

The Minimum Wage and Productivity: A Case Study of California Strawberry Pickers

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Motivation

CAPITOL ALERT

APRIL 04, 2016 9:47 AM

Jerry Brown signs \$15 minimum wage in California

30 JANUARY 2017

CALIFORNIA MINIMUM WAGE AND AGING FARMWORKERS

REGULATORY > LEGISLATIVE

Agriculture reacts to California's new overtime law



BY PHILIP MARTIN

Todd Fitchette | Sep 12, 2016

U.S. | U.S. NEWS

California Farmworkers to Get Overtime Pay After 8 Hours Under New Law

Agricultural workers now must work 10 hours a day or 60 hours a week to earn that benefit

Motivation



"We're being paid minimum wage so do only a minimum amount of work."

CartoonStock.com

Research Questions

Piece Rate Wages and the Minimum Wage

How does the minimum wage interact with piece rate wages for strawberry harvesters?

Payment Scheme Productivity Effects

What effect, if any, does an increase in the minimum wage have on worker productivity?

Policy Implications

What do these productivity effects mean in the face of rising minimum wages? Can producers mitigate these effects?

Literature on Payment Schemes and Productivity

Theoretical Literature:

- Asymmetric information and contract choice
 - e.g. Rasmusen, 2001 and Bolton & Dewatripont, 2005
- Heterogeneity and selection into payment schemes
 - Gibbons, 1987; Lazear, 1986; Magnum, 1962; Robertson, 1960; and Stiglitz, 1975

Empirical Literature:

- Productivity gains from piece rate payments, relative to fixed wage
 - Bandiera, Barankay, & Rasul, 2004; Lazear, 2000; Paarsch & Shearer, 1999; Pekkarinen & Riddell, 2006

Literature on Payment Schemes in Agriculture

Empirical Literature:

- Variation in local piece rate wages allows workers to sort according to their comparative advantage
 - Newman & Jarvis, 2000
- Variation in payment schemes allows workers to sort themselves based primarily on comparative advantage
 - Foster & Rosenzweig, 1996
- Piece rate payments increase effort and calories consumed
 - Foster & Rosenzweig, 1994

Contributions

Theoretical:

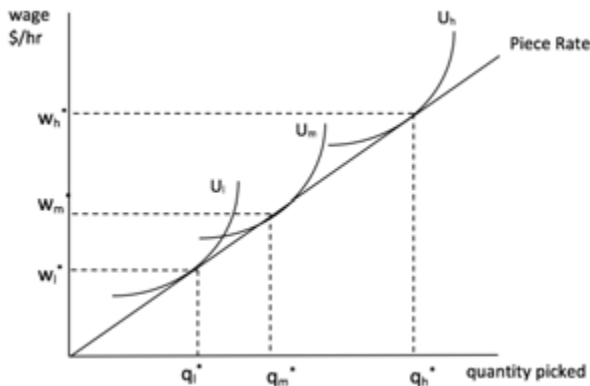
- A model that combines fixed and piece rate wage schemes
- Utilizes heterogeneity in worker productivity to elicit effects of a wage change
 - **Benefit to this approach:** All workers can face the same minimum wage increase.

Empirical:

- Short-run effect of a minimum wage increase on worker productivity
- Examine persistence of the productivity effect and mitigating factors

