

THE EFFECTS OF A DECLINING FARM LABOR SUPPLY ON CALIFORNIA AGRICULTURE

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OBJECTIVES



Source: <https://www.quora.com/What-is-pomology>

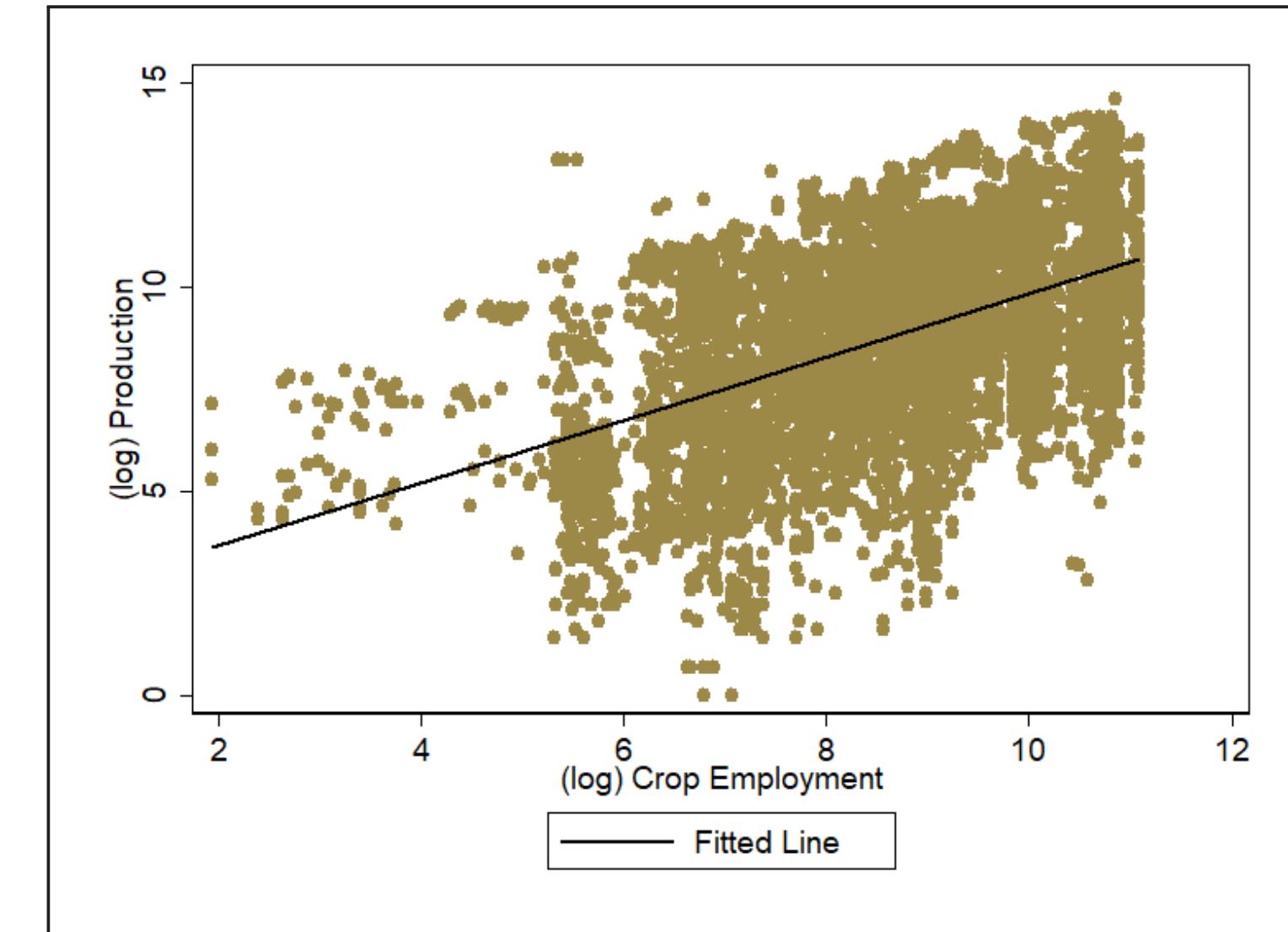
To estimate the effects of decreases in the farm labor supply on:

1. Fruit and Vegetable Production
2. Harvested Acreage
3. Crop Yields

DATA AND BACKGROUND

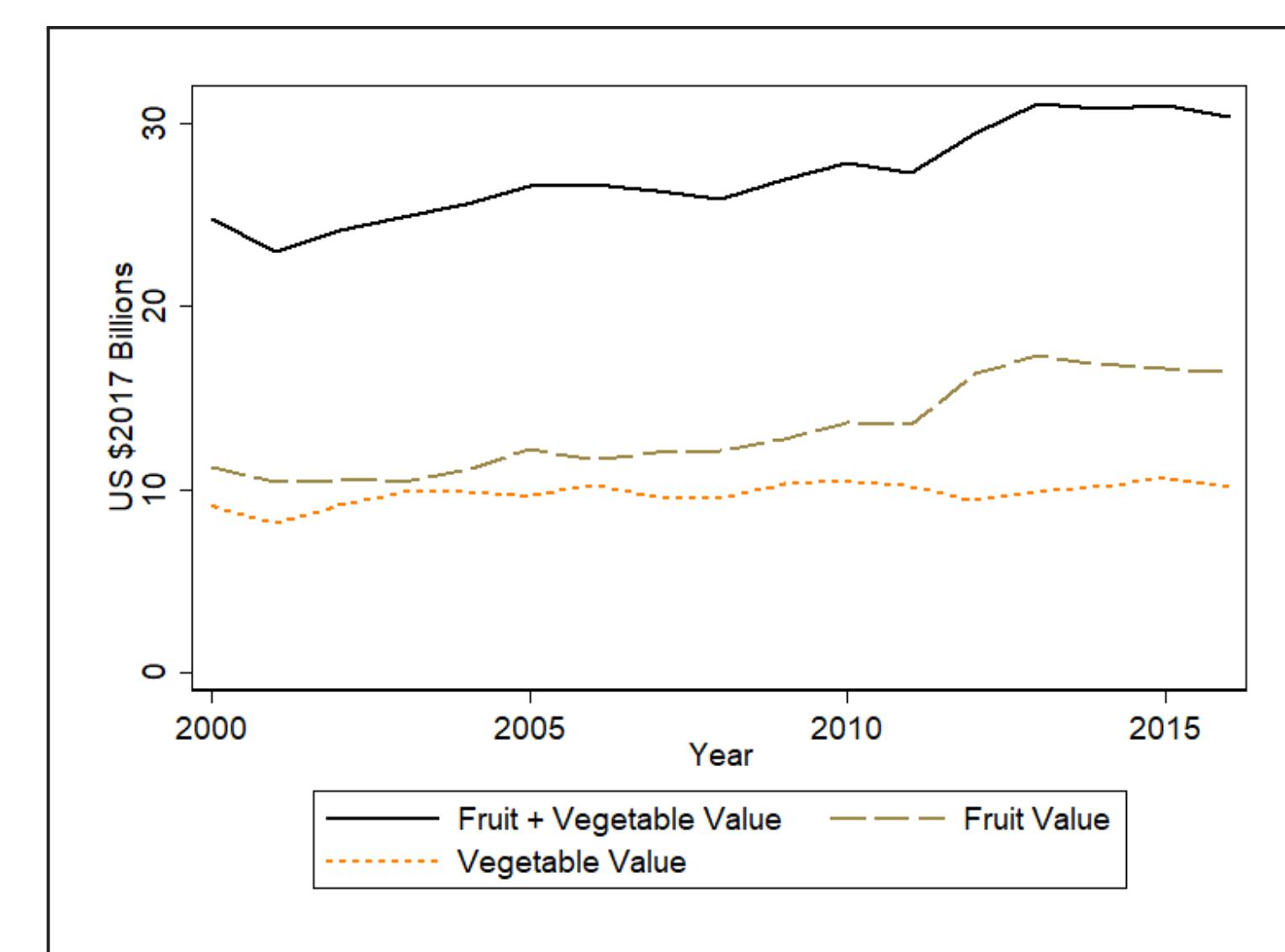
OVERVIEW OF DATA

- * Crop-specific county-level fruit and vegetable production data 2001-2016 (CDFA - NASS)
- * Crop employment data at the county level for 3rd quarter (QCEW - NAICS 111 + 115115)
- * Ongoing reports of labor shortages for at least 10 years



