and the cash leg is carried out through the transfer of funds to the seller, via the CUD large-value payment system.

Term operations (TES sell/buy-backs) are sent by the SEN and MEC systems to the Central Counterparty Clearing House (CRCC) for respective risk management (dotted lines in the diagram), while gross clearing and settlement are done in the DCV-CUD (solid lines in the diagram).

Variable Income

The BVC manages the value chain in the spot market for variable-income in Colombia, from trading to clearing and settlement. Forward transactions (repos on equities) are managed through the same infrastructure; however, their clearing and settlement are now handled through the CRCC, as of August 2017.[1]

Diagram A1.1
Flow of Operations in the Fixed Income Market



Source: *Banco de la República* (DSIF).

1 See Decree 2219 issued by the Ministry of Finance and Public Credit on December 27, 2017. It modifies Decree 2555/2010 with respect to several aspects; namely, certain provisions applicable to transactions that are cleared and settled through a counterparty clearing house and the creation of a protocol for crisis situations or contingencies in the securities market.

As illustrated in Diagram A1.2, the flow starts in the trading system, where participants come together to bid on available securities.

Once the spot market closes, these transactions are confirmed and completed for clearing and settlement. The BVC uses Deceval for the securities leg, and the CUD large-value payment system for the cash leg.

In the forward market, the BVC sends the transactions to the CRCC for risk management, clearing and settlement. As in the spot market, the cash leg is settled through the CUD and the securities leg, through Deceval.

Foreign Currency

SET-ICAP-FX, GFI and Tradition manage the trading and trade registration systems in the Colombian forex market. The first does so through a matching system, where participants voluntarily decide which offers to accept. The others receive each participant's currency offers privately, through voice and data systems, and then disclose them to the rest of the market. The CRCC and the Foreign Exchange Clearing House of Colombia (CCDC) take charge of clearing and settling those transactions that can be accepted under the conditions established in their respective rules and regulations. The CCDC clears and settles FX spot transactions (pesos-dollars), but only those conducted between the participating financial entities.[2] It also clears and settles FX forwards (pesos-dollars) among its members, with non-deliverable forwards (NDF), either on a proprietary basis or on behalf of third parties (Diagram A1.3).

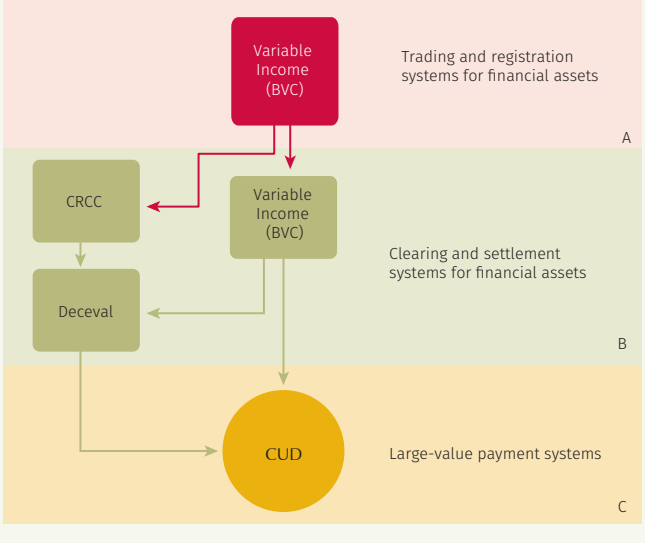
Currently, the CCDC processes spot and next day transactions from SET-ICAP-FX. As the central counterparty, it also clears and settles peso/dollar NDFs from all authorized systems. However, all these transactions are now received from SET-ICAP-FX.

Standardized Derivatives

The BVC and Derivex manage the trading and registration systems for the standardized-derivatives market. Diagram A1.4 shows the transactions carried out in these systems are sent to the CRCC for clearing and settlement.

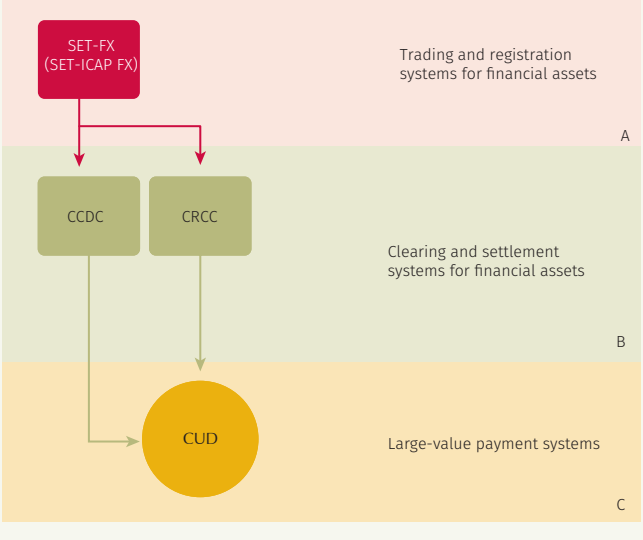
At this point, the CRCC, as the central counterparty, makes a novation, becoming the seller to every buyer and the buyer to every seller in these transactions. It then generates the obligations of its participants (clearing) and proceeds to settle them in the CUD large-value payment system. When settlement involves delivery of the underlying asset, the CRCC uses the depositories (DCV and Deceval) to receive the securities from the net debtors and deliver them to the net creditors.