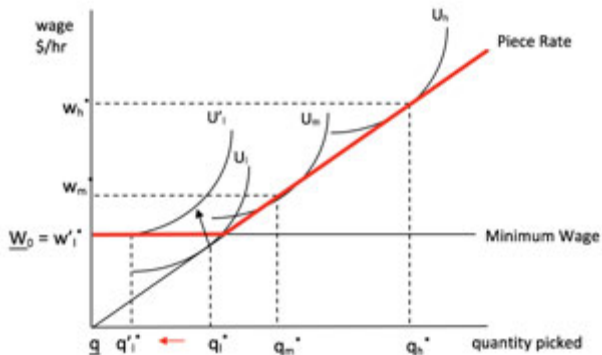
Theoretical Framework

Low, Medium, and High Productivity Workers Facing a Pure Piece Rate Wage



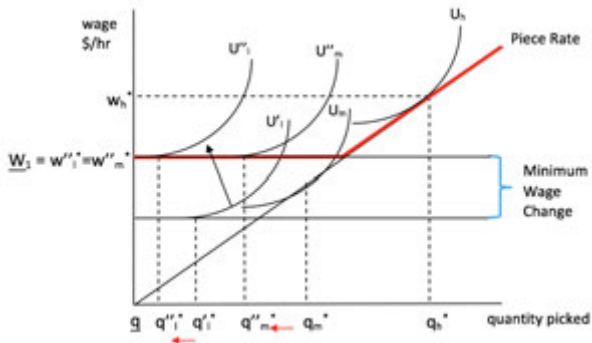
Theoretical Framework

The Piece Rate and Minimum Wage



Theoretical Framework Model

The Piece Rate and a Minimum Wage Increase



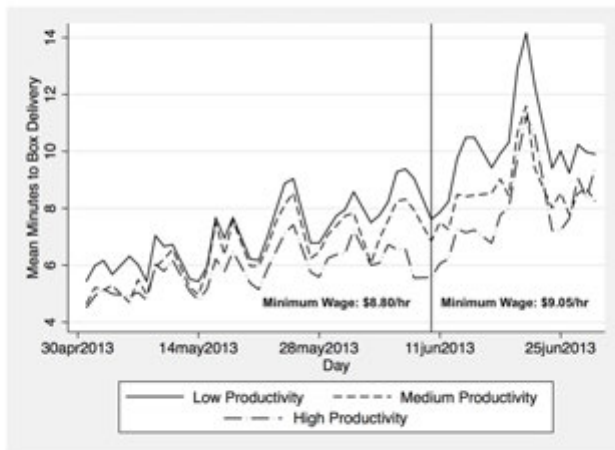
Data

Buenaventura Ranch

- 211 acre berry farm in Watsonville
- Panel Data from 2010 - 2016. Number of Workers
 - 1 **Timestamp** Productivity Summary
 - Worker clocks in, clocks out, goes on break, switches tasks, or drops off a box of strawberries
 - 2 **Payroll Data** Payroll Summary
 - Piece Rate wages, total boxes delivered, hours worked, and the hourly wage rate
 - Records when workers need a minimum wage adjustment

Minimum Wage Change and Worker Productivity

Examples



Preliminary Results

Empirical Model

Dependent Variable: Daily Mean Box Delivery Time

	(1)	(2)	(3)	(4)
Low-type	1.49*** (0.09)	1.21*** (0.09)	1.20*** (0.09)	0.42* (0.18)
Medium-type	0.93*** (0.09)	0.56*** (0.09)	0.57*** (0.09)	0.07 (0.19)
Min Wage Δ	2.09*** (0.21)	-0.32 (0.21)	-0.10 (0.20)	0.06 (0.19)
Min Wage Δ ·Low	0.83*** (0.22)	1.02*** (0.21)	1.03*** (0.20)	0.85*** (0.18)
Min Wage Δ ·Med	-0.20 (0.22)	0.10 (0.21)	0.10 (0.20)	-0.050 (0.19)
Time Trend	N	Y	Y	Y
Day of Week	N	N	Y	Y
Crew	N	N	N	Y
N	21,964	21,964	21,531	21,531
F-stat	1296.10	1511.65	1025.88	475.03
R ²	0.228	0.292	0.344	0.456

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Preliminary Results

To Summarize:

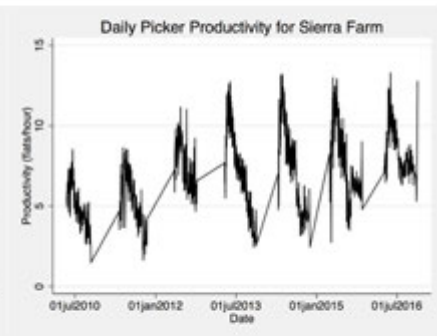
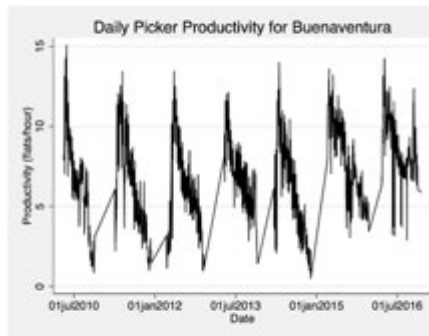
- Significant productivity losses in the short-run for low-types only.
 - 50 seconds - 1 minute slower delivering *each flat*.
- In this sample, low-types constitute roughly half of the pickers
 - In the short-run, this is a substantial productivity loss for the workforce.
- Controlling for crew removes baseline significance of worker productivities.

