

Amarillo

ubbock

FOURTH QUARTER 2018

Southwest Economy

Dallas

Texas Top-Ranked State for Firm Relocations

PLUS

- Mexico's Nascent Fintech Offers Promise, Faces New Rules
- On the Record: Artificial Intelligence Will Dramatically Affect Businesses
- Spotlight: Texas Pre-K Enrollment Exceeds U.S. Rate

PRESIDENT'S PERSPECTIVE



One important driver of Texas economic growth has been the migration of people and firms to the state. he Federal Reserve Bank of Dallas forecasts 2018 Texas job growth of approximately 2.5 percent. Employment growth has been robust and broad based across industries and geographic locations despite concerns regarding labor availability and trade policy.

One important driver of Texas economic growth has been the migration of people and firms to the state. In this issue, Anil Kumar and Alexander Abraham take our first look at firms that move to the state in "Texas Top-Ranked State for Firm Relocations." Kumar and Abraham's research confirms that Texas has been the nation's top destination for businesses relocating within the U.S.

Also in this issue, Michael Perez explores the impact of technology-enabled disruption on Mexico's financial services industry in "Mexico's Nascent Fintech Offers Promise, Faces New Rules." Perez finds that fintech startups are using innovative technology to broaden access to credit for Mexico's large unbanked population. Mexico's regulators have worked to craft a legal framework that preserves the potential benefits of new technologies while also protecting consumers.

Dallas Fed economists will continue to produce economic research that explores the implications of economic and demographic trends as well as the impacts of technology-enabled disruption. This work has critical implications for how we think about economic growth in our region, the U.S. and the world.

Robert S. Keplon

Robert S. Kaplan *President and Chief Executive Officer Federal Reserve Bank of Dallas*



Texas Top-Ranked State for Firm Relocations

By Anil Kumar and Alexander T. Abraham

ABSTRACT: Texas is the leading destination for companies relocating from other states. The economic benefits of the moves may be best measured in terms of the ancillary activity generated rather than the benefits directly attributable to the relocations. R elocations of firms and corporate offices generate interest among policymakers and the public who view them as generators of jobs and positive economic spillovers. Apple's plans for a \$1 billion corporate campus in Austin and the intense national competition to land Amazon's HQ2 are striking examples of the importance placed on landing the big prize.

Texas, with its hospitable business climate, is a leading contender for firms looking to cross state borders.¹ Anecdotal reports have long highlighted the state's ability to attract businesses from high-tax and heavyregulation places, such as California and New York, though exact counts of businesses that relocate to Texas and their contribution to overall job growth are hard to come by.

Analysis of National Establishment Time Series (NETS) data confirms the popular view that Texas is the top destination for firm relocations. Counting all moves of businesses in or out of Texas from 2000 to 2013, more than 25,000 establishments came to Texas from other states, bringing more than 300,000 jobs.

At the same time, close to 18,000 establishments left the state, costing about 200,000 jobs. Nevertheless, with a net migration of 100,000 jobs from 2000 to 2013, Texas led all states. California emerged as the largest net exporter to the rest of the U.S. during the period. California accounted for about one in three of the net migration jobs landing in Texas. (For more information about NETS, see "National Establishment Time Series Database Tracks Firm Mobility," page 8.)

Trends in Business Relocations

The number of establishments moving into Texas has consistently exceeded the number leaving since 1992 (*Chart 1*). In-migration and outmigration picked up after 2000, and both largely moved in tandem, except between 2004 and 2007 when in-migration was little changed and outmigration declined. Both in-migration and out-migration picked up during the Great Recession, before slowing during the recovery.

Nonetheless, the number of establishments relocating to or from the state remains a small share of all establishments in the NETS database. Those relocating to Texas accounted for about 0.09 percent of the nearly 2.3 million establishments in the state in 2013, and those leaving totaled 0.07 percent, for a net in-migration rate of slightly more than 0.02 percent of Texas' establishments.

Persistent Net Inflow of Jobs

A key indicator in the competition for business relocations is the number of jobs that potential movers would bring. Looking at trends from 1990 to 2013, job gains from in-migrating establishments generally exceeded losses from departing businesses—except in 2004 and 2012—making Texas generally a net jobs importer.

The net migration rate of employment—net migration of jobs as a share of total employment—remained generally positive in Texas (*Chart 2*). Job gains due to in-migration averaged around 0.2 percent of Texas' total employment, exceeding the average out-migration rate of 0.1 percent.





NOTE: Shaded areas indicate U.S. recessions.

SOURCES: National Establishment Time Series database; authors' calculations.



Job Migration Leader

Small numbers notwithstanding, Texas was the top destination in terms of net jobs gained from business relocations from 2000 to 2013. Georgia, Florida, Virginia and Arizona followed (*Chart 3*).

California and New York have been the largest net job exporters, with the District of Columbia, Washington and Massachusetts rounding out the top five areas. The net migration of jobs appears correlated with a state's business environment, particularly for the bottom-ranked areas; California, New York and the District of Columbia rank at the low end of indexes measuring the tax climate for businesses.²

Notably, comparing states based on total number of jobs can be misleading as it does not adjust for size; larger states will gain or lose more jobs simply due to their higher populations.

The overall story changes slightly when examining states' 2000–13 average annual net job migration attributable to business relocation as a share of overall employment. Texas remains high but slips to seventh nationally, trailing Nevada, Delaware, Arizona, Georgia, Connecticut and Kansas. California ranks sixth from the bottom, with the District of Columbia exporting the most jobs as a share of overall employment, followed by Alabama, Washington, Alaska and Iowa.

Businesses relocating to Texas are mostly going to large metropolitan statistical areas (MSAs). Dallas and Houston have been favored destinations, accounting for two-thirds of all jobs moving from other states (*Chart 4*). Businesses' choice of large MSAs such as Dallas and Houston is driven not only by relative size but also by population density, availability of an educated workforce, diversity of industries and adequate infrastructure.

Dallas, Austin and Houston emerge as the top three in terms of the net migration rate of jobs due to interstate business relocation.

