

Job Change and Self-Control of Waste Pickers: Evidence from a Field Experiment in the Philippines

September 2015

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Background

- Public policies often require job changes to workers in specific industries and/or resettlement of residents.
Ex. Construction of dams or roads.
- Another example is a change in municipal solid waste disposal policy from open dumping to sanitary landfilling.
- It requires a job change of people who pick up recyclable waste at a dumpsite (so called *waste pickers; WP*).
- Open dumping is widely used methods mainly in developing countries.
- Switching to environmentally friendly disposal methods result in landfilling or burning waste and it will inevitably disturb a job of WP (Paul et al. 2012).





Example of sanitary landfills: Bayawan city in the Philippines



Motivation

- Agents operating waste management services plan to close open dumpsite in order to decrease environmental cost of solid waste.
- They face a normative expectation to provide opportunities of alternative employments viable for waste pickers.
- Note that waste pickers prefer their occupation because of its earning and flexibility (Medina 2000).

Minimize social cost of solid waste.

Priority 1. **Maximize the number of job changes.**

Priority 2. **Make workers to pay an efficient level of effort.**

- Municipalities wish no moral hazard by workers.

Priority 3. **Raise a profit.**

- Municipalities do not want to make a loss from hiring WP.
- Hopefully, they want to raise a profit from hiring WP.

Steps toward the objective

- Two steps (at least) towards inducing a job change of workers in a specific industry.
 1. Municipalities find or create a job.
 2. Given this alternative job, municipalities make targeted workers to take up it as many as possible.
- This study examines the second step above.
- This study offer a new job to dumpsite WP and promote them to take up it.

Research Questions

Assuming that municipalities already found enough employment,

RQ1 What percent of WP can we successfully induce to change a job using a job offer with output-based pay (performance pay)?

RQ2 Do changes in payment schemes of job offers increase the number of WP who take up an alternative job?

Payment schemes we examine:

- (i) How to determine the level of salary
(Output-based and/or input-based pay)
- (ii) Payment frequency

RQ3 Can municipalities raise a profit from that business while keeping the number of job changes constant?

Method: Field survey and experiment

This study conducted a field experiment at a dumpsite to examine three RQs above.

- Field survey: August 2013
- **Job offer experiment**: November 2013
- Production experiment: December 2013

This study focuses on “Job offer experiment.”

Four types of job offer letters are prepared. Only one type of the letters was randomly distributed to each WP.

112 WP received the letter.

The number of WP who accept the offer is observed.

Related literatures and Contributions (1)

Development studies

Understanding preferences and behaviors of waste pickers.

Hayami, Dikshit and Mishra (2006) *JDS*

“Waste pickers and collectors in Delhi: Poverty and Environment in an urban informal sector”

Gill (2007) *JDS*

This study is the first study that made an intervention to the lives of waste pickers.

Incentive schemes and behavior of workers

Hamilton, Nickerson and Owan (2003) *JPE*

Bandiera, Barankay and Rasul (2005) *QJE*

This study investigate the effect of the change in payment schemes mentioned in job offers on the rate of taking it up.

Our framework of a field experiment can be applied to any other settings of studies related to labor supply.

Related literatures and Contributions (2)

Environmental policy and job loss

Morgenstern, Pizer and Shih (2002) *JEEM*

Walker (2011) *AER*

Give an insight on how to mitigate social cost of environmental policies regarding to labor market.

