

What Will Blockchain Really Mean for Business?

For much of the last decade, blockchain was known chiefly as a technology developed to support bitcoin, the world’s first all-digital currency. However, the technology supporting it has emerged as a way to potentially revolutionize how companies process transactions. In a 2018 global Deloitte survey, 65 percent of surveyed business executives said their companies would invest \$1 million or more in blockchain technology in the coming year and 84 percent predicted that blockchain is “broadly scalable” and will become a mainstream technology.

One way blockchain may become mainstream would be through food traceability that improves food safety. For instance, the Center for Disease Control and Prevention issued a food safety alert on November 20 for romaine lettuce, one of many food scares in 2018. This has the potential to force an entire season of romaine lettuce in the U.S. to be lost, costing millions of dollars. Blockchain has the potential to help the producers, processors, retailers and consumers of certain foods – romaine in this instance – by narrowing the scope of a safety alert.

Still, as with any new technology, predictions about blockchain’s future are often marked by hyperbole. While some observers dismiss blockchain as a fad, others insist the technology will disrupt entire industries. The more likely answer is somewhere in the middle, says Cesare Fracassi, associate professor of finance and director of the Blockchain Initiative at the McCombs School of Business at The University of Texas at Austin. OUTLOOK spoke with Fracassi about how the technology started, its potential to add speed, efficiency and transparency to business transactions, the remaining technological hurdles, and why blockchain may be a game-changer for some businesses, but not for others.

OUTLOOK: When did it become apparent that blockchain would have business potential beyond bitcoin and other cryptocurrencies?

Cesare Fracassi: Around 2015, people started realizing that blockchain could be used to create digital “smart contracts.” With a smart contract, a transaction occurs automatically once certain mutually agreed-upon conditions are met. That can potentially be a very powerful tool for companies looking to execute agreements quickly, cost-effectively and transparently.

WHAT WILL BLOCKCHAIN REALLY MEAN FOR BUSINESS?	1-8
INTEREST RATES AND ECONOMIC INDICATORS	9
COBANK COMMITS \$350,000 TO CAMP FIRE RELIEF EFFORTS	10
COBANK REPORTS THIRD QUARTER FINANCIAL RESULTS	11
ABOUT COBANK	13

This Month's Expert



Cesare Fracassi is associate professor of finance and director of the Blockchain Initiative at the McCombs School of

Business at The University of Texas at Austin. The UT Blockchain Initiative is one of 17 university programs around the world funded by Ripple, a blockchain-based currency exchange company, to investigate new uses for the technology.

Beyond blockchain, Fracassi's primary research interest is in corporate finance. His research includes corporate governance, executive compensation, credit rating agencies, small business financing, and the effects of social networks and cultural preferences on financial policies. Fracassi's articles have been published in the *Journal of Finance*, the *Journal of Financial Economics*, and the *Journal of Financial and Quantitative Analysis*, among other publications. He holds a bachelor's degree in electrical engineering from Italy's Politecnico di Milano, and MBA and PhD degrees in finance from UCLA.

OUTLOOK: Lots of people are talking about the potential of blockchain to change how businesses operate. Are these ideas still theoretical, or are things starting to happen?

Fracassi: Most business applications for blockchain are still in the “use case” stage – they’re still being studied. Some companies are already starting to invest heavily in the technology.

Blockchain does have the potential to add efficiencies in every part of the supply chain to include interactions between producers in agriculture, processors of those goods and exporters of those goods.

For example, Walmart has launched a test case for tracking mangoes through the supply chain from growers all the way to consumers. Before blockchain, it took as long as two weeks to trace the origin of a particular mango because of the number of intermediate steps and handlers, each with its own record-keeping system. That inefficient process posed huge problems in terms of food safety – if there's an outbreak of E. coli tied to mangoes, you need to find the source quickly.

