MEASURING WORK CAPACITY

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Work Capacity in the Literature

- Work capacity is one's *potential* to work; i.e., whether someone has the ability to work, apart from whether they actually work
- Generally, "ability" measurement not linked to occupational requirements
 - Focus is on cognitive ability, often low-dimensional (fluid, crystallized intelligence)
 - In older populations, to assess dementia (e.g., word recall, serial 7s, counting backwards)
 - Achievement tests
 - ASVAB (e.g., math, reading comp, knowledge of electronics & mechanics)
 - Recall ability is unobserved in standard Mincer wage regressions
- Consequently, we have aggregate estimates of work capacity for populations
 - Estimate work capacity from labor supply responses to policy variation (e.g., Moffitt 1986; Friedberg 2000; Maestas, Mullen, Strand 2013)
 - Predict potential employment from population association between employment and health (e.g., Coile, Milligan, Wise 2016; Cutler, Meara, Powell, Richards-Shubik 2014)

Our Contribution

- We want to know who has work capacity, which occupations can they do, and which abilities are limiting
- Develop a new measure of work capacity that maps individuals' functional abilities to potential occupations
 - Key insight: If measure abilities on same scale used to measure ability requirements of occupations, can compare each person's functional abilities to ability requirements of every occupation to find their set of *potential* occupations
- Collect **new data** from nationally representative sample, compare individual abilities to requirements of U.S. jobs; identify potential occupations, earnings
- Today: Describe the new measure of work capacity, investigate variation by age cohort, describe ongoing work to refine measure and analyze work capacity over life cycle

What Does It Mean To Be Able to Work?

- In order to work, one must be able to perform a(t least one) job
- A job is a bundle of tasks, or activities, that workers agree to perform in exchange for a wage (Autor, Levy and Murnane, 2003; Yamaguchi, 2012)
- Tasks require knowledge, skills and abilities in order to perform them
 - Knowledge "sets of facts and principles needed to address problems and issues that are part of your job" (O*NET)
 - **Skill** "the ability to perform a task well... usually developed over time through training and experience" (O*NET)
 - Ability "an enduring talent that can help a person do a job" (O*NET)

Example: Janitors

Required Education: High school diploma or equivalent

Job Titles Building Custodian, Building Service Worker, Building Services Technician, Cleaner, Custodial Worker, Custodian, Floor Tech (Floor Technician), Heavy Duty Custodian, Institutional Custodian, Janitor

	Tasks (3 out of 19)	
Service, clean or supply restrooms	Clean building floors by sweeping, mopping, scrubbing, or vacuuming	Follow procedures for the use of chemical cleaners and power equipment
Knowledge	Skills	Abilities
Customer and Personal Service	Active Listening	Near Vision
English Language	Tool and machine use	Oral Comprehension
	Excel, Word software	Static Strength
		Trunk Strength
		Extent Flexibility
		Manual Dexterity

Functional Abilities Needed for U.S. Jobs (DOL O*NET)

Cognitive

Oral Comprehension Written Comprehension **Oral Expression** Written Expression Fluency of Ideas Originality **Problem Sensitivity Deductive Reasoning** Inductive Reasoning Information Ordering Category Flexibility Mathematical Reasoning Number Facility Memorization Speed of Closure Flexibility of Closure Perceptual Speed **Spatial Orientation** Visualization Selective Attention **Time Sharing**

Psychomotor

Arm-Hand Steadiness Manual Dexterity Finger Dexterity Control Precision Multi-limb Coordination Response Orientation Rate Control Reaction Time Wrist-Finger Speed Speed of Limb Movement

Physical

Static Strength Explosive Strength Dynamic Strength Trunk Strength Stamina Extent Flexibility Dynamic Flexibility Gross Body Coordination Gross Body Equilibrium

Sensory

Near Vision Far Vision Visual Color Discrimination Night Vision Peripheral Vision Depth Perception Glare sensitivity Hearing Sensitivity Auditory Attention Sound Localization Speech Recognition Speech Clarity

