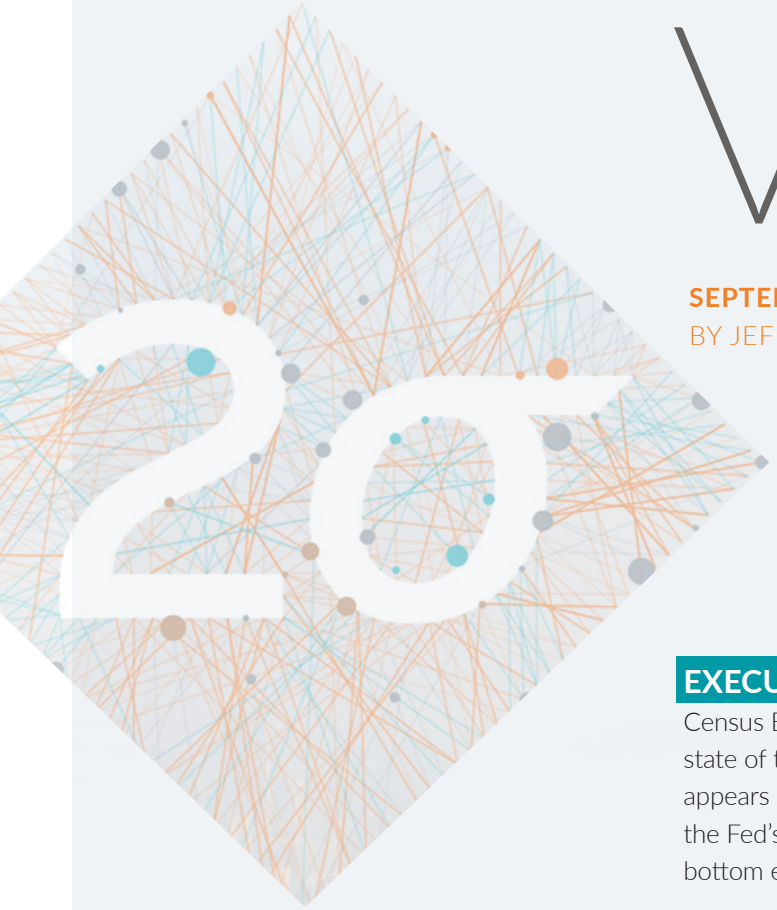
TWO SIGMA

Street View

SEPTEMBER 2016

BY JEFFREY N. SARET & BARBARA ZHAN



EXECUTIVE SUMMARY Recent announcements from the US Census Bureau and the Federal Reserve offer conflicting guidance on the state of the US labor market. Data on highly skilled foreign workers (H-1B) appears more consistent with the Census Bureau's findings than with the Fed's observation: wage pressure in the US may be coming from the bottom end of the distribution more than the top.

www.twosigma.com
NEW YORK HOUSTON
LONDON HONG KONG

Inside:
Clues on the US Labor Market

CLUES ON THE US LABOR MARKET

"Data! Data! Data! I can't make bricks without clay!" Sherlock Holmes exclaims in *The Adventure of the Copper Beeches.* The famed sleuth knew the value of data in solving mysteries, but even he might struggle to piece together a coherent narrative from the confusing data about the current state of the US labor market.

Two recent announcements highlight this challenge. The US Census Bureau revealed on September 13, 2016, that median income grew a robust 5.2 percent during 2015. Bucking the long-term trend, US workers at the 20th percentile of the distribution enjoyed faster income growth (6.3 percent) than those at the 80th percentile (4.1 percent).[1] In contrast, the Fed's September 2016 Beige Book describes "moderate" payroll growth and wage pressure with "rapid gains" applying only to the "specialized skill sets" typically found at the upper end of the income distribution.[2]

Holmes might try to solve this mystery by searching for more evidence. The US Office of Foreign Labor Certification offers one avenue worth pursuing—data on the high-skill immigrant labor market. US companies legally recruit foreign workers to temporarily fill "specialty occupations" through the H-1B visa application process. The US Office of Foreign Labor Certification distributes data dating back to 2009 on both the quantity of foreign applicants and the wages US employers offered to them. This data highlights two trends more consistent with the Census Bureau's findings than the Fed's observation: while demand for certain "specialized skill sets" remains high, particularly in Professional, Scientific, and Technical services, wage growth for these workers has trailed average US wage growth by one to two percentage points per year since 2014. In other words, the wage pressure in the US comes from the bottom end of the distribution, not the top. Holmes would likely refrain from calling this conclusive proof, but it would offer him more clay to build his story.

