Replication:
Lagakos, Mobarak & Waugh (2023): The welfare effects of encouraging rural–urban migration. *Econometrica 91(3), 803-837*

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Replication approach

The package for replicating the results of the paper is provided by one of the authors, Michael E. Waugh, in GitHub (`https://github.com/mwaugh0328/welfare-rural-urban-migration`. The repository does not give a master file to replicate all results by running a single script. Therefore, we have used discretion in choosing which parts of the package to run for replication purposes.

The paper estimates a structural model of household decisions whether not to migrate, to migrate seasonally, or to migrate permanently between rural and urban regions. The parameters of this model are either pre-set (Table I in the paper) or estimated by simulated method of moments (Table III in the paper).

We found it interesting that the paper does not appear to build on micro-level data of earnings and locations. Instead, the approach of the paper seems to be quite model-centered, where data is only used to calculate coarse moments for calibrating their model. The authors often refer to the "data", but it appears that they are mostly referring to their calculated real-world moments instead of an actual data that they use. However, they do provide the data and the code for the earlier paper that they use for calculating moments from a migration subsidy experiment, so the calculation of these moments could be replicated. However, calculation of the aggregate moments calculated from survey-data cannot be replicated with the replication package.

In replicating the paper, we proceed in two steps as follows. First, taken the target moments as given, we estimate the model without tweaking anything in the replication package, to replicate the estimates of the model parameters in Table III of the paper. This calibration (estimation) is done by running the `calibration/calibrate_baseline.m` script which takes a few hours to iterate. After running this file, we use the parameter vector estimated by it and run code `pe_welfare_analysis/_baseline.m`, which produces the results presented in Tables II, IV, VII, and VIII. These estimates were very fast to produce; it took under fifteen minutes. All it required us to do was to hit command analyze_outcomes(x1, [], [], [], [], [], [], 1) in the command window. x1 is the vector estimated with code `calibration/calibrate_baseline.m`. We also replicate some of the counterfactual results of the paper, which evaluate the effect of migration subsidies (section 5 in the paper).

Second, we tweak one of the targeted macro-moments slightly to test how this affects the estimates, model fit, and counterfactual policies. Such tweaks have already been discussed in the Online Appendix of the paper, where some sensitivities to changes in the discount factor or the return on assets have been calculated. In addition, the authors have calculated marginal elasticities of different coefficients with respect to specific model outcomes in the Online Appendix as well. Nevertheless, we considered that analyzing the effects of such tweaks is still interesting in studying how the replication package operates and whether our results would be aligned with those in the Online Appendix.

Finally, we briefly discuss the challenges in replicating the paper.

1 Replication of parameter estimates

In this section, we replicate Tables II, III, IV, VII, and VIII without any changes to the code. The code output to which we refer in the text are attached at the end of this section.

Model estimation

Table 1 shows the results of Table III replicated when we run code `calibration/calibrate_baseline.m`. The first row includes the estimates presented in the paper and the second row the results from out replication. The code produces the point estimates in a different order than in Table III of the paper (see vector x1 in the attachment), but here we have ordered them as in Table III to make them comparable.

We ran the code exactly as it was given in the replication package. In the code, the maximum number of evaluations was set to 30, and that was reached before the target function had reached a threshold value. Therefore, the code refused to continue calculating and we took the estimates it was able to produce up to this point. We obtain point estimates quite close to those shown in the paper. Due to time constraints, we do not attempt to obtain standard errors, as these are obtained by bootstrap.

Table 1: Replication of Table III

	$\frac{1}{\theta}$	$\bar{u}$	λ	π	γ	A_u	σ_s	ρ	σ_v
Paper	0.55	1.54	0.66	0.60	0.52	1.55	1.30	0.75	0.13
Our replication	0.56	1.51	0.66	0.61	0.52	1.56	1.34	0.74	0.13

Model fit: targeted and nontargeted moments

Next, we show the other replications that exploit the estimates presented in Table 1. Because our estimates in that table differ from those estimated in the paper, the other estimates are also likely to be somewhat different, even though we made no modifications to the code.

Table 2 shows the replication of Table II in the paper. It shows, simulated and estimated moments, only for targeted ones. Column "Data" are the empirical moments that Lagakos et al. (2023) tried to match. "Model (paper)" are the moments that Lagakos et al. (2023) estimated and "Model (our)" are the moments we estimated in the replication. Our replication results can be read from the output the code produced. LATE and OLS estimates can be read from lines "LATE Estimate" and "LATE - OLS estimates" (OLS is LATE-(LATE-OLS)). Seasonal migration rate in the control group can be read from the first column of line "Control: Year One, Repeat Two", and its second column divided by the first one gives the share of repeat migrants in the control group. Percentage of rural households with no liquid assets is at line "Fraction of Rural with No Assets". Treatment group's seasonal migration relative to control in year one and two are in the columns of line "Expr Elasticity: Year One, Two". Urban rural wage gap is at line "Wage Gap", and Percentage in rural area at line "Average Rural Population". Variance of urban wages can be found from the last line "ans", the third element of the vector printed. This printed number is the standard deviation of urban wages, so it is raised to power of two: $0.4382^2 = 0.66$.

We again obtain results close but not identical to those in the paper (which we expected given that our point estimates are only close to the authors). Variance of log urban wages differs quite a lot from both the data and the model of Lagakos et al. (2023).