Behavioral economics of self-control

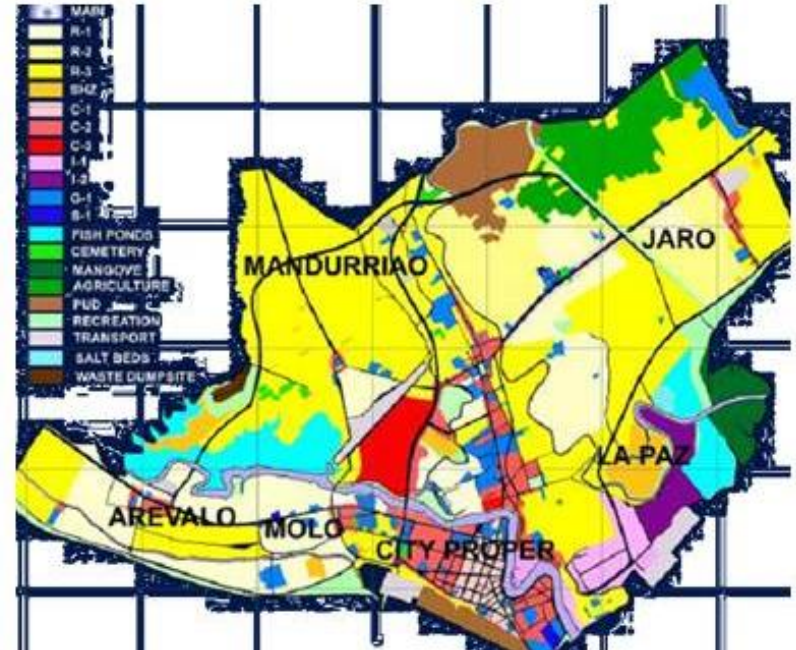
Ashraf, Karlan and Yin (2006) *QJE*

Kaur, Kremer and Mullainathan (forthcoming) *JPE*

We found the evidence of self-control at a job change of the waste pickers.

2. The current and the offered job

Study area



<http://www.swm4lgus.net/partner-lgu/IloiloCity.php>

Iloilo city, the Philippines

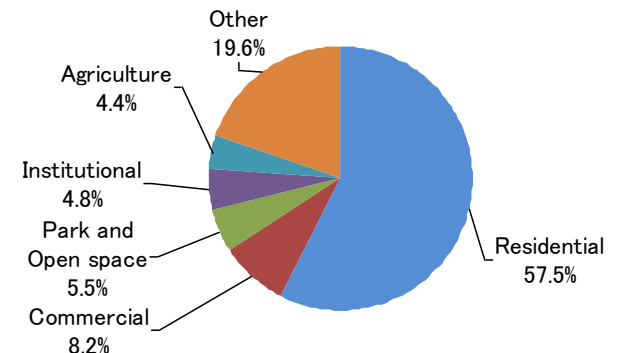
Population: 437,366 (2012)

Size: 78.34 km²

Population density: 5,583 persons/km² (2011)

Share of business:

Service 82%, Manufacturing 14%, Agriculture 4%.



Main land use of Iloilo city
(SWM4LGUs, <http://www.swm4lgus.net/>)























The current job: A job of picking waste

- They pick waste papers, metals, cans, plastic bottles and anything can be sold.
- They sell waste to middlemen.
- They can obtain cash everyday by selling waste.
- Working conditions are bad. Bad smell, hot and humid.
- In the case of Iloilo, WP are not employed by anyone.
- The working time is flexible.
- The level of earning is determined by their output.
- Entry to this industry seems easy.
- There are movements to develop an association of WP.

Dumpsite WP at Iloilo

From our interview survey (240 WP, 18 years old and older):

The average age of WP: 34.9 years old

A share of female: 52%

The average years of education: 7 years (Min 0, Max 13)

The average daily earnings by waste picking: 123.8 PHP (=2.83 USD) (Min 30 PHP, Max 480 PHP)

c.f. Minimum wage at Iloilo: 245-287 PHP/day

The program for dumpsite WP at Iloilo

Paul et al. (2012) *Waste Management*

In 2005, the city government of Iloilo planned to eventually shutdown the open dumpsite from 2007 and switch to a sanitary landfill.

Since 2006, the city government, German International Cooperation (GIZ) and NGO LOOB started programs of supporting livelihoods of dumpsite waste pickers at Iloilo.

The objective of these programs are, supporting poor workers at the dumpsite, promoting them to stop picking waste and providing an opportunities of alternative jobs.

In addition, the city gov't and GIZ developed **an association of dumpsite waste pickers** (UCLA).

One alternative job that the program has just started to provide is production of **briquettes made from waste papers** generated at University.

The meeting place of the association



The offered job: A job of producing PB

What kind of a new job do we propose?

A job of producing **paper briquettes (PB)**:

The paper briquette is solid fuel made by waste paper, rice husk and saw dust.

It is used for cooking instead of charcoal.

Central Philippine University (CPU) with a support from GLZ developed technology to produce this PB.













