

Online Appendix for “Statistical Discrimination and Affirmative Action in  
the Lab”

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**Abstract**

We reproduce the main results of the paper, first using session-level clustering and then using data from only the last five rounds of each stage. We illustrate that results remain qualitatively similar. We then present evidence that participants’ beliefs are, with a few important exceptions, well-calibrated with their opponents’ actions. We also provide evidence that the results are not primarily driven by one side of the market: rather, both workers and firms exhibit simultaneous and similar responses to changes in game parameters. Finally, we include various robustness regression analyses.

# 1 Session-Level Clustering

In Tables 3 - 6 in the paper, we assessed statistical significance using probit regressions of the relevant outcome variable (i.e., investment or hiring) on a dummy variable for worker color. Standard errors were clustered at the individual level. In Tables 1 - 4 below, we present more conservative tests in which standard errors are clustered at the session level. Although we lose significance in several cases, we find that our core results remain unchanged.

Clustering at the session level often reduces significance due to there being too “few” clusters. To alleviate this issue, Table 5 presents results in which the data are pooled across treatments, generating 15 clusters rather than 5 clusters. Although these tests necessarily mask between-subject treatment effects arising from the different affirmative action policies, they may still be helpful in measuring the aggregate within-subject treatment effect arising from the introduction and removal of affirmative action. Similarly, we find that our core results remain unchanged.

Treatment	Seed Stage					
	Investment			Hiring		
	GREEN		PURPLE	GREEN		PURPLE
Subsidy	0.90	>***	0.07	0.91	>***	0.14
High Subsidy	0.92	>***	0.14	0.90	>***	0.17
Long Subsidy	0.88	>***	0.05	0.84	>***	0.10

Table 1: Investment/hiring decisions in the seed stage (unequal investment costs)  
Significance levels are indicated as follows: \*\*\*  $p < 0.01$

Treatment	Baseline Stage					
	Investment			Hiring		
	GREEN		PURPLE	GREEN		PURPLE
Subsidy	0.86	>***	0.50	0.89	>***	0.52
High Subsidy	0.89	>	0.58	0.90	>***	0.54
Long Subsidy	0.83	>	0.75	0.83	>**	0.63

Table 2: Investment/hiring decisions in the baseline stage (equal investment costs)  
Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$

Treatment	Introducing AA					
	Investment			Hiring		
	GREEN		PURPLE	GREEN		PURPLE
Subsidy	0.76	>	0.65	0.73	>	0.70
High Subsidy	0.78	>	0.69	0.72	<	0.86
Long Subsidy	0.74	<**	0.88	0.69	<*	0.85

Table 3: Investment/hiring decisions during affirmative action  
Significance levels are indicated as follows: \*\*  $p < 0.05$ , \*  $p < 0.10$

Treatment	Removing AA					
	Investment			Hiring		
	GREEN		PURPLE	GREEN		PURPLE
Subsidy	0.80	>**	0.48	0.72	>***	0.42
High Subsidy	0.83	>	0.59	0.78	>	0.52
Long Subsidy	0.80	>	0.67	0.71	>	0.63

Table 4: Investment/hiring decisions after affirmative action  
Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$

Stage	All Treatments					
	Investment			Hiring		
	GREEN		PURPLE	GREEN		PURPLE
Seed Stage	0.90	>***	0.09	0.88	>***	0.13
Baseline Stage	0.86	>***	0.61	0.87	>***	0.57
Introducing AA	0.75	<	0.78	0.71	<*	0.82
Removing AA	0.81	>**	0.58	0.74	>***	0.53

Table 5: Investment/hiring decisions pooled across all treatments  
Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$

## 2 Learning within Stages

One may worry that the first few rounds of each stage are tainted by participants' attempts to learn various features of the relevant game. Tables 6 - 9 reproduce Tables 3 - 6 presented in the paper using data from the last five rounds of each stage. As can be readily seen, results resemble those reported in the body of the paper.