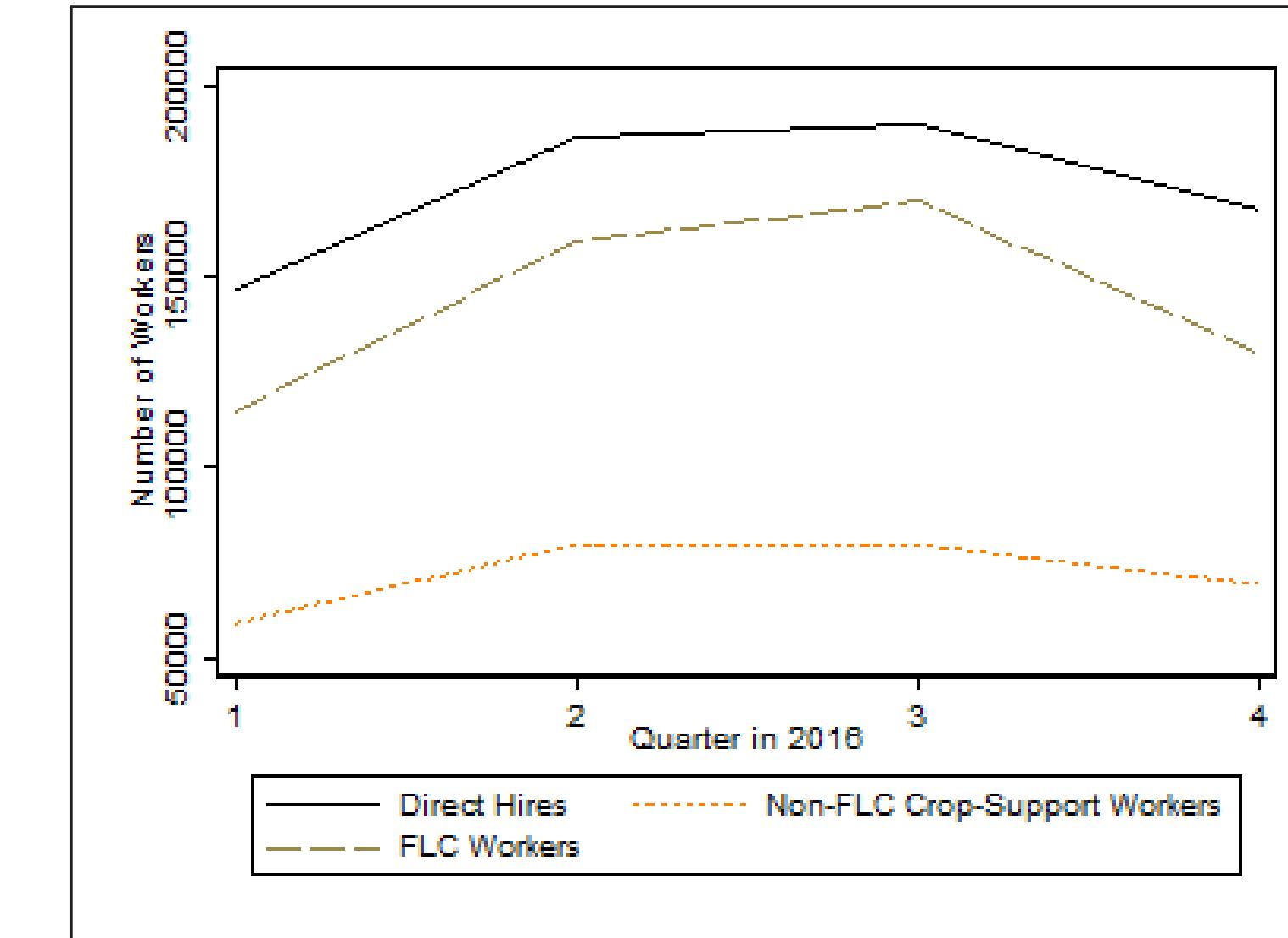
CROP PRODUCTION

- * Largest fruit and vegetable producer in the U.S.
- * Worth nearly \$30 billion
- * 2/3 of U.S. fruits
- * 1/3 of U.S. vegetables
- * Production has been slowly expanding since 2000



