Tackling Youth Unemployment:

Evidence from a Labor Market Experiment in Uganda

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Motivation

- youth unemployment and underemployment are key policy challenges in the developing world
- East Africa: majority of popn aged below 25, youth represent 60% of the unemployed
- factors driving youth unemployment [Freeman 1979, Becker 1994, Pissarides 1994]:
  - pre labor market: young workers lack skills/info
  - barriers to labor market entry
- **this paper:** labor market field experiment to study these issues

This Paper: Two-Sided Market RCT Design

- workers: young entrants into the labor market
- firms: SMEs in eight sectors [manufacturing, services]
- two sided experimental design: T and C workers; T and C firms
- the RCT measures causal impacts **on workers and firms** of experimentally varying:
  - vocationally training workers before they enter the labor market [**VT**]
  - incentivising firms to hire and train workers on-the-job [**FT**]
  - matching
- sheds light on L^S, L^D and matching elements of the labor market
- **context:** Uganda
  - skewed age distn, youth unemployment key policy issue

Research Questions 1: Treatment Effects on Workers

- how do the impacts on workers of VT and FT differ?
  - contrasting supply- and demand-side policies
- **outcomes:** verified skills, employment, wages, productivity, earnings

Research Questions 2: Mechanisms

- tracked workers for four years since baseline
- what are the steady **state impacts** of VT/FT on workers?
- structurally estimate a job ladder model of worker search
- **key outcomes**: job offer arrival rates (UJ, JJ), unemployment rates, earnings
- feed into IRR calculations

Research Questions 3: Firm-Side Responses

- two sided experimental design: T and C workers; T and C firms
- firm side experiment allows us to measure:
  - whether returns to VT/FT reflect matching to differential firms
  - within-firm employment displacement
  - profit impacts and rent-sharing

Context: Workers

- oversubscription design used for intervention
- targeted to poorest/disadvantaged youth
  - not the kinds of individual that can self-finance VT or FT
  - many job training programs target youth [Card *et al.* 2011, Attanasio *et al.* 2012]
- **panel data:** 1714 workers tracked from baseline and three follow-ups
- [Table 1: C-group Worker Characteristics and Labor Market Outcomes]

Table 1: Baseline Balance on Worker Labor Market Outcomes

Means, robust standard errors from OLS regressions in parentheses
P-value on t-test of equality of means with control group in brackets
P-value on F-tests in braces

	Number of workers	Currently working	Has worked in the last month	Has done any wage employment in the last month	Any self employment in the last month	Has done any casual work in the last month	Total earnings in the last month [USD]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All Workers	1714	.360	.383	.130	.046	.257	5.93
		(.045)	(.044)	(.023)	(.013)	(.508)	(1.11)

Context: Firms

- urban labor markets throughout Uganda
- matched to nationally representative sample of 1500 SMEs
  - $L \in [1, 15]$, $\bar{L} = 3$, operating in eight sectors:
  - welding, motor mechanics, construction,..,hairdressing
- wage subsidy covering firm's screening/learning costs
  - employer learning [Farber and Gibbons 1996, Altonji and Pierret 2001]
  - apprenticeships as screening technologies [Autor 2001, Hardy and McCasland 2015]
- [Table 2: Vocational Training]
- [Table 3: On-the-Job Training]