California a Top Job Exporter

Anecdotal reports have long indicated that Texas is a favored destination of businesses departing California because of the high cost of doing business attributable to labor expense, taxes and regulatory burden. NETS data confirm that perception. Between 2000 and 2013, California was the source of more than 51,000 jobs—about one-fifth of all jobs moving to Texas.

Meanwhile, Texas sent 18,000 jobs to California—creating a net migration of 33,000 jobs to Texas. South Carolina, Oklahoma, Louisiana and New Jersey rounded out the top five states with net migration to Texas (*Chart 5*). Relatively high firm migration from Oklahoma and Louisiana indicates that in addition to differences in economic conditions and business climates, proximity also plays an important role in business relocation-based employment change. Distance matters because businesses may relocate, in part, to minimize costs, and moving expenses can be substantial. Not surprisingly, the number of interstate moves pales in comparison to intrastate moves—the 25,000 businesses relocating to Texas from other states between 2000 and 2013 represented less than 10 percent of the number of establishments that changed addresses within Texas over the same period.

Office Jobs, Small Businesses

Among major sectors, professional and business services accounted for more than 25 percent of employment from in-migration of establishments, followed by manufacturing (21 percent) and trade, transportation and utilities (18 percent). The three sectors also accounted for the bulk of jobs moving from Texas between 2000 and 2013 (*Table 1*). Almost all supersectors saw positive net migration from business relocation, with professional and business services and manufacturing responsible for close to 60 percent of moves.

On average, 90 percent of businesses moving into or out of Texas were stand-alone, single-establishment firms. They accounted for about half of net job migration. The share of multi-establishment firms relocating their headquarters to Texas was relatively small but represented about 40 percent of employment moves. Thus, multi-establishment businesses moving their headquarters are mainly large firms.

Not surprisingly, small businesses tend to be more mobile. Establishments with fewer than five workers constitute about 80 percent of all businesses moving to Texas but account for less than 12 percent of all jobs (*Chart 6*).

On the other hand, large establishments—ones with 1,000 or more workers—account for very few moves but almost a quarter of all jobs relocating to Texas. Overall, relatively smaller businesses—ones with fewer than 500 workers—account for about two-thirds of jobs coming to Texas. The average establishment size of all in-migrating businesses is about two workers.



NOTE: States with near-zero activity were omitted.

SOURCES: National Establishment Time Series database; authors' calculations.



NOTE: Data shown are migration totals from 2000 to 2013. SOURCE: National Establishment Time Series database.

Small establishments moving to Texas also often exhibit stronger growth if they can succeed. Small businesses tend to be younger and contribute more to net job creation over time than their large counterparts.³

Relocation Costs, Benefits

When new enterprises move in, local residents benefit not only because of new business investment and greater employment opportunities, but also because of increased property values, reflecting net gains in economic welfare.⁴ Furthermore, a new firm could have significant positive spillovers for existing firms and, through agglomeration economics, increase overall productivity.

While the majority of business moves involve relatively smaller entities with few employees, interstate relocations of large firms who bring many employees can come with larger benefits but also at a substantial cost to state and



California Leads in Net Export of Jobs to Texas



NOTE: The period 2000–13 is depicted. SOURCE: National Establishment Time Series database.

TABLE

In-migration of Establishments and Employment, 2000–13

	In-migration		Out-migration	
Supersector	Estblshmnts	Employment	Estblshmnts	Employment
Professional and business services	9,904	77,475	7,256	43,012
Manufacturing	1,489	64,470	1,076	39,816
Trade, transportation and utilities	4,481	59,562	3,474	46,179
Finance	1,828	25,223	19,509	19,509
Leisure and hospitality	1,079	18,883	701	14,493
Educational and health services	1,620	14,402	1,217	9,007
Information	777	13,321	630	14,556
Construction	1,784	10,825	1,155	11,046
Mining, oil and gas	282	7,762	204	3,971
Other services	1,424	7,040	1,012	5,748
Agriculture	464	1,589	282	1,738
Total movement	25,183	301,097	18,239	200,402

NOTE: Supersectors shown represent a subset of total Texas mover population, so columns do not sum to entries in "Total movement" row.

SOURCE: National Establishment Time Series database

local governments. These high-profile moves often include governmentbacked incentive packages. The costs of providing assistance for relatively few establishments may affect tax revenue through multiple tax breaks and additional expenditures on infrastructure and public services.

Texas' Incentive Pitch

Nationally, spending on business relocation incentives exceeds \$80 billion each year across all states and local governments, with Texas leading at \$19 billion annually, according to a database compiled by the *New York Times*. In per capita terms, state and local governments in Texas spend \$759 annually, ranking fourth among states. A separate analysis of state business incentives that calculates the value of the programs as a percentage of value added ranks Texas 17th of 33 states.⁵

Within Texas, there are about two dozen programs to attract businesses from other states.⁶ Key among them is the Texas Enterprise Fund (TEF)-one of the largest "deal-closing" funds in the nation-that provides cash grants to mostly larger companies that choose Texas over another state and create at least 75 jobs in urban areas (25 jobs in rural areas) with average wages above the county average. The TEF funded 146 projects from its inception in 2004 through 2016, paying out about \$610 million.⁷In a recent example, Toyota received \$40 million from the fund to move its North American headquarters from Torrance, California, to Plano, Texas, and create 4,000 jobs.8

Another widely used program falls under Chapter 313 of the Texas Tax Code. It allows school districts to provide property tax breaks by capping a new firm's appraised property value for 10 years in return for businesses committing to create at least 25 jobs in nonrural school districts (10 in rural districts). The state makes up the foregone school tax revenue.9 In the first 10 years of this program, which began in 2001, a total of 128 awards worth \$2.4 billion were made.¹⁰ Still other property tax abatements offered by cities and counties-under Chapter 312 of the Texas Tax Code-don't involve state funding but are used to attract new industries and retain existing ones.11

Are Tax Incentives Worthwhile?