Table 2: Replication of Table II

	Data	Model (our)	Model (paper)
Control: Percentage of rural households with no liquid assets	47	48	47
Control: Seasonal migration rate	36	36	36
Control: Consumption increase of migrants (OLS)	10	9	10
Control: Repeat migration rate	68	71	71
Treatment: Seasonal migration relative to control	22	21	21
Treatment: Seasonal migration relative to control in year 2	9	5	5
Treatment: Consumption increase of induced migrants (LATE)	30	29	29
Urban–rural wage gap	1.89	1.89	1.89
Percentage in rural area	62	60	60
Variance of log urban wages	0.56	0.66	0.56

In table 3 we replicate Tabel IV of the paper. Again, "Data" are the real values observed in empirical data, "Model" are those simulated by Lagakos et al. (2023) with their model and "Our replication" are the simulated moments from our replication. Our replication results can be read from the output at lines beginning with "Below Median Consumption..." and "Above median consumption...".

Our replication results are exactly the same as in the model of Lagakos et al. (2023), at least up to the rounding precision used.

Table 3: Replication of Table IV

		Assets	
		$\leq$ 800 Taka	>800 Taka
	Data		
Consumption	Below median	40	29
	Above median	36	31
	Our replication		
Consumption	Below median	41	28
	Above median	41	38
	Model		
Consumption	Below median	41	28
	Above median	41	38

In Table 4 we replicate the results of Table VII in the paper. Here we have the estimates implied by the empirical data ("Data"), our replication results ("Our replication"), estimates implied by the model of Lagakos et al. (2023) at line "Model" and the estimates of an older paper by Bryan, Chowdhury, and Mobarak (2014). Our replication results can be read from the output, from lines "LATE Estimate" (the LATE estimate), "LATE - OLS estimate" (the OLS estimate), "PE Unconditional Cash Transfer: Average Welfare Gain and Migration Rate" (second column is the cash transfer effect on treatment group migration), and "Control: Year One, Repeat Two" (the first column is the migration rate in the control group).

Again, our replication results are very close to those of Lagakos et al. (2023). Only the OLS estimate of the consumption effects differs, but the difference may be much smaller than a unit, because the rounding is imprecise.

Table 4: Replication of Table VII

Panel A: Effect of migration on consumption

	OLS	LATE
Data	10	30
Our replication	9	29
Model	10	29
Model of Bryan, Chowdhury, and Mobarak (2014)	57	52

Panel B: Effects of an Unconditional Transfer on Migration

	Control	Treatment
Data	34	44
Our replication	36	35
Model	36	35
Model of Bryan, Chowdhury, and Mobarak (2014)	66	88

Counterfactual analysis

Table 5 shows our estimates of Table VIII in the paper. Now we present only our replication results to save space. To compare to the results of the paper, see page 827 of it. In the code output, the numbers can be found, in the order of table 5, under lines "PE Conditional Migration Transfer...", "Migration Policy Function Fixed..." and "PE Unconditional Cash Transfer...". The first columns of the tables under those lines give the estimated welfare effect and the second columns give the estimated migration rate. The results are practically the same as in Table VIII of Lagakos et al. (2023).

