



Metropolitan Policy Program  
at BROOKINGS

# The Shortage of STEM Skills

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# Three Approaches to Defining Shortage

Academic definitions of shortage by Nobel-prize winning economists:

1. David Blank and George Stigler (1957): A shortage is indicated by an increase in relative wages
2. Kenneth Arrow and William Capron (1959): A “dynamic” shortage is indicated by unfilled vacancies, even if wages don’t increase

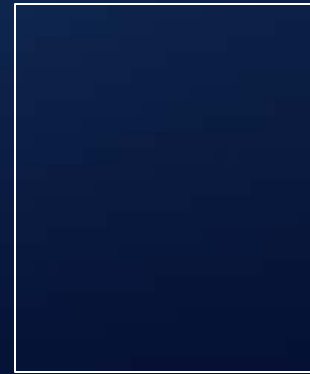
Intuitive non-academic definition:

3. Workers who get the skills that are in shortage tend to be better off (in terms of employment opportunities and earnings) than those who do not

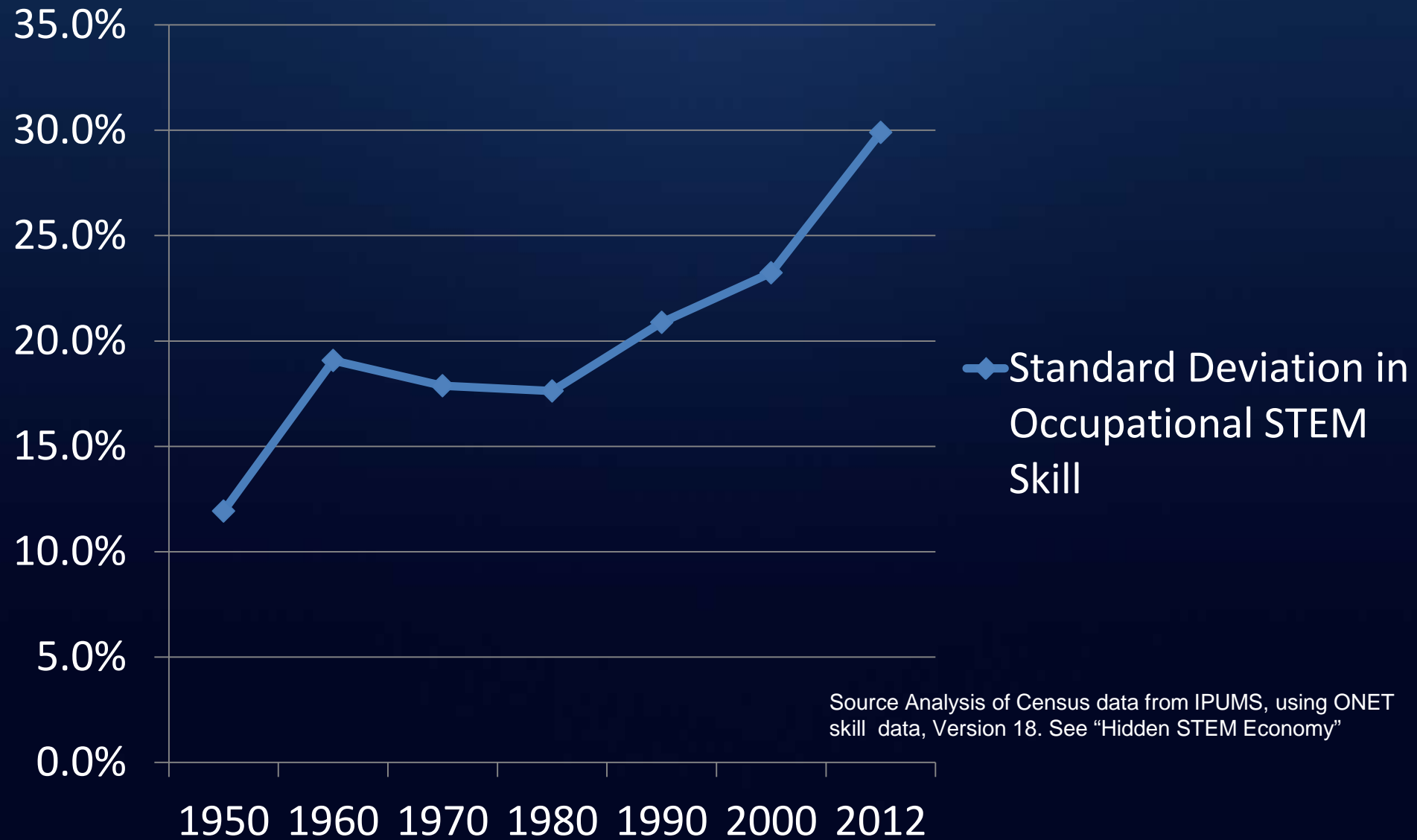
STEM skills are in shortage by all three definitions.