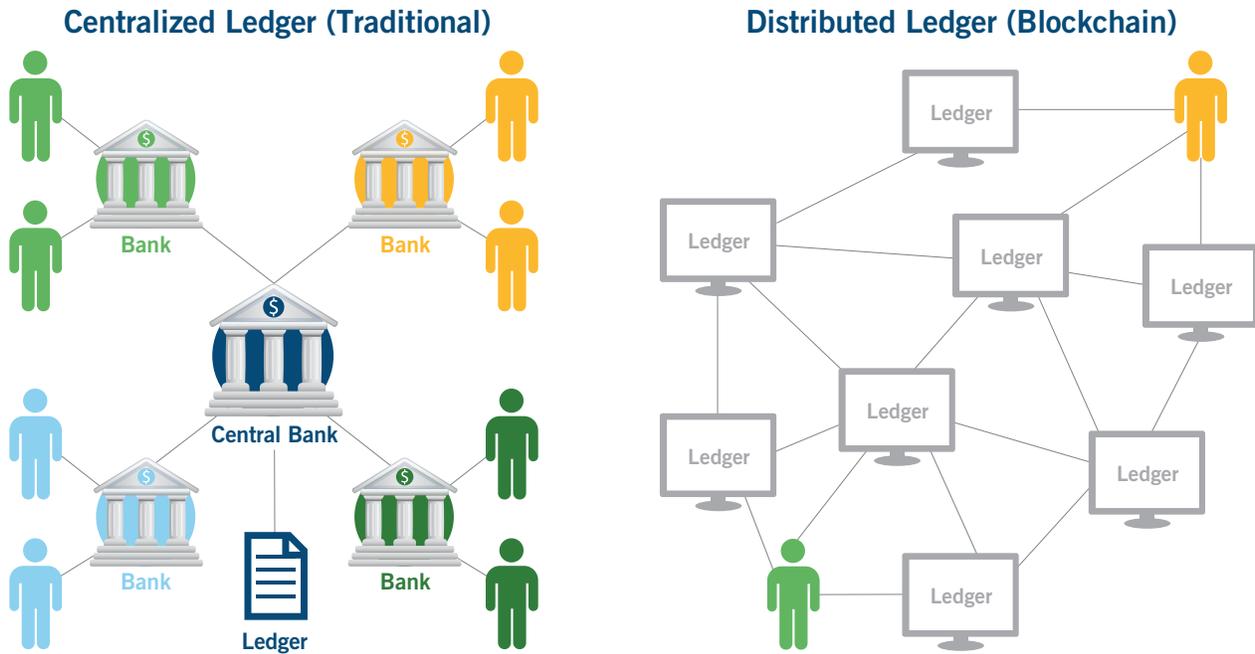
With blockchain, each player in the supply chain, from the farmer on, enters its transaction into the same ledger. In a matter of seconds, rather than days or weeks, Walmart and others in the blockchain network can see not only who handled the mangoes, but also when they were picked, how long it took to go from tree to distributors to store shelves, and even what temperature they were kept at along the way. All of the information is right there for all participants to see.

OUTLOOK: What is blockchain technology, and how does it change things?

Fracassi: Blockchain technology essentially rewrites the rules for how transactions are recorded and verified. For the past 3,000 years, societies have used centralized ledgers kept by a central player, whether private or government, that basically has the authority to say whether or not an event happened. Business transactions, real estate and stock and bond sales, vital statistics about births, marriages, deaths and health records – all are entered into a ledger.

A ledger establishes consensus about a fact, meaning “this transaction happened between two parties.” When I sell my house, an authority approves the transaction. Health care records are stored in private centralized servers in hospitals. The Federal Reserve manages the supply of money in the economy. When you buy something with a debit card, the information passes to your bank, which has to approve whether you have the money to buy what you want to buy.

HOW BLOCKCHAIN TECHNOLOGY REWRITES THE RULES



Source: CoBank

Now, innovations in technology and cryptography have allowed us to create decentralized, or distributed, ledgers called blockchains. They consist of a distributed network of parties who basically get together and create a consensus on whether or not something happened or is allowed to happen. Without the need to rely on a centralized authority, transactions can potentially occur much faster, even instantaneously, and with much greater visibility for all interested parties.

OUTLOOK: Who came up with the idea of blockchain?

Fracassi: The technology was invented in 2008 by “Satoshi Nakamoto” – an alias for a person or persons who have chosen to remain anonymous – to support bitcoin. With a digital currency, the challenge is how to prevent “double spending.” How do you keep someone from spending money once, and then spending that same money again for something else? With traditional currency, the bank is the centralized, single point of authority that allows the transaction. With bitcoin and blockchain, the whole idea is that nobody is in charge of making that decision. Instead, it depends on a network of “miners,” located around the world, that look at your history of transactions. They can see whether you’ve received bitcoin from someone else, and whether you’ve already spent it. If you’ve received it and haven’t spent it, the transaction goes through. And although the transaction is made public, the miners don’t reveal, or even know, your personal identity.



