

Asymmetric Information and Remittances: Evidence from Matched Administrative Data

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Migration and Remittances

- International migration can generate enormous welfare gains (Clemens 2011)
 - ▶ Rapid growth in international migration: 154 million in 1990 to 230 million in 2013 (UN 2013)
- Remittances have been shown to improve the economic outcomes of households in developing countries (Yang 2008)
 - ▶ Remittances flows estimated at over \$400 billion in 2009
 - ▶ Exceeded foreign aid (\$104 billion in 2007) and approaching foreign direct investment (over \$1 trillion in 2009 from OECD estimates)


Paper Agenda

- How does asymmetric information about migrants' income affect their remittance decisions?
 - ▶ Geographic separation increases potential for information asymmetries
- Context: International migration to the United Arab Emirates (UAE)
 - ▶ Over 8 million international migrants
 - ▶ 5th largest stock of migrants in the world

Approach

- Unique linked data sets:
 - ▶ high frequency administrative remittance transactions of migrants
 - ▶ administrative records on monthly salary disbursements of migrants in the UAE
- Simple, new framework on remittance decisions of migrants
- Variety of fluctuations in migrants' incomes that vary in their observability by households at home and in other characteristics

Exploiting Different Income Fluctuations

- Observable - easy for households to verify
 1. Seasonalities and Ramadan
 2. Weather shocks - heat and rain
 3. Labor reform
- Hard for households to observe
 4. Rate of economic assimilation varies by individual
- Other differences in characteristics 
 - ▶ Permanence
 - ▶ Anticipation
- Results preview: remittances will move with earnings in all cases except when the income can be hidden from the family at home

Literature: Asymmetric Information in Households

- Resource allocation within households (who controls income or assets) has important implications for outcomes including savings, consumption, childrens' outcomes
 - ▶ Anderson and Eswaran 2009, Duflo 2003, Luke and Munshi 2011, Thomas 1990, Wang 2014
- Theoretical models of non-unitary households have largely assumed perfect information
 - ▶ Chiappori 1992, Manser & Brown 1980, McElroy & Horney 1981, Lundberg & Pollack 1993

- Growing evidence that public versus private nature of information (on income or assets) mattering for outcomes
 - ▶ Lab experiments: Ambler 2014, Ashraf 2009, Jakiela and Ozier 2012
 - ▶ Field experiments: Goldberg 2011
 - ▶ Experimental evidence is limited to windfalls
 - ★ transitory, unanticipated, rare, small
- Key contribution: Real-world variation in earned income including permanent and anticipated changes as well as transitory and unanticipated

Context: United Arab Emirates

- Foreign workers are 89% of the population and 95% of the labor force in the UAE in 2011
- Majority enter visas that ties them to a specific employer for the length of their 2 or 3 year contract
- Most receive in-kind benefits, including housing and food in labor camps, health insurance, return airfare
- Vast majority of workers stay after their initial contract but there is no pathway to citizenship for men
- Unlikely for remittances to occur in this context through informal channels such as cash
 - ▶ Multiple workers share a dorm room (so saving at home in the UAE may not be that safe)
 - ▶ 2011 World Bank Global Findex survey: 78% did not save in a financial institution in the past 12 months

Cost of Migration

- Most matches are made in the country of origin (through recruiting agencies or hiring by the firms directly)
- It is illegal for migrants to be charged fees for getting a job assignment in the UAE and recruiting firms are only supposed to be paid by firms.
- In informal interviews, Human Rights Watch (2009) found all construction workers paid manpower firms in their home countries amounts ranging from \$1800 to \$4100.
 - ▶ Average GDP per capita \$1500 in India in 2013

Asymmetric Information + Income-Sharing Contract

- Workers earn y , which is comprised of 2 components, y_h and y_o
 - ▶ h denotes hidden, o denotes observable
- Each component has its own shock: μ_h and μ_o
- Cost to family of verification: $c_h > c_o \geq 0$
- Migrant promises to remit a fixed proportion, τ , of income
 - ▶ Income-sharing contract
 - ▶ An equity-like contract for financing the cost of migration
 - ▶ Social norm for income sharing

- Migrant chooses what income to report \tilde{y} (and remits $\tau\tilde{y}$)
 - ▶ Migrant's utility increases with $y - \tau\tilde{y}$
 - ▶ based on the tradeoff between keeping more income for his own consumption and the probability and severity of punishment
- Family decides whether to bear the cost of verification and can inflict a punishment $m(y, \tilde{y})$ which is increasing in $y - \tilde{y}$

Testable Predictions

- Remittances should move with y
 - ▶ Also consistent with models of pure altruism and exchange
- Observability matters: remittances should move more with y_o than with y_h
 - ▶ Two measures of observability:
 1. Test by examining 4 different types of income fluctuations
 2. Heterogeneity in the share of co-workers at the firm from the same home area
- Remittances are more likely to move down with negative fluctuations in y_h than positive fluctuations in y_h
 - ▶ Incentive to share bad income fluctuations and hide good income fluctuations

Testing for Consumption Smoothing and Altruism

- If remittances finance consumption of family members at home and migrants treat family consumption akin to their own, the permanent income hypothesis would suggest:
 - ▶ Smoothing remittances over anticipated income changes (such as seasonalities) but move with unanticipated ones
- First paper to look at whether there is evidence of remittance smoothing

Data Sets

Match three administrative data sets

1. Administrative payroll data from a payroll processing firm
 - ▶ Monthly payroll disbursement from January 2009 - October 2012
 - ▶ Firm implements payments for 10-15% of the UAE migrant workforce
 - ▶ Used by thousands of firms of all sizes to adhere to laws requiring electronic records of wage payments
 - ▶ Limited demographic information (nationality, age, gender)
2. Administrative records on remittance transactions from the same firm
 - ▶ More than 50% of the remittance market in the UAE
 - ▶ Offers many different types of transactions, including Western Union, Associate Bank Transfer, Xpress Money, Demand Draft
 - ▶ Cheapest options approx. USD\$4.50 per transaction