Whether tax incentives' benefits outweigh their costs has long been a subject of intense economic research. While there is some evidence that such programs may benefit local economies, for the nation as a whole, they are mostly a zero-sum game—one state's gain is another state's loss.¹²

Business relocation incentives may also distort optimal location decisions. An optimal location choice based purely on economic grounds of cost minimization and profit maximization might have been different. Therefore, one state attempting to outbid another with corporate tax breaks can encourage a "race to the bottom," leading to lower levels of public services or higher taxes on existing firms or households than would otherwise be the case.

Still, under certain conditions, economic development subsidies may not be a zero-sum game at the local level if there are enough agglomeration spillovers. This is particularly the case if the new firm acts as a magnet for more firms to move to the area and motivates existing firms to expand. Indeed, if these conditions are met, tax incentives may even improve location efficiency.¹³

Small Job Growth Impact

Although jobs from business relocations remain an important focus of state and local policymakers, they are just a minor component of the overall churn in the labor market. Other elements include job creation from the birth of new firms and growth among existing establishments countered by job destruction from business closures and job losses in contracting businesses.

The Texas economy created about 1.4 million jobs and destroyed 1.3 million jobs per year between 2000 and 2013, for a net job creation per year of about 180,000 jobs, Business Dynamic Statistics data indicate.¹⁴

Thus, 22,000 jobs gained annually from businesses coming to Texas from 2000 to 2013 accounted for just 1.5 percent of all job creation each year. In other words, more than 98 percent of new jobs came from either creation of new businesses or growth among expanding ones. Analogously, 14,000 jobs lost per year due to business moving out of Texas represented just 1.1 percent of all jobs destroyed. Therefore, net migration of 8,000 jobs per year from other states to Texas accounts for just about 4 percent of annual net job creation in the state.

Incentives Play Small Role

A variety of factors makes Texas a favored destination for businesses looking to relocate. Some relate simply



SOURCE: National Establishment Time Series database.

to the state's traditional advantages favorable business climate, central location, large size, accessibility to ports, diverse industrial structure and abundant energy resources.¹⁵ Other characteristics also work to Texas' advantage: an ample supply of educated workers relative to many other states, a lower cost of living, less union activity and adherence to the federal minimum wage of \$7.25 an hour. Other large states, such as California and New York, enforce above-federal standards, with some local governments pushing pay floors even higher.¹⁶

Texas' attractiveness in terms of lower tax burden is more of a mixed bag—the state imposes less onerous income and unemployment insurance taxes than most other states but relatively more burdensome sales and property taxes.¹⁷

Although some tax breaks may be unavoidable when competing for interstate relocations, evidence suggests that subsidies at best play a small role in affecting location choices, with few firms receiving subsidies.^{18, 19} Thus, the influence of Texas' traditional growth advantages on relocation appears to predominate.²⁰

Moreover, job gains from startups and expansions of existing firms far outnumber those from interstate business relocations. Therefore, pro-growth policies that improve a state's business climate and encourage new business formation can be more economically efficient than programs designed to lure businesses from other jurisdictions.

Kumar is an economic policy advisor and senior economist, and Abraham is an economic programmer in the Research Department at the Federal Reserve Bank of Dallas.

Notes

¹ "America's Top States for Business 2018," CNBC, July 2018, accessed Dec. 14, 2018, www. cnbc.com/2018/07/10/americas-top-states-forbusiness-2018.html.

² For example, see "2019 State Business Tax Climate Index," by Jared Walczak, Scott Drenkard and Joseph Bishop-Henchman, Tax Foundation, 2018, https:// taxfoundation.org/state-business-tax-climate-index-2018/. ³ See "Who Creates Jobs? Small Versus Large Versus Young," by John Haltiwanger, Ron S. Jarmin and Javier Miranda, *Review of Economics and Statistics*, vol. 95, no. 2, 2013, pp. 347–61.

⁴ A rise in property values is a sufficient condition for net welfare benefits to local residents. See "Bidding for Industrial Plants: Does Winning a 'Million Dollar Plant' Increase Welfare?" by Michael Greenstone and Enrico Moretti, National Bureau of Economic Research, NBER Working Paper no. 9844, July 2003.

⁵ See "Explore the Data" infographic, *New York Times*, http://archive.nytimes.com/www.nytimes.com/ interactive/2012/12/01/us/government-incentives.html.

National Establishment Time Series Database Tracks Firm Mobility

The National Establishment Time Series (NETS) database, constructed by Walls & Associates and Dun & Bradstreet, tracks the characteristics and movement of about 60 million U.S. establishments from 1990 through 2014. Data showing firm movements are complete through 2013. Available establishment characteristics include location, employment, sales, industry, headquarters, and first and last years of operation.¹ Establishment characteristics are updated annually.

When an establishment relocates, NETS provides a move event record that changes its street address and ZIP code. A move event record includes location details pre- and post-move.

The NETS database covered 2.3 million Texas establishments, accounting for 15.2 million employees, in 2013. By comparison, the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW) covered about 600,000 Texas establishments, involving 11 million employees in 2013.

The two counts differ in scope. QCEW captures jobs specifically covered by the unemployment insurance program; NETS captures a broader range of jobs. Establishments with relatively few years in business and/or low employee counts are more likely to be included in NETS.² NETS contains a collection of observed and imputed employment data. Previous research has shown that NETS data are best suited for longer-term analyses, with a recommended horizon of at least three years.³ NETS annual employment numbers tend to lag official data. This is primarily because the NETS sample for a particular year reflects numbers as of January of that year. For instance, employment numbers in any month between February and December 2012 would count toward NETS employment for 2013.⁴

Notes

¹ For a detailed description of the NETS database, see "Employment Dynamics and Business Relocation: New Evidence from the National Establishment Time Series," by David Neumark, Junfu Zhang and Brandon Wall, *Research in Labor Economics*, Emerald Group Publishing Ltd., 2007, pp. 39–83.

² See "Business Establishment Employment Data: NETS Versus ES-202," by Gary Kunkle, Business Dynamics Research Consortium, University of Wisconsin System, June 2011, http://exceptionalgrowth.org/insights/NETSvsES-202.pdf.
³ See note 1.