Table 5: Replication of Table VIII

	Migration Subsidy Migration Endogenous		Migration Subsidy Migration Policy Fixed		Unconditional Transfer Migration Endogenous	
	Welfare	Migr. Rate	Welfare	Migr. Rate	Welfare	Migr. Rate
Income Quintile						
1	1.17	85	0.77	48	1.05	45
2	0.45	63	0.31	38	0.56	37
3	0.29	52	0.20	34	0.40	33
4	0.20	45	0.15	31	0.32	30
5	0.12	40	0.10	31	0.20	31
Average						
Rural & Low Assets	0.22	41	0.30	36	0.51	35
All Rural	0.45	57	0.15	31	0.25	30

```
    0.0023


 Iteration   Func-count     min f(x)         Procedure
     0            1       0.00705292
     1           10       0.00705292         initial simplex
     2           12       0.00705292         contract outside
     3           13       0.00705292         reflect
     4           15       0.00705292         contract outside
     5           17       0.00705292         contract inside
     6           18       0.00705292         reflect
     7           20       0.00705292         contract inside
     8           22       0.00705292         contract inside
     9           24       0.00705292         contract inside
    10           26       0.00705292         contract inside
    11           28       0.00665378         contract inside
    12           30       0.00639049         contract inside

Exiting: Maximum number of function evaluations has been exceeded
         - increase MaxFunEvals option.
         Current function value: 0.006390

    0.0023

    0.0064

>> x1

x1 =

    1.3420    0.5586    1.5644    0.7359    1.5112    0.6052    0.6630    0.5159 ↙
0.1276

>>
```

```
>> analyze_outcomes(x1, [], [], [], [], [], [], 1)
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   11-Dec-2023 15:25:16


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MATLAB Version: 9.7.0.1261785 (R2019b) Update 3
MATLAB License Number: 659924
Operating System: Microsoft Windows 10 Home Version 10.0 (Build 19045)
Java Version: Java 1.8.0_202-b08 with Oracle Corporation Java HotSpot(TM) 64-Bit ↙
Server VM mixed mode
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MATLAB                                                Version 9.7         (R2019b)
Simulink                                              Version 10.0        (R2019b)
Econometrics Toolbox                                  Version 5.3         (R2019b)
Optimization Toolbox                                  Version 8.4         (R2019b)
Statistics and Machine Learning Toolbox               Version 11.6        (R2019b)
Symbolic Math Toolbox                                 Version 8.4         (R2019b)
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Saving policy functions in plotting folder...



Migration Policy Function Fixed: Welfare by Income Quintile: Welfare, Migration ↙
Rate, Z, Experience
    0.7700   48.3200    0.5500   24.6700
    0.3100   37.9800    0.5500   23.8400
    0.2000   33.6400    0.5600   24.4900
    0.1500   30.7200    0.5600   24.9700
    0.1000   31.1100    0.6000   35.3100

Averages, Mushfiqs sample: Welfare, Migration Rate, Experience
    0.3000   36.3500   26.6600

Averages, All Rural: Welfare, Migration Rate
    0.1500   30.5200


PE Conditional Migration Transfer: Welfare by Income Quintile: Welfare, Migration ↙
Rate, Z , Experience
    1.1700   85.2400    0.5500   24.6700
    0.4500   62.5200    0.5500   23.8400
    0.2900   51.7900    0.5600   24.4900
    0.2000   45.3600    0.5600   24.9700
    0.1200   40.4800    0.6000   35.3100

Averages, Mushfiqs sample: Welfare, Migration Rate, Experience
    0.4500   57.0800   26.6600
```

```
Averages, All Rural: Welfare, Migration Rate
    0.2200   40.9100


PE Unconditional Cash Transfer: Welfare and Migration by Income Quintile
    1.0500   45.2600
    0.5600   36.8400
    0.4000   32.9800
    0.3200   30.3100
    0.2000   30.9200

PE Unconditional Cash Transfer: Average Welfare Gain, Migration Rate
    0.5100   35.2600

Averages, All Rural: Welfare, Migration Rate
    0.2500   30.0000


Wage Gap
    1.8898

Average Rural Population
    0.5991

Fraction of Rural with No Assets
    0.4757

Expr Elasticity: Year One, Two
    0.2081    0.0483

Control: Year One, Repeat Two
    0.3627    0.2565

LATE Estimate
    0.2926

LATE - OLS Estimate
    0.2010

Below Median Consumption: Migration Below 800 Taka assets, Above 800 Taka
    0.4073    0.2830

Above Median Consumption: Migration Below 800 Taka assets, Above 800 Taka
    0.4069    0.3750


ans =

    1.8898    0.5991    0.4382    0.4757    0.3627    0.2081    0.0483    0.2926 ↙
0.2010    0.2565

>>
```

2 The effects of switching targeted moments

To test the functioning of the replication package and the sensitivity of results of the paper, we edit the targeted moments slightly. We decrease the urban-rural wage gap by one standard deviation from 1.89 to 1.71. We feel that this edit is feasible because we cannot rule out that the true underlying population moment could be 1.71. The main problem with tweaking only one moment is that the moments could be correlated, implying that the model fits the data poorly if only one moment is edited.

Nevertheless, given that this aggregate moment is one of the most salient ones in terms of its economic relevance, we view tweaking it as an interesting tool for exploring the flexibility of the model.

To tweak the moment, we have changed 1.89 to 1.71 on row 9 in `calibration/calibrate_baseline.m`. In addition we have for this exercise made the present estimated moments after each step of the iteration process, which is why the print from MatLab command window below is lengthy.

Table 6: Replication of Table II, tweaked moment

	Target (tweaked)	Model (ours)	Model (paper)
Control: % rural, no assets	47	40	47
Control: Seasonal migration rate	36	69	36
Control: (OLS)	10	44	10
Control: Repeat migration rate	68	71	71
Treatment: Seasonal migration rel. y1	22	13	21
Treatment: Seasonal migration rel. y2	9	3	5
Treatment: (LATE)	30	32	29
Urban–rural wage gap	**1.71**	**1.72**	1.89
Percentage in rural area	62	63	60
Variance of log urban wages	0.56	0.66	0.56

The target moments, moments simulated in the paper, and moments simulated from the tweaked estimation are presented in Table 6. The simulated moments from the tweaked calibration seem to mostly fit the target moments poorly, which can also be seen in the relatively high value of the target function in the calibration (0.07 vs. 0.006 without the tweak). In particular, the model predicts much higher seasonal migration rates, but somewhat lower permanent migration rates. This suggests that our tweak might lead to difficulties in household optimization in the model. As the number of function evaluations was restricted to 30, it remains unclear if the moments would have converged somewhere if given more evaluations. Though we expected that issues might arise with the tweak, it is somewhat surprising that the model fit is as poor as it is.

Table 7: Replication of Table III, tweaked moment

	$\frac{1}{\theta}$	$\bar{u}$	λ	π	γ	A_u	σ_s	ρ	σ_v
Paper	0.55	1.54	0.66	0.60	0.52	1.55	1.30	0.75	0.13
Our replication	0.56	1.51	0.66	0.61	0.52	1.56	1.34	0.74	0.13
Tweaked moment	0.55	1.54	0.82	0.48	0.37	1.52	1.33	0.71	0.17

The parameters estimated after tweaking the urban-rural wage gap moment are presented in Table 7. This tweak kept some parameters rather unchanged, but changed a couple dramatically. The largest changes occurred for λ, π and γ. The probability of remaining inexperienced after a move (λ) increased and the probability of remaining experienced if not moving (π) decreased. The urban relative risk (γ) decreased. These three specific parameters had quite wide bootstrapped confidence intervals in the paper, so the changes in estimates here are not too surprising.