3. Ministry of Labor (MOL) data on terms of work contracts

- ▶ Includes all migrants in the UAE under the jurisdiction of the MOL (excludes domestic workers and free zone workers)
- ▶ Terms of contracts: contract hours and contract earnings (differs from actual earnings)
- ▶ Allows us to link the same individuals across contracts (both within the same firm and across firms) in the payroll data

Main Advantages of Data:

- Reduces measurement error
- High frequency records
- Large sample size

Limitations of Data:

- No information on hours worked
- No information on families in home country

Data Matching

- 1+2 Matching by customer registration number (firm identifier) or by labor card identifier (government issued number associated with a person-contract) [▶ Distributions](#)
- +3 Match by labor card identifier
 - ▶ About 80% of the individuals in the payroll match into the MOL data [▶ Distributions](#)

Table: Summary Statistics

	Remittance Only	Earnings Only	Merged
Panel A: Financial Firm Variables			
Remittances	2668.2 (3069.5)		1327.2 (1383.5)
India	0.501 (0.500)	0.487 (0.500)	0.496 (0.500)
Monthly Earnings		1433.7 (1305.6)	1559.8 (1214.9)
Age		35.52 (8.722)	36.31 (8.734)
Male		0.991 (0.0926)	0.992 (0.0895)
Observations	34997684	6521954	553647
Panel B: Constructed Financial Firm Variable			
Outdoor Occupation		0.446 (0.497)	0.516 (0.500)
Observations		2944509	269761
Time in UAE (mo/10)		2.477 (1.858)	2.109 (1.618)
Observations		5267546	537836

Notes: Standard deviations in parentheses. Remittances and earnings are in real 2007 dirham.

Table: Summary Statistics Continued

	Remittance Only	Earnings Only	Merged
Panel C: MOL Variables			
Muslim		0.340 (0.474)	0.323 (0.468)
High Education		0.388 (0.487)	0.404 (0.491)
Observations		5351152	551052
Panel D: Within Contract Coefficient of Variation			
CV Earnings		0.278 (0.195)	0.295 (0.173)
CV Remittances			0.700 (0.478)
Observations		547572	112357

Notes: Standard deviations in parentheses. Remittances and earnings are in real 2007 dirham.

▶ More

Table: Impact of Log Earnings on Log Remittances

	(1)	(2)
Log(Earnings)	0.325** [0.005]	0.326** [0.005]
Worker Controls	No	Yes
Observations	573132	543655
Adjusted R^2	0.404	0.404

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. The regressions include individual fixed effects, year fixed effects and a constant term. Worker controls include time-varying effects of age, Indian nationality, male and an indicator for high education.

▶ More

Negative versus Positive Income Changes

- Prediction of asymmetric information model: income elasticity of remittances is greater for negative income changes than for positive ones ($\beta_1 < \beta_2$)

Estimate for individual i in year-month i

$$\begin{aligned} \text{Log} \frac{R_{it}}{R_{i,t-1}} = & \beta_0 + \beta_1 \left(\text{Log} \frac{E_{it}}{E_{i,t-1}} \times I(E_{it} > E_{i,t-1}) \right) + \\ & \beta_2 \left(\text{Log} \frac{E_{it}}{E_{i,t-1}} \times I(E_{it} \leq E_{i,t-1}) \right) + \delta_T + \epsilon_{it} \end{aligned} \quad (1)$$

where


- R : remittances
- E : earnings
- $I(E_{it} > E_{i,t-1})$: positive income changes
- $I(E_{it} \leq E_{i,t-1})$: negative ones item γ_T : year and month FE

Table: Asymmetries in the First Difference Relationship

	(1)	(2)	(3)	(4)
Log(E/Lag E)	0.337** [0.006]	0.336** [0.007]		
Log(E/Lag E) × Positive Δ			0.075** [0.013]	0.080** [0.014]
Log(E/Lag E) × Negative Δ			0.296** [0.010]	0.292** [0.010]
Worker Controls	No	Yes	No	Yes
Observations	253026	240943	253026	240943
Adjusted R ²	0.017	0.018	0.018	0.018
F-test: $\beta_1 = \beta_2$ (p-value)			0.000	0.000

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Regressions include year fixed effects, month fixed effects and a constant term.

Returns to Time in the UAE

- Builds on literature estimating the rate of economic assimilation of immigrants
- Specification estimating returns to time in the UAE
 - ▶ Linear, Quadratic, Fully flexible 
- Selection issues (who stays in the UAE longer)
 - ▶ Limit sample to first contract (very little exits prior to first contract expiration)
 - ▶ Bounding exercise


- Assumption: an individual's earnings gradient over time in the UAE is not easy to observe by families at home
 - ▶ Migrants with very similar characteristics upon arrival in the UAE experience very different earnings gradients over time
 - ▶ After the initial screening, employers learn and pay them differently according to their productivity
- Evidence:
 - ▶ Some individuals' earnings evolve up and others down over time
 - ▶ Variation across workers within the same firm in evolution of earnings over time 
 - ▶ Exploit heterogeneity by number of co-workers from the same home location

Table: Estimates of Time in the UAE on Income and Remittances

	Log Earnings		Log Remittances	
	(1)	(2)	(3)	(4)
Panel A: Full Sample				
Time in UAE	0.017** [0.002]	0.018** [0.003]	-0.096** [0.005]	-0.086** [0.007]
Time in UAE ²		-0.000 [0.000]		-0.002* [0.001]
Observations	543903	543903	543903	543903
Adjusted R ²	0.719	0.719	0.400	0.400
Panel B: First Contract Sample				
Time in UAE	0.018** [0.003]	0.050** [0.005]	-0.079** [0.006]	-0.055** [0.011]
Time in UAE ²		-0.008** [0.001]		-0.006** [0.002]
Observations	496266	496266	496266	496266
Adjusted R ²	0.727	0.727	0.404	0.404

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Regressions include year fixed effects, month fixed effects, individual fixed effects and a constant term.

We estimate for individual i in year-month t :

$$\log Y_{it} = \beta_0 + \beta_1 \text{TimeinUAE}_{it} \times I(\text{NegChange})_i + \beta_2 \text{TimeinUAE}_{it} \times I(\text{PosChange})_i + \gamma_i + \delta_T + \epsilon_{it} \quad (2)$$

where

- $I(\text{PosChange})$: indicator for an individual with a positive time-earnings gradient
- $I(\text{NegChange})$: indicator for a negative time-earnings gradient
- δ_T : year indicators + month indicators

Prediction: $\beta_1 > \beta_2$

Assumption: This pattern is not being driven by other differences between these two groups of individuals.