⁴ See "An Assessment of the National Establishment Time Series (NETS) Database," by Keith Barnatchez, Leland D. Crane and Ryan A. Decker, Opportunity & Inclusive Growth Institute, Federal Reserve Bank of Minneapolis, December 2017, www.minneapolisfed.org/institute/working-papers/wp17-29.pdf.

Also see "As Companies Seek Tax Deals, Governments Pay High Price," by Louise Story, *New York Times*, Dec. 1, 2012. For analysis of states' business incentives as a percent of value added, see "A New Panel Database on Business Incentives for Economic Development Offered by State and Local Governments in the United States," by Timothy J. Bartik, Upjohn Institute, February 2017. ⁶ See "Texas Business Incentives and Programs," Office of the Governor, Economic Development & Tourism, 2018, https://gov.texas.gov/uploads/files/business/ incentivessummary.pdf.

⁷ "Texas Enterprise Fund, 2017 Legislative Report," Office of the Governor, January 2015–December 2016, https://gov.texas.gov/uploads/files/business/ tef_legislative_report_.pdf.

⁸ See "Texas to Pay \$10,000 for Each Toyota Job," by Mike Ramsey and Joseph B. White, *Wall Street Journal*, April 28, 2014, www.wsj.com/articles/toyota-toconsolidate-u-s-operations-in-texas-hub-1398699006.
⁹ See "Fiscal Notes, Chapter 313: Attracting Jobs and Investment," by Olga Garza and Annet Nalukwago, Texas Comptroller of Public Accounts, April 2016, https:// comptroller.texas.gov/economy/fiscal-notes/2016/ april/%20chap313.php.

¹⁰ See "Update to Texas Economic Development Incentive, Comprehensive Summary Tables," Texas Comptroller of Public Accounts, 2014, https://comptroller.texas. gov/%20transparency/local/docs/96-1453-update.pdf. ¹¹ For some examples of companies getting the tax break, see "Incentives Draw Firms, but at What Cost?" by Michael Weiss, Federal Reserve Bank of Dallas, *Southwest Economy*, First Quarter, 2015.

¹² For empirical evidence, see "State Investment Tax Incentives: A Zero-Sum Game?" by Bob Chrinko and Daniel Wilson, *Journal of Public Economics*, vol. 92, no. 12, 2008, pp. 2,362–84.

¹³ For a summary of theoretical explanations for economic development subsidies, see "The Economics of Location-Based Tax Incentives," by Edward L. Glaeser, Harvard Institute of Economic Research Working Papers, no. 1932, 2001.

¹⁴ Data from Business Dynamics Statistics, Census Bureau, www.census.gov/ces/dataproducts/bds/, accessed Nov. 9, 2018.

¹⁵ "Business Location Decisions in the United States: Estimates of the Effects of Unionization, Taxes and Other Characteristics of States," by Timothy J. Bartik, *Journal of Business & Economic Statistics*, vol. 3, no. 1, 1985, pp. 14–22.

¹⁶ For more on state and local-level minimum wage laws, see "Minimum Wage Tracker," Economic Policy Institute, accessed Nov. 13, 2018, www.epi.org/minimum-wagetracker/#/min_wage.

¹⁷ The Tax Foundation ranked Texas 15th in its 2019 State Business Tax Climate Index, https://taxfoundation. org/publications/state-business-tax-climate-index/. ¹⁸ See "Taxes and the Location of Production: Evidence from a Panel of U.S. Multinationals," by Michael P. Devereux and Rachel Griffith, *Journal of Public Economics*, vol. 68, no. 3, 1998, pp. 335–67.
¹⁹ Between 2007 and 2013, about 1,878 firms locating within Texas received a subsidy. The total includes all firms, not just those relocating from other states, https:// www.goodjobsfirst.org/.

²⁰ For major drivers of faster economic growth in Texas relative to the nation, see "Why Texas Grows Faster: The Role of Smaller Government" by Jason Saving, in *Ten-Gallon Economy: Sizing Up Economic Growth in Texas*, ed. Pia Orrenius, Jesus Cañas and Michael Weiss, New York: Palgrave Macmillan, 2015.

Texas Pre-K Enrollment Exceeds U.S. Rate

By Stephanie Gullo

exas since 1985 has required public school districts to offer half-day prekindergarten to 4-year-olds who meet certain criteria and schools may extend enrollment to 3-year-olds. Children are eligible if they qualify for free or reduced-price lunches, available to those from homes with household incomes that are at or below 185 percent of the federal poverty level. Other students gain entrance because they are not proficient in English.

During the 2016–17 school year, 49.4 percent of Texas 4-year-olds were enrolled in state-backed pre-K programs, compared with 32.7 percent nationally (*Chart 1*). A total of 8.5 percent of Texas 4-year-olds participated in the federal pre-K program, Head Start, versus 8.9 percent for the U.S.

Texas' high enrollment rates reflect its disproportionate number of children of immigrants whose first language is not English. About 40 percent of Texas pre-K students are English learners.

Getting Up to Speed

Pre-K is important because in the years before children start kindergarten, skill discrepancies emerge that can have lifelong consequences. At age 5, less than half of children from low-income households are prepared to start school, compared with three-quarters of children from high-income households.

Children from disadvantaged backgrounds start kindergarten with significantly fewer skills in math and reading. They may have difficulty with self-control, leading to behavioral problems. The preparedness gap is troubling because studies have shown that skills at kindergarten entry are a strong predictor of academic achievement and adult earnings.

Local, state and federal governments as well as private entities fund and operate pre-K programs. Texas state government spending was \$3,846 per child



NOTE: Four-year-olds enrolled in both Head Start and state pre-K are included in both categories (an estimated 1.2 percent of all 4-year-olds in the U.S. are in both programs). SOURCE: National Institute for Early Education Research.

enrolled in pre-K in 2017–18, down slightly from the prior year and well below the more than \$5,000 average state spending per enrollee across the country. Texas reduced pre-K funding 11.6 percent, to \$803.5 million, in 2018. The drop was largely due to elimination of the High Quality Prekindergarten Grant, which awarded funds to school districts to improve pre-K programs.