We next turn to counterfactual policies. Does this tweak impact the propensity to move? This can be seen in Table 8, where Table VIII from the paper is replicated again. It seems that the welfare gains from receiving migration subsidies only increased marginally despite the migration rate approximately doubling. The impact of tweaking the moment on migration rates seem to be drastic because in the first income quintile, 96 % of households migrate if they receive a subsidy conditional on migrating, and 84 % of these households migrate if they receive an equivalent unconditional transfer.

Table 8: Replication of Table VIII, tweaked moment

	Migration Subsidy Migration Endogenous		Migration Subsidy Migration Policy Fixed		Unconditional Transfer Migration Endogenous	
	Welfare	Migr. Rate	Welfare	Migr. Rate	Welfare	Migr. Rate
Income Quintile						
1	1.57	96	1.41	87	1.02	84
2	0.79	91	0.65	77	0.56	76
3	0.44	80	0.36	66	0.40	66
4	0.35	75	0.29	62	0.32	61
5	0.19	62	0.16	52	0.20	52
Average						
Rural & Low Assets	0.67	81	0.57	69	0.48	68
All Rural	0.34	65	0.29	59	0.24	58

In our opinion, this result is rather surprising because we expected that reducing the urban-rural wage gap would reduce incentives to migrate. We believe that in the tweaked model, the utility gain from being an experienced migrant rather than inexperienced is more significant than in the baseline model. As becoming experienced in more rare and losing experience is more common, more frequent migration is necessary to remain an inexperienced household. In other words, households would like to migrate when they experience a bad shock in the rural area, but as an inexperienced migrant, the cost is relatively high. Therefore, the households want to be experienced migrants even before they face a bad shock because the wage gain from migrating to an urban area is not large enough for inexperienced households to cover the migration cost. Overall, this is a rather interesting result. Rural households seem to prepare for bad shocks by accumulating experience in migrating rather than being reducing their migration rates due to low wage gains.

3 Challenges in replicating the results

The authors did not explain much in the paper how they had conducted the estimation. As their results were obtained from simulation, they should have explained their process more thoroughly. For instance, the number of iterations used when targeting the moments was not reported. In the code, the maximum number of iterations was set to 30, and this was reached before the target function had reached low enough a value, when we replicated the simulation. Therefore, our estimates somewhat differ from those of Lagakos et al. (2023). But this raises a question: was the code they submitted the one they really used for the paper? Probably they had set a different maximum number of iterations, but then they should have used the same one in the replication package.

Even though the replication package was extensive and README files were included in each folder, the instructions were not always very clear. For instance, code `pe_welfare_analysis/_baseline.m` that was needed for replicating Tables III, IV, VII and VIII of the paper required typing one additional command but this was very unclearly stated in the instructions. Also, it was not always so clear which results of the paper the code output was supposed to correspond, and some of the tables and vectors were ordered differently in the paper than in the code output.

```
Starting parallel pool (parpool) using the 'Processes' profile ...
Connected to parallel pool with 10 workers.
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   11-Dec-2023 17:25:23


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Wage Gap
    1.9020

Average Rural Population
    0.5454

Fraction of Rural with No Assets
    0.4407

Expr Elasticity: Year One, Two
    0.3518    0.0451

Control: Year One, Repeat Two
    0.0374    0.4192

LATE Estimate
    0.2679

OLS Estimate
    0.1218

    0.2428

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   11-Dec-2023 17:26:58


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Wage Gap
    1.9657

Average Rural Population
    0.5682

Fraction of Rural with No Assets
    0.5092

Expr Elasticity: Year One, Two
    0.2417    0.0310

Control: Year One, Repeat Two
```

```
    0.0208    0.3751

LATE Estimate
    0.2950

OLS Estimate
    0.1468


 Iteration   Func-count         f(x)         Procedure
     0            1         0.292072
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   11-Dec-2023 17:28:31


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Wage Gap
    1.8530

Average Rural Population
    0.5377

Fraction of Rural with No Assets
    0.4229

Expr Elasticity: Year One, Two
    0.2749    0.0245

Control: Year One, Repeat Two
    0.0215    0.3809

LATE Estimate
    0.2728

OLS Estimate
    0.1161

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   11-Dec-2023 17:30:05


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Wage Gap
    2.0984

Average Rural Population
    0.5977
```

```
Fraction of Rural with No Assets
    0.5092

Expr Elasticity: Year One, Two
    0.2089    0.0275

Control: Year One, Repeat Two
    0.0175    0.3780

LATE Estimate
    0.2933

OLS Estimate
    0.1482

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   11-Dec-2023 17:31:37


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Wage Gap
    1.9677

Average Rural Population
    0.5302

Fraction of Rural with No Assets
    0.4888

Expr Elasticity: Year One, Two
    0.2729    0.0315

Control: Year One, Repeat Two
    0.0183    0.3584

LATE Estimate
    0.2933

OLS Estimate
    0.1306

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   11-Dec-2023 17:33:10


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Wage Gap
    2.0781
```

```
Average Rural Population
    0.6054

Fraction of Rural with No Assets
    0.9500

Expr Elasticity: Year One, Two
    0.1732    0.0275

Control: Year One, Repeat Two
    0.0263    0.3953

LATE Estimate
    0.3195

OLS Estimate
    0.2014

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   11-Dec-2023 17:34:42


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Wage Gap
    2.0093

Average Rural Population
    0.5732

Fraction of Rural with No Assets
    0.5119

Expr Elasticity: Year One, Two
    0.1437    0.0179

Control: Year One, Repeat Two
    0.0090    0.3125

LATE Estimate
    0.3318

OLS Estimate
    0.1582

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   11-Dec-2023 17:36:16


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```