▶ Alternative

Table: Summary Statistics by Individual Type

	Changes over Time		
	Negative	Positive	Diff
Panel A: Individual Characteristics (Time-Invariant)			
Initial Contract Salary	1130.98 (1021.02)	1182.72 (1037.71)	-51.74*
Initial Contract Hours	8.02 (0.18)	8.03 (0.19)	-0.01*
Initial Contract Length	34.13 (6.32)	33.35 (7.90)	0.79*
Initial Remittance	1163.08 (1007.40)	1113.59 (983.03)	49.49*
Muslim	0.40 (0.49)	0.37 (0.48)	0.03*
India	0.55 (0.50)	0.55 (0.50)	-0.00
Age	35.04 (8.63)	35.05 (8.62)	-0.01
Male	0.99 (0.10)	0.99 (0.10)	0.00
Dubai	0.33 (0.47)	0.34 (0.47)	-0.01*
Observations	19188	18659	
Panel B: Time-Varying Variables			
Exit UAE	0.021 (0.144)	0.019 (0.136)	0.002*
Observations	346684	284916	

Table: Asymmetries in the Effects of Time in UAE on Income and Remittances

	Log Earnings		Log Remittances	
	(1)	(2)	(3)	(4)
Time X Neg_Changes	-0.096** [0.003]	-0.103** [0.013]	-0.106** [0.006]	-0.106** [0.024]
Time X Pos_Changes	0.114** [0.002]	0.108** [0.013]	-0.016** [0.006]	-0.014 [0.024]
Worker Controls	No	Yes	No	Yes
Observations	535254	507812	535254	507812
Adjusted R^2	0.728	0.730	0.408	0.409

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Time in UAE refers to the number of months that they have been in the UAE divided by 10. Regressions include year indicators and month indicators, individual fixed effects and a constant term.

Home Connections

- Income patterns of individuals who have more co-workers from the same community are harder to hide from families at home
 - ▶ Can potentially observe both consumption in the UAE and amount of overtime, promotions, etc. at work
- Two measures based on what is available in the data:
 - ▶ Receiving **state** of remittance by coding strings for India
 - ★ median 17%
 - ▶ For a different and smaller subset of remittances, have a code that identifies **district** for all countries
 - ★ median 7%
- Key prediction: those with more co-workers from the same location are more likely to remit more of their positive private income changes than those with less co-workers from the same place

Table: Summary Statistics by Home State Connections

	Less	More	Diff
Panel A: Individual Characteristics (Time-Invariant)			
Initial Contract Salary	1276.49 (971.51)	1299.07 (1078.17)	-22.58*
Initial Contract Hours	8.01 (0.13)	8.03 (0.16)	-0.01*
Initial Contract Length	30.41 (11.09)	32.41 (7.94)	-2.00*
Initial Remittance	1039.88 (963.12)	973.97 (874.54)	65.91*
Muslim	0.18 (0.39)	0.20 (0.40)	-0.02
India	0.96 (0.20)	0.97 (0.16)	-0.01*
Age	35.25 (8.83)	35.05 (9.01)	0.20
Male	1.00 (0.03)	0.99 (0.08)	0.01*
Observations	4741	5499	
Panel B: Time-Varying Variables			
Exit UAE	0.025 (0.157)	0.021 (0.145)	0.004*
Observations	90199	125714	

Notes: Standard deviations in parentheses. * denotes significance at 5% level

Table: Asymmetries in the Effects of Time in UAE and Home Connections

	Log Earnings		Log Remittances	
	Less (1)	More (2)	Less (3)	More (4)
<i>Home Connections:</i>				
Time X Neg_Changes	-0.110** [0.007]	-0.106** [0.008]	-0.088** [0.017]	-0.056** [0.021]
Time X Pos_Changes	0.075** [0.007]	0.106** [0.008]	0.002 [0.017]	0.045* [0.020]
Observations	64929	65014	64929	65014
Adjusted R^2	0.043	0.043	0.042	0.031

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Time in UAE refers to the number of months that they have been in the UAE divided by 10. Regressions include year indicators, month indicators, individual fixed effects and a constant term.

Weather Shocks


- Weather data from the World Meteorological Organization for 5 cities in the UAE
- Two types of weather shocks - deviations from average in each city and month 
 - ▶ Rainfall - amount of precipitation (in inches)
 - ▶ Heat - maximum temperature (in degrees Fahrenheit, daily averaged to month)
- Heterogeneity by whether the job is likely to be outdoors

Table: Impact of Weather Shocks on Income and Remittances

	Log Earnings		Log Remittances	
	(1)	(2)	(3)	(4)
Panel A: Rainfall Shocks				
Precipitation	-0.356** [0.034]	-0.305** [0.067]	-0.266** [0.078]	-0.364* [0.155]
Precipitation × Outdoor		-0.170* [0.078]		-0.005 [0.183]
Observations	563312	267432	563312	267432
Adjusted R ²	0.715	0.698	0.392	0.371
Panel B: Heat Shocks				
Maximum Temperature	-0.003** [0.001]	-0.003** [0.001]	-0.010** [0.001]	-0.017** [0.002]
Temperature × Outdoor		-0.001** [0.000]		-0.001** [0.000]
Observations	563312	267432	563312	267432
Adjusted R ²	0.714	0.698	0.392	0.372
Mean of Outcome	7.172	7.160	6.992	6.958
Standard Deviation	0.598	0.588	0.956	0.962

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Regressions include fixed effects for year, city-month and individual and a constant term.