I'm skeptical about predicting that any industries will disappear or be created based on blockchain. That said, blockchain can provide a benefit in any industry that has a long supply chain."

OUTLOOK: Where does the term "blockchain" come from?

Fracassi: All information about a transaction is contained in blocks of information connected to one another in a long chain. When a bitcoin transaction occurs, miners verify it, create a new block and then move on to the next transaction. These blocks are connected digitally, creating long "chains" of information, hence the term "blockchain." These chains offer protection, because in order to hack any individual block, someone would first have to hack into every earlier block in the very long chain.

OUTLOOK: What industries are most likely to be affected by blockchain technology?

Fracassi: I'm skeptical about predicting that any industries will disappear or be created based on blockchain. That said, blockchain can provide a benefit in any industry that has a long supply chain. That includes agriculture, manufacturing and many others. It can also be a key part of the luxury goods market and others where provenance is important. Is that Prada bag really a Prada bag? When that bag enters the supply chain in a blockchain system, you can easily trace it back to its precise origin and pinpoint who made it.

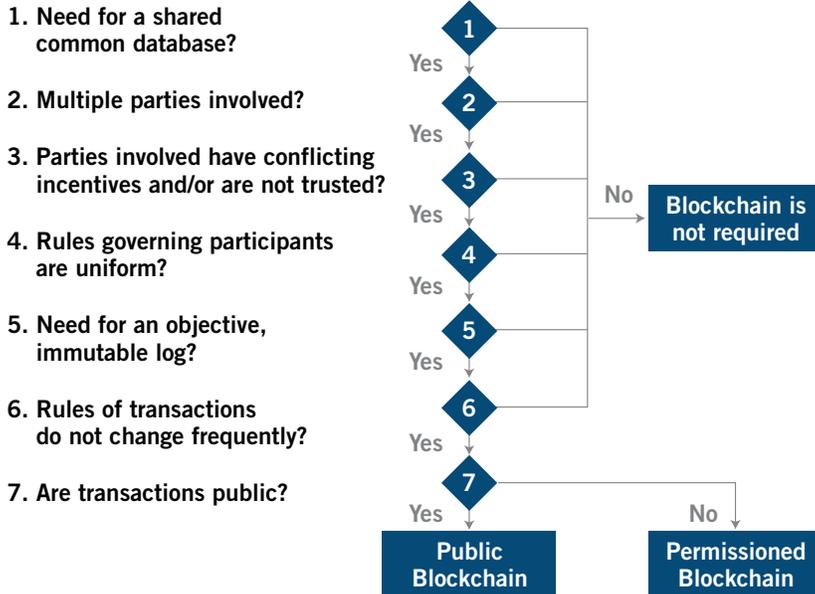
Banking and finance is another industry likely to be affected. With blockchain, one company could make a financial smart contract with another without relying on a bank: My company agrees to borrow money from your company and promises to pay you back with interest every six months. If my company fails to make those payments, its default will be recorded in a public ledger. All of that can be written into the signed smart contract. That also eliminates the need for a credit agency score.

We'll also see changes in accounting. Right now, each company has its own accounting system and they don't talk to each other. Blockchain offers the potential for companies to automatically reconcile transactions. In other words, when a transaction occurs, and one company recognizes that as revenue, the other company automatically recognizes that as a cost.

OUTLOOK: You mentioned banking and finance. What are the implications for traditional banks, for instance, who provide loans and revolving lines of credit for businesses?

Fracassi: Assessing how well a company is really doing is one of the big challenges banks have when considering business loans or credit. Blockchain will likely provide greater visibility and transparency. In addition to reviewing financial statements and other documents, a loan officer could ask to be added to a blockchain in order to review the company's transactions. This could help the bank determine how creditworthy that potential borrower is.

BLOCKCHAIN DECISION PATH



Source: Hyperledger

OUTLOOK: Will blockchain have an effect on how utilities, such as power providers, work?

Fracassi: With more power customers producing their own solar and other energy, there's been some speculation that blockchain could enable customers to sell power directly to other customers, rather than selling it back through the utility. I'm not an energy expert, but that doesn't sound like the best use to me. It's hard for me to see how that's going to provide a clear advantage for customers over just dealing with the power company.