```
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Wage Gap
    2.0157

Average Rural Population
    0.5753

Fraction of Rural with No Assets
    0.5122

Expr Elasticity: Year One, Two
    0.2511    0.0245

Control: Year One, Repeat Two
    0.0164    0.2895

LATE Estimate
    0.3012

OLS Estimate
    0.1242

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   11-Dec-2023 17:37:49


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Wage Gap
    1.9417

Average Rural Population
    0.5741

Fraction of Rural with No Assets
    0.5067

Expr Elasticity: Year One, Two
    0.2531    0.0453

Control: Year One, Repeat Two
    0.0375    0.5084

LATE Estimate
    0.2958

OLS Estimate
    0.1838

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```

```
   11-Dec-2023 17:39:22


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Wage Gap
    2.0739

Average Rural Population
    0.5981

Fraction of Rural with No Assets
    0.5118

Expr Elasticity: Year One, Two
    0.1709    0.0211

Control: Year One, Repeat Two
    0.0126    0.2964

LATE Estimate
    0.3126

OLS Estimate
    0.2319

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   11-Dec-2023 17:40:55


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Wage Gap
    1.9277

Average Rural Population
    0.5745

Fraction of Rural with No Assets
    0.5072

Expr Elasticity: Year One, Two
    0.2657    0.0319

Control: Year One, Repeat Two
    0.0406    0.3325

LATE Estimate
    0.2912

OLS Estimate
```

```
    0.1885

     1           10         0.205247         initial simplex
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   11-Dec-2023 17:42:27


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Wage Gap
    1.9295

Average Rural Population
    0.5300

Fraction of Rural with No Assets
    0.2915

Expr Elasticity: Year One, Two
    0.2402    0.0209

Control: Year One, Repeat Two
    0.0101    0.2654

LATE Estimate
    0.2819

OLS Estimate
    0.0658

     2           11         0.205247         reflect
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   11-Dec-2023 17:44:00


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Wage Gap
    1.8699

Average Rural Population
    0.5268

Fraction of Rural with No Assets
    0.4357

Expr Elasticity: Year One, Two
    0.3014    0.0376

Control: Year One, Repeat Two
```

```
    0.0281    0.3810

LATE Estimate
    0.2833

OLS Estimate
    0.0993

     3           12         0.205247         reflect
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   11-Dec-2023 17:45:34


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Wage Gap
    2.0519

Average Rural Population
    0.5974

Fraction of Rural with No Assets
    0.9498

Expr Elasticity: Year One, Two
    0.2018    0.0315

Control: Year One, Repeat Two
    0.0315    0.4110

LATE Estimate
    0.3211

OLS Estimate
    0.1965

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   11-Dec-2023 17:47:07


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Wage Gap
    1.9412

Average Rural Population
    0.5459

Fraction of Rural with No Assets
    0.3862
```

```
Expr Elasticity: Year One, Two
    0.2466    0.0256

Control: Year One, Repeat Two
    0.0153    0.3248

LATE Estimate
    0.2862

OLS Estimate
    0.1071

     4           14         0.205247         contract inside
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   11-Dec-2023 17:48:40


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Wage Gap
    1.8823

Average Rural Population
    0.5415

Fraction of Rural with No Assets
    0.4369

Expr Elasticity: Year One, Two
    0.2352    0.0339

Control: Year One, Repeat Two
    0.0283    0.4212

LATE Estimate
    0.2846

OLS Estimate
    0.1751

     5           15         0.205247         reflect
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   11-Dec-2023 17:50:14


------------------------------------------------------------------------------------ ↙
------------------

Wage Gap
    1.8564
```

```
Average Rural Population
    0.5420

Fraction of Rural with No Assets
    0.4252

Expr Elasticity: Year One, Two
    0.4139    0.0509

Control: Year One, Repeat Two
    0.0589    0.4361

LATE Estimate
    0.2441

OLS Estimate
    0.1216

     6           16         0.205247         reflect
-------------------------------------------------------------------------------------- ↙
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   11-Dec-2023 17:51:46


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------------------

Wage Gap
    1.7071

Average Rural Population
    0.4822

Fraction of Rural with No Assets
    0.4100

Expr Elasticity: Year One, Two
    0.3645    0.0495

Control: Year One, Repeat Two
    0.0434    0.4027

LATE Estimate
    0.2727

OLS Estimate
    0.1489

     7           17         0.205247         reflect
-------------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 17:53:18
```

```
------------------------------------------------------------------------------------- ↙
------------------

Wage Gap
    1.8598

Average Rural Population
    0.5450

Fraction of Rural with No Assets
    0.7031

Expr Elasticity: Year One, Two
    0.3266    0.0524

Control: Year One, Repeat Two
    0.0502    0.4505

LATE Estimate
    0.2808

OLS Estimate
    0.1567

     8           18         0.205247         reflect
------------------------------------------------------------------------------------- ↙
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   11-Dec-2023 17:54:50


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------------------

Wage Gap
    1.7743

Average Rural Population
    0.5607

Fraction of Rural with No Assets
    0.4248

Expr Elasticity: Year One, Two
    0.3121    0.0464

Control: Year One, Repeat Two
    0.0551    0.4278

LATE Estimate
    0.2587

OLS Estimate
    0.1503
```

```
-------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 17:56:23


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------------------

Wage Gap
    1.6831

Average Rural Population
    0.5820

Fraction of Rural with No Assets
    0.3817

Expr Elasticity: Year One, Two
    0.3211    0.0505

Control: Year One, Repeat Two
    0.0856    0.4523

LATE Estimate
    0.2443

OLS Estimate
    0.1481

     9           20          0.160574          expand
-------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 17:57:55


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------------------

Wage Gap
    1.7387

Average Rural Population
    0.5076

Fraction of Rural with No Assets
    0.4095

Expr Elasticity: Year One, Two
    0.3391    0.0522

Control: Year One, Repeat Two
    0.0431    0.5077
```

```
LATE Estimate
    0.2571

OLS Estimate
    0.1333

    10          21         0.160574         reflect
----------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 17:59:27


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Wage Gap
    1.6487

Average Rural Population
    0.4970

Fraction of Rural with No Assets
    0.3810

Expr Elasticity: Year One, Two
    0.3790    0.0608

Control: Year One, Repeat Two
    0.0689    0.4579

LATE Estimate
    0.2449

OLS Estimate
    0.1465

    11          22         0.160574         reflect
----------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 18:00:59


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Wage Gap
    1.7447

Average Rural Population
    0.5176

Fraction of Rural with No Assets
    0.3133
```

```
Expr Elasticity: Year One, Two
    0.3080    0.0371

Control: Year One, Repeat Two
    0.0371    0.4178

LATE Estimate
    0.2530

OLS Estimate
    0.1212

    12           23          0.160574         reflect
-------------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 18:02:32


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------------------

Wage Gap
    1.7387

Average Rural Population
    0.5500

Fraction of Rural with No Assets
    0.3692

Expr Elasticity: Year One, Two
    0.3440    0.0531

Control: Year One, Repeat Two
    0.0571    0.4932

LATE Estimate
    0.2458

OLS Estimate
    0.1687

    13           24          0.160574         reflect
-------------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 18:04:04


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------------------

Wage Gap
    1.7203
```

```
Average Rural Population
    0.5395

Fraction of Rural with No Assets
    0.3839

Expr Elasticity: Year One, Two
    0.3676    0.0720

Control: Year One, Repeat Two
    0.1071    0.5436

LATE Estimate
    0.2490

OLS Estimate
    0.1442

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------------------
   11-Dec-2023 18:05:51


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------------------

Wage Gap
    1.7166

Average Rural Population
    0.5592

Fraction of Rural with No Assets
    0.3498

Expr Elasticity: Year One, Two
    0.3693    0.0796

Control: Year One, Repeat Two
    0.2145    0.6198

LATE Estimate
    0.2470

OLS Estimate
    0.1069

    14          26        0.0690911         expand
---------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 18:07:32


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```