Standard deviation of precipitation=0.02 and of temperature=10.95

Seasonalities

- Estimate coefficient for each calendar month
- Focus on Ramadan
 - ▶ 30 day period - fasting from sunrise to sunset for Muslims
 - ▶ Law stipulates that the standard workday is reduced by 2 hours
- Measure as days of Ramadan that month divided by 10
- Heterogeneity by whether the worker is Muslim or not

Figure: Coefficients on Month: Log Earnings

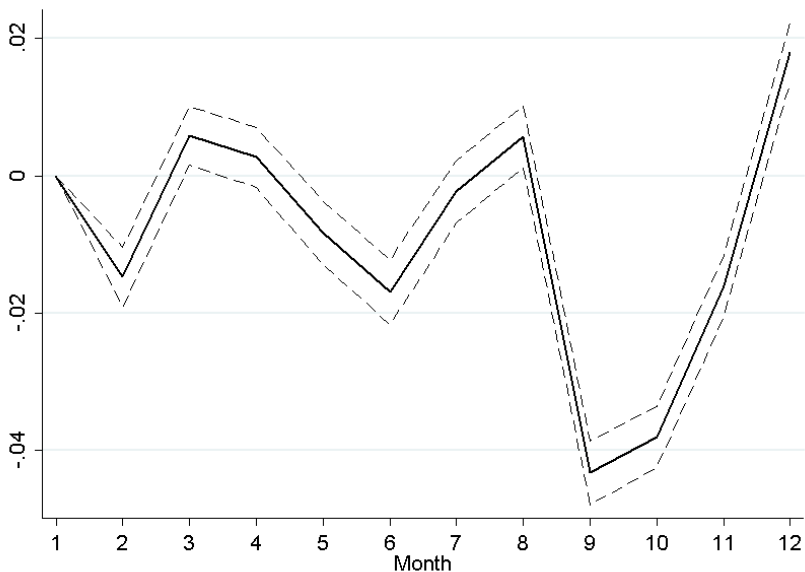


Figure: Coefficients on Month: Log Remittances

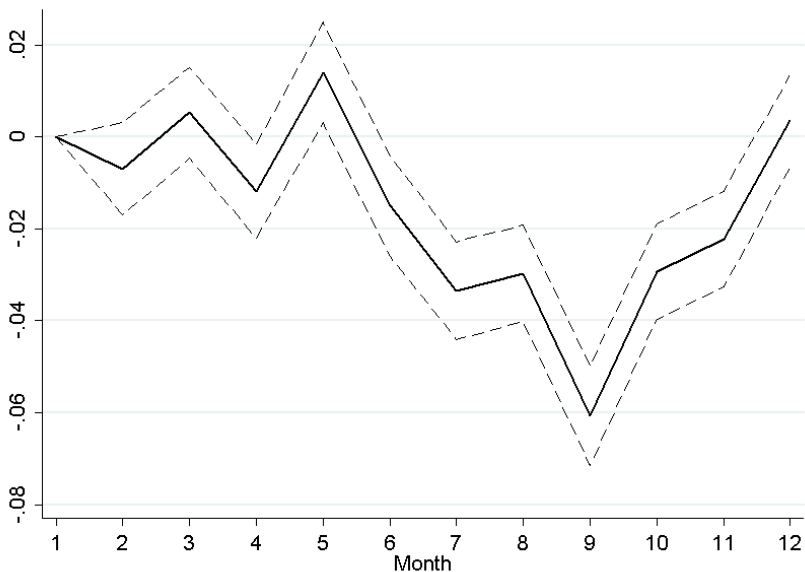



Table: Effects of Ramadan on Income and Remittances

	Log Earnings		Log Remittances	
	Full Sample (1)	All Mons (2)	Full Sample (3)	All Mons (4)
Panel A: Ramadan Effects				
Days Ramadan/10	-0.012** [0.001]	-0.010** [0.001]	-0.023** [0.002]	-0.024** [0.002]
Observations	573132	359908	573132	359908
Adjusted R^2	0.714	0.704	0.392	0.360
Panel B: Ramadan \times Muslim Effects				
Days Ramadan/10	-0.004* [0.002]	-0.002 [0.002]	-0.015** [0.004]	-0.018** [0.004]
Muslim \times Ramadan Days/10	-0.020** [0.003]	-0.019** [0.003]	-0.020** [0.006]	-0.019** [0.007]
Observations	233204	159700	233204	159700
Adjusted R^2	0.720	0.708	0.392	0.363

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Regressions include year fixed effects, individual fixed effects and a constant term.

Main Concerns

1. Drop in earnings and remittances driven by workers' travel during Ramadan 
2. Remittance patterns driven by seasonalities in consumption demand by households rather than by seasonalities in earnings

For *non-Muslim* migrants i from country j at time t :

$$y_{ijt} = \alpha_0 + \alpha_1 R_{it} + \alpha_2 R_{it} \times \text{MuslimShrOrigin}_j + \delta_i + \delta_t + \epsilon_{ijt} \quad (3)$$

where

- R_{it} : indicator for Ramadan
- MuslimShrOrigin_j : share of migrants in the UAE from country j who are Muslim
- Under alternative hypothesis of consumption demands of household: $\alpha_1 = 0$

Table: Effects of Ramadan on Income and Remittances by Muslim Share in Country of Origin

	Log Earnings (1)	Log Remittances (2)
Ramadan	-0.011* [0.005]	-0.031** [0.012]
Ramadan X Muslim Share in Origin Country	-0.001 [0.019]	-0.038 [0.052]
Observations	129283	129283
Adjusted R^2	0.722	0.417

Notes: Sample restricted to non-Muslim workers. Robust standard errors clustered by individual in parentheses. +, *, ** denote significance at the 10%, 5% and 1% levels, respectively. Regressions include year fixed effects, individual fixed effects and a constant term.

Labor Reform


- Announced in December 2010 and implemented in January 2011
- Removed a requirement for workers to provide a no-objection certificate (NOC) from their initial employer to change employers at the end of a contract
 - ▶ Before reform, without the NOC a worker had to leave the UAE for at least 6 months before he could return to work for another employer
 - ▶ No changes to requirements during a contract
- Difference-in-difference approach
 - ▶ Before and after the reform
 - ▶ Before and after an individual's contract expires
 - ▶ Focus on 7 periods around a contract expiration
- Public, permanent shock to earnings

Table: Impact of a Labor Reform on Income and Remittances

	Log Earnings (1)	Log Remittances (2)
Post Reform X Post Expiration	0.040+ [0.024]	0.117* [0.056]
Post Reform X Contract Expiration	0.035** [0.013]	0.065* [0.033]
Observations	56057	56057
Adjusted R ²	0.010	0.010

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Regressions include year-month fixed effects, individual fixed effects and a constant term.