3. Job change and payment schemes

3.2 Simple model of a job change (1)

$$U(s, e, r, w)$$

U : Utility from a job

s : The level of payment (salary)

e : The level of effort

r : Frequency of the salary payment

w : Working conditions

where $\frac{\partial U}{\partial s} > 0, \frac{\partial U}{\partial e} < 0, \frac{\partial U}{\partial w} > 0$.

f : The level of output of the worker, and

$$f(e)$$

If the job is an output-based pay (performance pay), it means

$$s(f)$$

3.2 Simple model of a job change (2)

A worker takes up a new job ($C = 1$) if,

$$U(s_{off}, e_{off}, r_{off}, w_{off}) > U(s_{cur}, e_{cur}, r_{cur}, w_{cur}) \quad (1)$$

x_{off} : Variable x when a worker takes up an offered job

x_{cur} : Variable x when a worker remains a current job

4 types of payment schemes

Table I Payment schemes of the four groups

	Group 1	Group 2	Group 3	Group 4
Way to determine salary level	Output-based pay	Output-based pay with a draw	Input-based pay	Output-based pay
	1 PHP per 4 pieces of production	A draw of 30 PHP per day, and 1 PHP per 4 pieces of additional production of more than 150 pieces	65 PHP per day	1 PHP per 4 pieces of production
Frequency of the payment	Once in three days			Everyday

3.3 Payment schemes we offered

If a firm can observe output of workers without cost, it should pay depending on it. (Lazear, 1998)

The optimal level of a payment to workers should be equal to the net revenue.

(Set the commission rate to exhaust total revenue.)

In other word,

$(\text{Payment per production}) = (\text{Price}) - (\text{VC other than wage}).$

This payment scheme ($P=MC$) will make workers to pay efficient levels of effort.

Note that the firm cannot raise a profit.

Output-based pay for PB production

The PB production is easy to measure output of workers.

Thus, output-based pay (OBP) would be the best payment scheme.

40 pieces (1 kg) can be sold with 15 PHP to retail shops.

Cost of input materials to produce 40 pcs is around 5 PHP.

Thus,

$$X = 15 - 5$$

(Payment per 40 pcs production) = (Price) – (VC other than wage).

The optimal compensation will be

1 PHP per 4 pcs (10 PHP per 40 pcs).

How to raise a profit?

Lazear (1998) “A draw”

The mix of input-based (fixed rate) and output-based pay.

However, it does not decrease marginal payment.

Workers are guaranteed a certain amount of salary (a draw).

But workers receive no commission until they have produced at least the threshold level.

Exceeding that production level, workers begin to earn the same rate as the pure output-based pay.

Ex. 30 PHP of a draw until 150 pcs. 1 PHP per 4 pcs for the additional production above 150 pcs.

(c.f. 37.5 PHP for 150 pcs if it adopts the pure output-based pay.)

This leads 7.5 PHP of profit per workers per day.

Input-based pay

For the comparison, we propose not only output-based but also input-based pay (IBP).

Our ultimate target is to induce a job change for 100% of WP who received a offer.

However, this is quite difficult to achieve.

We set our initial target as 15% of the recipient.