Current Work: New Data

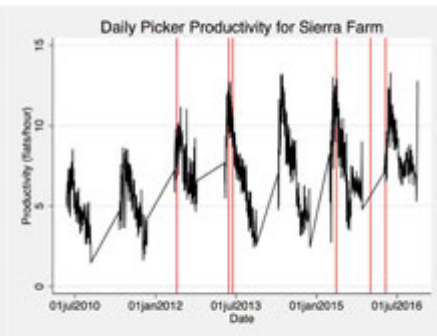
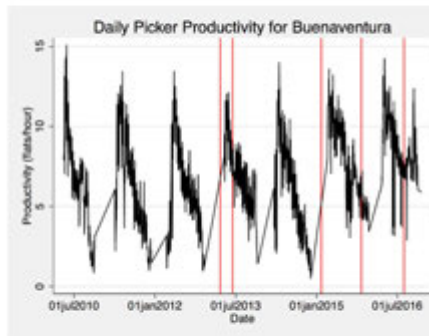
Sierra Farms

- 67 acre berry farm in Watsonville
- Panel Data from 2010 - 2016
- Wage rates differ from Buenaventura (both piece rate and minimum wages)

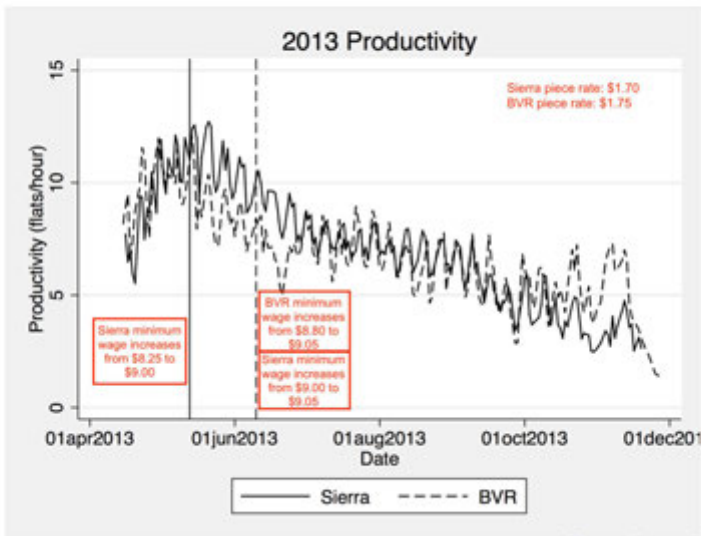
Trends in Productivity



Productivity and Minimum Wage Increases



2013 Minimum Wage Changes



Future Work

Next Steps

- Defining Low, Medium, and High Productivity Workers
- Consider short and long-run effects
- Using differential wage changes at the ranches
- Effects of a change to the piece rate wage
- Other applications of these data

Thank You!



Theoretical Model

$$\max_e U = w(q(e, s, \theta)) - c(e) - \lambda[q(\theta) - q(e, s, \theta)]$$

- $w(\cdot)$ is the wage, $q(\cdot)$ is output, $c(\cdot)$ is the cost function
- e is effort, s is skill, θ are external factors (e.g. harvest abundance)
- $\underline{q}(\theta)$ is the minimum output required to keep the job
- $\lambda \geq 0$

Back to [Theoretical Framework](#)

Theoretical Model

First Order Condition:

$$w_q q_e + \lambda q_e = c' \quad (1)$$

Back to [Theoretical Framework](#)

Theoretical Model

Piece Rate and the Minimum Wage:

- The pure piece rate wage is expressed as: $w = r \cdot q$
- The piece rate wage with a minimum wage is expressed as: $w = \max\{\underline{w}_0, r \cdot q\}$

First Order Conditions :

$$\lambda q_e = c' \quad \text{if } \underline{w}_0 \geq r \cdot q^*; \lambda \geq 0$$
$$r \cdot q_e + \lambda q_e = c' \quad \text{if } \underline{w}_0 < r \cdot q^*; \lambda \geq 0$$

Back to [Theoretical Framework](#)

Supplemental: BVR Data

Table: Number of Workers in the BVR Data

Year	Total Observations	Unique Farmworkers	Unique Pickers
2010	41,955	651	548
2011	71,617	920	826
2012	64,240	1,128	1,002
2013	65,500	1,398	1,092
2014	85,463	1,544	1,232
2015	105,808	2,422	1,787
2016	60,220	2,594	1,527
Total	494,803	6,676	5,020

Back to [BVR Data](#)

Supplemental: BVR Data

Table: Summary of (All) Worker Retention

Years in Data	Frequency	Percent
1	4,608	69.11
2	1,152	17.28
3	409	6.13
4	217	3.25
5	120	1.80
6	84	1.26
7	78	1.17

Back to [BVR Data](#)