```
------------------

Wage Gap
    1.8267

Average Rural Population
    0.5890

Fraction of Rural with No Assets
    0.3921

Expr Elasticity: Year One, Two
    0.3137    0.0570

Control: Year One, Repeat Two
    0.0810    0.5563

LATE Estimate
    0.2437

OLS Estimate
    0.1468

    15           27        0.0690911         reflect
---------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 18:09:09


---------------------------------------------------------------------------------- ↙
------------------

Wage Gap
    1.6351

Average Rural Population
    0.5494

Fraction of Rural with No Assets
    0.3423

Expr Elasticity: Year One, Two
    0.4281    0.0694

Control: Year One, Repeat Two
    0.1327    0.5428

LATE Estimate
    0.2183

OLS Estimate
    0.1152

    16           28        0.0690911         reflect
```

```
------------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 18:10:40


------------------------------------------------------------------------------------- ↙
------------------

Wage Gap
    1.8072

Average Rural Population
    0.5939

Fraction of Rural with No Assets
    0.4828

Expr Elasticity: Year One, Two
    0.3759    0.0693

Control: Year One, Repeat Two
    0.1763    0.6289

LATE Estimate
    0.2518

OLS Estimate
    0.1255

    17           29         0.0690911         reflect
------------------------------------------------------------------------------------- ↙
------------------
   11-Dec-2023 18:12:13


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------------------

Wage Gap
    1.6379

Average Rural Population
    0.5722

Fraction of Rural with No Assets
    0.3670

Expr Elasticity: Year One, Two
    0.3174    0.0727

Control: Year One, Repeat Two
    0.1315    0.5996

LATE Estimate
```

```
    0.2508

OLS Estimate
    0.1590

    18           30        0.0690911         reflect

Exiting: Maximum number of function evaluations has been exceeded
         - increase MaxFunEvals option.
         Current function value: 0.069091

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------------------
   11-Dec-2023 18:13:46


------------------------------------------------------------------------------------- ↙
------------------