Collected New Data, Linked to BLS Data

- American Work Capacity and Abilities Survey
 - Survey Module #508 in RAND American Life Panel (ALP)
 - July-September 2018
 - N=2,270, ages 18-71, response rate = 82%
- O*NET (Occupational Information Network) from U.S. Bureau of Labor Statistics
 - May 2019 Release
 - Six-digit detailed occupations, plus some 8-digit
- Occupational Employment Statistics from U.S. Bureau of Labor Statistics

Example of O*NET Rating Scale

22. Arm-Hand Steadiness	The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.
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A. How <u>important</u> is ARM-HAND STEADINESS to the performance of *your current job*?



* If you marked Not Important, skip LEVEL below and go on to the next activity.

B. What <u>level</u> of ARM-HAND STEADINESS is needed to perform *your current job*?



Highest Level

Instructions for Rating Your Abilities

In this survey, you will be asked to rate your level of functioning for a series of different abilities. When giving your rating, please rate your *current* level of ability, not what you were able to do in the past or what you could do in the future with additional training. If you use an assistive device (e.g., glasses), please rate your ability when using the assistive device.

First you will be shown the name and definition of an ability. Please read the definition carefully. For example:

Arm-Hand Steadiness

The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.

You will then be asked to rate your level of ability on a scale from 1 to 7, where 1 is the lowest possible level and 7 is the highest possible level. If you cannot do *any* level of the ability, please select that response below the numeric scale. To help you understand what we mean by **level**, we provide you with examples of tasks or activities at different levels for each ability. The examples are meant to help you find your own rating within the scale; do not focus on whether you perform the *specific* activity, which may come from an unfamiliar context. For example:

Please rate your level of ARM-HAND STEADINESS by clicking the circled number that best matches your level of ability. If you cannot do any level of the ability, please select the response below the number scale instead of clicking a circled number.



Average Ability Levels by Domain and Five-Year Age Group



Measuring Work Capacity

Occupation-Specific Work Capacity (OWC) — "Fraction of a job's requirements individual can do"

Relative importance of ability k for
occupation
$$j, \sum_{k=1}^{K} \pi_{j,k} = 1$$

 $OWC_{i,j} = \sum_{k=1}^{K} \pi_{j,k} 1(\theta_{i,k} \ge c_{j,k})$
Required level of ability k for
occupation j, scale 0-7

Individual *i* 's level of ability k, scale 0-7

Total Work Capacity (TWC) — "Fraction of all jobs an individual can do" or "Mean potential earnings"

$$TWC_i^e = \sum_{j=1}^J \omega_j^e * 1(OWC_{i,j} \ge T)$$

Occupation weight (e.g., occupation *j*'s share of all jobs held by

Occupation weight (e.g., occupation *j*'s share of all jobs held by people with education *e*, or occupation *j*'s share * *j*'s median earnings)

Relating Ability Ratings to Demands of Own Job: Arm-Hand Steadiness (AHS) Example



 Nearly all (98%) working respondents have more AHS than needed to perform own occupation

Implies they could lose AHS ability and still meet their job requirements

Validation: Can Workers Do Their Own Jobs?



for our analyses

Total Work Capacity by Self-Reported Health



Age-Related Differences in Functional Abilities Are Mostly Inframarginal With Respect to Occupational Requirements



- TWC much higher under generous measure → treatment of partial abilities key issue
- Neither measure declines much with age—because ability declines are modest and ability levels much higher than job demands
- Age-related ability declines not large enough to push many below job thresholds

Conclusion and Next Steps

- Age-related ability declines are modest, with physical abilities declining the most and cognitive abilities declining the least
- Average abilities overall and across four domains are high relative to average occupational demands → Potential occupation sets stable with age
- Limitations of current work & future directions
 - Self-reported ability measures we recently collected objective measures to estimate and correct for any systematic self-report bias
 - Comparing cross-sectional differences by age group planning longitudinal data collection to examine within-person changes over time
 - In a separate related project, Maestas, Mullen and coauthors adapted Dutch Functional Abilities List used for disability determination by Dutch SSA for self-administration in U.S. and combine with harmonized Dutch occupational requirements data to measure work capacity

