

# b\_verify

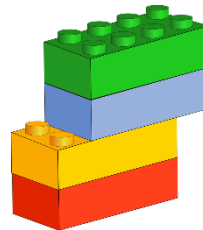
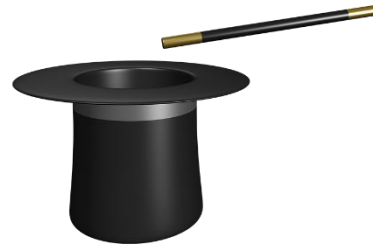
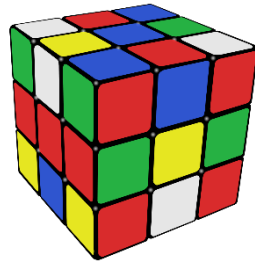
An open-source, blockchain protocol for verifiable  
records in supply chains (prototype and pilot kit)

[dci.mit.edu/b-verify](https://dci.mit.edu/b-verify)

# Agenda

- Unlocking wealth in our economies
- The impact of warehouse receipts
- Stakeholder research in Latin America and Europe
- b\_verify protocol design
- Demo of prototype version 2.0
- Technical architecture and considerations
- Contributions and next steps
- Business implications

# What is wealth?

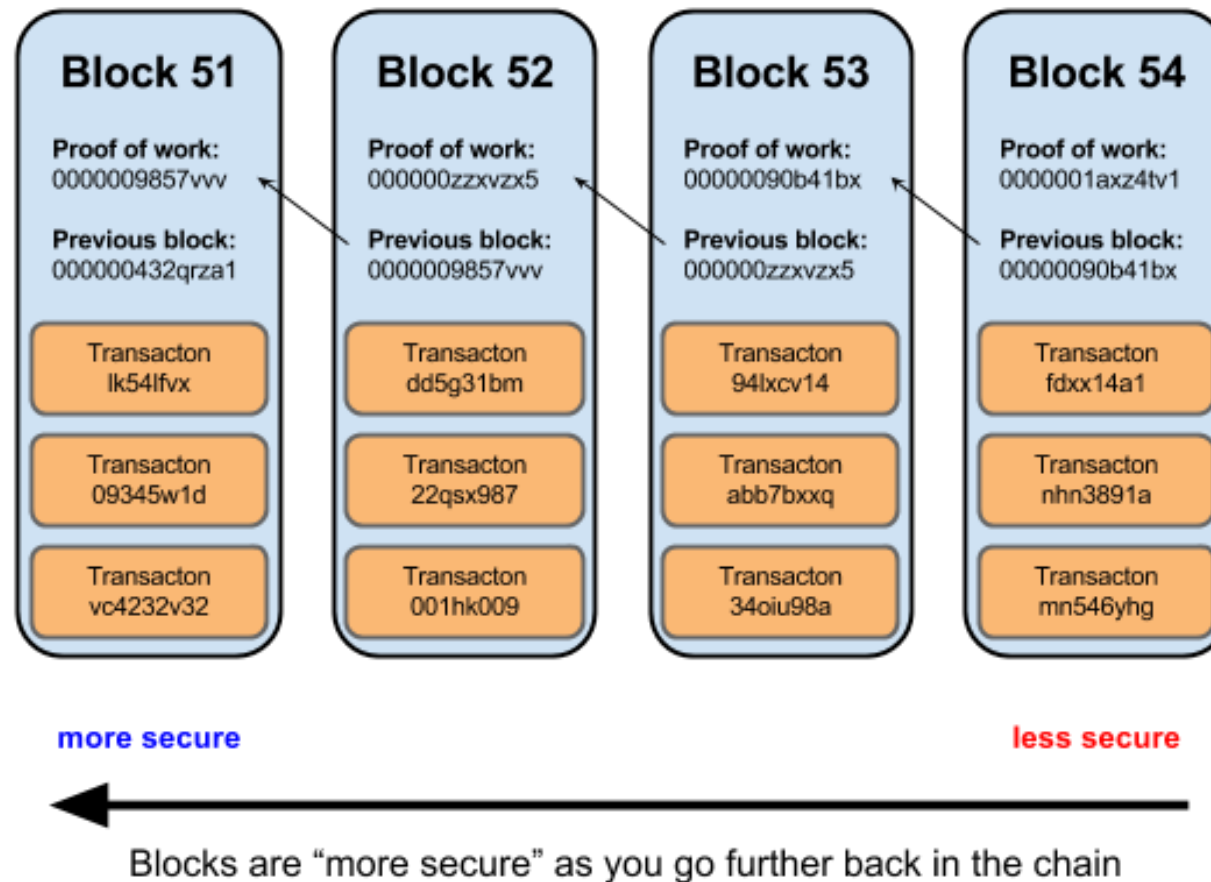




# The \$9 trillion problem



# Blockchain records?







# Warehouse Receipts

Title documents attesting to stored goods.

Used for:

1. Facilitating trade
2. Securing inventory as collateral
3. Settling futures contracts

Impact potential	Problems
<b>Access to credit</b> via inventory-based lending	Major frauds from <b>forged or duplicated receipts</b>