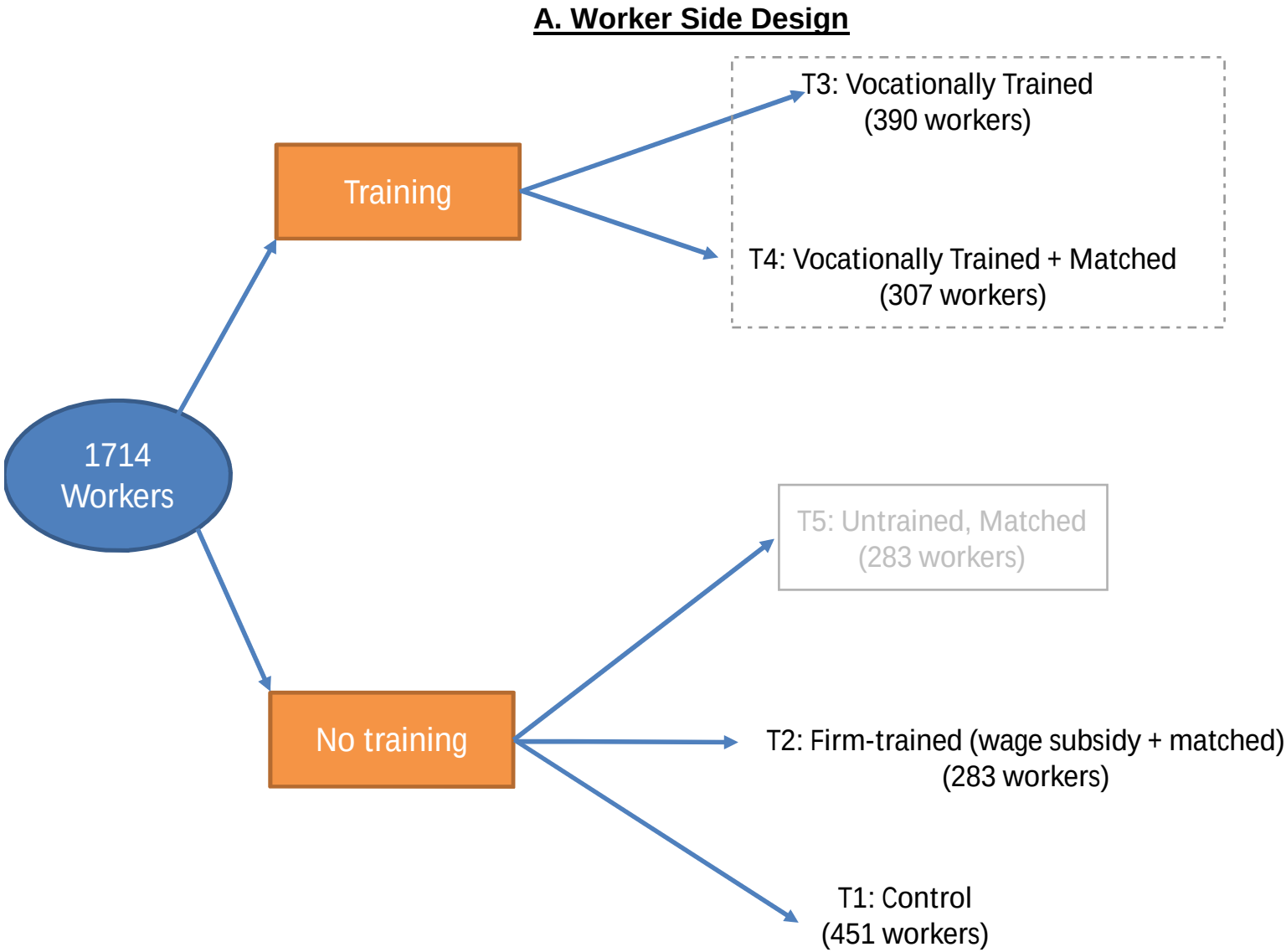
Table 2: The Mincerian Returns to Vocational Training

		Worker is skilled: self-reported VTI attendance	
	% workers skilled in sector	Coefficient and SE from worker wage regressions [USD]	Coefficient and SE from worker log(wage) regressions [USD]
All Sectors	**31.0%**	**26.2*** **	**.515*** **
		(3.15)	(.045)
Manufacturing			
Welding	24.9%	34.5***	.381***
		(6.40)	(.084)
Motor-mechanics	23.5%	16.1*	.294*
		(9.41)	(.153)
Electrical wiring	41.9%	27.3***	.486**
		(7.60)	(.189)
Construction	28.8%	11.5	.289*
		(9.39)	(.170)
Plumbing	49.1%	60.9***	.719**
		(19.0)	(.281)
Services			
Hairdressing	29.2%	22.9***	.444***
		(5.97)	(.069)
Tailoring	41.6%	15.9	.898***
		(9.76)	(.182)
Catering	40.2%	26.8**	.330***
		(11.6)	(.109)

Table 3: Characteristics of Apprenticeships

A. Availability	
Worker received on-the-job training at the current firm	.498
Duration of on-the-job training [months]	10
B. Payments	
In the first month of training, the worker:	
Was paid	.198
Was unpaid	.515
Was paying the firm owner	.288
Earnings (conditional on > 0) [US$] (median)	39.2 (40.1)
Amount worker was paying to owner (conditional on > 0) [US$] (median)	51.9 (33.3)
C. Trainers	
Who was mainly involved in training the worker:	
Firm owner only	.457
Other employees only	.091
Firm owner as well as other employees	.452