# Shortage Criteria 1

1. Are Relative  
Wages for STEM  
Growing?

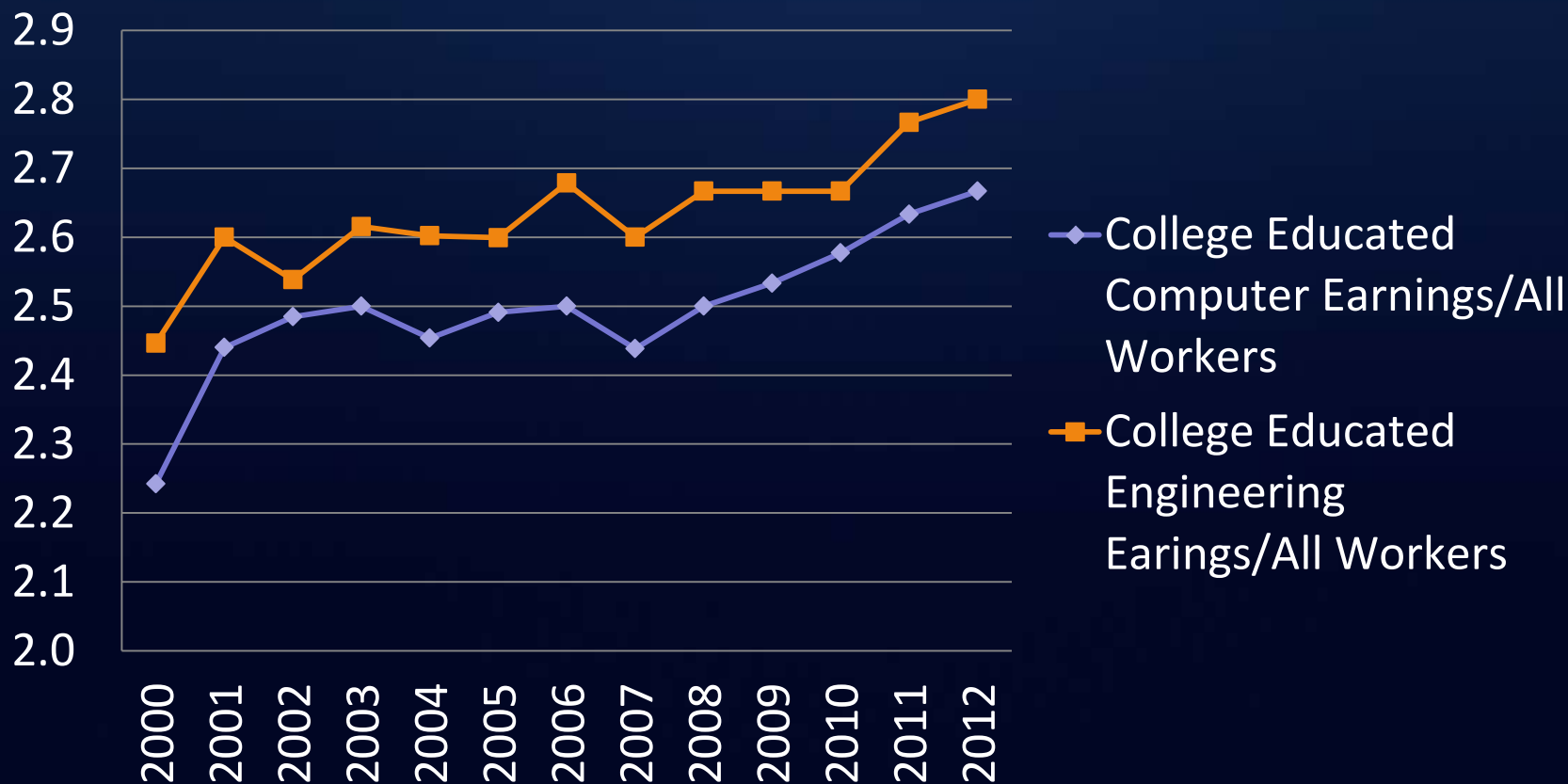


# Earnings Premium for STEM Skills, Controlling for Experience, Education, and Sex, 1950-2012

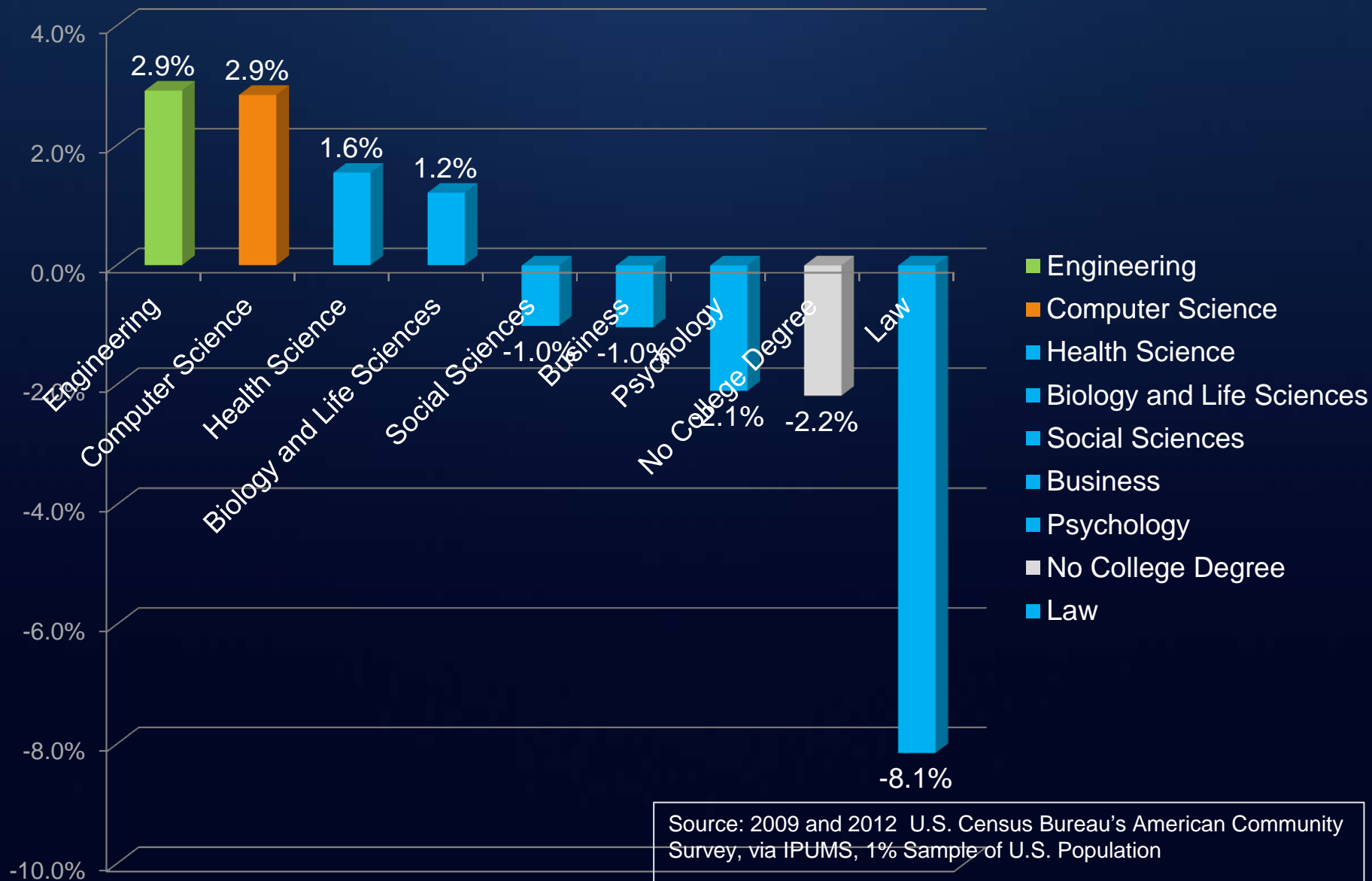


# Relative Earnings are Growing for Computer Workers and Engineers

## Median Wages of College Educated Computer and Engineering Workers Relative to all Workers, 2000-2012



# STEM Majors are Seeing higher Earnings Growth: Growth in total earnings of young adults aged 21-30 by bachelor's level field of study, 2009-2012



# What about longer-term wages for “IT” occupations?

For IT workers, “Wages have remained flat, with real wages hovering around their late 1990s levels.”

-From Salzman et al

**“Guestworkers in the High-skill U.S. Labormarket: An Analysis of Supply, Employment, And Wage Trends”**

Actually, wages for computer workers have increased since 1990, and the only group of computer workers with flat wages since 2000 were those whose graduate educational requirements fell, as millions of new computer jobs were created.