Wage Gap
    1.7166

Average Rural Population
    0.5592

Fraction of Rural with No Assets
    0.3498

Expr Elasticity: Year One, Two
    0.3693    0.0796

Control: Year One, Repeat Two
    0.2145    0.6198

LATE Estimate
    0.2470

OLS Estimate
    0.1069

    0.2428

    0.0691

>> analyze_outcomes(x1, [], [], [], [], [], [], 1)
------------------------------------------------------------------------------------- ↙
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   11-Dec-2023 18:14:51


------------------------------------------------------------------------------------- ↙
------------------
MATLAB Version: 23.2.0.2380103 (R2023b) Update 1
MATLAB License Number: 659924
```

```
Operating System: Microsoft Windows 10 Education Version 10.0 (Build 19045)
Java Version: Java 1.8.0_202-b08 with Oracle Corporation Java HotSpot(TM) 64-Bit ↙
Server VM mixed mode
-------------------------------------------------------------------------------------- ↙
------------------
MATLAB                                                Version 23.2        (R2023b)
Simulink                                              Version 23.2        (R2023b)
5G Toolbox                                            Version 23.2        (R2023b)
AUTOSAR Blockset                                      Version 23.2        (R2023b)
Aerospace Blockset                                    Version 23.2        (R2023b)
Aerospace Toolbox                                     Version 23.2        (R2023b)
Antenna Toolbox                                       Version 23.2        (R2023b)
Audio Toolbox                                         Version 23.2        (R2023b)
Automated Driving Toolbox                             Version 23.2        (R2023b)
Bioinformatics Toolbox                                Version 23.2        (R2023b)
Bluetooth Toolbox                                     Version 23.2        (R2023b)
C2000 Microcontroller Blockset                        Version 23.2        (R2023b)
Communications Toolbox                                Version 23.2        (R2023b)
Computer Vision Toolbox                               Version 23.2        (R2023b)
Control System Toolbox                                Version 23.2        (R2023b)
Curve Fitting Toolbox                                 Version 23.2        (R2023b)
DDS Blockset                                          Version 23.2        (R2023b)
DSP HDL Toolbox                                       Version 23.2        (R2023b)
DSP System Toolbox                                    Version 23.2        (R2023b)
Data Acquisition Toolbox                              Version 23.2        (R2023b)
Database Toolbox                                      Version 23.2        (R2023b)
Datafeed Toolbox                                      Version 23.2        (R2023b)
Deep Learning HDL Toolbox                             Version 23.2        (R2023b)
Deep Learning Toolbox                                 Version 23.2        (R2023b)
Econometrics Toolbox                                  Version 23.2        (R2023b)
Embedded Coder                                        Version 23.2        (R2023b)
Filter Design HDL Coder                               Version 23.2        (R2023b)
Financial Instruments Toolbox                         Version 23.2        (R2023b)
Financial Toolbox                                     Version 23.2        (R2023b)
Fixed-Point Designer                                  Version 23.2        (R2023b)
Fuzzy Logic Toolbox                                   Version 23.2        (R2023b)
GPU Coder                                             Version 23.2        (R2023b)
Global Optimization Toolbox                           Version 23.2        (R2023b)
HDL Coder                                             Version 23.2        (R2023b)
HDL Verifier                                          Version 23.2        (R2023b)
Image Acquisition Toolbox                             Version 23.2        (R2023b)
Image Processing Toolbox                              Version 23.2        (R2023b)
Industrial Communication Toolbox                      Version 23.2        (R2023b)
Instrument Control Toolbox                            Version 23.2        (R2023b)
LTE Toolbox                                           Version 23.2        (R2023b)
Lidar Toolbox                                         Version 23.2        (R2023b)
MATLAB Coder                                          Version 23.2        (R2023b)
MATLAB Compiler                                       Version 23.2        (R2023b)
MATLAB Compiler SDK                                   Version 23.2        (R2023b)
MATLAB Report Generator                               Version 23.2        (R2023b)
MATLAB Test                                           Version 23.2        (R2023b)
Mapping Toolbox                                       Version 23.2        (R2023b)
Medical Imaging Toolbox                               Version 23.2        (R2023b)
Mixed-Signal Blockset                                 Version 23.2        (R2023b)
```

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Model Predictive Control Toolbox                      Version 23.2        (R2023b)
Model-Based Calibration Toolbox                       Version 23.2        (R2023b)
Motor Control Blockset                                Version 23.2        (R2023b)
Navigation Toolbox                                    Version 23.2        (R2023b)
Optimization Toolbox                                  Version 23.2        (R2023b)
Parallel Computing Toolbox                            Version 23.2        (R2023b)
Partial Differential Equation Toolbox                 Version 23.2        (R2023b)
Phased Array System Toolbox                           Version 23.2        (R2023b)
Powertrain Blockset                                   Version 23.2        (R2023b)
Predictive Maintenance Toolbox                        Version 23.2        (R2023b)
RF Blockset                                           Version 23.2        (R2023b)
RF PCB Toolbox                                        Version 23.2        (R2023b)
RF Toolbox                                            Version 23.2        (R2023b)
ROS Toolbox                                           Version 23.2        (R2023b)
Radar Toolbox                                         Version 23.2        (R2023b)
Reinforcement Learning Toolbox                        Version 23.2        (R2023b)
Requirements Toolbox                                  Version 23.2        (R2023b)
Risk Management Toolbox                               Version 23.2        (R2023b)
Robotics System Toolbox                               Version 23.2        (R2023b)
Robust Control Toolbox                                Version 23.2        (R2023b)
Satellite Communications Toolbox                      Version 23.2        (R2023b)
Sensor Fusion and Tracking Toolbox                    Version 23.2        (R2023b)
SerDes Toolbox                                        Version 23.2        (R2023b)
Signal Integrity Toolbox                              Version 23.2        (R2023b)
Signal Processing Toolbox                             Version 23.2        (R2023b)
SimBiology                                            Version 23.2        (R2023b)
SimEvents                                             Version 23.2        (R2023b)
Simscape                                              Version 23.2        (R2023b)
Simscape Battery                                      Version 23.2        (R2023b)
Simscape Driveline                                    Version 23.2        (R2023b)
Simscape Electrical                                   Version 23.2        (R2023b)
Simscape Fluids                                       Version 23.2        (R2023b)
Simscape Multibody                                    Version 23.2        (R2023b)
Simulink 3D Animation                                 Version 23.2        (R2023b)
Simulink Check                                        Version 23.2        (R2023b)
Simulink Code Inspector                               Version 23.2        (R2023b)
Simulink Coder                                        Version 23.2        (R2023b)
Simulink Compiler                                     Version 23.2        (R2023b)
Simulink Control Design                               Version 23.2        (R2023b)
Simulink Coverage                                     Version 23.2        (R2023b)
Simulink Design Optimization                          Version 23.2        (R2023b)
Simulink Design Verifier                              Version 23.2        (R2023b)
Simulink Desktop Real-Time                            Version 23.2        (R2023b)
Simulink Fault Analyzer                               Version 23.2        (R2023b)
Simulink PLC Coder                                    Version 23.2        (R2023b)
Simulink Real-Time                                    Version 23.2        (R2023b)
Simulink Report Generator                             Version 23.2        (R2023b)
Simulink Test                                         Version 23.2        (R2023b)
SoC Blockset                                          Version 23.2        (R2023b)
Spreadsheet Link                                      Version 23.2        (R2023b)
Stateflow                                             Version 23.2        (R2023b)
Statistics and Machine Learning Toolbox               Version 23.2        (R2023b)
Symbolic Math Toolbox                                 Version 23.2        (R2023b)
System Composer                                       Version 23.2        (R2023b)
```