Figure 1: Experimental Design



Firm Training [T2]

- firm paid 120K UGX/month = $50 (for 6 months) to hire an untrained worker
- inflexible wage subsidy with designated split: $12.5 to owner, $38 to worker
- two anchors for this split:
- for those reporting to be an apprentice with a wage, mean wage is $39
- wages of all unskilled workers
  - subsidy rate for unskilled workers (subsidy/average wage): 63% [de Mel *et al.* 2010, SR=50%]

Certification and Skills Composition

- certification:
  - VT workers can signal their skills to employers
  - value of certification [Pallais 2014, MacLeod *et al.* 2016, Bassi and Nansamba 2017]
  - SM evidence: UJ and JJ transitions
- incentives for firms to train workers depends on labor market imperfections [Acemoglu and Pischke 1998, 1999]
- VT workers more likely to be poached than FT $\longrightarrow$ tilts to balance towards latter having relatively more firm specific skills
  - RF evidence: skills, wages, productivity, firm profits
  - SM evidence: UJ and JJ transitions

Estimation

- observe worker i in treatment group d in strata s in survey wave $t = 0, 1, 2, 3$
- estimate the following ANCOVA specification in survey waves $t = 1, 2, 3$:

$$y_{ist} = \sum_j \beta_j T_i + \gamma y_{i0} + \delta \mathbf{x}_{i0} + \lambda_s + \vartheta_t + u_{ist}$$

- worker i's assigned treatment T_i (j treatments)
- λ_s, ϑ_t: strata and survey wave fixed effects
- randomization at worker level (i): robust standard errors

Skills: Task Composition, Sector- and Firm-specific Skills

- firm-sponsored training
- conducted sectoral-specific skills test on workers (incl. C), administered at second and third follow-up
- try to measure firm-specific skills (third follow up)
- sectoral task lists by training type (O*NET)
- [Table 4: Skills]
- [Figure 3: Tasks]
- [Table 5: Employment (Extensive and Total Margins)]
- [Figure 4: Productivity Bounds]

Table 4: Skills

OLS regression coefficients, IPW estimates, robust standard errors in parentheses

	Firm-Provided Training	
	Received OTJ-T at First Employer	Position in First Job is "Trainee"
	(1)	(2)
Firm Trained	.144***	.215***
	(.052)	(.041)
Vocationally Trained	-.029	-.019
	(.042)	(.025)
Mean (SD) Outcome in Control Group	.404	.092
Control for Baseline Value	No	No
P-values on tests of equality:		
Firm Trained = Vocationally Trained	[.000]	[.000]
N. of observations	792	794

Table A5: Sector Skills Test for Motor Mechanics

<table>
<tr><th colspan="3">1. MOTOR-MECHANICS</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>1</td><td>multiple-choice
What are you advised to do when servicing the engine by changing oil?</td><td>A. Top up lubricating oil
B. Replace oil filter
C. Over hand engine
D. Over hand cylinder head
Correct Answer: B</td></tr>
<tr><td>2</td><td>multiple-choice
What immediate remedy can you give to a vehicle with a problem of excessive tyre wear in the center more than other parts?</td><td>A. Increase tyre pressure
B. Reduce tyre pressure
C. Inflate pressure
D. Remove the vehicle tire
Correct Answer: B</td></tr>
<tr><td>3</td><td>multiple-choice
If a customer reports to you that his/her vehicle charging system works at lower rate, how can you help him?</td><td>A. Replacing the charging system
B. Adjusting the alternator tension
C. Replacing alternator housing
D. Renewing wire insulator
Correct Answer: B</td></tr>
<tr><td>4</td><td>multiple-choice
Which of the following set of systems or component call for mechanical adjustment during general vehicle service?</td><td>A. Tyres, cooling system, master cylinder
B. Break shoes, alternator, and valve clearance
C. Distributor, radiator, propeller shaft
D. Tank, crank shaft, Turbo charger
Correct Answer: B</td></tr>
<tr><td>5</td><td>multiple-choice
What solution would you give a customer with a vehicle engine producing blue smoke?</td><td>A. Top up lubricant
B. Time the engine
C. Replace piston rings
D. Remove carbon deposits
Correct Answer: C</td></tr>
<tr><td>6</td><td>matching
What should you do to stop the following vehicle troubles?</td><td>
<table>
<tr><td>1</td><td>Battery over charging</td><td>A</td><td>Leaking fuel tank</td></tr>
<tr><td>2</td><td>Engine over heating</td><td>B</td><td>Renew regulator</td></tr>
<tr><td>3</td><td>Lubricant leakage</td><td>C</td><td>Reduce oil to the correct level</td></tr>
<tr><td>4</td><td>Smoke in exhaust</td><td>D</td><td>Renew piston rings</td></tr>
<tr><td>5</td><td>Engine fails to start</td><td>E</td><td>Charge the battery</td></tr>
</table>
Correct Answer: 1B, 2A, 3C, 4D, 5E
</td></tr>
<tr><td>7</td><td>order
When changing engine oil, in which order should you perform the following steps?</td><td>A. Drain oil through drain plug
B. Remove oil filter cup
C. Run engine to check leaks
D. Fill new oil through filler cup to level
E. Remove oil filter
F. Warm up the engine
Correct Answer: B, E, A, D, F, C</td></tr>
</table>