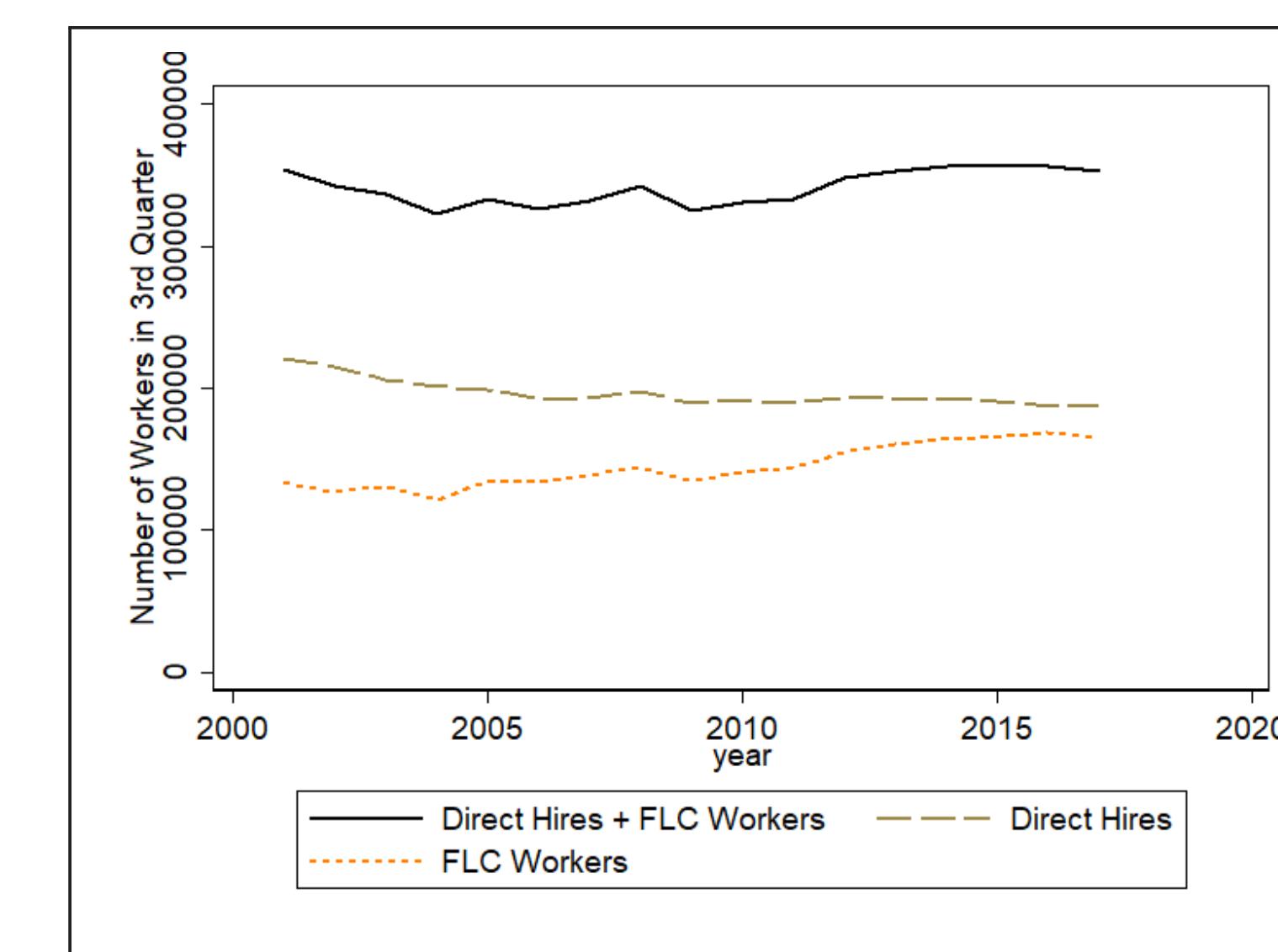
CROP EMPLOYMENT

- * Direct hires (about 45%)
- * Farm labor contractor workers (FLCs) (about 38%)
- * Non-FLC crop-support workers (about 17%)
- * Peak labor demand occurs in 3rd quarter due to need for harvest workers



EMPLOYMENT TRENDS

- * An average of 390,000 workers
- * Downward trend in direct hires since 1986 (IRCA)
- * Upward trend in FLC use
- * Hiring workers through an FLC protects the farmer against legal repercussions associated with employing undocumented workers