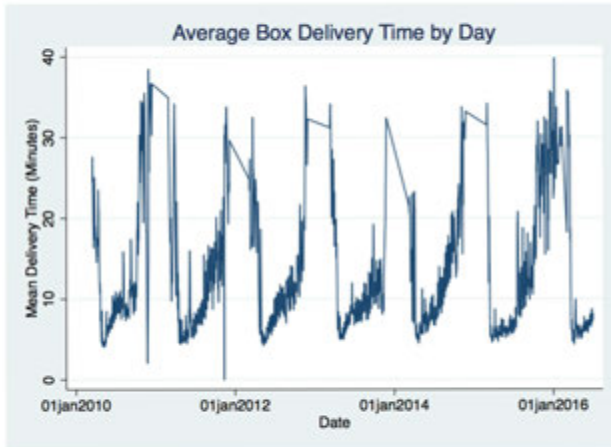
Supplemental: BVR Data

Table: Summary of Picker Retention

Years in Data	Frequency	Percent
1	3,432	68.37
2	876	17.45
3	348	6.93
4	173	3.45
5	91	1.81
6	61	1.22
7	39	0.78

Back to [BVR Data](#)

Supplemental: BVR Data



Back to [BVR Data](#)

Supplemental: BVR Data

Year	Rate per flat (\$)		Daily Flats Delivered		Hourly Rate (\$/hr)	
	Mean	Min/Max	Mean	Min/Max	Mean	Min/Max
2010	1.60 (.01)	Min: 1.60 Max: 2.00	38.22 (28.96)	Min: 1 Max: 167	10.07 (5.57)	Min: 0 Max: 60
2011	1.73 (.14)	Min: 1.60 Max: 2.00	26.75 (25.68)	Min: 1 Max: 189	10.31 (5.34)	Min: 0 Max: 137.65
2012	1.79 (.17)	Min: 1.60 Max: 2.15	30.96 (24.04)	Min: 1 Max: 151	11.59 (5.42)	Min: 0 Max: 120
2013	1.87 (.14)	Min: 1.75 Max: 2.15	29.38 (21.41)	Min: 1 Max: 122	12.98 (6.07)	Min: 0 Max: 150
2014	2.39 (.58)	Min: 1.75 Max: 3.00	26.35 (24.50)	Min: 1 Max: 156	11.73 (6.44)	Min: 0 Max: 175
2015	1.85 (.21)	Min: 1.75 Max: 3.00	24.88 (18.37)	Min: 1 Max: 138	15.90 (6.42)	Min: 0 Max: 153.13
2016	1.90 (.09)	Min: 1.85 Max: 2.20	33.73 (23.54)	Min: 1 Max: 150	17.78 (5.17)	Min: 0 Max: 82.5

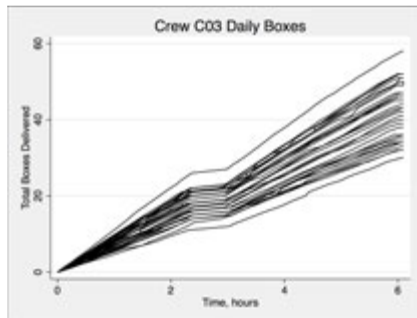
Back to [BVR Data](#)

Hourly Wage Rate by Crew, 2013

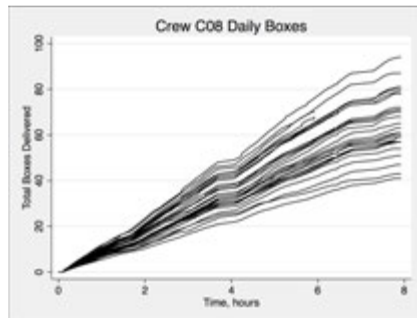
Crew #	Mean	SD	Min	Max
1	12.24	(5.71)	0.35	52.5
2	9.89	(6.27)	0.49	43.75
3	11.60	(6.45)	1.44	48.48
4	12.15	(6.18)	0.44	65.63
5	12.83	(5.44)	1.33	100.00
6	14.30	(5.99)	0.71	150.00
7	14.67	(5.52)	1.17	52.50
8	15.38	(6.65)	1.71	105.00
9	12.37	(5.09)	0.81	105.00
10	13.41	(5.65)	0.96	58.82
11	15.03	(5.83)	1.43	82.35
12	14.38	(5.78)	2.41	150.00
13	12.53	(5.97)	0.22	150.00
14	12.79	(4.77)	0.84	75.00
15	13.70	(5.58)	1.11	105.00
16	11.92	(4.63)	1.23	40.00

Back to [Paper 2](#)