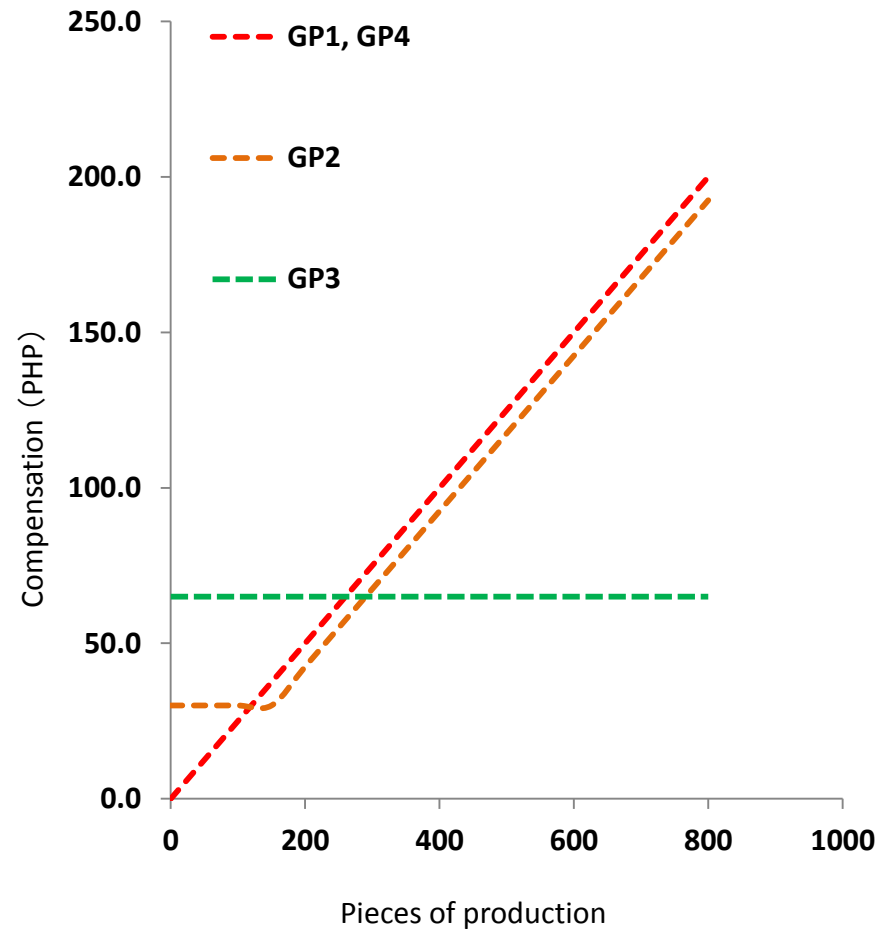
We found from the survey that 15% of WP's daily earning is equal to or less than 65 PHP.

So we decided to propose 65 PHP per day of fixed rate, no matter how many they produce.

Examples and graph of payment schemes

Pieces of production
and payment by groups

Pcs	PP (GP1, GP4)	PP /a draw (GP2)	FP (GP3)
100	25	30	65
120	30	30	65
150	37.5	30	65
200	50	$30 + (50/4) = 42.5$	65
260	65	$30 + (110/4) = 57.5$	65
290	72.5	$30 + (140/4) = 65$	65
500	125	117.5	65
800	200	192.5	65
1,000	250	242.5	65



Frequency of the payment

We examine whether a change in frequency of the payment affect to the decision to take up a job.

Since a dumpsite waste picking can earn cash everyday, we consider a **daily** payment scheme.

However, since frequent payment incurs administrative cost, we examine **once every three days** (twice a week) payment scheme.

Four types of payment schemes

Table I Payment schemes of the four groups

Group	1	2	3	4
Way to determine the level of the salary	Performance pay	Performance pay with a draw	Fixed-rate pay	Performance pay
	1 PHP per four pieces of production	A draw of 30 PHP per day, and 1PHP per four pieces of additional production greater than 150 pieces	65 PHP per day	1 PHP per four pieces of production
Frequency of the payment	Once every three days			Daily

Econometric framework

Estimation model for the effects of different payment schemes on taking up an offered job:

$$C_i^* = \beta_{draw} D_{draw,i} + \beta_{fr} D_{fr,i} + \beta_{daily} D_{daily,i} + \gamma X_i + \epsilon_i,$$

C_i : An indicator variable for take up the job offer by WP i

$D_{draw,i}$: An indicator variable for receiving OBP with a draw

$D_{fr,i}$: An indicator variable for receiving IBP

$D_{daily,i}$: An indicator variable for receiving OBP every day

X_i : A vector of demographic and other survey responses

ϵ_i : An error term for WP i

Hypotheses

Compare to the offer for Group 1:

- (i) Offer for group 2 will not affect the probability to accept since 30 PHP is a small amount and it is difficult to calculate the expected compensation.

Thus, a municipality can raise a profit while keeping efficiency. However, “at least 30 PHP” might send them a signal of a not good job.

- (ii) Offer for group 4 will increase the probability to accept since WP are now earning everyday.

Observing offer for group 3 might be still insightful since it will give us casual comparison between OBP and IBP.

We might be able to say “OBP is (less) attractive than IBP of 65 PHP.”

3.4 Survey

August 2013

4 enumerators

240 waste pickers (≤ 18 years old, those who do not receive any job from the program)

One interview took around 30 to 45 minutes.