Selection of Migrants out of UAE

- Issue: selective exits may drive the results
- For example, the migrants that remit are more likely to return to their home countries.
- Bounding exercise 
 - ▶ Maximize the impact of selection on the estimates
 - ▶ Assume the outcome of exiters are at the 10th or the 90th percentile of the distribution

Conclusion

- Evidence that asymmetric information over the earnings realizations of migrants affect their remittance behavior
- No evidence that migrants try to smooth remittances over a variety of income fluctuations
- Important for development policy - how to design policies or financial products for migrants
- Possible welfare consequences
 - ▶ Migrants exerting less effort if it increases observability of income (i.e. promotions)
 - ▶ Households less willing to finance or facilitate migration of one member

Table: Summary Statistics

	Remittance Only	Earnings Only	Merged Sample	Unobserved as Zero
Remittances	2668.2 (3069.5)		1527.2 (1383.5)	912.0 (1305.4)
India	0.501 (0.500)	0.487 (0.500)	0.496 (0.500)	0.543 (0.498)
Monthly Earnings		1433.7 (1305.6)	1559.8 (1214.9)	1474.1 (1150.8)
Age		35.52 (8.722)	36.31 (8.734)	36.05 (8.617)
Male		0.991 (0.0926)	0.992 (0.0895)	0.993 (0.0845)
Observations	34997684	6521954	553647	927158
Time in UAE		2.477 (1.858)	2.109 (1.618)	2.134 (1.620)
Observations		5267546	537836	895480
Muslim		0.492 (0.500)	0.446 (0.497)	0.418 (0.493)
High Education		0.388 (0.487)	0.404 (0.491)	0.382 (0.486)
Observations		5351120	551052	922782

Table: FE Relationship between Log Earnings and Log Remittances

	(1)	(2)
Panel A: Merged Sample		
Log(Earnings)	0.325** [0.005]	0.326** [0.005]
Worker Controls	No	Yes
Observations	573132	543655
Adjusted R^2	0.404	0.404
Panel B: Unobserved Observations as Zero		
Log(Earnings)	1.027** [0.012]	1.028** [0.012]
Worker Controls	No	Yes
Observations	957764	904375
Adjusted R^2	0.176	0.175
Panel C: All Months Sample		
Log(Earnings)	0.403** [0.017]	0.398** [0.018]
Worker Controls	No	Yes
Observations	40969	38739
Adjusted R^2	0.433	0.433

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. The regressions include individual fixed effects, year fixed effects and a constant term.

Pure Altruism

- Adapted from Lucas and Stark (1985)
- Migrant maximizes utility with respect to the amount remitted:

$$u_m = u[c_m(w - r), a_h u_h(c_h)] \quad (4)$$

where

c_m : migrants consumption

w : the migrant's earnings in the host country

r : amount remitted

a_h : altruism weight attached to household at home by the migrant

- Consumption at home where y is home household's earnings:

$$c_h = c(y + r) \quad (5)$$

- Predictions: $\partial r / \partial w > 0$ and $\partial r / \partial y < 0$

Permanent Income Hypothesis

- Desire to smooth marginal utility of consumption over short-run fluctuations in income:

$$E_{t-1} u'(c_{it}) = u'(c_{it-1}) \quad (6)$$

- Key assumptions: perfect credit markets, quadratic preferences
- Predictions:
 - ▶ Consumption responds to unpredictable income shocks but not to predictable, transitory changes
 - ▶ Consumption moves with unanticipated, permanent income changes
 - ▶ Saving respond to transitory changes but not to permanent ones

Table: Impact of Lags and Leads of Earnings on Log Remittances

	(1)	(2)	(3)	(4)	(5)
Log(Earnings)	0.323** [0.005]	0.324** [0.006]	0.334** [0.005]	0.339** [0.006]	0.335** [0.007]
Lag1 Log(Earnings)	0.044** [0.004]	0.046** [0.005]			0.051** [0.005]
Lag2 Log(Earnings)		0.023** [0.005]			0.028** [0.005]
Lag3 Log(Earnings)		0.004 [0.005]			0.009+ [0.005]
Lead1 Log(Earnings)			-0.028** [0.004]	-0.031** [0.005]	-0.033** [0.006]
Lead2 Log(Earnings)				0.018** [0.004]	0.023** [0.005]
Lead3 Log(Earnings)				0.007+ [0.004]	0.011* [0.005]
Observations	523609	428683	540938	480236	363033
Adjusted R^2	0.404	0.403	0.404	0.399	0.396

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. The regressions include individual fixed effects, year fixed effects and a constant term.

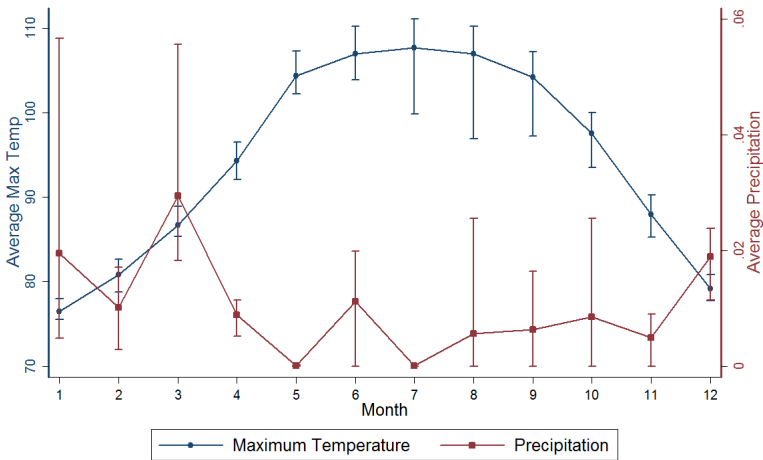
We estimate for individual i in year-month t :

$$\log Y_{it} = \beta_0 + \beta_1 \text{TimeinUAE}_{it} \times I(\text{NegChange})_{it} + \beta_2 \text{TimeinUAE}_{it} \times I(\text{PosChange})_{it} + \gamma_i + \delta_T + \epsilon_{it} \quad (7)$$

where

- $I(\text{PosChange})$: indicator for an individual with a positive time-earnings gradient for the past 12 months (or less) at time t
- $I(\text{NegChange})$: indicator for a negative time-earnings gradient for the past 12 months (or less) at time t
- δ_T : year indicators + month indicators

Figure: Average Precipitation and Temperature by Month



Notes: The dots give the monthly average across all days and cities of the maximum daily temperature. The bands give the value associated with city-level maximum and minimum monthly average. The squares indicate the monthly average precipitation across all days and cities. The corresponding bands provide the city-level maximum and minimum precipitation in that month.