METHODOLOGY

The goal is to estimate the following model:

$$\ln(Y_{ict}) = \beta_0 + \beta_1 \ln(L_{ct}) + \theta_t + \phi_i + \delta_c + \gamma_c \times t + \epsilon_{ict}$$

Y_{ict} ∈ (production (in tons), harvested acres, yield per acre) [i = crop, c = county, t = year]

L_{ct} = number of crop workers employed in a county

θ_t = year fixed effects

ϕ_i = crop fixed effects

δ_c = county fixed effects

$\gamma_c \times t$ = county-specific time trends

$10 \times \beta_1$ = the percent decrease in production caused by a 10% decrease in the crop labor supply

IMPERFECT INSTRUMENT METHODOLOGY ESTABLISHES UPPER BOUND FOR β_1

$$\ln(L_{ct}) = \alpha_0 + \alpha_1 \ln(L_{ct}^{Adj}) + \theta_t + \phi_i + \delta_c + \gamma_c \times t + \nu_{ict}$$

L_{ct}^{Adj} = crop workers in county + adjacent counties

Let X = endogenous regressor

Let Z = imperfect instrument

Two conditions are required:

1) $\rho_{zu} \rho_{xu} > 0$

2) $|\rho_{xu}| \geq |\rho_{zu}|$

Define $\lambda^* = \frac{\rho_{zu}}{\rho_{xu}}$

Then $\sigma_x Z - \lambda^* \sigma_z X$ is a valid instrument

$$E[(\sigma_x Z - \lambda^* \sigma_z X)U] = \frac{\rho_{zu}}{\rho_{xu}} \sigma_{xu} \sigma_z - \frac{\rho_{zu}}{\rho_{xu}} \sigma_{xu} \sigma_z = 0$$

λ^* is not known but lies in the interval [0,1]

Define $V(\lambda) = \sigma_x Z - \lambda \sigma_z X$

$$\beta \leq \min(\beta_Z^{IV}, \beta_{V(1)}^{IV})$$

MAIN RESULTS

Production Regressions

	Production		Harvested Acres		Yield	
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
50 Counties						
$\ln(L_{ct})$	0.119** (0.0586)	0.0807 (0.0665)	0.119*** (0.0448)	0.0878* (0.0476)	0.00257 (0.0419)	-0.00747 (0.0418)
N	8007	8007	8007	8007	8007	8007
40 Counties						
$\ln(L_{ct})$	0.160*** (0.0501)	0.127** (0.0527)	0.141*** (0.0411)	0.114*** (0.0403)	0.0218 (0.0422)	0.0133 (0.0411)
N	7769	7769	7769	7769	7769	7769
30 Counties						
$\ln(L_{ct})$	0.124* (0.0640)	0.114* (0.0634)	0.139*** (0.0437)	0.114** (0.0444)	-0.0137 (0.0552)	-0.259 (0.208)
N	6776	6776	6776	6776	6776	6776
20 Counties						
$\ln(L_{ct})$	0.141** (0.0594)	0.117* (0.0610)	0.135*** (0.0456)	0.105** (0.0498)	0.00728 (0.0512)	-0.145 (0.238)
N	5736	5736	5736	5736	5736	5736
10 Counties						
$\ln(L_{ct})$	0.340** (0.137)	0.250 (0.176)	0.237*** (0.0828)	0.125* (0.0746)	0.102 (0.127)	0.0118 (0.238)
N	4232	4232	4232	4232	4232	4232

Standard errors in parentheses are clustered at the county level

* $p < .1$, ** $p < .05$, *** $p < .01$

MAIN CONCLUSIONS

* Moderate reductions in the number of workers only leads to minor decreases in fruit and vegetable production.

* A 10% decrease in labor supply will lead to at most a 1.3% reduction in production. Effects are 3 times larger in largest 10 producing counties.

* Reduced production is mainly channeled through a decrease in harvested acres.

* Small effects may be due to the fact that:

(i) Farmworkers are working longer hours and more days per year, and these estimates only consider reductions in the number of workers.

(ii) Farmers are adapting to labor scarcity by adopting labor-saving technologies and cultivation practices that make the workforce more efficient.

AUTHOR INFORMATION

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