<b>Higher prices commanded by farmers</b> via information pooling and time flexibility	<b>High transaction costs</b> of verifying and transporting paper records
<b>Reduced waste</b> of perishable products	Concerns about <b>quality and honesty of custodianship</b>

Photo: grain silo in Ukraine, research visit 2018





**International Business Times**



Economy | Companies | Markets | Finance | Regulation

# China's Banks Have \$3.2bn Exposure to Qingdao Fraud Probe Companies



By Nigel Wilson

July 16, 2014 13:14 BST



# Stakeholder Research

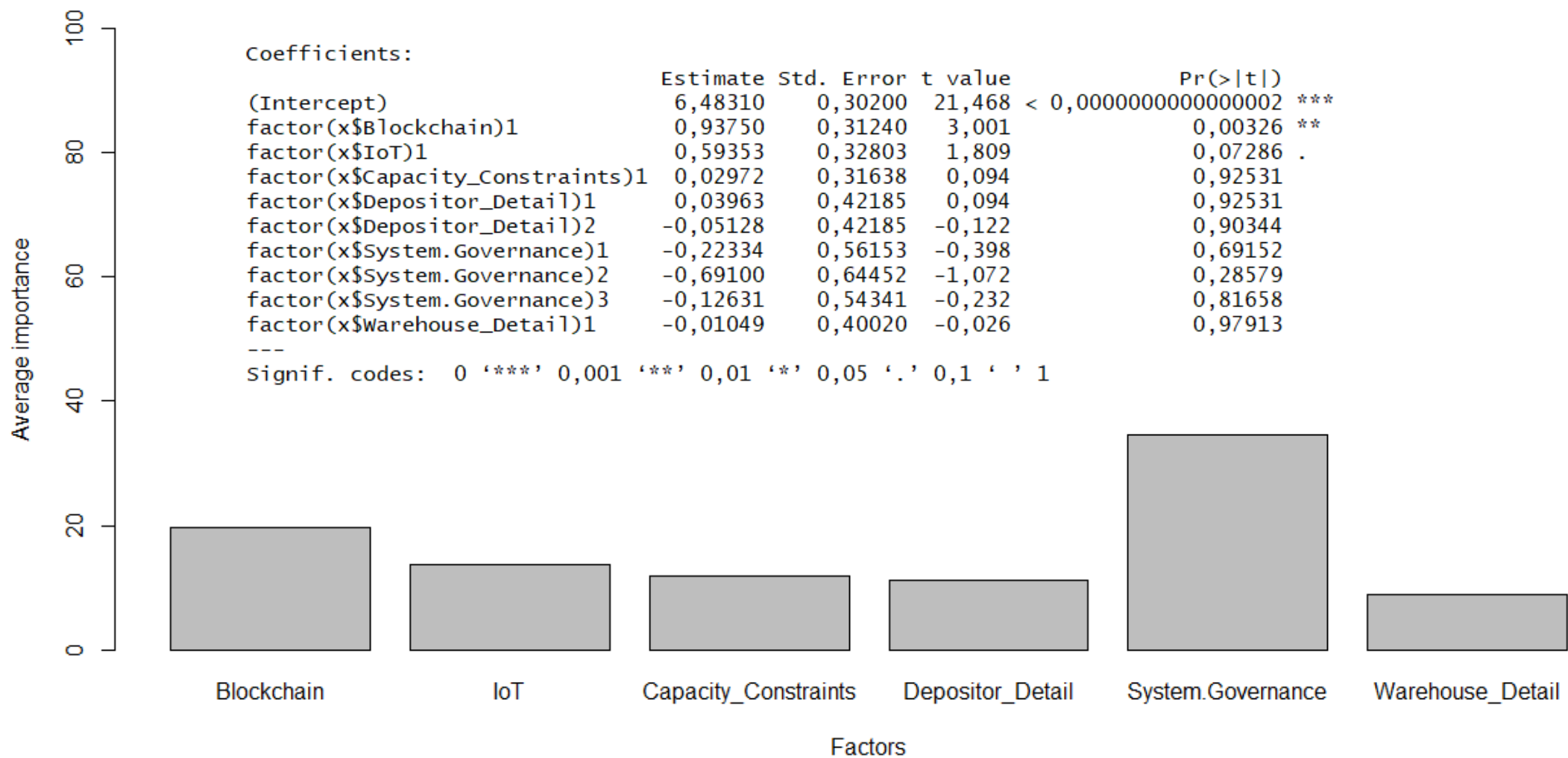
- Mexico
  - ✓ Visits to warehouse facilities
  - ✓ Meetings with government ministries, agencies, and development banks
  - ✓ Knowledge partnership with Ministry of Economy
- Ukraine ("the breadbasket of Europe")
  - ✓ Visits to warehouse facilities
  - ✓ Meetings with banks, agriholdings, commodities traders, seed and fertilizer providers and suppliers, blockchain entrepreneurs



