Blockchain Technology: Challenges and Opportunities

Regional Payments Week 2015

The World Bank, BIS and CEMLA

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Chief U.S. Economist
BBVA Research

Santo Domingo, Dominican Republic
Bitcoin and Blockchain
In the beginning there was Bitcoin

Bitcoin, the first decentralized cryptocurrency, peer-to-peer payment network, has gained popularity

Transaction per Day
Thousands

Hash Rate
Million GH/s

Per Second:
- Bitcoin: 2
- PayPal: 115
- Visa: 2,000

Harder to mine as more are available; 21M max. (2140)

Source: BBVA Research & Blockchain Info
Definitions and predictions as volatile as Bitcoin itself

However, there is a heated debate on whether it can be considered “money”

Daily Close Price and Volatility
USD and %

Transaction Volume
US$bn, daily average

Source: BBVA Research, Blockchain Info & Coinometrics
What matters the most is Blockchain technology.

The main contribution is Bitcoin’s technological backbone: Blockchain technology; a distributed ledger of verified transactions of a particular unit.

**Blockchain:**
- Decentralized and immutable ledger; no central repository or single administrator
- Holds and reports the numbers of every transaction
- Available to everybody, so all transactions are public

Centralized

Decentralized (hubs)

Distributed
Blockchain technology can effectively build trust

Property rights and prosperity are inextricably linked

Rule of Law and Economic Growth

% and Index

“Virtually every commercial transaction has within itself an element of trust”
Arrow

Trust facilitates transactions and lowers monitoring & screening costs
A broader and stronger protection of property rights enhances resource allocation, which translates into greater wealth creation

- Are you who you say you are?
- Do you own what you claim to own?
- Will you deliver on your commitment?

Source: Barro & Sala-i-Martin
The essentials of Blockchain

- Transactions are added to the ledger as new blocks on a chain
- “Copies” are replicated by each transaction agent or “validator”
- Transactions’ validators operate through consensus mechanism = self-policing, verifiable, trustable
- Validation resilient to malicious attacks
- System is consistent and failure tolerant

<table>
<thead>
<tr>
<th>Applications</th>
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<tbody>
<tr>
<td>Identity</td>
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<table>
<thead>
<tr>
<th>Transaction validation/ consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed environment</td>
</tr>
<tr>
<td>Semi-open environment</td>
</tr>
<tr>
<td>Open environment</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>“Closed” ledger</th>
<th>Permissioned ledger</th>
<th>Permissionless ledger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access: private vs. public</td>
<td>Infrastructure: Homogeneous vs. heterogeneous</td>
<td>Block’s size: limited vs. extensive</td>
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Cryptoprotocols and related infrastructure
Great interest in exploring its capabilities

**2015: Fast and Furious**

**February**
- Coinbase announces first licensed Bitcoin exchange

**March**
- Circle raises $50 million led by Goldman Sachs and IDG

**April**
- Digital Asset Holdings plans to use the blockchain for syndicated loans, Treasury repos, and settlement. Acquires Hyperledger

**September**
- Visa, Citi et al. invest $30 million in Chain.com
- BBVA and other banks join the Distributed Ledger Group, formed by R3 CEV, to jointly explore architecture, identity and security, and regulatory/legal frameworks

Source: Media Reports
New players and uses continue emerging

### Financial and Non Financial use cases

#### Cloud Storage
- Filecoin
- STORJ.IO

#### Digital Identity
- Onename
- SbsCard
- Filament
- Tilepay

#### Internet of things
- Synereo
- Twister
- Thingchain
- ChromaWay

#### Social networks
- Everledger
- Factom

#### Supply chain
- Thingchain
- Funderbeam

#### Digital asset issuance
- Interledger
- Hyperledger

#### Asset Registries/ Anti counterfeiting
- Monegraph
- Verisart

#### Private chains
- Ethereum
- Xapo

#### Analytics
- Coinalytics

#### Smart contracts
- Appliedblockchain

#### Custody
- Circle

#### Cross Border
Endless possibilities in the age of Internet of Things

“The Programmable World”

10% of world GDP will be stored on blockchain by 2027

Source: Gartner, World Economic Forum
Will a thousand chains blossom?