H-1B APPLICATIONS HAVE INCREASED BY 7.1x BETWEEN 2009 AND 2015, WITH THE LARGEST GROWTH IN PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES (10.7x)[3]

The US government caps the number of H-1B visas each year at 85,000, but the number of applicants varies as a function of US labor demand and global labor supply. Since 2009, the number of applicants has only trended higher.[4] Figure 1 shows the number of applications submitted by industry category since 2009.

The aggregate number of applicants masks important industry variation, particularly during the past few years. For example, demand for "specialty occupations" within the manufacturing industry grew 374 percent between 2009 and 2011 but declined by 2.1 percent since 2011. In contrast, applications for Professional, Scientific, and Technical Services increased 449 percent between 2009 and 2011 and another 49.5 percent since 2011. These results appear consistent with the Fed's observation of "strong demand for skilled labor, with challenges filling positions in fields such as IT…"

1 See table A-2 of Income and Poverty in the United States: 2015 (https://www.census.gov/content/dam/Census/library/publications/2016/demo/p60-256.pdf)

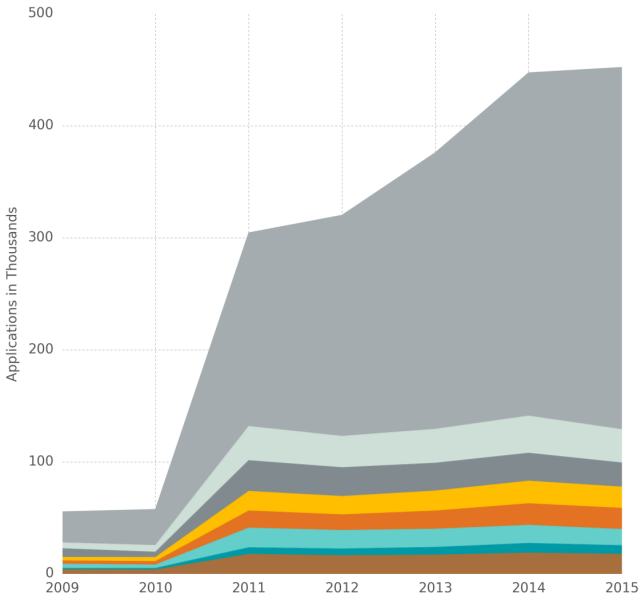
2 See September Beige Book (http://www.federalreserve.gov/monetarypolicy/beigebook/files/Beigebook_20160907.pdf)

3 Professional, Scientific, and Technical Services include establishments that specialize in areas such as engineering, accounting, and computer services. See Bureau of Labor Statistics (http://www.bls.gov/iag/tgs/iag54.htm).

4 2009 was the first year that the US Office of Foreign Labor Certification makes the data available with consistent industry categorizations (NAIC) and wage data.

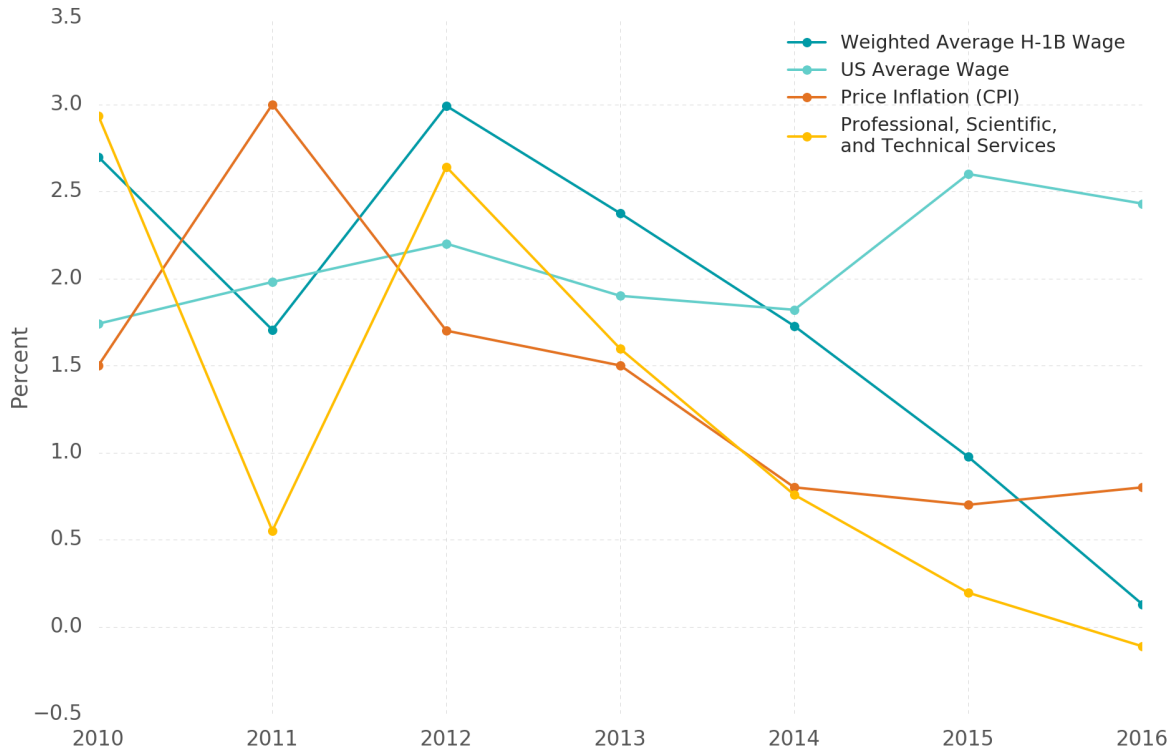
5 https://www.foreignlaborcert.doleta.gov/performancedata.cfm