# Data Collection & Analysis

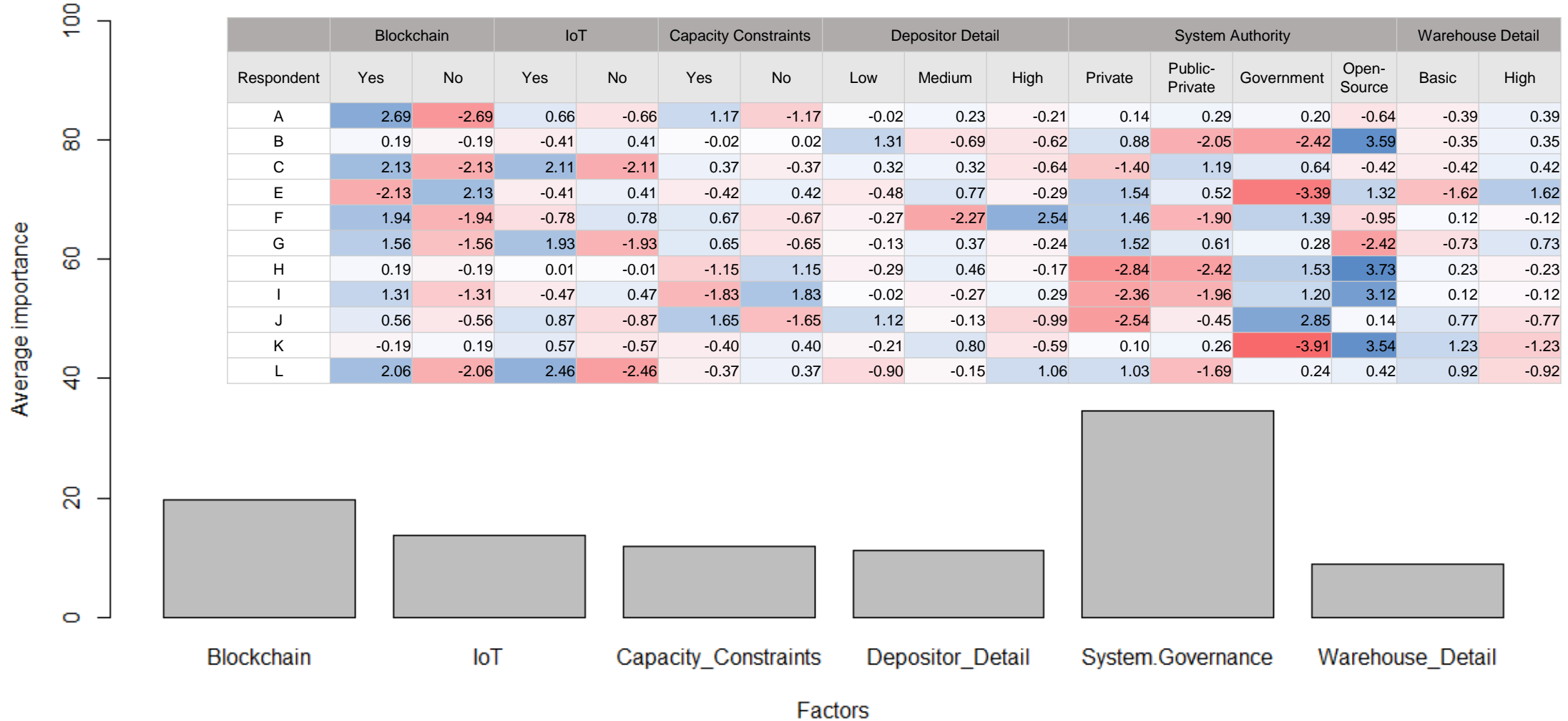
- Survey to Latin American lenders
  - ✓ Conjoint analysis to extract part-worth utilities of system attributes
  - ✓ Clustering of lenders
- “Enabling the Business of Agriculture” data (World Bank)
  - ✓ Linear regression to gauge power of warehouse receipts on agricultural economy
  - ✓ Clustering of countries by warehouse receipts programs to identify prospective pilot countries