**Intangibles:** Coupons; Vouchers; Reservations; Movie tickets; Patents; Copyrights; Trademarks; Software licenses; Videogame licenses; Music/movie/book licenses (DRM); Domain names; Online identities; Proof of authorship / Proof of prior art

**Private Records:** Contracts; Signatures; Wills; Trusts; Escrows; GPS trails

**Semi-public:** Degrees; Certifications; Learning outcomes; Grades; HR records; Medical; Accounting; Business transaction; Genome data; GPS trails (institutional); Delivery; Arbitration

**Physical Assets:** Home/ Apartment/ Vacation home/timeshare keys; Hotel room keys Car keys; Rental car keys; Locker keys Safety deposit box keys; Package delivery; Betting; Fantasy sports

**Public Records:** Land titles; Vehicle registries; Business license; Business incorporation / dissolution; Business ownership; Regulatory records; Criminal records; Passports; Birth certificates; Death certificates; Voter IDs; Voting/elections; Health/ Safety Inspections; Building permits; Gun permits; Forensic evidence; Court records; Voting records; Non-profit records; Government/ non-profit accounting/transparency

**Other:** Temperature; Sports; Sim Cards; Spam control; Nuclear launch codes!
More to come in the years ahead

Early uses: currency and wallets

Standards: Fight to define infrastructure & tools

Broader Applications: Decentralized trust: registries, identity, trading
Implications for Banks
Banks are adapting to a new environment

**Macroeconomic Conditions**
- Global rebalancing
- USD appreciation
- Drop in commodity prices
- Muted inflation
- Lower trend-growth
- Divergent monetary policies

**Business Environment**
- Pressures on margins
- New regulations
- Commoditytization
- Utility model
- Disruption
- Consumer preferences

**Structural Trends**
- Digital revolution
- Productivity and K/L
- Demographic changes
- Climate change
- Sustainability
- Emerging risks
Banks face significant challenges

Shrinking provisions helped offset margin pressures. However, profitability still remains below pre-crisis levels.

U.S. Banks: Income Statement
US$ Billions, Same Quarter, Last Available

U.S. Banks: Profitability and Capital
% & US$bn per quarter

Source: BBVA Research, FDIC & Haver
Banks face significant challenges

Banks need to develop new sources of profitability while regaining trust and maintaining stability

U.S. Banks Efficiency and Allowances

U.S. Chartered Banks Share of Total

Source: BBVA Research & Haver
### Difficulty attracting top talent

Banks face challenges in attracting young talent. Imperative to offer the ability to innovate and a sense of purpose.

#### Top Career Goals Reported by Generation

<table>
<thead>
<tr>
<th></th>
<th>Millennials</th>
<th>Gen X</th>
<th>Baby Boomers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make a positive impact on my organization</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Help solve social and/or environmental challenges</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Work with a diverse group of people</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Work for an organization among the best in my industry</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Do work I am passionate about</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage my work/life balance</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Top Companies Preferred by Millennials

1. **Information Technology**

2. **Entertainment**

3. **Healthcare**

4. **Electronics**

5. **Government**

Source: IBM
Source: National Society of High School Scholars
Disruptors expand their nibbling

Payments dominate Fin Tech space but personal finance startups gain in share and are strong in funding

**Fin Tech by Area**

<table>
<thead>
<tr>
<th>Year</th>
<th>Personal finance management</th>
<th>Payments</th>
<th>Data analysis</th>
<th>Capital markets</th>
<th>Banking &amp; corporate finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>90%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2009</td>
<td>80%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2010</td>
<td>70%</td>
<td>30%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2011</td>
<td>60%</td>
<td>40%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2012</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2013</td>
<td>40%</td>
<td>60%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Fin Tech Startups: Age, Funding and AUM***

- **Funding** (in Millions $ / years)
- **Age**
- **Kabbage**
- **Lending Club**
- **Kreditech**
- **Prosper**
- **Wealthfront**
- **Betterment**

*Source: BBVA Research, CrunchBase & company websites

*AUM (assets under management) represented in bubble size*
The digital revolution will not wait

Strong growth of mobile technologies and fast adoption

Mobile Technologies

Mobile Devices and World Population

Source: BBVA Research, HBR & Cisco
Who wants to be an spectator?

The march of giants into Bitcoin and Blockchain startups
Not short for money

Around $500bn in 2015, expanding into later rounds

Bitcoin/Blockchain Financing Activity
US$M and Number

Bitcoin/Blockchain Deal Trend by Round
US$M

Source: BBVA Research and CB Insights
An opportunity to boost efficiency and profitability

**Major problems solved**

- Overhaul inefficient legacy IT systems
- Reduce forgery (i.e. identity theft, payment fraud)
- Censorship of transaction (i.e. posts deleted, services taken down)
- Reversal of transaction (i.e. chargebacks)

**Major gains ahead**

- More effective capital allocation
- Greater efficiency
- “Distributed ledger technology could reduce banks’ infrastructure costs attributable to cross-border payments, securities trading and regulatory compliance by between $15-20 billion per annum by 2022” *
- Reduce/eliminate credit and liquidity risk