Table 4: Skills

OLS regression coefficients, IPW estimates, robust standard errors in parentheses

	Sector-Specific Skills Test			Firm-Specific Skills
	Report Some Skills	ITT	LATE: Offered Worker-Firm Match	Skills Transferability
	(3)	(4)	(5)	(6)
Firm Trained	.110***	2.13	4.49	-.051
	(.032)	(1.53)	(3.00)	(.109)
Vocationally Trained	.269***	6.96***	56.8***	.150**
	(.023)	(1.20)	(15.5)	(.068)
Mean (SD) Outcome in Control Group	.596	30.1 (22.9)	30.1 (22.9)	-
Control for Baseline Value	No	No	No	No
P-values on tests of equality:				
Firm Trained = Vocationally Trained	[.000]	[.001]	[.000]	[.025]
N. of observations	1,818	1,818	1,302	650

Figure 3: Tasks Performed by Vocationally Trained and Firm Trained Workers

Panel A: Manufacturing

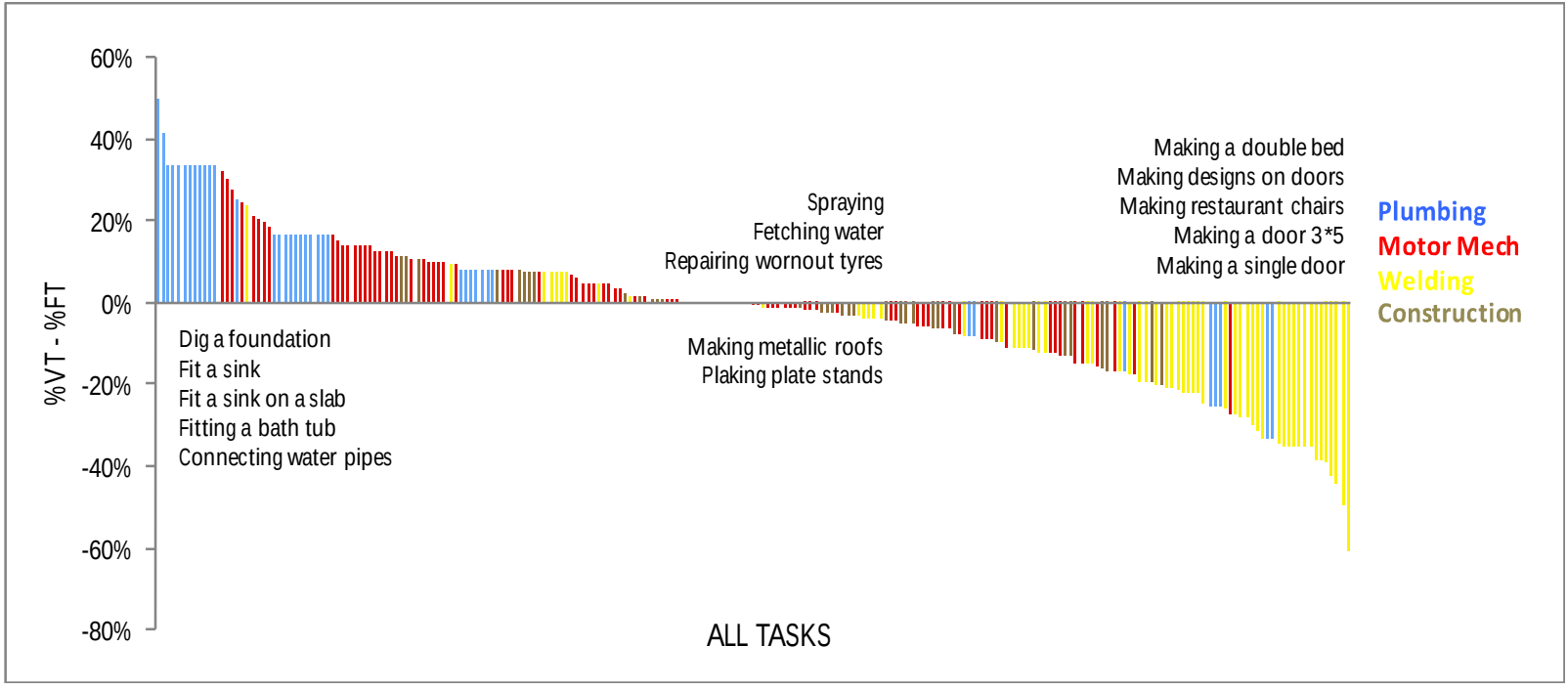


Table 5: Employment and Earnings

OLS regression coefficients, IPW estimates, robust standard errors in parentheses

	Has done any work in the last month	Number of months worked in the last year	Hourly wage rate [USD]	Total earnings in the last month [USD]
	(1)	(2)	(3)	(4)
Firm Trained	.063**	.518**	.028**	5.80**
	(.025)	(.259)	(.012)	(2.53)
Vocationally Trained	.090***	.879***	.031***	9.75***
	(.020)	(.207)	(.009)	(2.01)
Mean Outcome in Control Group	.438	4.52	.074	28.7
Control for Baseline Value	Yes	No	Yes	Yes
P-values on tests of equality:				
Firm Trained = Vocationally Trained	[.255]	[.134]	[.799]	[.111]
N. of observations	3,256	3,256	3,099	3,111

Underlying Market Failure

- with such high returns from training, why do workers not self-invest in their HK?
- credit constraints likely bind in this sample
  - total cost: \$470 per trainee split as VTI (\$400) + out-of-pocket costs (\$70)
- credit constraints also prevent workers paying for FT