OUTLOOK: If companies are going to use blockchain, how does that get set in motion? Who sets it up if nobody controls it?

Fracassi: There are two different types of blockchains, public and private.

Those associated with bitcoin and other cryptocurrencies are public, or permissionless – they're open to anyone in the world, and verified by thousands of miners.

Private blockchains operate differently. They're "permissioned" – access is restricted to a certain number of parties and each one needs permission to join. Instead of being validated by miners, transactions in a private network are validated by rules the network establishes. You're basically creating a private consortium of all of the producers, distributors and sellers of a product or service, and everything is recorded in a blockchain that no individual party owns. Every player has a copy of digital data, and every transaction is validated immediately.

OUTLOOK: Why would a company join a private blockchain network?

Fracassi: It can be good for companies that have wanted to interact with each other but haven't been able to because of logistics or high costs. Having a system that allows every company to access a system or records, allowing for easier sharing of information, could have significant implications.

With a traditional, centralized, non-blockchain database, the big question is who owns the information. Who has control of the data, which may be very valuable, and who ensures that it's accurate? With blockchain, every party has permission to write and read, and no single party owns the information. Everybody who needs the data has access to it.



If you insert information that's misleading, everybody will see what you did. ...It limits the potential for fraud, because every transaction at every stage is visible.”

OUTLOOK: How do participants, such as producers of goods, benefit from the blockchain? Are they, or will they be, compensated for participating in one?

Fracassi: It's unlikely that participants would be paid to participate in a blockchain. Some participants may benefit more than others, and in some cases a major retailer or other large company may require its suppliers to participate. Still, the underlying idea is that blockchain creates efficiencies for all of the participants.

OUTLOOK: In a blockchain network, what's to prevent one company from putting in fraudulent data that other companies might see and be misled by?

Fracassi: If you insert information that's misleading, everybody will see what you did. Consider agriculture. Today, if I'm a buyer, it can be very difficult to verify whether what's claimed to be organic avocados actually are. With a blockchain, I can trace that fruit's origin back to where it was grown and see who first made the claim that it was organic, and validate the claim if necessary. It limits the potential for fraud, because every transaction at every stage is visible.

OUTLOOK: Will law enforcement agencies and regulators respect blockchain transactions the way they would trust, say, something validated by a notary or a lawyer?

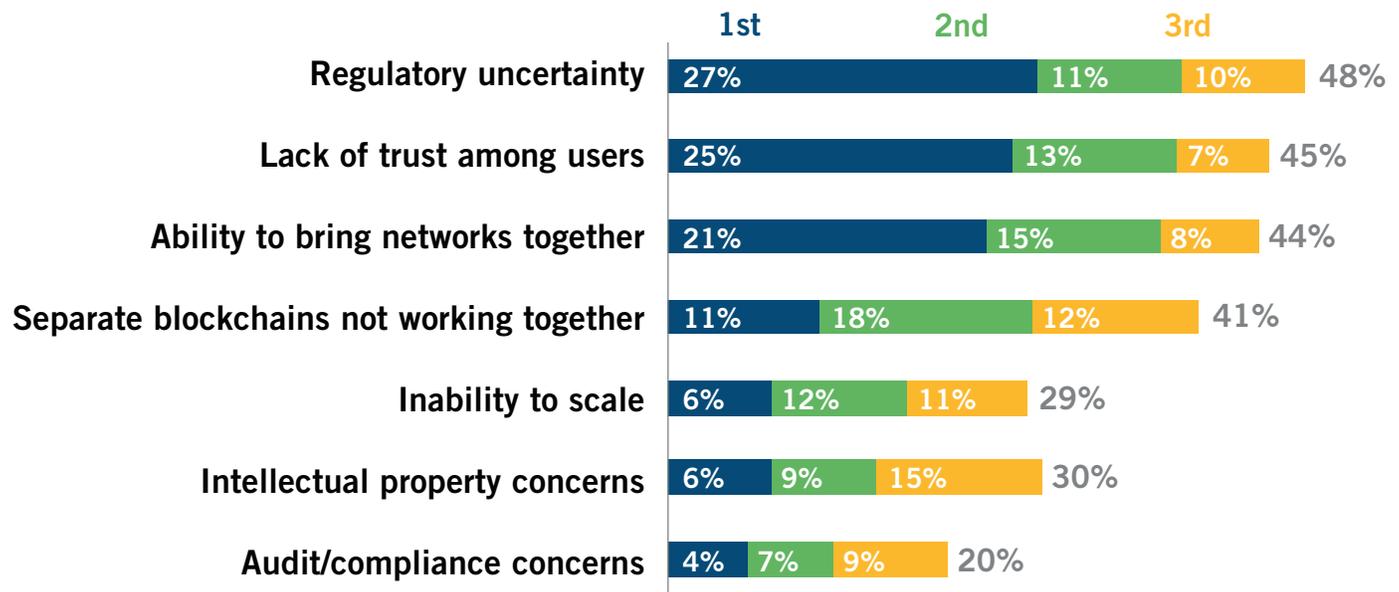
Fracassi: Lawyers will always have a presence. But now you're going to need smart lawyers who can write smart contracts. And the beauty of smart contracts in blockchain is that everything is in the code – anyone who's part of the network can access it. That's also great from a regulatory standpoint, because information can be traced.