Supporters say early childhood education programs such as pre-K can mitigate inequities by providing aid to disadvantaged children. Long-term studies of high-quality early learning programs for disadvantaged children have found that the benefits of participation include higher fifth-grade test scores, increased IQs as adults and a greater likelihood of high school graduation.

Other benefits are lifelong, such as improved adult health, decreased body mass index readings and lower rates of depression and substance abuse that all may help lead to increased earnings and lower rates of incarceration.¹ Low- and middle-income parents who cannot afford child care benefit as well, recording higher employment rates.

Widespread Availability

Many school districts across Texas offer expanded pre-K. While the state funds only half-day programs, 72 percent of districts offer full-day programs for at least some students—54 percent of students are in full-day programs.

Virtually all pre-K students in Dallas, Fort Worth and San Antonio are in full-day programs, while more than 80 percent of Austin and Houston students are in them.² Additionally, some districts offer pre-K to students who do not meet state eligibility requirements. Austin and Houston enroll hundreds of students outside the state's criteria but charge tuition, while Fort Worth offers its program free to all children, regardless of family income.

Notes

 ¹ For more information, see "The Current State of Scientific Knowledge on Pre-Kindergarten Effects," Brookings Institution, 2017, www.brookings.edu/wp-content/ uploads/2017/04/duke_prekstudy_final_4-4-17_hires.pdf.
 ² "Texas Public Education Resource Report," Texas Education Agency, 2016–17, www. texaseducationinfo.org/Home/Topic/Prekindergarten%20 Programs?br=PK-12. A Conversation with Manoj Saxena

Artificial Intelligence Will Dramatically Affect Businesses

Manoj Saxena, executive chairman of CognitiveScale and a founding managing director of The Entrepreneurs' Fund IV, serves on the board of the Saxena Family Foundation and AI Global, a nonprofit dedicated to promoting artificial intelligence. He was the first general manager of IBM Watson, a pioneering machinelearning effort, and recently retired after six years on the board of the San Antonio Branch of the Federal Reserve Bank of Dallas.

Q. You directed the Watson project at IBM. In what way do you see Watson as the father of Artificial Intelligence?

The creation of Watson is a seminal moment that brought artificial intelligence (AI) into the mainstream. Data is the new oil, and AI is the refinery that processes data into useful products. AI has been around about 75 years, and Watson emerged when cloud-computing costs were dropping, large amounts of data were being generated and businesses were searching for the next level of productivity growth, a competitive edge and a comparative advantage beyond the internet.

I gained four central insights while working on Watson. The first is that we are now at a dawn of a new class of computing that will transform us as a society and species. Whereas the industrial revolution amplified the power of our arms and legs via steam engines, AI will amplify the power of our brain. Every tool built since the dawn of human society has been inferior to our brain, and AI is the first that is equal to or superior.

The second is that the idea of human versus machine is incorrect. Instead, think of it as human and machine. The last big innovation of IBM was Deep Blue, the first computerized chess player that outcompeted the human brain in terms of calculations. Something very interesting happened after Deep Blue. Over the next 15 years, the average age of a chess grandmaster decreased by over 10 years as humans began to use the machine not as an opponent, but as a coach. Thus, the real power of AI is not about replacing what we do, but augmenting it.

Third, for AI to succeed, it needs to be applied deep into an industry or business process. A computer learns by understanding domain and context, both of which exist deep in an industry. Therefore, AI must be utilized vertically within an industry.

Lastly, AI is completely different than any machine previously built. Every machine created in information technology during the previous 75 years was built on the rules of "if-then-else" programming. An AI system self-learns from patterns and inferences while improving its knowledge exponentially.

Q. Many experts expect that AI will dramatically affect U.S. business over the next five years. How so?

In simple terms, it's embrace or be extinguished. Whether it's documents, images, words, speech or videos, AI is an intelligent computer program that perceives and understands all types of information, infers important signals from such data and continuously learns from its actions. It's going to be woven into every business application and system. It already surrounds us—how we watch movies on Netflix, the way you talk to Alexa, how you vacuum with Roomba, how you drive a car with lane detection and adaptive cruise control.

The notion of AI becoming a silver thread that runs across every application and system will be real. Furthermore, the rate of technological disruption will accelerate due to the amalgamation of an intelligent system with exponential learning capacity and today's digital media platform with exponential distribution. Seventy-five years passed before television reached 50 million users; Angry Birds [video game] achieved that within 30 days and Pokémon Go [mobile game] within 14 days.

Broadly speaking, AI will impact all facets of society. It'll influence how a business remains competitive and gains a competitive edge, how and whom it hires and where it invests. Overall, I believe there will be a significant shift in the workforce skills profile. AI will replace tasks, not jobs. Indeed, AI is the new frontier of economic and technological leadership for the U.S.

Is the U.S. playing a lead role in AI development? I wish my answer were yes, but when I look across the horizon, that's not the case. There is a real danger of the United States losing its competitive edge to China, where the government has put significant resources into AI investment and strategy.

A notable factor that can greatly affect American progress in AI is the current immigration sentiment. The potential to lose future foreign talent in academia and research institutes will play a central role in determining our position as a leader in AI development.

Q. What jobs and industries will be most affected?

There's no doubt AI will massively change the face of employment and industry. AI will primarily function as



"AI will impact all facets of society. It'll influence how a business remains competitive and gains a competitive edge, how and whom it hires and where it invests."

intellectually enhanced aids to individuals in their fields—for example, offering a comprehensive compendium of medical records to doctors and nurses to assist in diagnosis and treatments.

There will be a new class of employment opportunities for individuals who design and maintain the AI robots and systems. We previously saw such a transition during the emergence of the auto industry and entire new sets of jobs assembly-line workers who built autos, safety inspectors, warranty and service agents, and car wash employees.

Q. During the 20th century, we saw technology initially affect agriculture and then manufacturing. Is AI creating a productivity growth wave in the service sector?