Table: Estimates of the Impact of Weather (in Days) on Income and Remittances

	Log Earnings (1)	Log Remittances (2)
Panel A: Rainfall Shocks		
Days Any Precipitation	-0.003*** [0.000]	-0.005*** [0.001]
Observations	563312	563312
Adjusted R^2	0.714	0.392
Panel B: Heat Shocks		
Days Max Temp 70-80	-0.000 [0.001]	-0.005** [0.002]
Days Max Temp 80-90	-0.001 [0.001]	-0.007** [0.002]
Days Max Temp 90-100	-0.001 [0.001]	-0.011** [0.002]
Days Max Temp 100-110	-0.001 [0.001]	-0.011** [0.002]
Days Max Temp Over 110	-0.003** [0.001]	-0.015** [0.002]
Observations	563312	563312
Adjusted R^2	0.714	0.392

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Regressions include fixed effects for year, city-month and individual and a constant term.

Table: Estimates of Time in the UAE and Firm Tenure on Income and Remittances

	Log Earnings		Log Remittances	
	(1)	(2)	(3)	(4)
Time in UAE	0.030*	0.049*	-0.056**	-0.026
	[0.012]	[0.024]	[0.017]	[0.036]
Time in UAE ²		-0.002		-0.004
		[0.003]		[0.004]
Tenure	-0.014	-0.032	-0.041*	-0.060+
	[0.012]	[0.024]	[0.017]	[0.035]
Tenure ²		0.002		0.002
		[0.003]		[0.004]
F-Test: Time & Time ² (p-value)		0.012		0.001
Observations	543903	543903	543903	543903
Adjusted R ²	0.719	0.719	0.400	0.400

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Tenure refers to the number of months that they have been with the firm divided by 10. Regressions include year indicators, month indicators, individual fixed effects and a constant term.

Figure: Coefficients on Time in UAE: Log Earnings

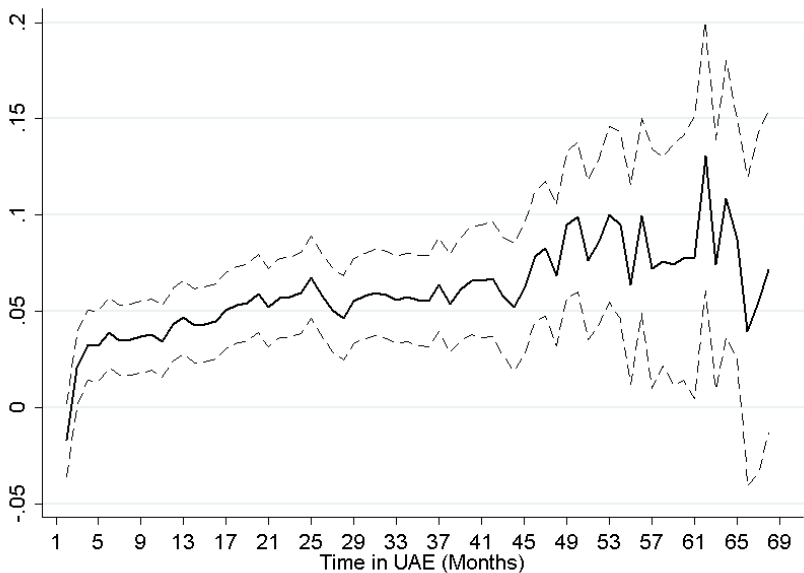


Figure: Coefficients on Time in UAE: Log Remittances

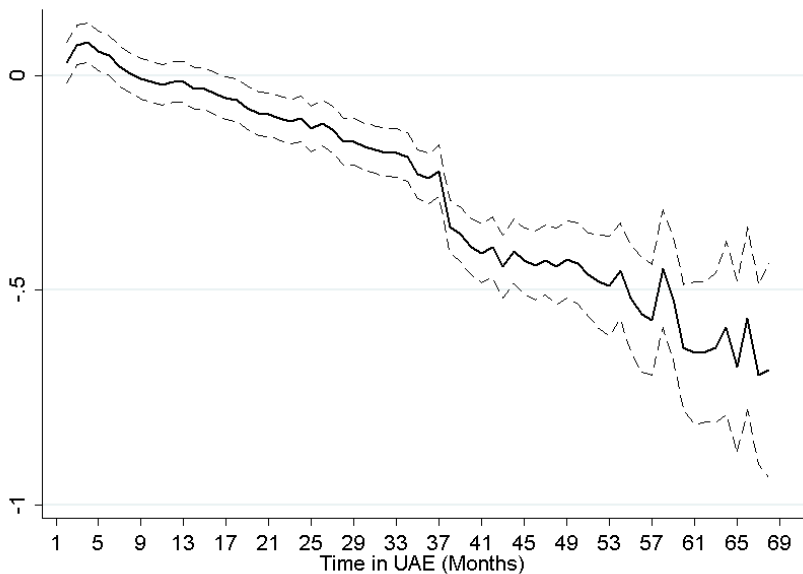


Table: Impact of Selection on the Relationship between Earnings and Remittances

	Log Remittances High		Log Remittances Low	
	(1)	(2)	(3)	(4)
Log Earnings High	0.391** [0.004]		0.248** [0.004]	
Log Earnings Low		0.203** [0.004]		0.383** [0.004]
Observations	771635	771635	771635	771635
Adjusted R^2	0.435	0.423	0.428	0.439

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Regressions include year fixed effects, individual fixed effects and a constant term.