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System Identification Toolbox                         Version 23.2        (R2023b)
Text Analytics Toolbox                                Version 23.2        (R2023b)
UAV Toolbox                                           Version 23.2        (R2023b)
Vehicle Dynamics Blockset                             Version 23.2        (R2023b)
Vehicle Network Toolbox                               Version 23.2        (R2023b)
Vision HDL Toolbox                                    Version 23.2        (R2023b)
WLAN Toolbox                                          Version 23.2        (R2023b)
Wavelet Toolbox                                       Version 23.2        (R2023b)
Wireless HDL Toolbox                                  Version 23.2        (R2023b)
Wireless Testbench                                    Version 23.2        (R2023b)
-------------------------------------------------------------------------------------- ↙
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Saving policy functions in plotting folder...



Migration Policy Function Fixed: Welfare by Income Quintile: Welfare, Migration ↙
Rate, Z, Experience
    1.4100   86.5000    0.5500   69.3200
    0.6500   76.9300    0.5600   68.3500
    0.3600   66.5700    0.5800   69.5800
    0.2900   61.8200    0.6000   70.7200
    0.1600   51.9600    0.6500   75.3700

Averages, Mushfiqs sample: Welfare, Migration Rate, Experience
    0.5700   68.7600   70.6700

Averages, All Rural: Welfare, Migration Rate
    0.2900   59.1800


PE Conditional Migration Transfer: Welfare by Income Quintile: Welfare, Migration ↙
Rate, Z , Experience
    1.5700   96.6300    0.5500   69.3200
    0.7900   91.9400    0.5600   68.3500
    0.4400   80.7000    0.5800   69.5800
    0.3500   75.1500    0.6000   70.7200
    0.1900   62.2400    0.6500   75.3700

Averages, Mushfiqs sample: Welfare, Migration Rate, Experience
    0.6700   81.3300   70.6700

Averages, All Rural: Welfare, Migration Rate
    0.3400   65.4500


PE Unconditional Cash Transfer: Welfare and Migration by Income Quintile
    1.0200   84.3200
    0.5500   75.8900
    0.3500   66.0000
    0.2900   61.4100
    0.1900   51.7800
```

```
PE Unconditional Cash Transfer: Average Welfare Gain, Migration Rate
    0.4800   67.8800

Averages, All Rural: Welfare, Migration Rate
    0.2400   58.7300


Wage Gap
    1.7248

Average Rural Population
    0.6300

Fraction of Rural with No Assets
    0.4025

Expr Elasticity: Year One, Two
    0.1269    0.0276

Control: Year One, Repeat Two
    0.6865    0.5219

LATE Estimate
    0.3234

LATE - OLS Estimate
    0.4360

Below Median Consumption: Migration Below 800 Taka assets, Above 800 Taka
    0.7024    0.5850

Above Median Consumption: Migration Below 800 Taka assets, Above 800 Taka
    0.7222    0.6552


ans =

    1.7248    0.6300    0.4390    0.4025    0.6865    0.1269    0.0276    0.3234 ↙
0.4360    0.5219

>> display(x1)

x1 =

    1.3305    0.5544    1.5198    0.7164    1.5425    0.4820    0.8214    0.3749 ↙
0.1650

>>
```