AI will certainly affect service sectors. Jobs such as concierges, fashion models, baseball umpires, mechanical drafters, credit authorizers and brokerage clerks will be dislocated and, in many cases, replaced. Ultimately, AI will support individuals in making better decisions. The essence of AI is to efficiently and effectively operationalize knowledge and, as a result, costs will decrease. Investment in infrastructure will grow and, subsequently, so will wages. That's the essential promise of AI: to use data to make better decisions while getting smarter and more efficient.

Q. Stagnant productivity growth has perplexed economists in recent decades. Are we still waiting to feel Al's impact?

Adding AI tools does not immediately translate to increasing productivity.

If you had given an individual a free car in 1915—when there was little knowledge of driving or maintaining vehicles—there would have been improvement in neither commerce nor productivity. AI is currently in that same early stage.

Q. How would you advise a young person to prepare for the workforce of the next 30 years?

There are four suggestions. The first is to learn multiple disciplines. What used to be referred to as STEM is now STEAM—science, technology, engineering, arts and math. The notion of combining technology and humanities is crucial. Steve Jobs showed us that beautiful products can result from it.

The second is to treat and view your career not as a ladder but as a jungle gym. Being willing to go sideways and accept jobs in different areas will advance your career faster.

Third is to learn and build strong digital abilities.

Finally, develop skills that machines find hard to imitate. Creativity, empathy, emotional intelligence and teamwork are all skills of the human mind, requiring context switching and processing, and these are what machines find most difficult to replicate.

Q. Given the expected future impact of AI, how would you advise Texas' political and business leaders?

There are five dimensions to consider. The first is education. Educate yourself on the complexities of AI and then educate the next generation by engaging different educational institutions to build the next generation of cognitive skills and expertise.

The second is regulations. We need to implement regulations around ownership and usage of data as a basic human right. As of now, data theft and exploitation are concerns as pivotal as the risk of AI machines and systems being hacked.

The third is access. As a nation, there exists a necessity to ensure AI tools are accessible across all social classes and regions. Modern society as we know it already recognizes the rich as becoming richer and the poor becoming poorer. Thus, if the issue of access is not properly addressed, the gap between the haves and have-nots will only be exacerbated.

The next suggestion is fostering academic and industry partnership and collaboration.

Fifth, and the most worrying to me, is to prevent AI from being weaponized. A similar phenomenon exists today through the weaponization of social media vis-á-vis fake advertisements. There are AI robots that create fake ads on the fly to target individuals based on their social media activity. If applied to drones, bombs or lasers, it would present great social concerns comparable in scale to nuclear weaponry.

Mexico's Nascent Fintech Offers Promise, Faces New Rules

By Michael Perez

ABSTRACT: The number of financial technology startups in Mexico has rapidly increased, promising to expand financial services to a large portion of the unbanked population. Officials are hopeful new regulations will aid the industry's development. inancial technology in Mexico has increased rapidly. The number of fintech startups rose 40 percent on a year-over-year basis to a total of 334 as of September 2018.¹

Mexico's fintech sector originally focused on expanding financial access through mobile payment applications, but entrants are spread across an array of financial segments and offer a mix of services (*Chart 1*).²

Although the sector remains relatively small, 36 percent of Mexicans who are active online have adopted fintech, according to the accounting firm and consultancy EY.³ The share exceeds the average global adoption rate of 33 percent.

A separate study shows that 60 percent of Mexican individuals are active online, compared with 77 percent in the United States.⁴

Fintech firms—specializing in technologically enabled financial service innovation—use computing power, artificial intelligence, mobile telecommunications and cloud-based systems to provide financial services.⁵

The services include electronic payments and remittances, crowdfunding, automated loan applications, and asset trading. Some fintech firms compete directly with traditional banking and financial institutions, while others partner with existing institutions.

A survey of Mexican fintech firms reveals that the majority have business models aimed at reaching financially excluded markets—those with limited or no access to basic financial services such as checking and savings accounts (*Chart 2*). Consumers in these markets are chiefly "underbanked" and "unbanked" individuals, as well as small businesses (11–50 employees) and medium-sized enterprises (51–250 employees) lacking relationships at established banks.

A smaller share of fintech firms focus on providing business-to-consumer products—online lending and creditscoring services—for banked customers and business-to-business solutions such as cross-border business payment platforms for large firms. Still others deal in products for banked small and medium-sized enterprises.

Fintech products are generally easier to access relative to traditional banking alternatives for those outside the mainstream, who may potentially realize financial inclusion. The fintech sector benefits from comparatively streamlined business models, greater ability to develop products for specific customers and less regulatory oversight.⁶

Greater financial inclusion comes with challenges, especially cyber risks, which are inherent with high interconnectivity in diverse environments where participants often function with a degree of anonymity. For example, most fintechs leverage internet access to collect client data and provide services, creating an opening for hackers looking to steal funds or customer identities.

Money-laundering concerns also exist given drug cartels' presence in Mexico. Moreover, because fintechs operate with minimal oversight relative to banks, the lack of consumer protections is a concern, especially in the event of firms failing.

Mexico's financial regulators responded in 2018 with regulations that establish a framework for the authorization and supervision of fintech firms, particularly those focusing on online lending and payments. Moreover, officials seek to incentivize collaborative relationships to allow innovation to occur as regulations are developed.

Fintechs Seek Traction

The majority of Mexican fintechs are venture-capital startups.⁷ More than 85 percent are less than five years old, and about 12 percent fail annually. Over half of Mexico's fintech firms employ fewer than 10 people, while only 8 percent have more than 50 employees. The value of fintech transactions in Mexico is expected to total US\$36 billion in 2018, representing 7 percent of commercial banking assets and 14 percent of commercial loans. Fintech volume is projected to reach \$68 billion by 2022, assuming growth at the current rate.⁸

Traditional financial institutions are entering the sector through direct investments in fintech companies, consulting, and development of fintech-like platforms such as mobile banking applications. For example, BBVA Bancomer, Mexico's largest commercial bank, purchased Openpay, a Mexican fintech startup that offers electronic payment applications for businesses.⁹ The bank said it would launch a \$250 million fund that will focus on early- to late-stage fintech investment opportunities.¹⁰

Mexican banks' growing fintech presence reflects the banks' desire to enter new markets and offer new products as well as the fintech firms' need for funding and access to payment systems. Fintech originally sought to unbundle banking through digital disintermediation. However, fintech firms cannot accept traditional deposits, making it difficult for them to attract cheap and stable funding. As a result, they generally rely on banks for their financial support and customer base. Fintech firms gain access to banks' payment systems and financial data through these partnerships.