OUTLOOK: What has the blockchain growth curve been and what do you think it might be going forward?

Fracassi: With public, permissionless blockchains used for cryptocurrencies, we've seen something similar to the early days of the internet, where initial hype and exuberance were followed by a burst of the bubble last December and January – with, possibly, a rebound coming in the future, though that has yet to happen. With private, permissioned blockchains used by businesses, we've seen less hype and exuberance (though there's been some). Moving forward, we're likely to see a slow but possibly steadier progression of solutions that provide value to companies and consumers.

THE BIGGEST BARRIERS TO BLOCKCHAIN ADOPTION

Respondents' Top Three Challenges



Source: Pricewaterhouse Coopers 2018 Global Blockchain Survey

OUTLOOK: Looking to the future, what are some macroeconomic changes that we could see as a result of blockchain?

Fracassi: Obviously, to the extent that we have more efficient systems, economies are going to grow faster. If you're asking what will the impact be on the GDP, that remains to be seen.

OUTLOOK: How can individual companies weigh the risk of neglecting blockchain versus investing too much too soon?

Fracassi: Before investing in blockchain, the first step for any business is to assess its needs. Then it should ask: Does blockchain technology help me address the problems we have? There are some good, straightforward flow charts that can help give you an idea whether blockchain could apply to your business.

Early adopters will establish standards for what blockchain should look like for grocery stores or insurance companies or any other industry. If your company isn't involved, others may design a system that doesn't fit how your company operates.

On the other hand, should all companies invest in blockchain technology now? Probably not. Blockchain makes sense only if your company is going to see a benefit. You could hear the buzz about blockchain and invest a lot of resources in it, only to realize that it isn't going to solve any of your problems.



Blockchain has pros and cons, just like any other technology. You have to weigh those pros and cons and see whether it makes sense for you.”

OUTLOOK: Are there major technological hurdles that still need to be overcome?

Fracassi: In terms of private, permissioned blockchains for business, a couple of technological issues are very important.

One is that if you create a new supply chain system, every business in that supply chain will have its own software, and it will have to figure out how it will communicate with the blockchain. That means big changes in a lot of IT systems.

The second major challenge involves who gets to create standards. Walmart, for example, has cooperated with IBM to create its own standard for Walmart’s supply chain of lettuce and spinach. Recently, Walmart announced it will require all its lettuce, spinach and other greens suppliers to use the permissioned blockchain technology by January 2019. This means that all of those suppliers will have to join Walmart’s blockchain network in order to continue doing business with the retail giant.

OUTLOOK: Some people compare blockchain to the internet in terms of its potential impact. Is there anything to that?

Fracassi: Yes, you hear people call blockchain “the internet of value.” Or say that blockchain is going to “complete” the internet. I’m a little skeptical, but where the comparison is valid is in decentralization. The internet has allowed the decentralization of information – when I send an email, for example, it doesn’t go through a central entity like the United States Postal Service. In the same way, blockchain eliminates the middle-man in transactions.

Blockchain has pros and cons, just like any other technology. You have to weigh those pros and cons and see whether it makes sense for you. ■

Interest Rates and Economic Indicators

The interest rate and economic data on this page were updated as of 10/31/18. They are intended to provide rate or cost indications only and are for notional amounts in excess of \$5 million except for forward fixed rates.