Year	Workers in occupation	Inflation adjusted earnings	Share of workers with at least bachelor's degree	Share of workers with graduate level education
Computer software developers				
1980	337,149	\$48,327	49%	15%
1990	590,031	\$53,922	56%	15%
2000	671,949	\$65,167	64%	16%
2013	1,718,899	\$82,215	78%	28%
Computer systems analysts and computer scientists				
1980	231,748	\$60,729	62%	27%
1990	649,368	\$60,804	65%	22%
2000	1,694,770	\$71,825	67%	17%
2013	1,911,566	\$67,976	60%	19%

Source: Analysis of U.S. Current Population Survey, March Supplement, via Integrated Publicuse Microdata Series (IPUMS). IPUMS "Occ1990" categories all modern day computer occupations (from the 2013 CPS) into one of the two categories listed above retrospectively through the years listed.



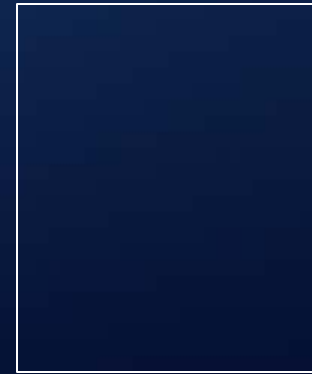
# Shortage Criteria 1

1. Relative Wages  
are Growing.

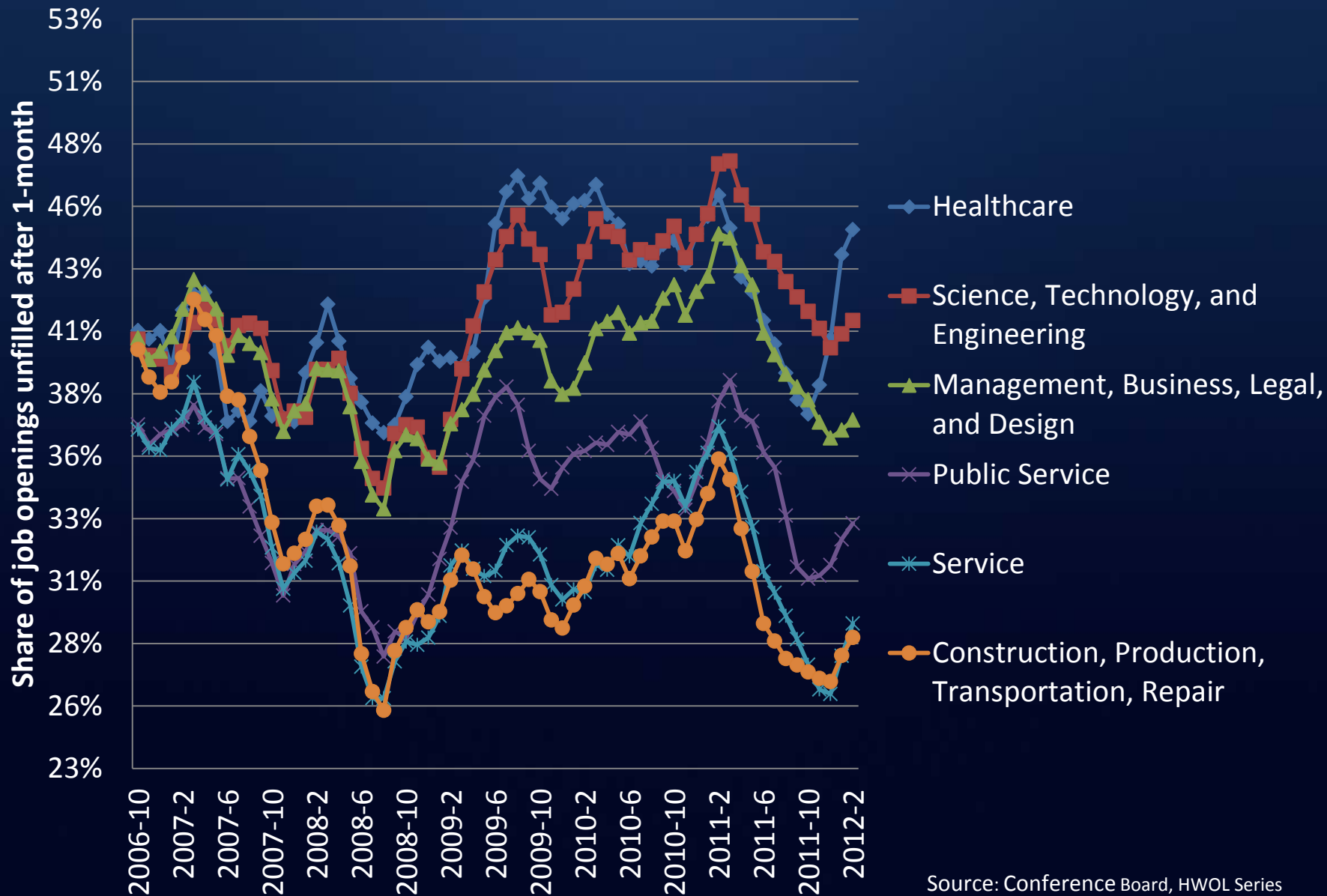


# Shortage Criteria 2

2. Are STEM  
Vacancies More  
Likely to go  
Unfilled?

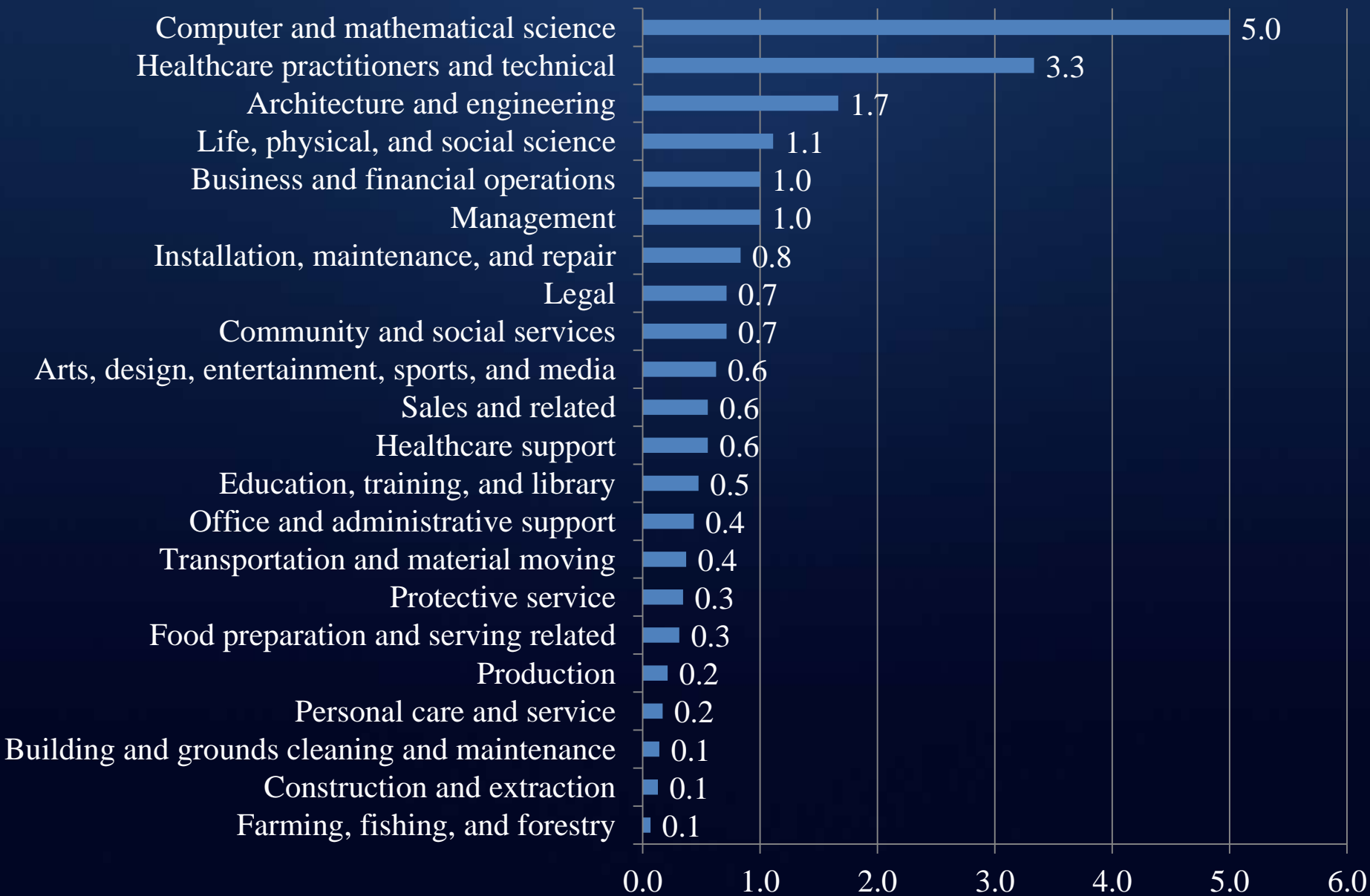


# Difficulty of Filling Job Vacancies in Largest Metropolitan Areas by Occupational Category, 3-month average 2006-Q4 to 2012-Q1