The blurring lines between fintech and traditional finance sectors present numerous regulatory challenges, particularly related to financial stability. As the interconnectivity between banks and fintechs increases, so do the risks for contagion. For example, fintech lender losses could spill over to banks funding the firms.

Accurately assessing the financialstability implications is challenging given the limited availability of official





SOURCE: Finnovista Radar 2018; author's calculations



NOTE: SME refers to small and medium-sized enterprises SOURCE: Finnovista Radar, 2018.

and privately disclosed fintech operations data. Moreover, a lack of internationally accepted guidelines or best practices renders regulatory frameworks fragmented across countries. Given the level of uncertainty regarding fintech vulnerabilities, there exist material risks that regulators have yet to realize or understand. For example, numerous cases of disappearing crowdfunding receipts have been reported in Mexico.

Inclusionary Opportunities, Costs

Financial system development, especially inclusion, remains a challenge in Mexico. In a reversal of prior trends, the share of the adult population with a bank account fell between 2014 and 2017. Lack of required funds, high costs and distrust are the main contributors to the decline (*Chart 3*). However, the rise of alternative financial arrangements, such as those fintechs offer, could also play a role.



Bank Account Ownership Down in Mexico

SOURCE: World Bank, Global Findex, 2017.

Banks tend to focus on existing clients, for whom they consolidate financial service offerings and make larger loans. As a result, fewer Mexicans access formal credit and instead seek out less-reliable, unregulated channels for accessing financial products (such as payday loans) via informal arrangements among friends (*tandas* in Spanish) and loan sharks.

Mexico's microbusinesses and smalland medium-sized enterprises (SMEs) face similar issues accessing formal finance. The majority of Mexico's enterprises are microbusinesses and SMEs operating in the country's informal sector, leaving many of them without access to key financial services.

These businesses account for 52 percent of Mexico's gross domestic product (GDP) and 72 percent of its employment, though most are ineligible to receive credit from commercial banks.¹¹ There are indications that Mexico's recent financial reforms are helping boost lending to smaller enterprises. Still, the base from which those improvements occur is small.¹²

While banking penetration remains low for consumers and smaller enterprises, the diffusion of technology is on the upswing—a necessary condition for the expansion of fintech. Cellular phone penetration is high, bolstered by structural reforms designed to increase competition in telecommunications.

An estimated 75 percent adults report having access to a mobile phone up from 69 percent in 2016—and 42 percent of those phones are smart devices.¹³ Meanwhile, mobile and internet subscription rates are trending higher (*Chart 4*).

The delivery of financial products through fintech comes at an added cost to customers. For example, fintech firms specializing in online lending can, more easily than banks, serve marginalized consumers without imposing credit, balance and collateral requirements.

These firms gauge borrowers' creditworthiness using unconventional models and algorithms before assessing relatively high interest costs that make up for high default risk.¹⁴ Conversely, the unconventional borrower screenings and significant financial burdens on borrowers may increase default rates and ultimately reduce confidence in the sector.

Moreover, fintech's increasing reliance on the internet renders consumers subject to cybersecurity attacks and identity theft risks. Financial education is another concern because users must feel comfortable using financial technologies, be able to identify issues and understand what recourse is available if something does go wrong. Challenges specific to Mexico's rural areas include a lack of electricity to power mobile phones and computers, spotty network coverage and a limited regulatory presence to provide consumer education and legal protection.

Laying Regulatory Groundwork

Regulators recognize challenges accompanying the benefits of wider fintech adoption. These considerations prompted passage of a comprehensive fintech law in 2018, making Mexico one of the first countries to craft legislation exclusively dedicated to the sector.¹⁵

The law seeks to provide legal security to fintech consumers, trigger greater competition in financial markets, combat money laundering and fraud in accordance with international standards and regulate transactions involving digital assets and platforms.¹⁶

The law identifies key fintech institutions and rules for their authorization, regulation and supervision.¹⁷ The institutions—primarily crowdfunding platforms and electronic payment services—first receive an initial consent to operate from an interagency committee comprised of two members each from the Ministry of Finance and Public Credit, the Bank of Mexico, and the Banking and Securities Commission. The Banking and Securities Commission provides final operational approval.

Fintechs must remit funds they receive to deposit accounts in approved banks and must obtain special dispensation to receive foreign funds. Each institution is subject to capital requirements, and the value of transactions sent via online payment is capped.

The law also lays out rules to facilitate the exchange of data and promote innovation. It encourages the sharing of financial consumer data between banks and fintechs through public application programming interfaces platforms that aggregate consumer financial data without violating financial secrecy regulations.¹⁸

The law also provides fintechs with regulatory sandboxes—testing grounds for new business models not protected by existing regulation. Sandboxes permit fintechs to experiment with innovative products in a controlled environment with limited oversight by regulators, who in turn can develop regulations around fintech products while directly observing them in action.

Additionally, the law created the Financial Innovation Group, a forum for startups, banks and public sector entities to promote fintech.

The Road Ahead

Mexico's traditional banks have historically struggled to offer financial inclusion. Private sector credit as a share of GDP is among the lowest in Latin America. Fintech, while relatively small, has the potential to deepen Mexico's financial system while offering improved access to credit for the unbanked and underbanked.

Regulators have formally acknowledged the importance of fintech and implemented prudential regulations that seek to balance stability with the freedom to innovate in order to ensure the sector can serve markets effectively. Fintech's growth will depend on the sector adhering to the new standards while innovating and providing value to consumers.