Treatment	Seed Stage					
	Investment			Hiring		
	GREEN		PURPLE	GREEN		PURPLE
Subsidy	0.90	>***	0.01	0.93	>***	0.09
High Subsidy	0.95	>***	0.10	0.91	>***	0.06
Long Subsidy	0.88	>***	0.00	0.85	>***	0.05

Table 6: Investment/hiring decisions in the seed stage (unequal investment costs)  
 Data from the last five rounds of the stage  
 Significance levels are indicated as follows: \*\*\*  $p < 0.01$

Treatment	Baseline Stage					
	Investment			Hiring		
	GREEN		PURPLE	GREEN		PURPLE
Subsidy	0.83	>***	0.43	0.85	>***	0.44
High Subsidy	0.90	>***	0.47	0.87	>***	0.49
Long Subsidy	0.82	>	0.72	0.82	>***	0.61

Table 7: Investment/hiring decisions in the baseline stage (equal investment costs)  
 Data from the last five rounds of the stage  
 Significance levels are indicated as follows: \*\*\*  $p < 0.01$

Treatment	Introducing AA					
	Investment			Hiring		
	GREEN		PURPLE	GREEN		PURPLE
Subsidy	0.77	>	0.65	0.67	>	0.65
High Subsidy	0.76	>	0.68	0.70	<***	0.90
Long Subsidy	0.72	<	0.88	0.60	<***	0.86

Table 8: Investment/hiring decisions during affirmative action  
 Data from the last five rounds of the stage  
 Significance levels are indicated as follows: \*\*\*  $p < 0.01$

Treatment	Removing AA					
	Investment			Hiring		
	GREEN		PURPLE	GREEN		PURPLE
Subsidy	0.79	>***	0.39	0.64	>***	0.31
High Subsidy	0.82	>**	0.52	0.77	>***	0.47
Long Subsidy	0.78	>	0.63	0.70	>	0.60

Table 9: Investment/hiring decisions after affirmative action  
 Data from the last five rounds of the stage  
 Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$

### 3 Are Participants' Beliefs Correct?



Figure 1: Workers' beliefs and firms' hiring decisions in the Subsidy treatment



Figure 2: Workers' beliefs and firms' hiring decisions in the High Subsidy treatment

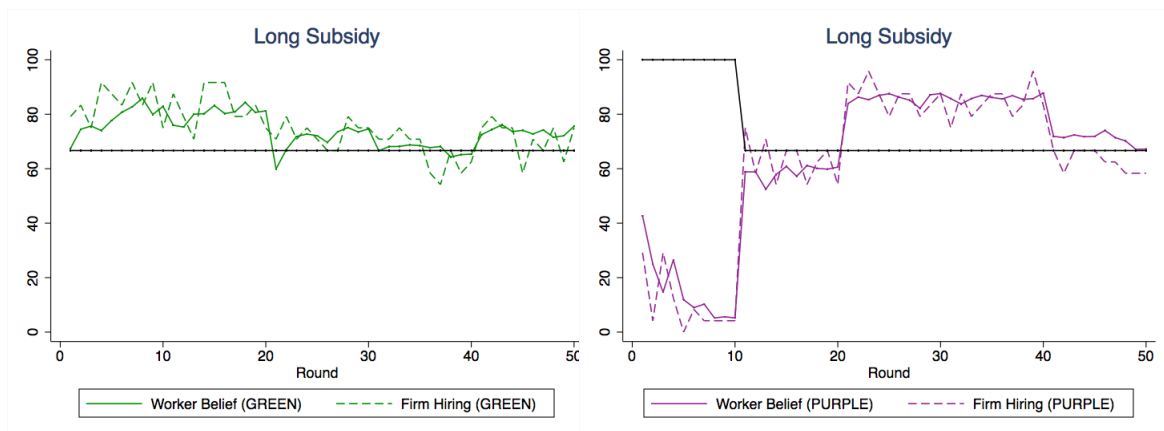


Figure 3: Workers' beliefs and firms' hiring decisions in the Long Subsidy treatment



Figure 4: Firms' beliefs and workers' investment decisions in the Subsidy treatment



Figure 5: Firms' beliefs and workers' investment decisions in the High Subsidy treatment



Figure 6: Firms' beliefs and workers' investment decisions in the Long Subsidy treatment

In general, participants hold fairly well-calibrated beliefs that track rather closely observed behavior. GREEN workers and firms facing them are somewhat excessively pessimistic at the very beginning. Nonetheless, their beliefs throughout are sufficiently optimistic to justify investment and hiring. When turning to PURPLE workers and the firms they are paired with, we see that both workers and firms are somewhat overly optimistic in the first, seeding stage. They are overly pessimistic when affirmative action is introduced, and then overly optimistic when it is lifted. Nonetheless, these deviations do not affect best responses, and are therefore consistent with the high rates of best responses reported in the main text.