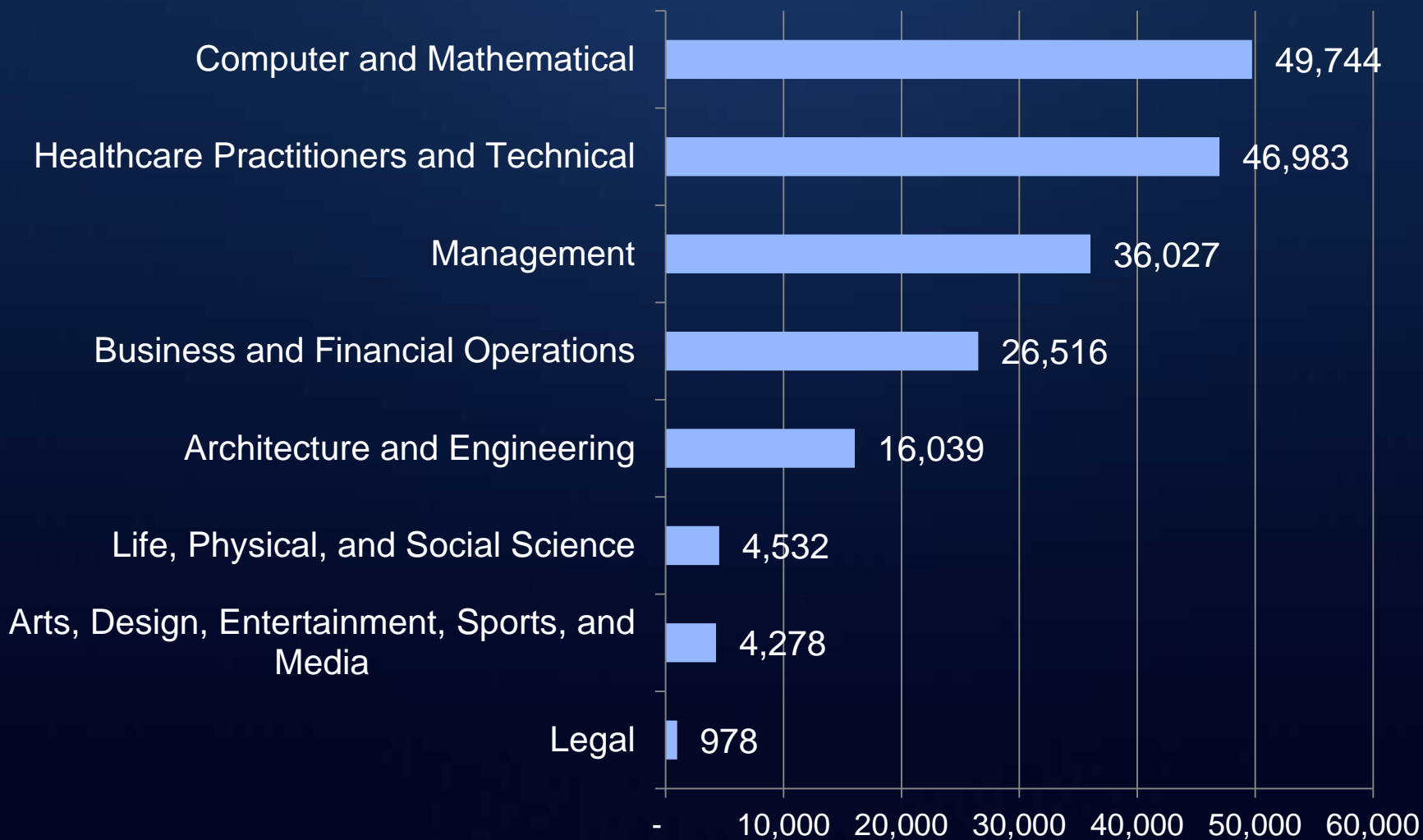


Source: Conference Board, HWOL Series

## Job vacancies per unemployed worker, January 2014



## 2013-Q1 job openings advertised for at least 60 days on company websites by selected occupations



Source: Analysis of data compiled for Burning Glass. Sample excludes job boards and is only for ads first posted between Jan-March of 2013.

# Shortage Criteria 2

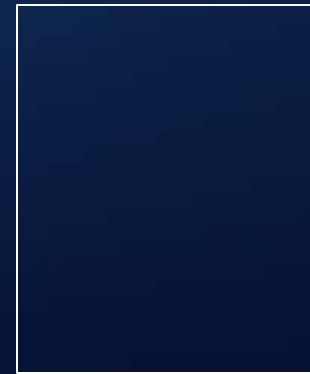
## 2. STEM

Vacancies are more likely to go unfilled.