- Demographic questions
- WTA a shutdown of the dumpsite for a month of December 2013
- Hypothetical risk preference questions
(Binswanger 1980, Holt and Laury 2002)
- Hypothetical time preference questions
(Thaler 1981, Benzion et al. 1989)
- Do you want to join the job of producing PB?
90% of WP answered “Yes”



Main gameCircle the answer

✱

No. of Qs	A			B					Answer
1	500	PHP	OR	750	PHP	or	50	PHP	A • B
2	500	PHP		750	PHP	or	150	PHP	A • B
3	500	PHP		750	PHP	or	200	PHP	A • B
4	500	PHP		750	PHP	or	300	PHP	A • B
5	500	PHP		750	PHP	or	350	PHP	A • B
6	500	PHP		750	PHP	or	400	PHP	A • B
7	500	PHP		750	PHP	or	450	PHP	A • B
8	500	PHP		750	PHP	or	500	PHP	A • B

✱After the respondent finishes answering, confirm the answers whether they are correct or not.

Main game **Set 5**

Circle the answer

No. of Qs	A					B			Answer
1	600	PHP	in	2 weeks	or	100	PHP	Today	A • B
2	600	PHP	in	2 weeks		200	PHP	Today	A • B
3	600	PHP	in	2 weeks		300	PHP	Today	A • B
4	600	PHP	in	2 weeks		400	PHP	Today	A • B
5	600	PHP	in	2 weeks		500	PHP	Today	A • B



Main game Set 4

Round	A	B	Score
1	600 PUP na 3 days	100 PUP Nasyon	A - B
2	600 PUP na 3 days	800 PUP Nasyon	A - B
3	600 PUP na 3 days	600 PUP Nasyon	A - B
4	600 PUP na 3 days	400 PUP Nasyon	A - B
5	600 PUP na 3 days	200 PUP Nasyon	A - B



Distribution of job offer letters

4 days: November 22, 23, 25 and 26.

An author and RA (CPU) as an translator.

- Starting from the association house with a help of vice president
- Climbing up the dump hill and visiting their houses along the dumpsite to find WP who we interviewed.

RA **shuffles the four cards** and show them with faces down to WP.

WP picks up one card.

The type of job offer letter is determined by the card WP chose.

Only one type of offer letter among four types is given to one WP.

Example of offer letters

JOB OPPOTUNITY ~Paper Briquette Producer~

Background

The University of Tokyo and Central Philippine University (CPU) will conduct an alternative livelihood project of producing paper briquettes for the people living in Calajunan, Iloilo city. Now we are looking for the following people who will participate in this project.

Job description

You will be tasked to produce paper briquettes with machines which were developed by CPU. The all materials and the equipment needed for the production will be provided by us. Technical staffs who instruct how to use the machines will be with you and support you everyday.

Working Patterns

- Monday - Saturday from 27th November to 18th December, 2013 for 16 days
- Duty hours: 5 hours from 10 am to 4 pm (including 1 hour for lunch time)

Working Place

Uswag Calajunan Livelihood Association Center

Number of vacancies

More than 16 people

Requirement

- Attendance for an orientation for the project on 27th.
- Open-minded or friendly. Both of male and female, old and young are welcome.

Flow of the application and after-the application

Application Period From 21th Nov 2013 to 26th Nov 2013

↓

An orientation for participants 27th Nov, 2013

↓

The production of Paper briquettes From 27th Nov 2013 to 18th Dec 2013.

How to apply?

Please fulfill the following application form and submit it at the fixed place in UCLA center until 26th November.

Page 2 of an offer letter of group 1

WHY DON'T YOU JOIN PAPER BRIQUETTE PRODUCTION?

■ Allowance

- 1 PHP per 4 pieces of paper briquettes

* Your salary will depend on the amount of your production.

- Payment will be done twice a week

*You will be paid your salary for 3 days on every Wednesday and Saturday



Contact:

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[1]



Econometric framework

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X_i : A vector of demographic and other survey responses

ϵ_i : An error term for WP i

A job change

Those who decided to accept the offered job are required to attend the orientation on November 27.

Orientation

We explained about the job in detail, demonstrated how to produce PB, and noticed about the payment scheme for each.