THANK YOU

Regressions of Labor Force Participation on Health and Fraction of Jobs Individuals Can Do

	Only Health		Strict M (T=	Strict Measure (T=1)		Generous Measure (T=0.88)	
	(1)	(2)	(3)	(4)	(5)	(6)	
Dep. Var.: LFP	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	
Fraction of jobs can do			0.173***	0.073**	0.232***	0.109***	
_			(0.027)	(0.026)	(0.027)	(0.027)	
Self-Reported Health Status				· · ·		· · ·	
Good	0.010			0.054***		0.052***	
	(0.019)			(0.019)		(0.019)	
Fair/Poor	-0.303***			-0.114***		-0.103***	
	(0.025)			(0.028)		(0.028)	
Has a work-limiting health problem		-0.365***		-0.297***		-0.293***	
		(0.021)		(0.024)		(0.024)	
Constant	0.340***	0.409***	0.220***	0.368***	0.136***	0.319***	
	(0.024)	(0.023)	(0.025)	(0.026)	(0.029)	(0.031)	
Number of observations	1,934	1,934	1,934	1,934	1,934	1,934	
Adjusted R2	0.273	0.313	0.219	0.330	0.232	0.333	

All regressions control for age groups with omitted category age 65-71. The omitted category for self-reported health status is excellent/very good. Standard Deviation of Work Capacity measures is 0.37.

Regressions of Subjective Probability of Working Past Age 65/70 on Fraction of Jobs Individuals Can Do

			Strict 1	Measure	Generous Measure	
	Only	/ Health	T)	[=1)	(T=0.88)	
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.: Probability of working past age 65 or 70	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Fraction of jobs can do			0.073***	0.066**	0.115***	0.114***
			(0.026)	(0.026)	(0.028)	(0.028)
Self-Reported Health Status						
Good	-0.052***			-0.046**		-0.048***
	(0.018)			(0.019)		(0.018)
Fair/Poor	-0.012			-0.003		0.000
	(0.029)			(0.030)		(0.030)
Has a work-limiting health problem		-0.002		0.010		0.011
		(0.027)		(0.028)		(0.028)
Constant	0.562***	0.542***	0.513***	0.531***	0.457***	0.474***
	(0.036)	(0.035)	(0.036)	(0.038)	(0.040)	(0.042)
Number of observations	1,296	1,296	1,296	1,296	1,296	1,296
Adjusted R2	0.012	0.007	0.013	0.016	0.020	0.024

All regressions control for age groups with omitted category age 65-71. The omitted category for self-reported health status is excellent/very good. Standard Deviation of Work Capacity measures is 0.37.

Regressions of SSDI Receipt on the Fraction of Jobs Individuals Can Do

			Strict N	Aeasure	Generous	s Measure
	Only Health		(T	=1)	(T=0.88)	
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.: SSDI receipt	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Fraction of jobs can do			-0.121***	-0.033*	-0.197***	-0.094***
			(0.020)	(0.019)	(0.019)	(0.019)
Self-Reported Health Status						
Good	0.011			-0.022		-0.023*
	(0.014)			(0.013)		(0.013)
Fair/Poor	0.263***			0.117***		0.232***
	(0.027)			(0.020)		(0.017)
Has a work-limiting health problem		0.299***		0.238***		0.232***
		(0.015)		(0.017)		(0.017)
Constant	0.021	0.016	0.103***	0.037*	0.189***	0.091***
	(0.019)	(0.017)	(0.020)	(0.020)	(0.023)	(0.023)
Number of observations	1,925	1,925	1,925	1,925	1,925	1,925
Adjusted R2	0.126	0.184	0.031	0.209	0.062	0.217

All regressions control for age groups with omitted category age 35-39. The omitted category for self-reported health status is excellent/very good. Standard Deviation of Work Capacity measures is 0.37.