- credit constraints on firms prevent them paying up front hiring/screening costs of employing youth
- worker beliefs:
  - imperfect information about returns to skills in low-income labor markets [Jensen 2009, Kaufmann 2014]
- [Table A6: Worker Beliefs]

Table A6: Worker Expectations

Means, standard deviations in parenthesis
All amounts in 2012 USD

	Expected probability of finding a job in the next 12 months		Average expected monthly earnings (triangular distribution)	
	With current Skill Set (1)	If received VT (2)	With current Skill Set (3)	If received VT (4)
All Workers (Baseline Interview)	.567	.867	57.8	118.3
	(.288)	(.144)	(46.9)	(71.5)
N. of observations	1,611	1,589	1,243	1,411

Value Functions

- value function for an unemployed worker is:

$$V^n(t) = -\varphi(c) + \beta \left[\begin{array}{c} \lambda_0(c,t) \max\{\int V(w,t)dF(w|t), V^n(t)\} \\ +(1-\lambda_0(c,t))V^n(t) \end{array} \right]$$

- value function for an employed worker with wage w is:

$$V(w,t) = w - \varphi(c) + \beta \left[\begin{array}{c} \delta V^n(t) + \lambda_1(c,t) \max\{\int V(w,t)dF(w|t), V(w,t)\} \\ +(1-\delta-\lambda_1(c,t)V(w,t) \end{array} \right]$$

Treatments and Job Search

- training can affect worker behavior through two mechanisms:
  - the probabilities of receiving a job offer: ($\lambda_0(c,t)$, $\lambda_1(c,t)$)
  - the distribution of offered wages ($F(w|t)$)
- through these mechanisms training impacts endogenous choices:
  - search effort (c)
  - whether to accept or reject wage offers (reservation wage)
- [Table 6: Worker Beliefs and Search]

Table 6: Worker Beliefs and Job Search

OLS regression coefficients, IPW estimates, robust standard errors in parentheses