KEY ECONOMIC INDICATORS

Gross Domestic Product (GDP) measures the change in total output of the U.S. economy. The Consumer Price Index (CPI) is a measure of consumer inflation. The federal funds rate is the rate charged by banks to one another on overnight funds. The target federal funds rate is set by the Federal Reserve as one of the tools of monetary policy. The interest rate on the 10-year U.S. Treasury Note is considered a reflection of the market's view of longer-term macroeconomic performance; the 2-year projection provides a view of more near-term economic performance.

ECONOMIC AND INTEREST RATE PROJECTIONS

Forecasts courtesy of Bloomberg and Blue Chip Economic Indicators

U.S. Treasury Securities

	GDP	CPI	Funds	2-year	10-year
2018					
Q4	2.80%	2.60%	2.28%	2.89%	3.17%
2019					
Q1	2.30%	2.50%	2.46%	3.02%	3.26%
Q2	2.50%	2.20%	2.64%	3.13%	3.33%
Q3	2.20%	2.10%	2.77%	3.21%	3.36%
Q4	2.00%	2.20%	2.86%	3.26%	3.41%

PROJECTIONS OF FUTURE INTEREST RATES

The table below reflects current market expectations about interest rates at given points in the future. Implied forward rates are the most commonly used measure of the outlook for interest rates. The forward rates listed are derived from the current interest rate curve using a mathematical formula to project future interest rate levels.

IMPLIED FORWARD SWAP RATES

Years Forward	3-month LIBOR	1-year Swap	3-year Swap	5-year Swap	7-year Swap	10-year Swap
Today	2.60%	2.90%	3.11%	3.13%	3.15%	3.21%
0.25	2.87%	3.04%	3.16%	3.14%	3.16%	3.21%
0.50	2.96%	3.13%	3.18%	3.15%	3.17%	3.23%
0.75	3.14%	3.21%	3.19%	3.18%	3.21%	3.26%
1.00	3.16%	3.22%	3.18%	3.16%	3.19%	3.25%
1.50	3.23%	3.19%	3.18%	3.19%	3.22%	3.28%
2.00	3.17%	3.20%	3.14%	3.17%	3.20%	3.26%
2.50	3.14%	3.16%	3.14%	3.18%	3.22%	3.28%
3.00	3.10%	3.12%	3.14%	3.19%	3.23%	3.29%
4.00	3.09%	3.13%	3.17%	3.23%	3.28%	3.32%
5.00	3.11%	3.18%	3.23%	3.31%	3.32%	3.34%

HEDGING THE COST OF FUTURE LOANS

A forward fixed rate is a fixed loan rate on a specified balance that can be drawn on or before a predetermined future date. The table below lists the additional cost incurred today to fix a loan at a future date.

FORWARD FIXED RATES

Cost of Forward Funds

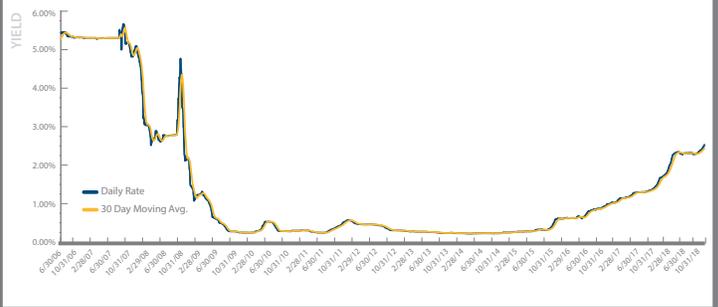
Forward Period (Days)	Average Life of Loan			
	2-yr	3-yr	5-yr	10-yr
30	5	5	5	5
90	8	6	6	5
180	15	10	11	9
365	23	17	22	16

Costs are stated in basis points per year.

SHORT-TERM INTEREST RATES

This graph depicts the recent history of the cost to fund floating rate loans. Three-month LIBOR is the most commonly used index for short-term financing.