We defined the one who attended this orientation and continued to work on this job for three weeks as an individual who accepted the offered job and stopped picking waste.



Table 3 Summary statistics

Group		1	2	3	4
Payment schemes	All the recipients of the letter	Perform. pay/ once in 3 days	Perform. pay with a draw/ once in 3 days	Fixed rate pay/ once in 3 days	Perform. pay/ Everyday
Female	0.500 (0.502)	0.500 (0.512)	0.536 (0.508)	0.471 (0.507)	0.500 (0.509)
Age	34.62 (12.36)	33.36 (12.70)	35.93 (13.38)	34.94 (13.41)	33.89 (10.00)
Years of education	7.246 (2.692)	7.114 (2.600)	7.321 (2.389)	7.147 (2.893)	7.393 (2.923)
Average hourly earnings	19.99 (11.46)	22.05 (15.22)	22.30 (13.48)	16.75 (7.831)	20.00 (9.013)
Sell to the association	0.348 (0.479)	0.227 (0.429)	0.357 (0.488)	0.382 (0.493)	0.393 (0.497)
No other workforce in HH	0.196 (0.399)	0.136 (0.351)	0.214 (0.418)	0.206 (0.410)	0.214 (0.418)
No other job	0.688 (0.466)	0.636 (0.492)	0.714 (0.460)	0.735 (0.448)	0.643 (0.488)
Want to join PB production	0.920 (0.273)	0.909 (0.294)	0.964 (0.189)	0.971 (0.171)	0.821 (0.390)
Risk averseness	6.768 (2.238)	7.318 (1.912)	6.179 (2.611)	6.735 (1.912)	6.964 (2.411)
Discount rate	3.027 (2.033)	2.500 (1.946)	3.286 (2.141)	3.000 (2.000)	3.214 (2.061)
Willingness to accept closure	5541 (3016)	5568 (2331)	5536 (2899)	5909 (3694)	5058 (2787)
Observations	112	22	28	34	28

4. Results

Descriptive results

17 WP (15.2%) applied to the offered job and joined the PB production for 3 weeks.

	Group 1	Group 2	Group 3	Group 4
Way to determine salary level	Performance pay	Performance pay with a draw	Fixed rate pay	Performance pay
	1 PHP per 4 pieces of production	A draw of 30 PHP per day, and 1 PHP per 4 pieces of additional production of more than 150 pieces	65 PHP per day	1 PHP per 4 pieces of production
Frequency of the payment	Once every three days			Daily
Number of Offer received	22	28	34	28
Number of the job changes	6	5	4	2
Share of the job changes	27.3%	17.9%	11.8%	7.1%

Logit estimation result (Coefficients)

Dependent variable is 1 if the offer is accepted and 0 otherwise.				
	(1)	(2)	(3)	(4)
Performance pay with a draw	-0.5452 (0.6906)	-0.9014 (0.7818)	-1.1038 (0.7610)	-1.1969 (0.8235)
Fixed-rate pay	-1.0341 (0.7191)	-1.4138* (0.8177)	-1.6915* (0.9374)	-1.5543* (0.8986)
Daily payment	-1.5841* (0.8801)	-2.2260** (1.0005)	-2.1712** (0.9529)	-2.4438** (1.0076)
Female		1.6071** (0.6977)	1.4664** (0.7283)	1.5604* (0.8103)
Age		0.0039 (0.0290)	0.0058 (0.0317)	0.0152 (0.0355)
Years of education		0.0074 (0.1077)	0.0335 (0.1147)	0.0320 (0.1220)
Average hourly earnings		0.0171 (0.0255)	0.0191 (0.0264)	0.0373 (0.0311)
Selling to the association		1.7475*** (0.6005)	1.7488*** (0.6334)	2.0995*** (0.6603)
No other income earner in HH		-1.5853 (1.1572)	-1.7054* (1.0360)	-2.0844* (1.0898)
No other job		-0.3412 (0.8007)	-0.4404 (0.8284)	-0.2391 (0.8559)
Wants to join PB production		0.4375 (1.2320)	1.0929 (1.2197)	1.6963 (1.4254)
Risk averseness			-0.1716 (0.1404)	-0.2296* (0.1295)
Discounting rate			0.0761 (0.1829)	0.0698 (0.2000)
Willingness to accept closure				-0.0002 (0.0001)
Observations	112	112	112	109
Log-likelihood	-45.55	-37.55	-36.65	-34.90
Wald χ squared	3.992	24.78	24.07	29.49
Pseudo R squared	0.0449	0.2125	0.2315	0.2605

Coefficients are reported. Robust standard errors are in parentheses.