	Job Offer Probability	Offered Wages	Search Intensity
	Expected probability of finding a job in the next 6 months (0 to 10 scale)	Average expected monthly earnings (triangular distribution) [USD]	Has actively looked for a job in the last year
	(1)	(4)	(5)
Firm Trained	.593***	.528	.001
	(.137)	(3.34)	(.025)
Vocationally Trained	1.87***	19.4***	.093***
	(.108)	(2.75)	(.020)
Mean Outcome in Control Group	2.81	72.6	.509
Control for Baseline Value	Yes	Yes	No
P-values on tests of equality:			
Firm Trained = Vocationally Trained	[.000]	[.000]	[.000]
N. of observations	3,136	1,905	3,255

Estimation

- follow two-step procedure in Bontemps *et al.* [2000]
  - λ_0, λ_1,δ are estimated, asymptotic se's calculated
- [Table 7, Panel A: Job Destruction and Job Offer Rates]
- [Table 7, Panel A: u, κ_1]
- [Table 7, Panel B: $F(.)$ and $G(.)$ Estimates]

Table 7: Estimates of the Job Ladder Search Model

Two-step estimation procedure in Bontemps, Robin and van den Berg [2000]

Panel A: Parameter Estimates		Steady State: November 2015 (Data from Second and Third Follow-up)		
		Control	Firm Trained	Vocationally Trained
		(1)	(2)	(3)
Job destruction rate (monthly):	δ	.0272	.0259	.0239
		(.0030)	(.0037)	(.0021)
Arrival rate of job offers if UNEMPLOYED (monthly):	λ_0	.0189	.0191	.0237
		(.0019)	(.0024)	(.0019)
Arrival rate of job offers if EMPLOYED (monthly):	λ_1	.0388	.0376	.0428
		(.0096)	(.0117)	(.0080)
Interfirm competition for workers	κ_1	1.426	1.452	1.791
Unemployment Rate	u	**.5892**	**.5755**	**.5024**
% Impact:			**2.3%**	**14.7%**

Table 7: Estimates of the Job Ladder Search Model

Two-step estimation procedure in Bontemps, Robin and van den Berg [2000]

		Steady State: November 2015 (Data from Second and Third Follow-up)		
Panel B: Function and Income Estimates				
Average (sd) monthly OFFERED wage [USD]	***F(.)***	44.8	47.0	46.3
		(37.4)	(43.6)	(41.9)
Average (sd) monthly ACCEPTED wage [USD]	***G(.)***	63.7	68.9	70.6
		(45.5)	(54.5)	(54.4)
Treatment Effect Impact on Annual Income [USD]			**37.0**	**107.6**
% Impact:			**11.8%**	**34.3%**