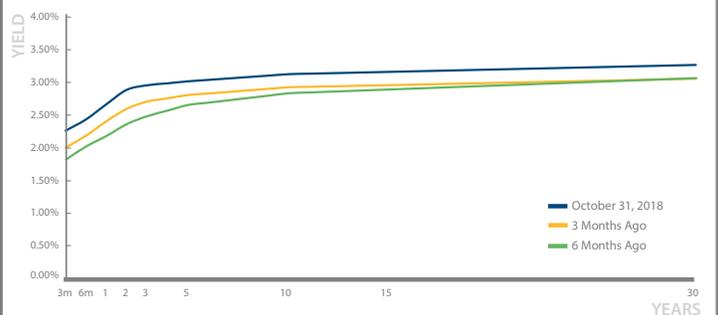
3-MONTH LIBOR



RELATION OF INTEREST RATE TO MATURITY

The yield curve depicts the relation between the cost of borrowing and the time to maturity of debt for a given borrower in a given currency. Typically, interest rates on long-term securities are higher than rates on short-term securities. Long-term securities generally require a risk premium for inflation uncertainty, for liquidity and for potential default risk.

TREASURY YIELD CURVE



COBANK UPDATE



CoBank Commits \$350,000 to Camp Fire Relief Efforts

CoBank, a cooperative bank serving agribusinesses, rural infrastructure providers and Farm Credit associations throughout the United States, announced that it has committed \$350,000 to support relief efforts in the Northern California communities impacted by the Camp Fire.

The Camp Fire, which ignited on November 8 in Butte County, has burned approximately 150,000 acres and destroyed close to 13,000 structures. Nearly 80 fatalities have been confirmed and recent reports indicate that up to 1,000 people remain unaccounted for. It has been declared the deadliest and most destructive wildfire in California history.



Thomas Halverson

“This critical region for agriculture has seen a multitude of natural disasters in recent years, but the Camp Fire stands apart due to the scale of the devastation and loss of life,” said Thomas Halverson, CoBank’s chief executive officer. “Our hearts go out to our partners and customers in the impacted area, and to everyone who has been affected by this fire.”

“The devastation in our community has been felt throughout the Association,” said J. Fletcher Monroe, president and chief executive officer of Golden State Farm Credit. “Everyone at Golden State Farm Credit has been touched by the Camp Fire, both directly – with staff losing their homes – and indirectly – knowing friends and family members that lost their homes. We are thankful to CoBank for their ongoing generosity, as well as their commitment to stand by Golden State Farm Credit and our community in times of need.”

“Our hearts go out to the victims and those affected by the Camp Fire,” said Rob Farris, president and chief executive officer of Colusa-Glenn Farm Credit. “We are deeply sympathetic to all those grieving in loss, and words cannot express our sorrow. Having said this, we are also encouraged that our community continues to support those in most desperate need. We look forward to partnering with CoBank and our other Farm Credit partners to support relief efforts.”



The bank is partnering with customers in the impacted area and with the California Farm Credit associations to provide grants to organizations supporting the immediate needs of those whose lives and livelihoods have been impacted by the fire. Organizations receiving support will include the California Farm Bureau Disaster Relief Fund, the Community Foundation of Richvale, North State Food Bank, the North Valley Community Foundation and the Salvation Army, among others.

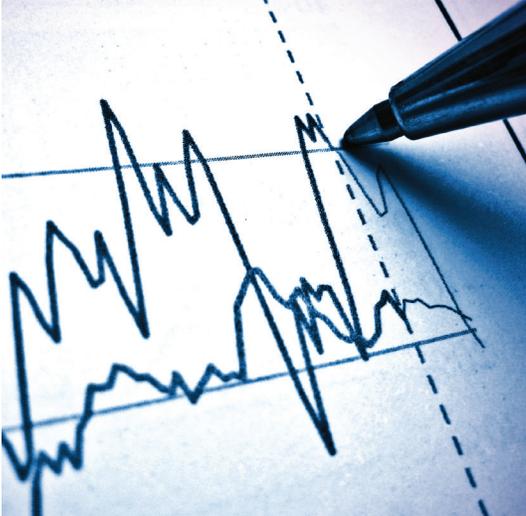
More information on CoBank's assistance will be provided as Camp Fire relief efforts continue and the full impact of the devastation is assessed. ■

CoBank Reports Third Quarter Financial Results

“We are pleased with our financial results and the overall business performance of the bank on behalf of our customer-owners,” said Thomas Halverson, CoBank's president and chief executive officer. “We have benefited from a number of non-recurring items in 2018, while the underlying performance of our core business has also been strong. CoBank remains in excellent financial condition and well-positioned to meet the needs of its customers across rural America.”