Diagram A1.2
Flow of Operations in the Variable Income Market



Source: *Banco de la República* (DSIF).

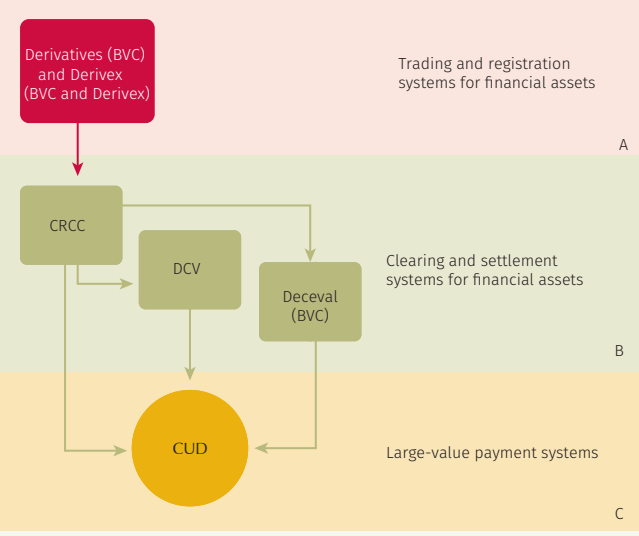
Diagram A1.3
Flow of Operations in the Forex Market



Source: *Banco de la República* (DSIF).

2 According to External Resolution 4 issued by the Board of Directors of *Banco de la República* in 2006, the institutions overseen by the Office of the Financial Superintendent of Colombia, the General Office of Public Credit and National Treasury at the Ministry of Finance and Public Credit, and *Banco de la República* may act as direct participants, subject to the regime regulating their activities and to other applicable provisions.

Diagram A1.4
Flow of Operations in the Market for Standardized Derivatives



Source: *Banco de la República* (DSIF).

Retail-value Payments

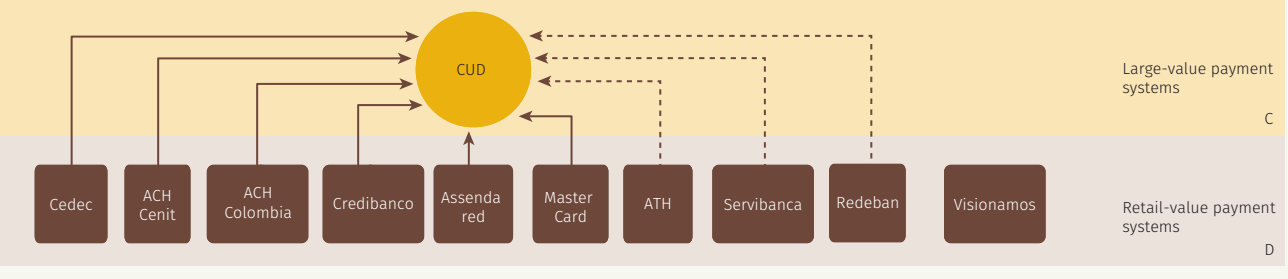
Diagram A1.5. depicts the Electronic Clearing House for Checks and Payment Instruments (CEDEC), which is managed by *Banco de la República* and clears checks and other payment instruments at the national level, and the automated clearing houses for electronic payments; namely, ACH and ACH-Cenit (managed by the central bank), and ACH-Colombia. These clearing houses process electronic orders, either for payments or for the transfer of funds or small-value collections. The orders are placed by related institutions, on behalf of their clients (private individuals or legal entities) with a checking or savings account. Also represented are Credibanco, Assenda Red, Mastercard, ATH, Servibanca and Redeban networks, which process debit and credit card transactions carried out at ATMs and retail establishments, among other operations.

Credibanco, Assenda Red and Mastercard have their own deposit account with the large-value payment system. Accordingly, they clear and settle transactions directly, using the resources in that account. The other networks do not have an account in the central bank system.[3] Consequently, they only clear transactions, which are settled in a commercial bank in the deposit accounts opened under their name with *Banco de la República*.

There is also the Visionamos network, which is part of the solidarity sector of the economy. It processes card transactions covered by participating cooperatives or international franchises.

Each entity performs a specific function within the structure of the payment systems. However, in the end, a significant proportion of the obligations generated by their participants in the clearing process are settled largely in the CUD large-value payment system.

Diagram A1.5
Flow of Operations in the Retail-value Payment Systems



Source: *Banco de la República* (DSIF).