FIGURE 1 APPLICATIONS BY INDUSTRY



Notes: Data on the Labor Condition Applications, a mandatory component of the H-1B application, from the Office of Foreign Labor Certification.[5] Not all applications result in successful visa issuances due to a statutory annual cap.

FIGURE 2 WAGE GROWTH



Notes: Data on H-1B applicant wages from the Office of Foreign Labor Certification. Average H-1B wage weighted by industry in 2010 to reflect changing composition of the applicant pool. Unweighted average shows similar results. Average US wage and overall price (CPI-U) inflation from the US Bureau of Labor Statistics.

DESPITE THE APPARENT DEMAND, WAGES FOR SKILLED LABOR HAVE INCREASED MORE SLOWLY THAN THE US AVERAGE SINCE 2014

The data on H-1B applications seems to conflict with the Fed's finding that the "strongest [wage] pressures [are] linked to skilled workers." Figure 2 plots the average wage offered to H-1B applicants as well as the average wage for the overall US working population.

Since 2014, H-1B applicants have seen their wages decrease 0.8 percent per year. In contrast, the average US worker saw her wages increase 0.3 percent per year during the same period. Data from 2016 shows that H-1B wage growth (0.1 percent) even lagged US price inflation (0.8 percent). This trend in wages holds both for the average H-1B applicant as well as for applicants in the highly-sought Professional, Scientific, and Technical Services.

IMPLICATION: LOOK FOR INFLATION AT THE BOTTOM, NOT THE TOP, OF THE WAGE DISTRIBUTION

If wage pressure is building in the US labor market, it appears to have bypassed most of the high skilled segment where H-1B applicants compete for jobs. This appears more consistent with the surprising Census Bureau finding that 2015 income growth accelerated faster for the low income brackets than the higher paid, seemingly more in-demand, skilled workers at the upper end of the income distribution. Market participants searching for clues about inflation might find this guidance insightful. While Sherlock Holmes would probably not declare it definitive proof, he once noted that "there is nothing like first-hand evidence."

INTERESTING TECHNOLOGY-RELATED ARTICLES

Two Sigma views itself as a technology company that applies a rigorous, scientific method-based approach to investment management. Our technology is inspired by a diverse set of fields including artificial intelligence and distributed computing. Occasionally, we read articles in the popular press that describe applications of technology that we find interesting, thought-provoking, and relevant for people thinking about improving the investment management process. Below is a subset of the articles we read this month. Please do not view the inclusion of these articles as an endorsement by Two Sigma of their viewpoints or the companies discussed therein. Two Sigma welcomes discussions (and contributions) about these and other such technology-related articles.

"The Rise of the Ag Bots Will Not Sow the Seeds of Unemployment" Jeremy Hsu, July 20, 2016 (http://www.scientificamerican.com/article/rise-of-the-ag-bots-will-not-sow-seeds-of-unemployment/?WT.mc_id=SA_DD_20160720)

> Cows can now milk themselves–with the help of agricultural robots. Thanks both to better technology and increasing distaste for the "dirty, heavy, not prestigious" life on the farm, the already small population of US farmhands (1.4 percent of the workforce) may shrink an additional 1.3 percent (approximately 110,000 roles) over the next decade. In parallel, the agricultural robotics market could grow almost 25 times to $74 billion by 2024. That includes automated milking and feeding systems for cows.