Table: Impact of Selection on the Estimates of Time in the UAE

	Log Earnings		Log Remittances	
	High (1)	Low (2)	High (3)	Low (4)
Panel A: Time in UAE				
Time in UAE	0.014** [0.003]	0.005+ [0.003]	-0.016** [0.005]	-0.032** [0.006]
Observations	771642	771642	771642	771642
Adjusted R^2	0.701	0.716	0.432	0.419
Panel B: Asymmetric Effect				
Time X Neg_Changes	-0.102** [0.003]	-0.084** [0.003]	-0.085** [0.006]	-0.057** [0.006]
Time X Pos_Changes	0.074** [0.003]	0.071** [0.003]	-0.010 [0.006]	-0.004 [0.006]
Observations	604021	604021	604021	604021
Adjusted R^2	0.705	0.721	0.434	0.419

Notes: Robust standard errors clustered by individual in parentheses. +, *, ** denotes significance at the 10%, 5% and 1% levels, respectively. Time in UAE refers to the number of months that they have been in the UAE divided by 10. Regressions include year indicators, month indicators, individual fixed effects and a constant term.

Figure: Kernel Density of Log Earnings

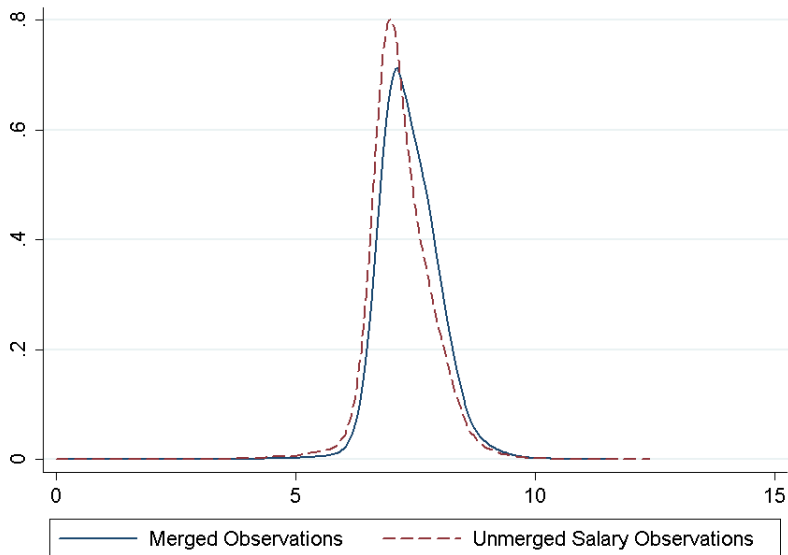
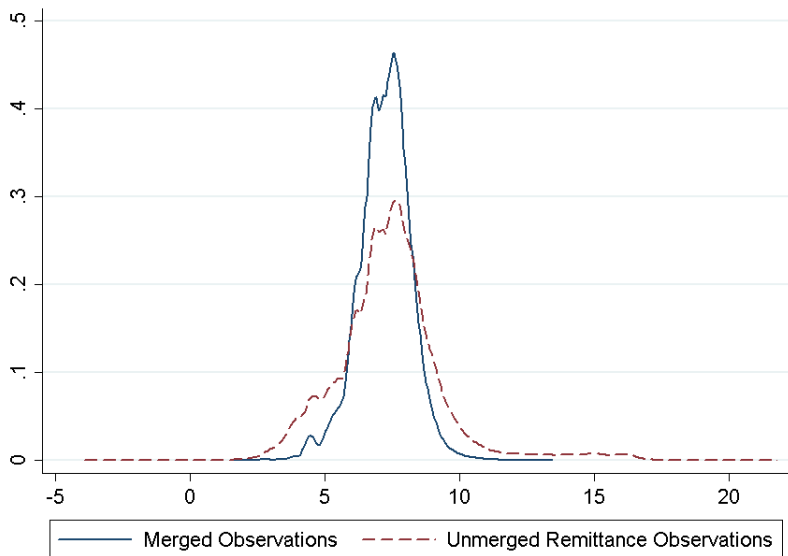