3 The dotted lines in Diagram A1.5 allude to the fact that these ATM and card networks do not have their own deposit account in the central bank's CUD system.

Documents Published Recently by the Financial Infrastructure Oversight Department

"The Evolution in World Trade from 1995 to 2014: A Network Approach"[1]

Freddy Cepeda, Fredy Gamboa, Carlos León, and Hernán Rincón

Network analysis is used as a tool in this paper to identify and characterize the connective structure of the global trade network and to study how it evolved during the period from 1995 to 2014. With information from the United Nations Comtrade Database, trade networks between 106 countries are constructed for the total and for sixteen trade sectors during ten biannual periods. The findings show the world trade network is dense (i.e., high connectivity), and the connections are distributed evenly. The rise in the number of trade relationships resulting from the globalization process is documented as an increase in the density and reciprocity of the global trade network. One sees the financial crisis in 2008-2009 did not lead to less connectivity in the global trade network, although its trend towards growth was interrupted. The construction of minimal spanning trees for the global trade network illustrates how world trade evolved from a hierarchical structure comprised of two groups, led by the United States and Germany, to one with three groups, led by the United States, Germany, and China.

Nowcasting Economic Activity with Electronic Payment Data: A Predictive Modeling Approach[2]

Carlos León and Fabio Ortega

A model for nowcasting economic activity in the Colombian case is introduced in this paper. The economy monitoring indicator (EMI) of the National Bureau of Statistics (DANE) is used as a short-term index of economic activity, and the payments registered with the two electronic transfer clearing houses (ACH Colombia and ACH Cenit) and the check clearing house (CEDEC) are used as predictors, as are EMI delays. The purpose of this nowcasting model is to predict present changes in the EMI, so as to anticipate the index approximately two months before DANE publishes the official data. The findings show the chosen predictors, together with a prediction model based on artificial neural networks, allow for an adequate nowcast of economic activity in Colombia. Hence, it is possible to reduce the delay in the availability of data on variations in the EMI from two months to just a few days, with the potential advantages this implies for economic agents in terms of better information for their decision-making process.

1 Published in *The Journal of International Trade & Economic Development*, Vol. 28, No. 4, pp. 452-485, 2019, with a preliminary version appearing in *Borradores de Economía,* No. 985, *Banco de la República*, 2017 (http://www.banrep.gov.co/sites/default/files/publicaciones/archivos/be_985.pdf).

2 Published in *Revista del Rosario*, Vol. 21, No. 2, 381-407, 2018, with a preliminary version appearing in *Borradores de Economía*, No. 1037, *Banco de la República*, 2017 (http://repositorio.banrep.gov.co//handle/20.500.12134/6997).

Ownership Networks Effects on Secured Borrowing[3]

Constanza Martínez, Pavel Čížek, and Carlos León

This paper examines the secured borrowing based on sell/buy-backs, taking into account both their quantity and price. The empirical evidence presented suggests that – after controlling for individual characteristics - group-specific effects (defined by belonging or not to a financial group) play a relevant role in this market. By applying spatial econometric models through the use of panel data, it was found the amount of liquidity obtained through sell/buy-backs depends on traditional determinants (size of the institution and financial leverage), but also on the average size of the financial group to which the institution belongs. Similarly, the cost of liquidity, which hinges on the amount of liquidity, depends to the same extent on the average size of the group to which the financial institution belongs. The findings are robust to different relationship structures specified for the financial groups.

Colombian Liberalization and Integration into World Trade Markets: Much Ado about Nothing[4]

Freddy Cepeda, Fredy Gamboa, Carlos León, and Hernán Rincón

The evolution of Colombia's liberalization and its integration into world trade between 1995 and 2016 are examined in this paper, as is the country's importance in the world trade network. This is done from a network analysis perspective and involves calculating a set of network centrality metrics based on the United Nations Comtrade Database. The highest value and volume of exports and imports observed for more than two decades was, according to Colombian economic literature, the result of trade policies and institutional changes. However, from the standpoint of network analysis, this increase in absolute terms was not reflected in a notable improvement in Colombia's integration into world trade. When contrasting the country's centrality with that of regional peers, such as Chile, Brazil, Mexico and Peru, and that of leading countries such as China and the United States, it is evident there was no progress in Colombia's position in the world trade network (in relative terms). Accordingly, the authors maintain the absolute changes in Colombia's trade flows did not translate into further integration into world markets. Peru and Chile, in contrast, improved their centrality significantly. The findings of this research provide elements for economic and institutional policymaking to address the challenges that lie ahead for Colombia, if it is to integrate more successfully into world markets.

3 Published under the title *CentER Discussion Paper*, Vol. 2018-015, Tilburg University, April 2018 (https://research.tilburguniversity.edu/en/publications/ownership-networks-effects-on-secured-borrowing).

4 Published in *Borradores de Economía,* No. 1065, *Banco de la República*, 2019 (http://repositorio.banrep.gov.co/bitstream/handle/20.500.12134/9648/be_1065.pdf)

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