"How NASA is using artificial intelligence to save lives of firefighters, first responders" Jason Henry, August 14, 2016 (http://www.pasadenastarnews.com/technology/20160814/how-nasa-is-using-artificial-intelligence-to-save-lives-of-firefighters-first-responders)

> NASA hopes to use AI to revolutionize how firefighters and first responders perform their dangerous jobs, giving them the crucial information they need as they save others' lives. AUDREY, an AI system, will pull in data from its surroundings including the wearer's own heartbeat, the surrounding temperature, and the presence of harmful gases. AUDREY's visual displays can also reveal both obstacles and opportunities. A cloud-based system, AUDREY can distill massive amounts of data to quickly advise a firefighter or first responder of potential dangerous situations—or even if she is at risk of a heart attack. This "guardian angel" will start tests within a year with the hope of commercial use soon thereafter.

IMPORTANT DISCLAIMER AND DISCLOSURE INFORMATION

This report is prepared and circulated for informational and educational purposes only and is not an offer to sell or the solicitation of an offer to buy any securities or other instruments. The information contained herein is not intended to provide, and should not be relied upon for investment, accounting, legal or tax advice. This document does not purport to advise you personally concerning the nature, potential, value or suitability of any particular sector, geographic region, security, portfolio of securities, transaction, investment strategy or other matter. No consideration has been given to the specific investment needs or risk-tolerances of any recipient. The recipient is reminded that an investment in any security is subject to a number of risks including the risk of a total loss of capital, and that discussion herein does not contain a list or description of relevant risk factors. As always, past performance is no guarantee of future results. The recipient hereof should make an independent investigation of the information described herein, including consulting its own tax, legal, accounting and other advisors about the matters discussed herein. This report does not constitute any form of invitation or inducement by Two Sigma to engage in investment activity.

The views expressed herein are not necessarily the views of Two Sigma Investments, LP or any of its affiliates (collectively, "Two Sigma") but are derived from the Two Sigma Alpha Capture system (the "Alpha Capture System"), which gathers inputs from sell-side contributors (not analysts) to the Alpha Capture System who receive compensation for their participation, as further described in the section titled "Brief Explanation of the Data" (page 1 hereof) and the document titled "Overview of the Two Sigma Alpha Capture System". Such views (i) may be historic or forward-looking in nature, (ii) reflect significant assumptions and subjective judgments of the contributors to the Alpha Capture System as well as, in some instances, the authors of this report, and (iii) are subject to change without notice. Two Sigma may have market views or opinions that materially differ from those discussed, and may have a significant financial interest in (or against) one or more of such positions or theses. In some circumstances, this report may employ data derived from third-party sources. No representation is made as to the accuracy of such information and the use of such information in no way implies an endorsement of the source of such information or its validity.

This report may include certain statements and projections regarding the anticipated future performance of various securities, sectors, geographic regions or of the Alpha Capture System generally. These forward-looking statements are inherently subject to significant business, economic and competitive uncertainties and contingencies, many of which are beyond our control. In addition, these forward-looking statements are subject to assumptions with respect to future business strategies and decisions that are subject to change. Factors which could cause actual results to differ materially from those anticipated include, but are not limited to: competitive and general business, economic, market and political conditions in the United States and abroad from those expected; changes in the legal, regulatory and legislative environments in the markets in which Two Sigma operates; and the ability of management to effectively implement certain strategies. Words like "believe," "expect," "anticipate," "promise," "plan," and other expressions or words of similar meanings, as well as future or conditional verbs such as "will," "would," "should," "could," or "may" are generally intended to identify forward-looking statements.

Two Sigma makes no representations, express or implied, regarding the accuracy or completeness of this information, and the recipient accepts all risks in relying on this report for any purpose whatsoever. This report is being furnished to the recipient on a confidential basis and is not intended for public use or distribution. By accepting this report, the recipient agrees to keep confidential the existence of this report and the information contained herein. The recipient should not disclose, reproduce, distribute or otherwise make available the existence of and/or all or any portion of the information contained herein to any other person (other than its employees, officers and advisors on a need-to-know basis, whom the recipient will cause to keep the information confidential) without Two Sigma's prior written consent. This report shall remain the property of Two Sigma and Two Sigma reserves the right to require the return of this report at any time.