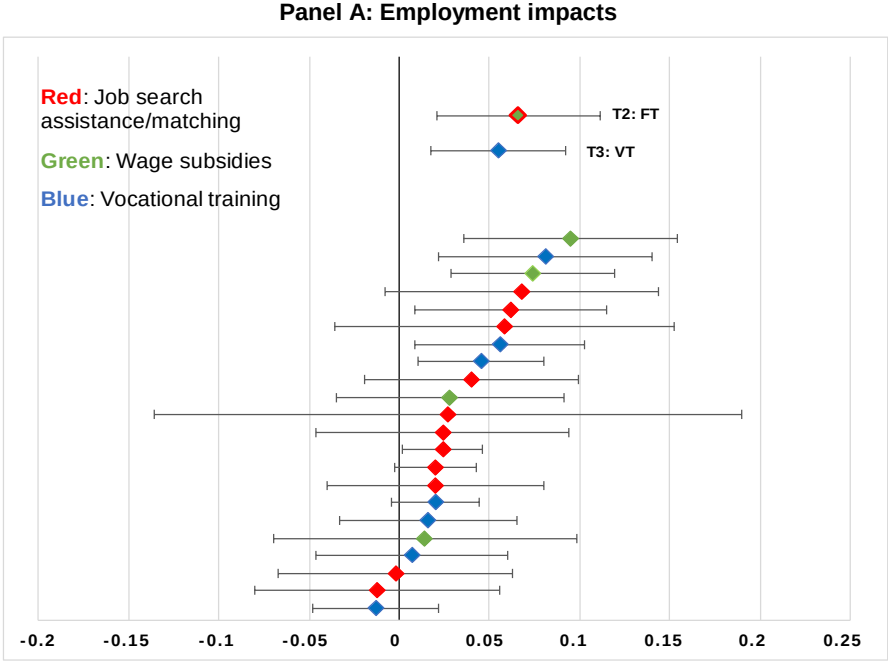
IRR

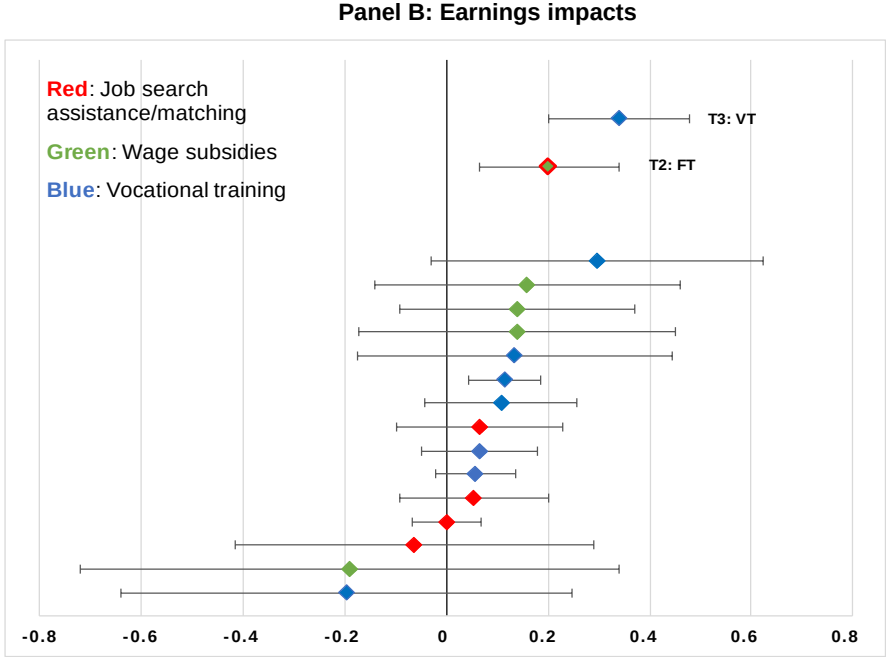
- IRR challenge versus capital/cash transfers in low-income settings [Blattman and Ralston 2015]
- VT cost: $470 per trainee split as VTI ($400) + out-of-pocket costs ($70)
- FT cost: $50.3 x 6 months = $302 per trainee
- SS earnings impact 3 times larger for vocational training: $107 versus $37
- opportunity costs: foregone earnings while being trained
- [Table 10: IRR]
- [Figure 7: McKenzie 2017 Meta-analysis]

Table 10: Internal Rate of Return

	Firm Trained	Vocationally Trained
	(1)	(2)
Social discount rate = 5%		
Remaining expected productive life of beneficiaries	38 years	38 years
Panel A. External parameters		
Total cost per individual at year 0 [USD]:	**368**	**510**
(i) Training costs (for 6 months)	302	470
(ii) Program overheads costs	31	4
(iii) Foregone earnings (for 6 months) - average at baseline	36	36
Panel B. Estimated total earnings benefits		
2 Benefits/cost ratio	**1.69**	**3.56**
Social discount rate = 10%	0.98	2.06
3 Internal Rate of Return (IRR)	**0.098**	**0.211**
Panel C. Sensitivity		
Sensitivity to different expected remaining productive life of beneficiaries		
Remaining expected productive life = 10 years	**0.001**	**0.166**
Panel D. Programme Costs for IRR to equate social discount rate		
5 Total cost per individual at year 0 [USD]	**624**	**1814**

Figure 7: Comparison of Treatment Impacts to Meta-analysis by McKenzie [2017]





External Validity

- we have documented large impacts of training relative to studies in middle- and high-income countries: **why?**
- our effect sizes are large relative to literature
- ranking of treatments similar to earlier studies (VT $>$ match)
  - sectoral focus: reduced mismatch
  - worker selection into evaluation sample, low attrition
  - treatment intensity
  - VTI quality (interacting with imperfect information of workers)

Motivation

- youth unemployment and underemployment are key policy challenges in the developing world
- factors driving youth unemployment:
  - pre labor market: young workers lack skills/info
  - barriers to labor market entry
- **this paper:** labor market field experiment to study these issues
  - both workers and firms constrained
  - returns to VT dominate FT
  - role of VTI sector and certification