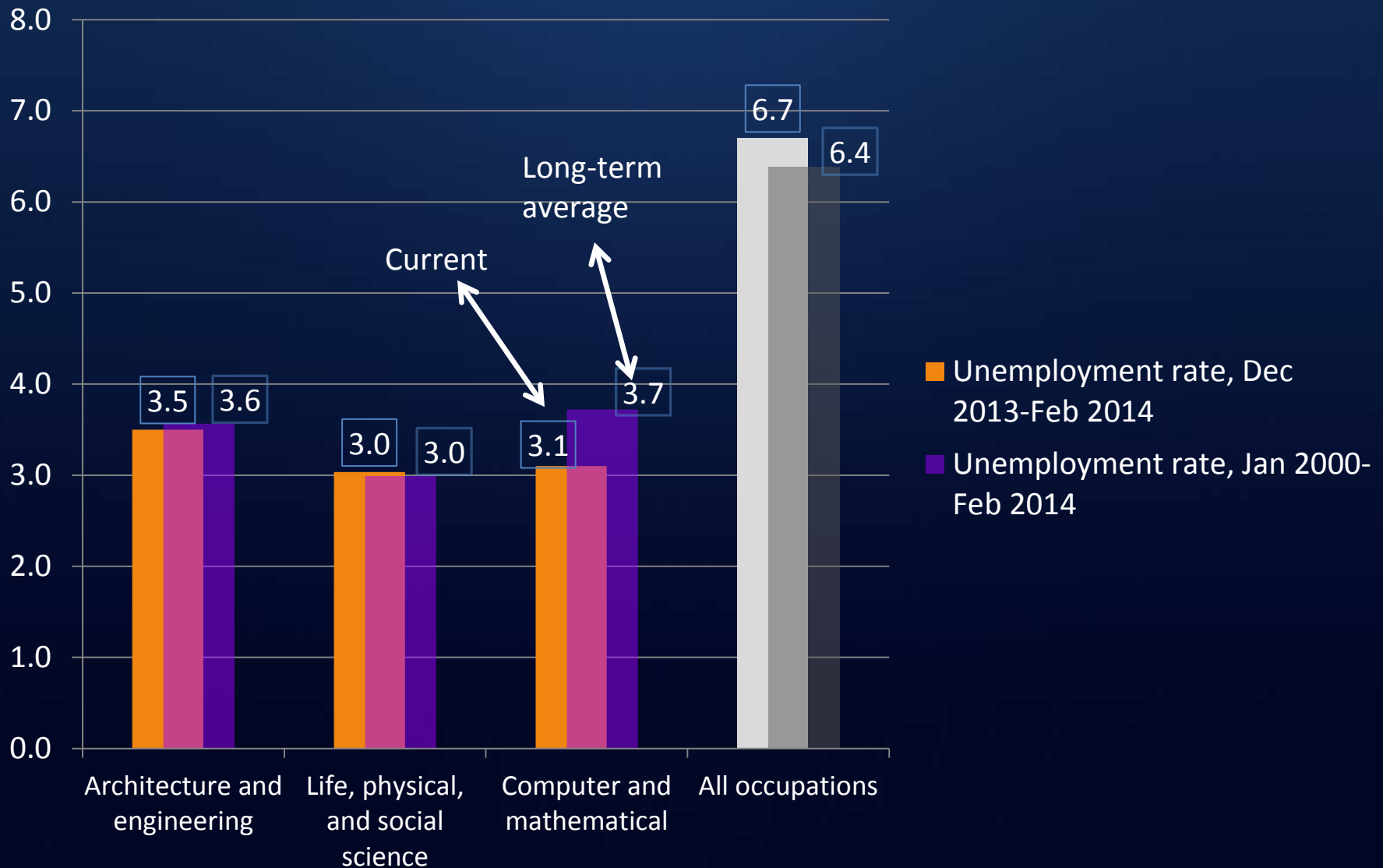


# Shortage Criteria 3

3. Does STEM  
Knowledge makes  
workers better off  
economically?



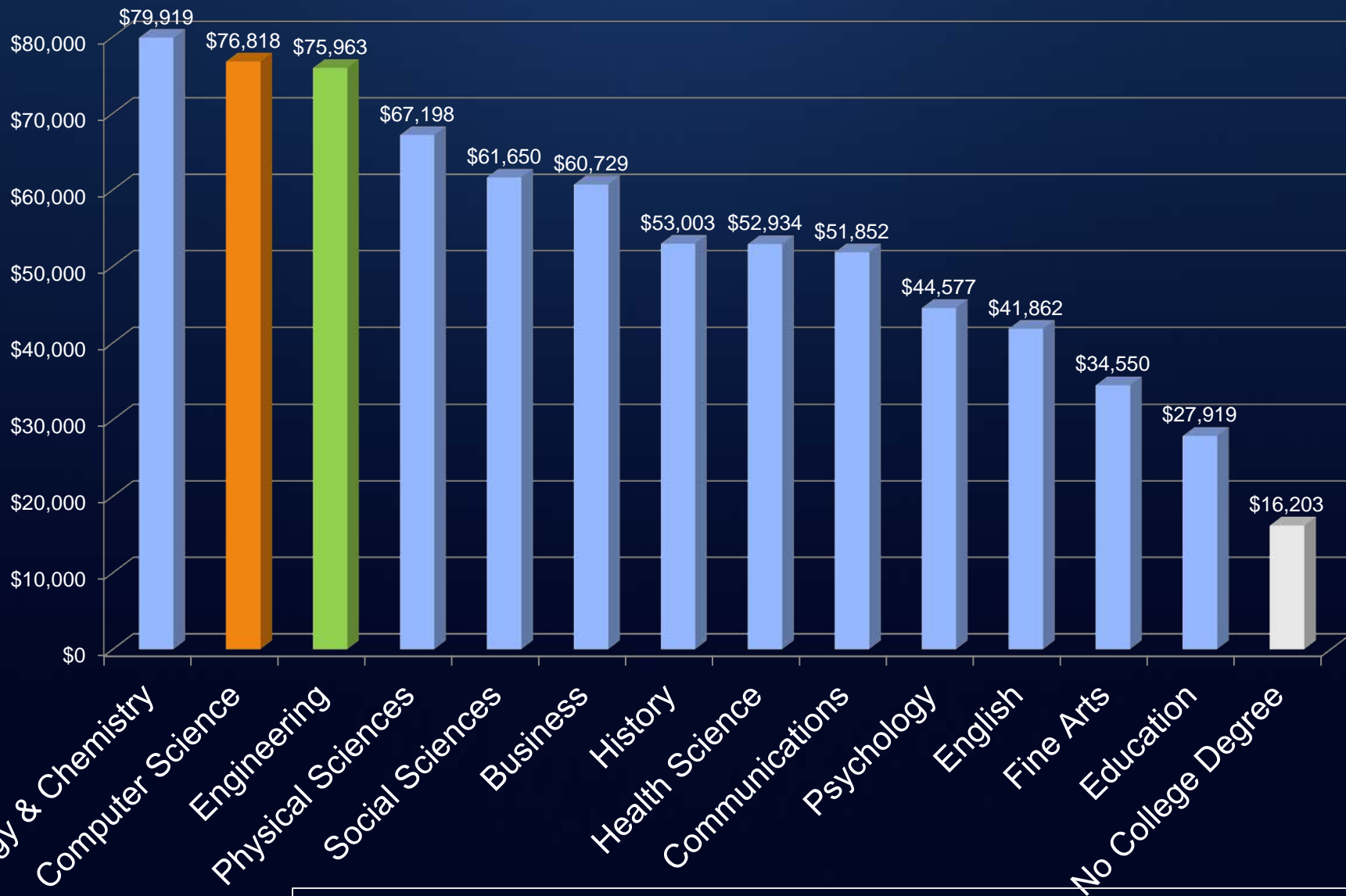
# Unemployment rates for STEM occupations are at or below average since 2000 and far below U.S. rate



Source: Current Population Survey, BLS.gov (Not seasonally adjusted). Since 1970, 3.6 is the record low US unemployment rate.



# STEM Grads are Highest Paid: Salaries of Recent Graduates Aged 21-30 in Most Popular Majors, 2012



Source: 2012 American Community Survey, via IPUMS. Majors with 1 million or more population.

# Computer Science majors are getting good jobs, over 90% of which require above average computer knowledge

## Occupations of computer science bachelor's degree holders for all groups with at least one percent of computer science degree holders , 2012

Minor Occupation	Share of computer science degree holders	Average earnings	Standardized Score for Computer Knowledge
Computer Occupations	47.4%	\$81,678	2.6
Operations Specialties Managers	6.9%	\$110,279	1.9
Other Management Occupations	6.9%	\$98,811	0.7
Business Operations Specialists	3.5%	\$85,583	1.0
Engineers	2.5%	\$98,660	1.8
Financial Specialists	2.0%	\$63,887	1.0
Top Executives	1.9%	\$152,833	0.8
Postsecondary Teachers	1.6%	\$54,071	0.9
Supervisors of Sales Workers	1.6%	\$87,280	0.0
Electrical and Electronic Equipment Mechanics, Installers, and Repairers	1.5%	\$49,748	2.1
Other Office and Administrative Support Workers	1.4%	\$49,686	1.0
Information and Record Clerks	1.3%	\$44,444	0.0
Preschool, Primary, Secondary, and Special Education School Teachers	1.2%	\$40,842	0.8
Retail Sales Workers	1.1%	\$51,075	0.0

Source: Analysis of 2012 American Community Survey via Integrated Public Use Microdata Series (IPUMS). Computer knowledge requirements are from O\*NET survey data using 6-digit level occupations.

# Shortage Criteria 3

3. STEM  
Knowledge  
benefits workers.