*** Indicates statistically significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Marginal effects: Table 5

Dependent variable is 1 if the offer is accepted and 0 otherwise.			
	(1)	(2)	(3)
Performance pay with a draw	-0.172 (0.137)		
Fixed-rate pay		-0.225* (0.134)	
Daily payment			-0.304** (0.150)
Variables that are set to zero or their mean value.			
Performance pay with a draw	Mean	Zero	Zero
Fixed-rate pay	Zero	Mean	Zero
Daily payment	Zero	Zero	Mean
Variables that are set to their mean values.			
Female, Selling to the association, No other income earner in HH, and Risk averseness		Mean	
Observations	112	112	112

Robust standard errors in parentheses. *** Indicates statistically significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Changing the payment scheme from once in three days payment to everyday decreases the probability to take up the offer by 30.4% points.

A Self-Control problem of WP?

- If WP have time-inconsistent preferences on savings and are sophisticated enough to recognize that, they might want to control themselves.
- Use a less frequent payment job as a commitment device for savings.

Self-control at a job change decision making by WP.

Anecdotal evidence

- A conversation with a worker in Group 1.
Happy with a large amount of salary on the end of the third day.
- Conversations with workers in Group 4.
Two asked us to pay the salary 2 weeks later claiming they wanted to make savings with this payment scheme.

A Self-Control problem of WP?

- If WP have time-inconsistent preferences on savings and are sophisticated enough to recognize that, they might want to control themselves.
- Use a less frequent payment job as a commitment device for savings.

Self-control at a job change decision making by WP.

Table 6: Accepting an offered job with interaction terms:
Coefficients (Logit estimations)

Dependent variable is 1 if the offer is accepted and 0 otherwise.		
	(1)	(2)
Performance pay with a draw	-6.1505*** (2.0014)	-6.7956*** (2.2229)
Performance pay with a draw * Risk averseness	0.7054** (0.3024)	0.7435** (0.3353)
Fixed-rate pay	-8.9772*** (2.4217)	-10.5367*** (2.7515)
Fixed-rate pay * Risk averseness	1.0635*** (0.3573)	1.2416*** (0.3854)
Daily payment	-9.0655*** (2.2573)	-9.4836*** (2.4396)
Daily payment * Discounting rate	1.5801*** (0.4920)	1.6034*** (0.5169)
Risk averseness	-0.8092*** (0.2128)	-0.9847*** (0.2555)
Discounting rate	-0.1824 (0.1874)	-0.1481 (0.1896)
Female	2.3772** (0.9250)	2.3971** (0.9913)
Age	-0.0062 (0.0270)	-0.0075 (0.0312)
Years of education	0.0958 (0.1211)	0.0673 (0.1114)
Average hourly earnings	0.0320 (0.0256)	0.0404 (0.0272)
Selling to the association	2.2101*** (0.7997)	2.4994*** (0.8057)
No other income earners in the HH		-1.5356 (1.1694)
No other job		-0.2678 (0.9990)
Wants to join PB production		2.7827** (1.2678)
Observations	112	112
Log-likelihood	-33.77	-31.71
Wald χ squared	30.11	31.96
Pseudo R squared	0.2918	0.3351

Findings and Discussions

- Job offers with uncertainty in salary level (output-based pay) attracted 7%-27% of WP.
- 13 out of 17 of them are female.
- Changing frequency of the payment from once in three days to everyday decreases probability to take up by 30% points.
- Evidence of “self-control” behavior by poors in a developing country.

C.f. Ashraf, Karlan and Yin (2006) “Self-control on saving”

Kaur, Kremer and Mullainathan (forthcoming) “Self-control at work”

Conclusion

- Environmental policies often enforce job changes to workers in a certain industry. This can be considered as social cost of environmental policies.
- We have found that a change in payment frequency from once every three days to daily will decrease a probability to accept an offer.
- The performance pay with once in three days payment scheme can mitigate self-control problem in saving while solving moral hazard problem at work.
- The idea of providing an alternative job with less frequent payment as a commitment device for mitigating self-control problem would be also useful for future studies.