Example Crew Productivity on 6/01/2013



(a) Example Low Productivity Crew



(b) Example High Productivity Crew

Back to [Paper 2](#)

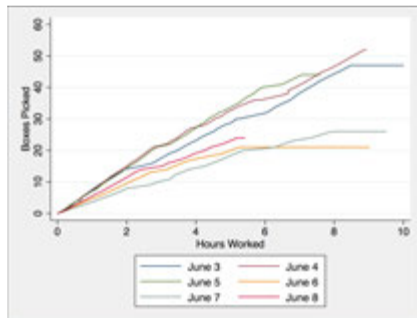
Supplemental: BVR Data

Table: Percent of Workers Receiving the Minimum Wage Adjustment

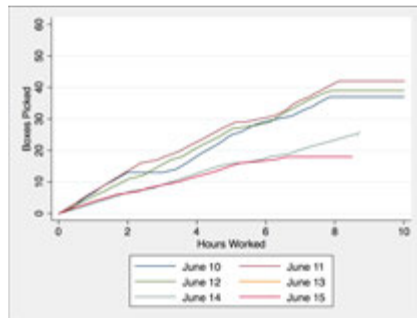
Year	At Least 1 Time %	At Least 3 Times %	5+ %
2010	96.35	93.98	91.06
2011	91.28	83.29	78.09
2012	83.33	72.75	67.66
2013	70.79	59.34	52.11
2014	85.88	73.62	67.21
2015	67.82	52.21	44.10

Back to [BVR Data](#)

Example Low-type Productivity



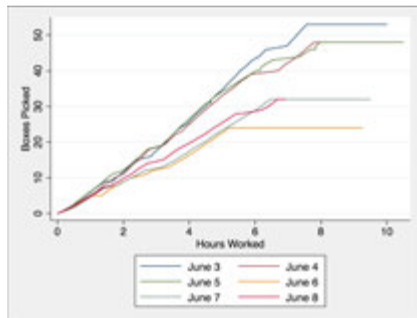
(a) Week Before Minimum Wage Δ



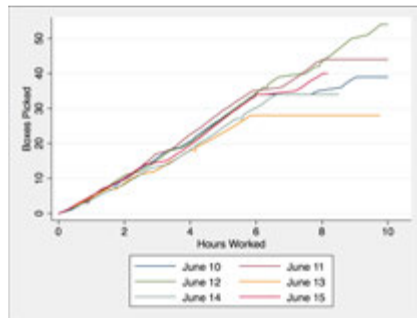
(b) Week After Minimum Wage Δ

Back to [Data](#)

Example Med-type Productivity



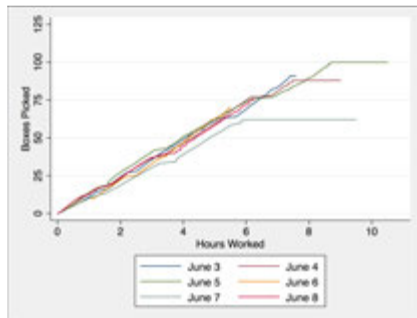
(a) Week Before Minimum Wage Δ



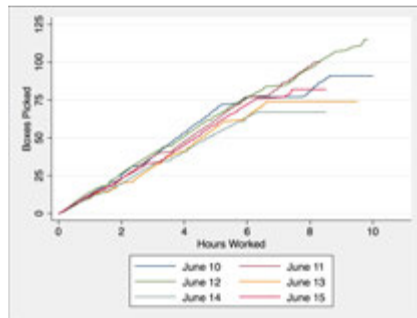
(b) Week After Minimum Wage Δ

Back to [Data](#)

Example High-type Productivity



(a) Week Before Minimum Wage Δ



(b) Week After Minimum Wage Δ

Back to [Data](#)

Supplemental: Empirical Model

$$y_{it} = \beta_0 + \beta_1 t + \beta_2 L_i + \beta_3 M_i + \beta_4 \text{dow}_t + \beta_5 (L_i \cdot \text{dow}_t) \\ + \beta_6 (M_i \cdot \text{dow}_t) + \beta_7 \text{crew}_i + \delta_1 \text{Post}_t + \delta_2 (L_i \cdot \text{Post}_t) \\ + \delta_3 (M_i \cdot \text{Post}_t) + \epsilon_{it}$$

- y_{it} is the average time to deliver a box for worker i on day t
- t is a time trend, L_i and M_i indicated whether the worker is a low-type or high-type
- dow_t is a factor variable that indicates the day of the week
- Post is a binary indicator equal to one after the minimum wage change

Back to [Results](#)