# Conjoint Analysis

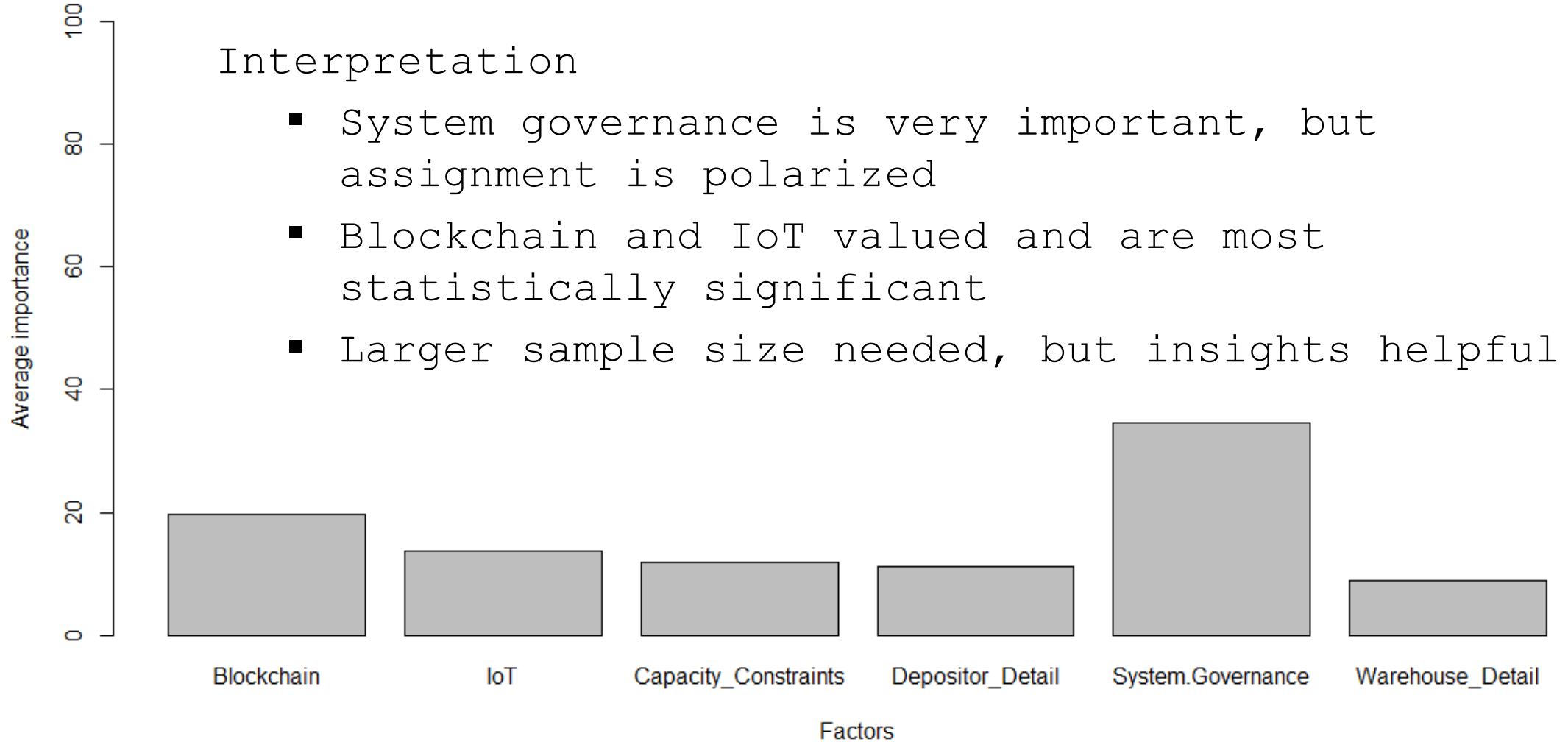




# Part-worth utilities for surveyed lenders



# Part-worth utilities for