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* Oliver Wyman, Anthemis, Santander InnoVentures
Vast opportunities across the value-chain

Blockchain in Financial Services

Source: W. Mougayar
## From payments to programmable money to smart property to autonomous firms

### Payments:
- **10min vs. 1-3 days; 24/7 bypass complex back-office process**

### Remittances
- **Instant FX conversion; no risks**

### Programmable Money
- Autonomous, self-executing.
  - Software vs. customer; property transfers, loan repayments, crowdfunding, donations, multi-signature accounts, trusts, dividend payments

### Micro-payments
- **Free, instant and w/o bank account**

### Internal payments
- **Avoid burdensome internal process**

### Smart Property
- **“Colored coins”; adds information:**
  - stocks, bonds, houses, cars & commodities.
  - Paperless, no maintenance, no central authority (custodial bank); insurance/leases; P2P lending and settlement

### P2P Data storage
- **Audit, KYC, info across network**

### Autonomous Firms?

**New technologies embraced with lags**
- Are our institutions/legal framework equipped for this transformation?
Industry alliances to promote interbank collaboration

- Alliance of global banks to build a “financial grade” trust network for use cases
- Workstreams on 1) architecture; 2) identity and regulation and 3) regulatory and legal frameworks

Source: DLG Steering Committee
"[ ] the distributed ledger technology [ ] may have considerable promise. [ ] This raises the question of whether central banks should themselves make use of such technology to issue digital currencies.”
One Bank Research Agenda, 2015

Imagine that the Fed [ ] makes available an open-source Bitcoin-like protocol [ ] called Fedcoin”
David Andolfatto, Federal Reserve of St Louis, February 2015

Central banks could consider – as a potential policy response to these developments – investigating the potential uses of distributed ledgers in payment systems or other types of FMIs.
BIS, November 2015

NYDFS issues regulatory framework for digital currency companies
June 2015

ESMA call for evidence on virtual currency or distributed ledger technology
April 2015

“although VCS can have positive aspects in terms of financial innovation and the provision of additional payment alternatives for consumers, it is clear that they also entail risks”
ECB, February 2015
Financial Inclusion: Opportunities

Despite ranking highly at the aggregate level, U.S. financial inclusion remains largely heterogeneous.

**World Account Ownership & GNI per Capita**
Share %, Current US$

**Bank Account Ownership**
% of households; selected countries and U.S. MSAs

- Denmark
- Sweeden
- Developed
- Seattle
- Thailand
- Houston
- South Africa
- Miami
- Algeria
- Charleston
- Developing
- Mexico

Source: BBVA Research, Haver, World Bank & FDIC
Financial Inclusion: Opportunities

Affordable access to technology is the most efficient, scalable and impactful solution to reaching the financial excluded.

Marginal impact on financial inclusion from having internet access

Source: BBVA Research, FDIC & Numbeo

Internet Cost (Selected Countries) (10 Mbps, US$ per month)
Challenges
A complex environment

Adoption is a matter of when not if

- Mass-market adoption/standards
  - Derivatives (5yrs) & settling share trading (10yrs)?
- Integration into pre-existing systems vs. start from scratch
- Security
  - Sybil attack, DoS, theft, sniffing
- Computing power
- Financial intermediation
- Public Sector
  - Regulators, Government Agencies, Central Banks
Central banks

Some central banks have taken the lead in understanding the new environment. However, significant known & unknown unknowns remain

- High volatility; no central authority monitoring or mitigating fiat currency exchange rates
- Both inflation and deflation risks cannot be mitigated or controlled
- The basic money concept of time value does not apply
- No reference base rate; lending/borrowing interest rates are arbitrary
- No direct (limited indirect) effects from monetary policies
- Consumer protection/financial stability/crime
- Research development and application of new technologies
- Legislation

A payment instrument or an asset class?
Continue monitoring / reassessing risks
Other regulators and industries

Adapting to the new environment

**Regulators**
- Regulate providers
- Promote competition
- Regulate standards and provide guidance
- Tax transactions
- Enforce rules and oversee safety

**Businesses**
- Accept in/out payments
- Cross border transactions
- Use smart contracts
- Develop relationships
- Improve processes/platforms
### Thank You

<table>
<thead>
<tr>
<th>Thank You</th>
<th>Merci</th>
<th>Grazie</th>
<th>Obrigado</th>
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<tr>
<td>Teşekkür Ederim</td>
<td>Tak</td>
<td>Gracias</td>
<td>Danke</td>
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