Appendix. Production experiment

Production experiment

Seventeen workers engaged in the production.

They were paid according to the job offer letter they received.

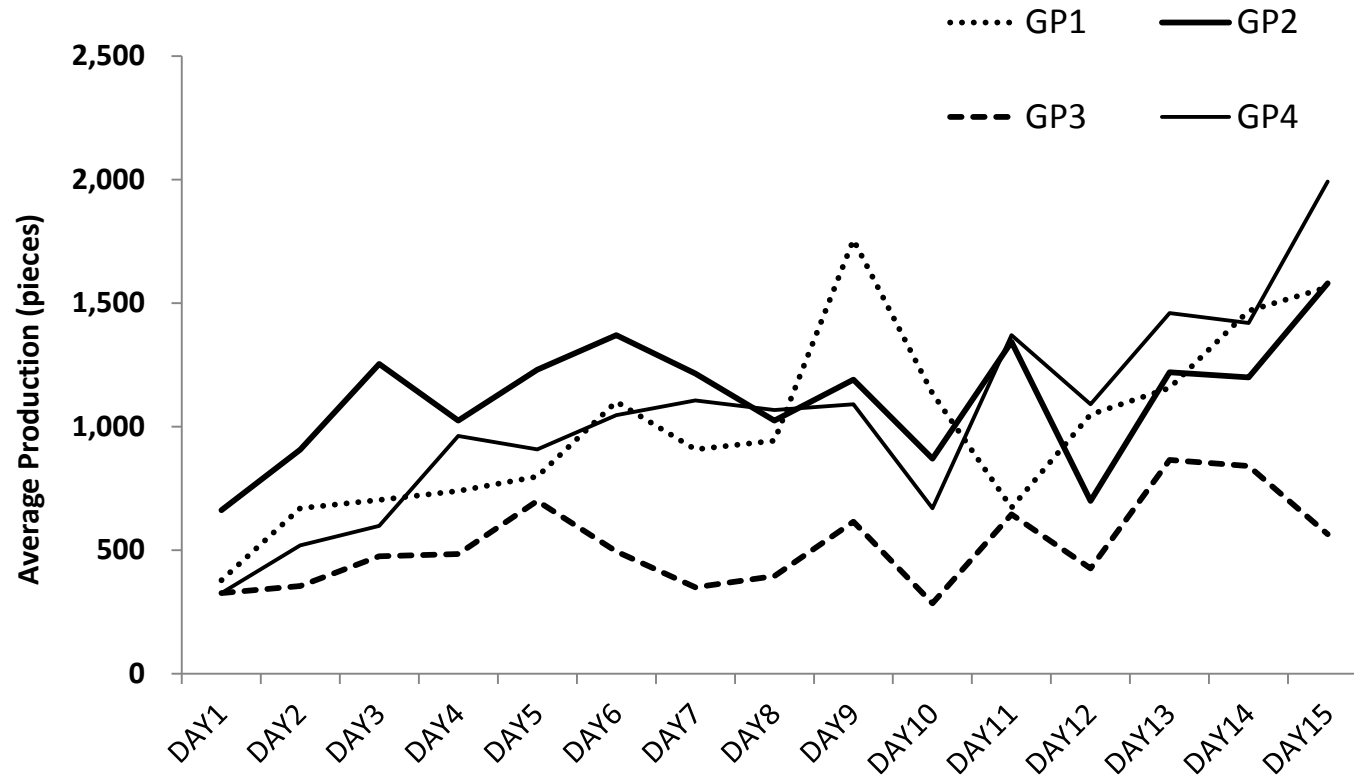
We observed 15 days from November 28.







Descriptive result



Production (pieces)	Batch1			Batch2			Batch3			Batch4			Batch5		
	DAY1	DAY2	DAY3	DAY4	DAY5	DAY6	DAY7	DAY8	DAY9	DAY10	DAY11	DAY12	DAY13	DAY14	DAY15
GP1	584			879			1,203			952			1,397		
GP2	941			1,208			1,143			971			1,333		
GP3	386			560			453			452			757		
GP4	482			973			1,088			1,044			1,624		