Regressions of Subjective Prob. of Returning to Work from *Retirement* on Fraction of Jobs Individuals Can Do

	Only Health		Strict Me (T=1	Strict Measure (T=1)		Generous Measure (T=0.88)	
	(1)	(2)	(3)	(4)	(5)	(6)	
Dep. Var.: Probability of returning to the labor force if retired	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	
Fraction of jobs can do			0.133***	0.123***	0.103**	0.094**	
			(0.041)	(0.043)	(0.042)	(0.044)	
Self-Reported Health Status							
Good	-0.018			-0.002		-0.004	
	(0.032)			(0.033)		(0.033)	
Fair/Poor	-0.053			-0.002		-0.002	
	(0.035)			(0.044)		(0.045)	
Has a work-limiting health problem		-0.049*		-0.031		-0.039	
		(0.028)		(0.035)		(0.035)	
Constant	0.213***	0.215***	0.154***	0.170***	0.132***	0.153***	
	(0.021)	(0.020)	(0.021)	(0.028)	(0.031)	(0.038)	
Number of observations	387	387	387	387	387	387	
Adjusted R2	0.005	0.010	0.028	0.024	0.018	0.015	

All regressions control for age groups with omitted category age 65-71. The omitted category for self-reported health status is excellent/very good. Standard Deviation of Work Capacity measures is 0.37.

Which Cognitive and Sensory Abilities Most Correlated with Max Potential Earnings?



T-statistics from Regression of Maximum Potential Earnings on All Abilities

Sample Distribution of Potential Earnings Measures



Potential Earnings: Rank an individual's potential occupations by average earnings, find the maximum and the median value

O*NET Abilities and Estimated Population Means Using AWCAS Sample

	Ability	Mean	Description
			Cognitive Abilities
1	Oral Comprehension	4.99	The ability to listen to and understand information and ideas presented through spoken words and sentences.
2	Written Comprehension	5.03	The ability to read and understand information and ideas presented in writing.
3	Oral Expression	4.88	The ability to communicate information and ideas in speaking so others will understand.
4	Written Expression	4.55	The ability to communicate information and ideas in writing so others will understand.
5	Fluency of Ideas	4.52	The ability to come up with a number of ideas about a topic (the number of ideas is important, not their quality, correctness, or creativity).
6	Originality	4.19	The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.
7	Problem Sensitivity	4.85	The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
8	Deductive Reasoning	4.46	The ability to apply general rules to specific problems to produce answers that make sense.
9	Inductive Reasoning	4.49	The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
10	Information Ordering	4.12	The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
11	Category Flexibility	4.55	The ability to generate or use different sets of rules for combining or grouping things in different ways.
12	Mathematical Reasoning	3.76	The ability to choose the right mathematical methods or formulas to solve a problem.
13	Number Facility	4.37	The ability to add, subtract, multiply, or divide quickly and correctly.
14	Memorization	3.99	The ability to remember information such as words, numbers, pictures, and procedures.
15	Speed of Closure	4.22	The ability to quickly make sense of, combine, and organize information into meaningful patterns.
16	Flexibility of Closure	4.43	The ability to identify or detect a known pattern (a figure, object, word, or sound) that is hidden in other distracting material.
17	Perceptual Speed	4.14	The ability to quickly and accurately compare similarities and differences among sets of letters, numbers, objects, pictures, or patterns. The things to be compared may be presented at the same time or one after the other. This ability also includes comparing a presented object with a remembered object.
18	Spatial Orientation	3.75	The ability to know your location in relation to the environment or to know where other objects are in relation to you.
19	Visualization	4.55	The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.
20	Selective Attention	4.45	The ability to concentrate on a task over a period of time without being distracted.
21	Time Sharing	4.46	The ability to shift back and forth between two or more activities or sources of information (such as speech, sounds, touch, or other sources).