Average loan volume rose 4 percent in the third quarter to \$98.1 billion, from \$94.1 billion in the same period last year. For the first nine months of 2018, average loan volume rose 5 percent to \$100.3 billion, from \$95.8 billion in the same period last year. The increases resulted primarily from an increase in borrowing from grain and farm supply cooperatives as well as affiliated Farm Credit associations.

Net interest income increased 1 percent to \$341.1 million in the third quarter of the year, from \$338.5 million in the same period last year. The increase was driven by higher loan volume largely offset by lower earnings on balance sheet positioning and a decrease in fair value accretion income resulting from CoBank's 2012 merger with U.S. AgBank. For the first nine months of the year, net interest income



increased 4 percent to \$1,085 million, compared to \$1,042 million for the first nine months of 2017, due to higher loan volume as well as increases in returns on invested capital. These items were partially offset by lower earnings on balance sheet positioning.

Net income for the third quarter of 2018 increased 38 percent to \$291.3 million, compared to \$211.6 million in the third quarter of 2017. In addition to higher net interest income, key drivers of the increase included lower losses on early extinguishments of debt, a lower provision for loan losses, higher fee income, a lower provision for income taxes, higher gains on the sale of investment securities and a decrease in operating expenses.

For the first nine months of 2018, net income increased 28 percent to \$937.1 million from \$734.2 million in the same period of 2017. Key drivers of the year-to-date increase included higher net interest income, gains recognized on the sale of investment securities, a return of \$35 million in excess Farm Credit insurance funds in the first quarter of 2018, and lower income tax and operating expenses as compared to the 2017 period. These positive factors were partially offset by a higher provision for loan losses during the current year-to-date period.

Net interest margin for the third quarter was 1.06 percent, compared to 1.09 percent a year ago. The decrease in net interest margin was primarily driven by lower earnings on balance sheet positioning and lower accretion income during the current quarter as compared to the same quarter in 2017. For the first nine months of 2018, net interest margin remained unchanged at 1.11 percent.

At quarter-end, 1.12 percent of CoBank's loans were classified as adverse assets, compared to 1.00 percent at December 31, 2017. Nonaccrual loans increased to \$377.8 million as of September 30, 2018, from \$246.8 million at December 31, 2017, primarily due to credit quality deterioration impacting a small number of agribusiness and rural infrastructure customers. The bank's allowance for credit losses totaled \$689.9 million at quarter-end, or 1.43 percent of non-guaranteed loans when loans to Farm Credit associations are excluded.

About CoBank

CoBank is a \$128 billion cooperative bank serving vital industries across rural America. The bank provides loans, leases, export financing and other financial services to agribusinesses and rural power, water and communications providers in all 50 states. The bank also provides wholesale loans and other financial services to affiliated Farm Credit associations serving more than 70,000 farmers, ranchers and other rural borrowers in 23 states around the country.

CoBank is a member of the Farm Credit System, a nationwide network of banks and retail lending associations chartered to support the borrowing needs of U.S. agriculture, rural infrastructure and rural communities. Headquartered outside Denver, Colorado, CoBank serves customers from regional banking centers across the U.S. and also maintains an international representative office in Singapore.

For more information about CoBank, visit www.cobank.com.



David P. Burlage

“Despite continued credit softening, overall credit quality for CoBank remains solid by historical measures,” said David P. Burlage, CoBank’s chief financial officer. “In addition, the bank’s strong allowance serves as an important layer of protection for the bank against losses in our loan portfolio.”

The bank’s capital levels remained in excess of regulatory minimums. As of September 30, 2018, shareholders’ equity totaled \$9.1 billion, and the bank’s total capital ratio was 15.92 percent, compared with 8.0 percent (10.5 percent inclusive of the fully phased-in capital conservation buffer) minimum established by the Farm Credit Administration, the bank’s independent regulator. At quarter-end, the bank held approximately \$29.0 billion in cash, investments and overnight funds and had 165 days of liquidity, which was in excess of regulatory liquidity requirements.

During the third quarter, the bank made a special all-cash patronage distribution totaling \$96.2 million as part of the company’s plan to share the benefits of recently enacted federal tax legislation with eligible borrowers and other key stakeholders. The distribution was incremental to standard patronage payments the bank typically makes in March of each year.

“We are delighted with the feedback we have received from our customer-owners about the special patronage distribution,” Halverson said.

“Patronage is an important part of CoBank’s value proposition as a financial cooperative, and our customers appreciate that we shared this incremental value with them.” ■