Perez is a financial industry analyst in the Surveillance and Industry Analysis Department at the Federal Reserve Bank of Dallas.

Notes

¹ Brazil is Latin America's largest fintech hub, while Colombia is the third largest. See "Mexico Exceeds the Barrier of 300 Fintech Startups and Reinforces Its Position as the Second Most Important Fintech Ecosystem in Latin America," Finnovista, 2018, accessed Nov. 9, 2018, www.finnovista.com/actualizacionfinnovista-fintech-radar-mexico-2018/?lang=en. ² See "Mobile Payments Promise to Improve Financial Accessibility in Mexico," by Michael Perez, Federal Reserve Bank of Dallas *Southwest Economy*, Third Quarter, 2016, www.dallasfed.org/-/media/documents/ research/swe/2016/swe1603g.pdf.

³ This survey was based on more than 22,000 online interviews in 20 international markets. Fintech users are defined as individuals who have used two or more fintech services in the past six months. See "EY FinTech Adoption Index 2017: The Rapid Emergence of FinTech," Ernst & Young, www.ey.com/Publication/vwLUAssets/



ey-fintech-adoption-index-2017/\$FILE/ey-fintechadoption-index-2017.pdf.

⁴ International Telecommunication Union statistics, 2016, accessed Nov. 9, 2018, www.itu.int/en/ITU-D/ Statistics/Pages/stat/default.aspx.

⁵ See note 2.

^e "FinTech and Financial Inclusion," World Bank, slide 6, http://pubdocs.worldbank.org/ en/877721478111918039/breakout-DigiFinance-McConaghy-Fintech.pdf.

7 See note 1.

⁸ See "Reporte Nacional de Inclusión Financiera" ("National Financial Inclusion Report"), Consejo Nacional de Inclusión Financiera (National Financial Inclusion Council), no. 9, 2018, p. 99, www.cnbv.gob. mx/Inclusi%C3%B3n/Documents/Reportes%20de%20 IF/Reporte%20de%20Inclusion%20Financiera%209.pdf. ⁹ See "BBVA Advances Its Fintech Strategy with the Acquisition of Openpay," by María del Carmen Peña Álvarez, BBVA, April 2017, www.bbva.com/en/bbvaadvances-fintech-strategy-acquisition-openpay/. ¹⁰ "BBVA Shuts In-House Venture Arm, Pours \$250M into New Fintech VC Propel Venture Partners." by Ingrid Lunden, TechCrunch, February 2016, https://techcrunch. com/2016/02/11/bbva-shuts-in-house-venture-armpours-250m-into-new-fintech-vc-propel-venture-partners. ¹¹ See "Pymes (small- and medium-sized enterprises)," by Comisión Nacional para la Protección y Defensa de los Usuarios de Servicios Financieros (National Commission for the Protection and Defense of Service Users), www.condusef.gob.mx/Revista/index.php/ usuario-inteligente/educacion-financiera/492-pymes. 12 See "Mexico Development Bank Lending Rises Following Financial Reforms," by Michael Perez, Federal

Reserve Bank of Dallas *Southwest Economy*, Fourth Quarter, 2015, www.dallasfed.org/~/media/documents/ research/swe/2015/swe1504f.pdf.

¹³ See "Smartphone Ownership on the Rise in Emerging Economies," by Jacob Poushter, Caldwell Bishop and Hanyu Chwe, Pew Research Center, June 2018, www. pewglobal.org/2018/06/19/2-smartphone-ownershipon-the-rise-in-emerging-economies.

¹⁴ For example, rates on loans from online lenders can range from 180.0 percent to 417.6 percent annually.
¹⁵ Mexico follows in the steps of the U.K., which was the first country to develop comprehensive regulatory standards and policies specifically for fintech.
¹⁶ See "Decree Enacting the Financial Technology Institutions Law ('Fintech Law')," by Ramón Bravo, Héctor Cuevas and Alfredo Chavero, Deloitte Legal, March 2018, www2.deloitte.com/content/dam/Deloitte/ mx/Documents/legal/2018/Fintech-Law-Decree.pdf.
¹⁷ See note 8, pp. 18–20.

¹⁸ See "Mexico Financial Technology Law Passes Final Hurdle in Congress," by Sheky Espejo and Julia Love, Reuters, March 1, 2018, www.reuters.com/article/ us-mexico-fintech/mexico-financial-technology-lawpasses-final-hurdle-in-congress-idUSKCN1GD6KX. Federal Reserve Bank of Dallas P.O. Box 655906 Dallas, TX 75265-5906 PRSRT STD U.S. POSTAGE **PAID** DALLAS, TEXAS PERMIT #1851



At the Heart of Texas Cities' Industry Clusters Drive Growth

The just-released second edition of this special report is a comprehensive look at the industry clusters, history and demographics shaping eight of Texas' key metropolitan areas: Austin-Round Rock, Dallas-Plano-Irving, El Paso, Fort Worth-Arlington, Houston-The Woodlands-Sugar Land, McAllen-Edinburg-Mission, Midland-Odessa and San Antonio-New Braunfels. Four new metro areas are covered: Amarillo, Beaumont-Port Arthur, Lubbock and Tyler-Longview.

The report's authors identify the dominant industry clusters—those exceeding the national average in their share of employment—that drive each metro's economy.

Now available online at dallasfed.org/research/heart.aspx.



Southwest Economy

is published by the Federal Reserve Bank of Dallas. The views expressed are those of the authors and should not be attributed to the Federal Reserve Bank of Dallas or the Federal Reserve System.

Articles may be reprinted on the condition that the source is credited to the Federal Reserve Bank of Dallas.

Southwest Economy is available on the Dallas Fed website, dallasfed.org.

Marc P. Giannoni, Senior Vice President and Director of Research Pia Orrenius, Keith R. Phillips, Executive Editors Michael Weiss, Editor Kathy Thacker, Dianne Tunnell, Associate Editors Justin Chavira, Darcy Taj, Graphic Designers

Federal Reserve Bank of Dallas 2200 N. Pearl St., Dallas, TX 75201