O*NET Abilities and Estimated Population Means Using AWCAS Sample

	Ability	Mean	Description				
	Psychomotor Abilities						
22	Arm-Hand Steadiness	4.65	The ability to keep your hand and arm steady while moving your arm or while holding your arm and hand in one position.				
23	Manual Dexterity	4.74	The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.				
24	Finger Dexterity	4.57	The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.				
25	Control Precision	4.26	The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.				
26	Multilimb Coordination	4.32	The ability to coordinate two or more limbs (for example, two arms, two legs, or one leg and one arm) while sitting, standing, or lying down. It does not involve performing the activities while the whole body is in motion.				
27	Response Orientation	4.65	The ability to choose quickly between two or more movements in response to two or more different signals (lights, sounds, pictures). It includes the speed with which the correct response is started with the hand, foot, or other body part.				
28	Rate Control	4.39	The ability to time your movements or the movement of a piece of equipment in anticipation of changes in the speed and/or direction of a moving object or scene.				
29	Reaction Time	5.62	The ability to quickly respond (with the hand, finger, or foot) to a signal (sound, light, picture) when it appears.				
30	Wrist-Finger Speed	4.71	The ability to make fast, simple, repeated movements of the fingers, hands, and wrists.				
31	Speed of Limb Movement	5.09	The ability to quickly move the arms and legs.				
			Physical Abilities				
32	Static Strength	4.67	The ability to exert maximum muscle force to lift, push, pull, or carry objects.				
33	Explosive Strength	3.99	The ability to use short bursts of muscle force to propel oneself (as in jumping or sprinting), or to throw an object.				
34	Dynamic Strength	4.27	The ability to exert muscle force repeatedly or continuously over time. This involves muscular endurance and resistance to muscle fatigue.				
35	Trunk Strength	4.46	The ability to use your abdominal and lower back muscles to support part of the body repeatedly or continuously over time without 'giving out' or fatiguing.				
36	Stamina	3.86	The ability to exert yourself physically over long periods of time without getting winded or out of breath.				
37	Extent Flexibility	4.78	The ability to bend, stretch, twist, or reach with your body, arms, and/or legs.				
38	Dynamic Flexibility	4.05	The ability to quickly and repeatedly bend, stretch, twist, or reach out with your body, arms, and/or legs.				
39	Gross Body Coordination	4.18	The ability to coordinate the movement of your arms, legs, and torso together when the whole body is in motion.				
40	Gross Body Equilibrium	3.99	The ability to keep or regain your body balance or stay upright when in an unstable position.				

O*NET Abilities and Estimated Population Means Using AWCAS Sample

	Ability	Mean	Description				
	Sensory Abilities						
41	Near Vision	4.51	The ability to see details at close range (within a few feet of the observer).				
42	Far Vision	4.57	The ability to see details at a distance.				
43	Visual Color Discrimination	4.36	The ability to match or detect differences between colors, including shades of color and brightness.				
44	Night Vision	4.41	The ability to see under low light conditions.				
45	Peripheral Vision	4.10	The ability to see objects or movement of objects to one's side when the eyes are looking ahead.				
46	Depth Perception	4.15	The ability to judge which of several objects is closer or farther away from you, or to judge the distance between you and an object.				
47	Glare Sensitivity	4.17	The ability to see objects in the presence of glare or bright lighting.				
48	Hearing Sensitivity	3.89	The ability to detect or tell the differences between sounds that vary in pitch and loudness.				
49	Auditory Attention	4.60	The ability to focus on a single source of sound in the presence of other distracting sounds.				
50	Sound Localization	5.06	The ability to tell the direction from which a sound originated.				
51	Speech Recognition	4.73	The ability to identify and understand the speech of another person.				
52	Speech Clarity	4.81	The ability to speak clearly so others can understand you.				

Binscatter of Observed Earnings on Number of Potential Occupations



Sample Distribution of Number of Potential Occupations