Figure: Kernel Density of Log Remittances



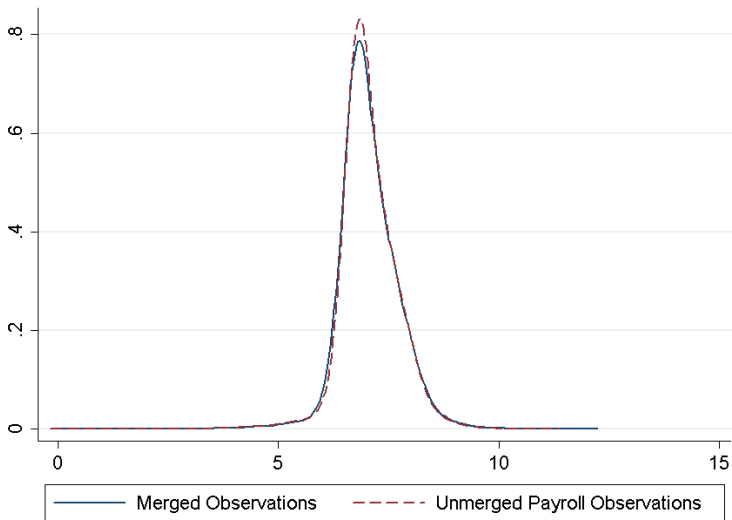


Figure: Density of Matched Payroll-MOL and Unmatched Payroll Log Earnings

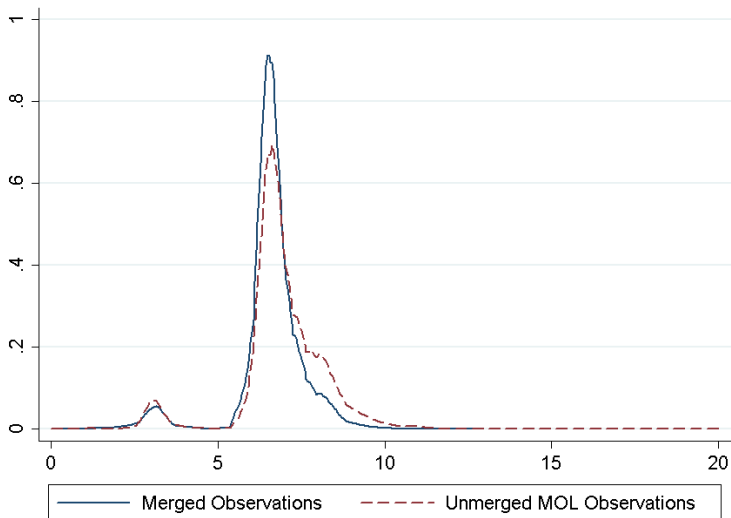


Figure: Density of Matched Payroll-MOL and Unmatched MOL Log Contract Salary

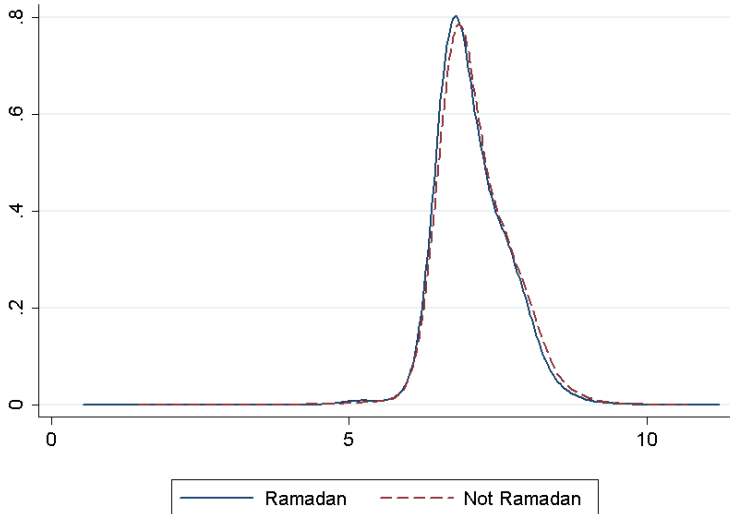


Figure: Density of Muslims' Log Salary in Ramadan and Other Months

Figure: Average Earnings by Month

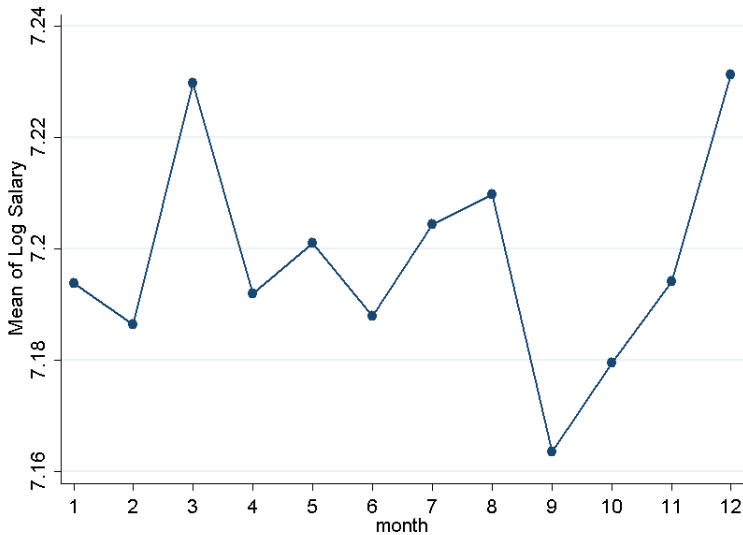


Figure: Average Earnings by Month

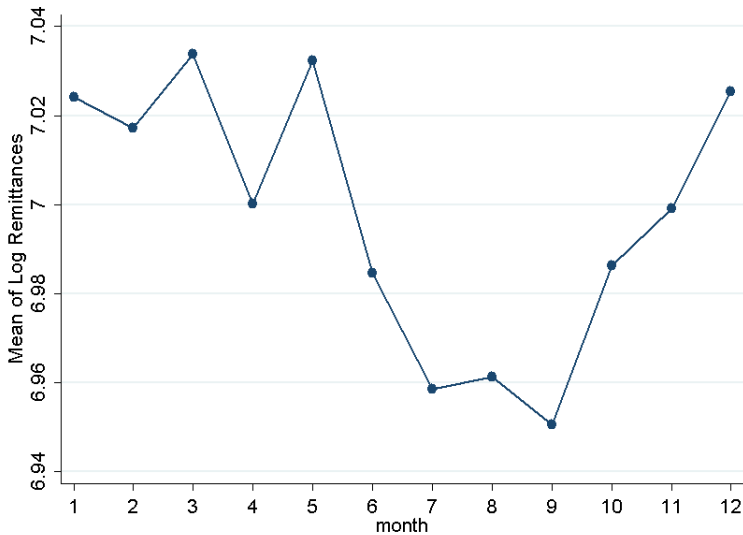


Figure: Average Amount of Earnings Kept by Month

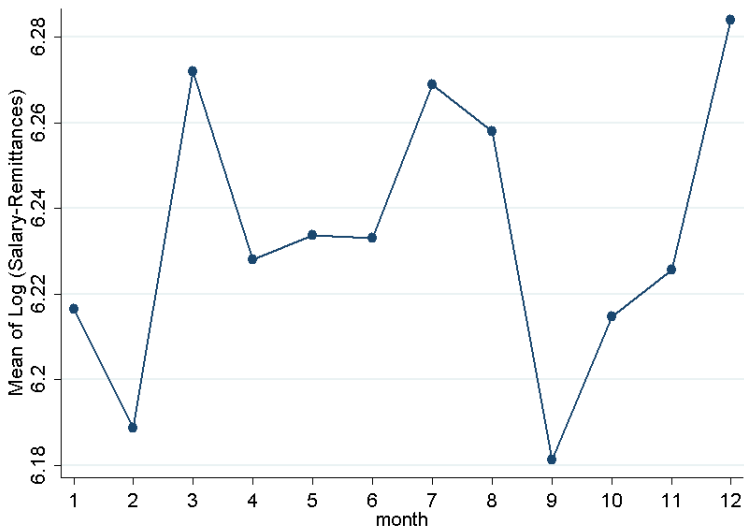


Figure: Kernel Density of Firms' Share of Workers with Positive Changes over Time