## 4 Which Side is Driving Results?

It is conceivable that the responses we see in the experiment are primarily driven by one side of the market. For instance, one may wonder whether when affirmative action is removed, PURPLE workers initially continue to invest, giving firms the benefit of the doubt, even though firms immediately cut back on their hiring of PURPLE workers. After experiencing the lower hiring rates, PURPLE workers would then respond, with a time lag, by reducing their investment rates. To investigate whether these types of narratives have empirical content, we look at the average investment and hiring rates of PURPLE workers in the two rounds before and after each stage transition. As Table 10 shows, both PURPLE workers and the firms paired with them respond simultaneously and similarly to changes in stage parameters across our treatments. This suggests that neither side of the market is uniquely responsible for either the emergence or the breakdown of efficient coordination.



	Subsidy		High Subsidy		Long Subsidy	
	Investment	Hiring	Investment	Hiring	Investment	Hiring
Round 9	0.00	0.05	0.05	0.05	0.00	0.04
Round 10	0.00	0.14	0.05	0.14	0.00	0.04
BASELINE (EQUAL COSTS)						
Round 11	0.59	0.82	0.76	0.71	0.83	0.75
Round 12	0.73	0.45	0.81	0.67	0.75	0.58
Round 19	0.41	0.36	0.43	0.52	0.67	0.67
Round 20	0.32	0.41	0.48	0.33	0.75	0.54
AFFIRMATIVE ACTION						
Round 21	0.64	0.91	0.71	0.81	0.83	0.92
Round 22	0.68	0.64	0.67	0.86	0.88	0.88
Round 29/39	0.68	0.68	0.71	0.90	0.92	0.96
Round 30/40	0.73	0.73	0.71	0.86	0.92	0.83
REMOVAL OF AFFIRMATIVE ACTION						
Round 31/41	0.50	0.55	0.67	0.67	0.79	0.67
Round 32/42	0.59	0.64	0.57	0.71	0.71	0.58

Table 10: Behavior before and after stage transitions (PURPLE workers and paired firms).

## 5 Survey Responses and Risk Attitudes as Controls

As mentioned in the body of the paper, we elicited risk attitudes at the end of each session using two tasks of the form suggested by Gneezy and Potters (1997). Namely, participants had to allocate 200 tokens (translating to 2 dollars) between a safe project, which returned the amount of tokens invested for sure, and a risky project. In one task, the risky project returned 2.5 times the amount invested with 50% probability and 0 otherwise; in the second task, the risky project returned 3 times the amount invested with 40% probability and 0 otherwise. In addition, we had participants fill a survey containing various demographic questions.<sup>1</sup>

Tables 11 and 12 reproduce the regression analysis reported in Tables 15 and 16 in the paper, adding responses to the risk elicitations and survey as controls. Specifically, the control variables we use are constructed as follows:

- Female: dummy variable that equals 1 if the participant identifies her gender as “Female”
- Minority: dummy variable that equals 1 if the participant identifies her ethnicity as “Hispanic”, “African American”, or “Native American”<sup>2</sup>
- Right-Wing: dummy variable that equals 1 if the participant identifies her political views as “Moderate”, “Conservative”, or “Very Conservative”<sup>3</sup>
- Risk Task 1: the number of tokens the participant chooses to invest in the first risk task (from 0 to 200)
- Risk Task 2: the number of tokens the participant chooses to invest in the second risk task (from 0 to 200)

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<sup>1</sup>Details of the survey are available at [http://www.leeatyariv.com/papers/Discrimination\\_Demographics.pdf](http://www.leeatyariv.com/papers/Discrimination_Demographics.pdf)

<sup>2</sup>No participants identified as Native American in our experimental sessions.

<sup>3</sup>In the experiment, only 7% of participants identified as either “Conservative” or “Very Conservative”. Constructing the variable in this fashion allows us to classify 34% of participants as “Right-Wing”.

VARIABLE: Firm Belief	Subsidy (1)	High Subsidy (2)	Long Subsidy (3)	Long Subsidy (4)
Introducing AA	0.086** (0.039)	0.067** (0.032)	0.145*** (0.035)	
Removing AA	0.031 (0.055)	-0.003 (0.031)	0.098*** (0.032)	0.098*** (0.032)
Introducing AA (first half)				0.131*** (0.038)
Introducing AA (second half)				0.159*** (0.038)
Female	-0.064 (0.062)	-0.015 (0.096)	-0.116 (0.070)	-0.116 (0.071)
Minority	-0.093 (0.068)	-0.197** (0.092)	-0.082 (0.077)	-0.082 (0.077)
Right-Wing	-0.024 (0.069)	-0.123 (0.081)	0.022 (0.071)	0.021 (0.071)
Risk Task 1	0.000 (0.000)	-0.001 (0.002)	-0.002 (0.001)	-0.002 (0.001)
Risk Task 2	0.000 (0.000)	0.002 (0.001)	0.002 (0.001)	0.002 (0.001)
Constant	0.502*** (0.087)	0.569*** (0.148)	0.721*** (0.114)	0.722*** (0.114)
Observations	660	630	960	960
Number of participants	44	42	48	48

Table 11: Results from OLS regressions. Standard errors are shown in parentheses and are clustered at the individual level. Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .

VARIABLE: Hire	Subsidy (1)	High Subsidy (2)	Long Subsidy (3)	Long Subsidy (4)
Introducing AA	0.178*** (0.064)	0.331*** (0.054)	0.215*** (0.052)	
Removing AA	-0.088 (0.076)	-0.017 (0.053)	-0.006 (0.054)	-0.006 (0.054)
Introducing AA (first half)				0.228*** (0.055)
Introducing AA (second half)				0.203*** (0.055)
Female	-0.070 (0.089)	-0.081 (0.136)	-0.138 (0.088)	-0.138 (0.088)
Minority	-0.041 (0.082)	-0.218* (0.119)	-0.093 (0.091)	-0.093 (0.091)
Right-Wing	-0.015 (0.086)	0.009 (0.096)	-0.012 (0.103)	-0.012 (0.104)
Risk Task 1	0.000 (0.001)	-0.003 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Risk Task 2	0.001 (0.001)	0.003 (0.002)	0.002 (0.001)	0.002 (0.001)
Constant	0.494*** (0.121)	0.630*** (0.179)	0.753*** (0.149)	0.753*** (0.148)
Observations	660	630	960	960
Number of participants	44	42	48	48

Table 12: Results from OLS regressions. Standard errors are shown in parentheses and are clustered at the individual level. Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .

As apparent from these tables, even with the additional controls, coefficients on treatment dummies remain virtually identical to those reported in the paper. Furthermore, all but one control in one treatment (reflecting membership in a minority group) exhibit no significant effect on hiring decisions or reported beliefs. Given the number of controls and treatments, we suspect the significant effect we see for minority membership might be spurious.

## 6 Identifying Firm Types

One might suspect that firms' responses to affirmative action policies being introduced and removed depends on the extent to which they treat GREEN and PURPLE workers differently initially, in the baseline stage. In this section, we identify firm "types" according to their likelihood of hiring a PURPLE worker in the baseline stage. We then inspect firms' responses to affirmative action and its removal, in terms of hiring patterns and reported beliefs, for different types separately.

Specifically, we first calculate each firm's average hiring rate for GREEN workers in our baseline Stage 2 ( $Stage2_G$ ) and average hiring rate for PURPLE workers in the baseline Stage 2 ( $Stage2_P$ ). Using these values, we define a variable  $Stage2_\Delta = Stage2_G - Stage2_P$  that captures each firm's level of discrimination. The types are then constructed as follows:

- Non-discriminatory:  $Stage2_\Delta \leq 0$
- Low-discriminatory:  $Stage2_\Delta \in (0, 0.50]$
- High-discriminatory:  $Stage2_\Delta > 0.50$

Across all treatments, the 134 participants in firm roles are divided as follows: 40% are non-discriminatory, 29% are low-discriminatory, and 31% are high-discriminatory. Of the non-discriminatory firms, 87% have equal hiring rates between GREEN and PURPLE workers ( $Stage2_\Delta = 0$ ) and 13% favor PURPLE workers in their hiring decisions ( $Stage2_\Delta < 0$ ).

Tables 13 - 15 reproduce the regression analysis reported in Table 16 separately for different firm types, while Tables 16 - 18 reproduce the regression analysis reported in Table 15 separately for different firm types.

Unsurprisingly, we see little effect of affirmative action or its removal on actions or beliefs of non-discriminatory firms. The patterns for firms that are initially discriminatory are qualitatively in line with those reported in the paper: affirmative action alleviates discrimination, its removal brings the market close to its baseline prior to affirmative action, and beliefs are less responsive to affirmative action than hiring likelihoods. Furthermore, the Long Subsidy treatment is more effective in eroding some discriminatory tendencies. All these effects are more pronounced for highly discriminatory firms.