surveyed lenders





# Warehouse Receipts

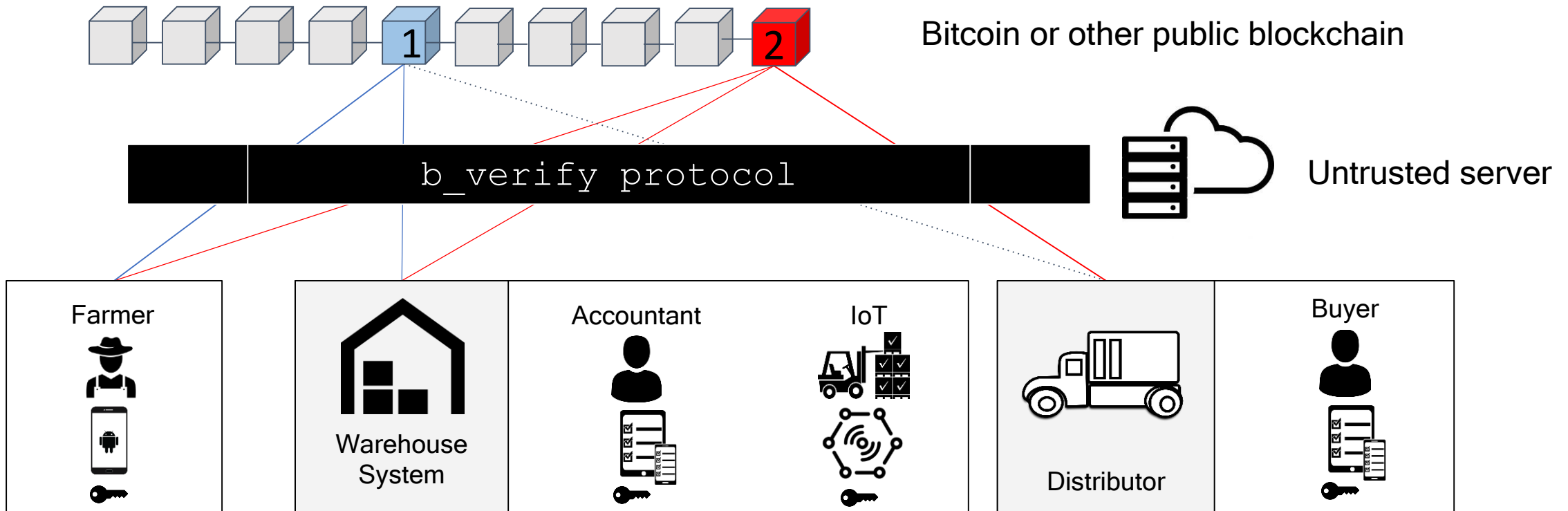
Title documents attesting to stored goods. Used for:

1. Facilitating trade
2. Securing inventory as collateral
3. Settling futures contracts

Impact potential	Problems	b_verify protocol
<b>Access to credit</b> via inventory-based lending	Major frauds from <b>forged or duplicated receipts</b>	<b>Cryptographic commitments</b> to a public blockchain
<b>Higher prices commanded by farmers</b> via information pooling and time flexibility	<b>High transaction costs</b> of verifying and transporting paper records	<b>New method of coordinating updates</b> using proofs constructed by an untrusted server
<b>Reduced waste</b> of perishable products	Concerns about <b>quality and honesty of custodianship</b>	<b>IoT integrations</b> for access control and monitoring

# Deposit and sale of goods

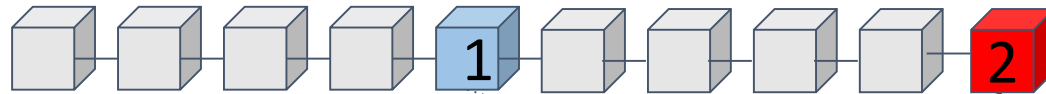
1. Deposit goods (owner and warehouse sign commitment to a public blockchain)
2. Transfer ownership (buyer authenticates, owner and warehouse update commitment)





# Inventory-based lending

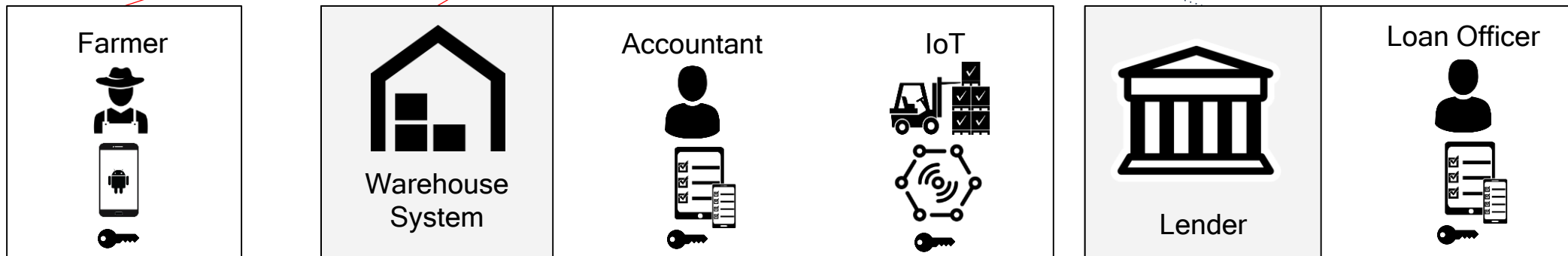
1. Bank authenticates record via blockchain query
2. Lien is placed on pledged assets (owner and warehouse update commitment)
  - Opportunities for "smart contract" enforcement of terms



Bitcoin or other public blockchain



Untrusted server



# What's different about b\_verify

- The server is a central repository of authentication information but uses Bitcoin in a way to make it so that the server can't manipulate the information
- Client proofs are still valid even if the server goes offline
- Clients store their own data and submit proofs to one another to authenticate it
- Light-weight protocol allows mobile devices to fully and securely participate

# Business Implications

- Using a protocol like b\_verify for supply chain can:
  1. Reduce transaction friction
  2. Improve access to credit
  3. Improve price discovery and power
  4. Improve supply chain provenance (entire history preserved)
  5. Improve transparency in asset-backed securities markets
- Blockchain verifiable records can be constructed without a trusted server
- You do not need to use a private-permissioned blockchain
- b\_verify is open-source and will be made available for experimentation in 2018



# Contributions

- Academic and industry papers
- “Pilot Kit” containing open-source reference code (Java), the system architecture for the b\_verify protocol, template desktop and mobile applications, and additional considerations for real world experimentation



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## Vision

b\_verify is an open-source protocol developed at the Digital Currency Initiative at the MIT Media Lab. Its purpose is to provide a technical foundation for the issuance, verification, and transaction of certain financial instruments and tradable securities, using public blockchains.

## Use Case

**Warehouse receipts** are title documents attesting to goods in a storage facility. They can be used to secure inventory as collateral for loans, to facilitate trade, and to settle expiring futures contracts. Research shows these tools help farmers access credit and command higher prices for their goods.

## Contributions

- Academic and industry papers
- “Pilot Kit” containing open-source reference code (Java), the system architecture for the b\_verify protocol, template desktop and mobile applications, and additional considerations for real world experimentation
- Pathway to venture opportunities to customize systems servicing the b\_verify protocol

## Problems

High profile frauds involving **forged or duplicated warehouse receipts** have cost banks hundreds of millions of dollars; this makes banks wary of lending against them and traders wary of buying them.

**High transaction costs** of verifying and transporting paper records especially in countries with poor infrastructure

Concerns about quality and honesty of **warehouse custodianship**; e.g. the goods are removed illegally

## Solutions

Cryptographic commitments to the data structure of the **Bitcoin blockchain as a secure, public source of record**

**New method of coordinating updates** to records using cryptographic proofs constructed by untrusted server

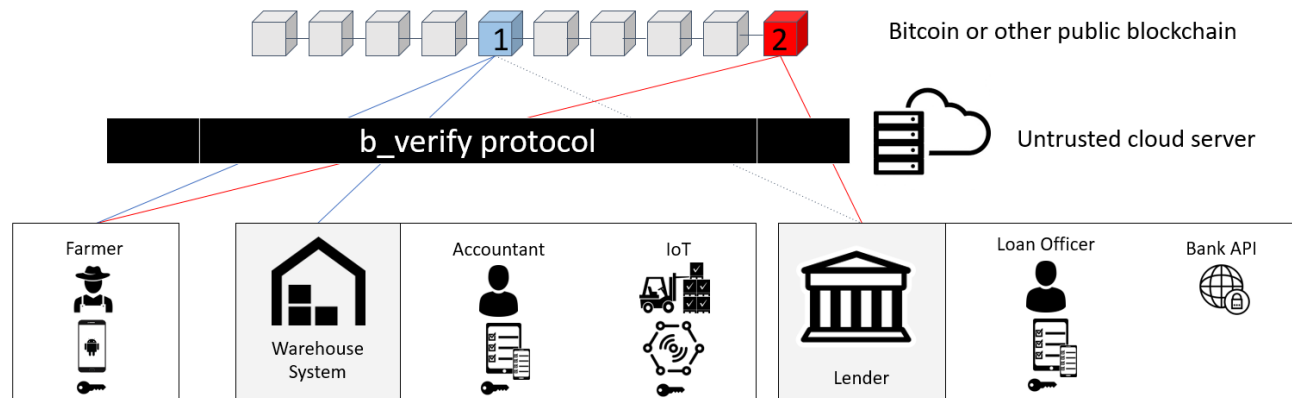
**IoT integration** for access control and monitoring; e.g. authentication requirements on outflows of grain



## How it works

Cryptographic commitments to the data structure of the Bitcoin blockchain enable the issuance, verification, pledging, and transactions of warehouse receipts, as well as smart contracts and public monitoring

## Inventory-Based Lending



## Warehouse receipt financing for farmers (pictured left)

1. Owners store goods in a b\_verify registered facility which signs the deposit on Bitcoin's public blockchain
2. Lenders query the blockchain to verify assets as collateral, then place a lien by signing a loan agreement on the blockchain
3. Repayment triggers re-permissioning of assets to the owner; default triggers change of ownership to the lender

Please contact Mark Weber, [m.weber@sloan.mit.edu](mailto:m.weber@sloan.mit.edu) with interest or questions.



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