VARIABLE: Hire	Subsidy (1)	High Subsidy (2)	Long Subsidy (3)	Long Subsidy (4)
Introducing AA	-0.121* (0.067)	-0.011 (0.034)	-0.017 (0.041)	
Removing AA	-0.365*** (0.117)	-0.030 (0.040)	-0.167*** (0.055)	-0.167*** (0.055)
Introducing AA (first half)				-0.015 (0.057)
Introducing AA (second half)				-0.020 (0.035)
Constant	0.848*** (0.088)	0.915*** (0.084)	0.853*** (0.067)	0.853*** (0.067)
Observations	243	214	444	444
Number of participants	17	14	23	23

Table 13: Results from OLS regressions for non-discriminatory firms. Standard errors are shown in parentheses and are clustered at the individual level. Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .

VARIABLE: Hire	Subsidy (1)	High Subsidy (2)	Long Subsidy (3)	Long Subsidy (4)
Introducing AA	0.170 (0.119)	0.376*** (0.079)	0.185** (0.071)	
Removing AA	-0.155 (0.090)	-0.013 (0.107)	-0.031 (0.095)	-0.031 (0.095)
Introducing AA (first half)				0.192*** (0.050)
Introducing AA (second half)				0.178* (0.094)
Constant	0.567*** (0.072)	0.487*** (0.073)	0.646*** (0.060)	0.646*** (0.060)
Observations	168	225	296	296
Number of participants	11	14	14	14

Table 14: Results from OLS regressions for low-discriminatory firms. Standard errors are shown in parentheses and are clustered at the individual level. Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .

VARIABLE: Hire	Subsidy (1)	High Subsidy (2)	Long Subsidy (3)	Long Subsidy (4)
Introducing AA	0.467*** (0.105)	0.622*** (0.090)	0.729*** (0.050)	
Removing AA	0.193 (0.119)	-0.003 (0.097)	0.330** (0.129)	0.330** (0.129)
Introducing AA (first half)				0.754*** (0.047)
Introducing AA (second half)				0.695*** (0.091)
Constant	0.173*** (0.042)	0.190*** (0.035)	0.196*** (0.047)	0.196*** (0.047)
Observations	249	191	220	220
Number of participants	16	14	11	11

Table 15: Results from OLS regressions for high-discriminatory firms. Standard errors are shown in parentheses and are clustered at the individual level. Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .



VARIABLE: Firm Belief	Subsidy (1)	High Subsidy (2)	Long Subsidy (3)	Long Subsidy (4)
Introducing AA	0.000 (0.050)	-0.027 (0.055)	0.033 (0.041)	
Removing AA	-0.180** (0.081)	0.045 (0.036)	0.015 (0.037)	0.015 (0.037)
Introducing AA (first half)				0.022 (0.053)
Introducing AA (second half)				0.045 (0.038)
Constant	0.700*** (0.064)	0.774*** (0.067)	0.704*** (0.058)	0.704*** (0.058)
Observations	243	214	444	444
Number of participants	17	14	23	23

Table 16: Results from OLS regressions for non-discriminatory firms. Standard errors are shown in parentheses and are clustered at the individual level. Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .

VARIABLE: Firm Belief	Subsidy (1)	High Subsidy (2)	Long Subsidy (3)	Long Subsidy (4)
Introducing AA	0.084 (0.063)	0.091 (0.062)	0.144*** (0.044)	
Removing AA	0.034 (0.060)	-0.066 (0.054)	0.079** (0.034)	0.079** (0.034)
Introducing AA (first half)				0.114** (0.045)
Introducing AA (second half)				0.169*** (0.050)
Constant	0.441*** (0.066)	0.480*** (0.058)	0.626*** (0.055)	0.626*** (0.055)
Observations	168	225	296	296
Number of participants	11	14	14	14

Table 17: Results from OLS regressions for low-discriminatory firms. Standard errors are shown in parentheses and are clustered at the individual level. Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .

VARIABLE: Firm Belief	Subsidy (1)	High Subsidy (2)	Long Subsidy (3)	Long Subsidy (4)
Introducing AA	0.177** (0.079)	0.140** (0.061)	0.395*** (0.074)	
Removing AA	0.204** (0.090)	0.021 (0.054)	0.285** (0.108)	0.285** (0.108)
Introducing AA (first half)				0.388*** (0.063)
Introducing AA (second half)				0.404*** (0.106)
Constant	0.321*** (0.055)	0.370*** (0.040)	0.385*** (0.066)	0.385*** (0.066)
Observations	249	191	220	220
Number of participants	16	14	11	11

Table 18: Results from OLS regressions for high-discriminatory firms. Standard errors are shown in parentheses and are clustered at the individual level. Significance levels are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .