

Mobile Internet Access and the Desire to Emigrate

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Motivation: why mobile internet?

- ▶ Adopted by more than 4 billion people worldwide in 2021 (GSMA, 2021)
- ▶ Pluriform technology that transcends borders easily:
 - ▶ Contact with family, friends, and the diaspora
 - ▶ **Social media** and **Search engines**

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 - ▶ Contact with family, friends, and the diaspora
 - ▶ **Social media** and **Search engines**
- ▶ Reduces the **cost of acquiring information**: easier to find information about job opportunities, differences in the standard of living and the quality of local amenities, by purpose or accidentally.
- ▶ Reduces the **cost of migration**: Internet makes it easier to communicate with people in a potential destination prior to migration and with people in the country of origin after migration, and it also facilitates irregular migration.
- ▶ No prior **causal evidence** of the effect of internet access on international migration (aspirations and intentions)

Connection to literature

Determinants of migration intentions:

- ▶ Intentions shaped by earnings prospects (Docquier, Peri, and Ruysen, 2018) and broad and close networks (Manchin and Orazbayev, 2018)
- ▶ Migration intentions strongly predict subsequent bilateral migration flows (Tjaden et al., 2019)

Economic and political effects of broadband and mobile internet:

- ▶ Hjort and Poulsen (2019) show positive effects on employment in Africa
- ▶ Falck, Gold and Heblich (2014) show negative effects on voter turnout in Germany
- ▶ Guriev, Melnikov and Zhuravskaya (2021) find negative effects on government approval

Broadband internet and migration:

- ▶ Pesando et al. (2021) find a positive association between broadband internet and migration aspirations: a ten p.p. increase in the population using the Internet is associated with a 1.2% increase in the population desiring to emigrate.

This paper

- ▶ Merging Gallup World Poll (GWP) with fine geographic data on mobile network coverage
- ▶ How and to what extent are **desire and plans to emigrate** of GWP respondents affected by **mobile internet coverage**?
- ▶ We explore heterogeneity by using the Causal Forests methodology
- ▶ We delve into several potential mechanisms
- ▶ We study actual municipal-level emigration from Spain

Preview of results

- ▶ Main result: an increase of 3G internet coverage of 10 p.p. increases the desire to emigrate by 0.27 p.p. and plans to emigrate by 0.09 p.p.
- ▶ This is sizeable: for a full rollout of 3G that is 12 and 32 % of the baseline share of respondents desiring and planning to migrate

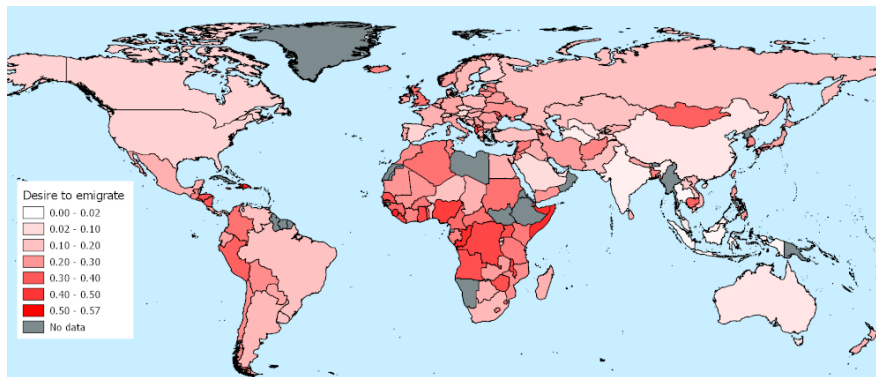
Preview of results

- ▶ Main result: an increase of 3G internet coverage of 10 p.p. increases the desire to emigrate by 0.27 p.p. and plans to emigrate by 0.09 p.p.
- ▶ This is sizeable: for a full rollout of 3G that is 12 and 32 % of the baseline share of respondents desiring and planning to migrate
- ▶ Results are driven by high-income countries and above-median-income individuals in lower-middle-income countries
- ▶ We find indications that internet decreases information costs, finding larger effects for those without network abroad and changing preferred destinations
- ▶ 3G access increased **actual** yearly emigration rates from Spanish municipalities by around 15%

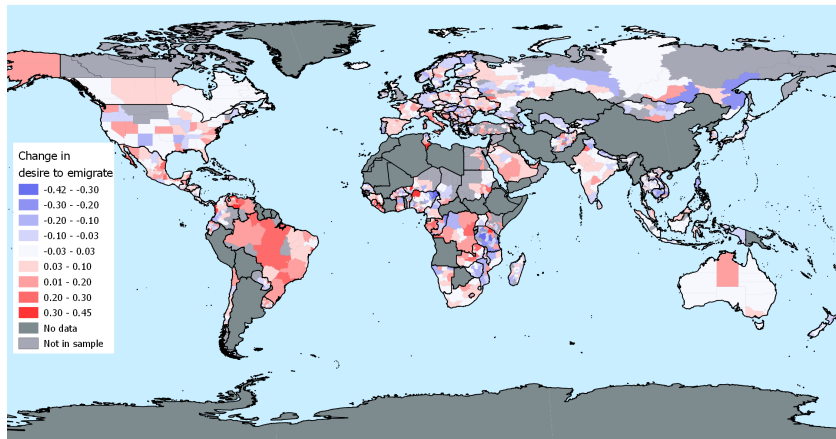
Data

- ▶ Gallup World Poll (GWP): a representative survey of generally around 1000 individuals per year in around 150 countries with *subnational divisions*, probes the following migration *aspirations* and *intentions*:
 1. Ideally, if you had the opportunity, would you like to move permanently to another country, or would you prefer to continue living in this country? (2008-2018) **22%**
 - ▶ if yes, which country would you like to move to?
 2. Are you planning to move permanently to another country in the next 12 months, or not? (2008-2015) **2.7%**
 - ▶ if yes, which country would you like to move to?

Desire to emigrate across the globe (2008-2011)

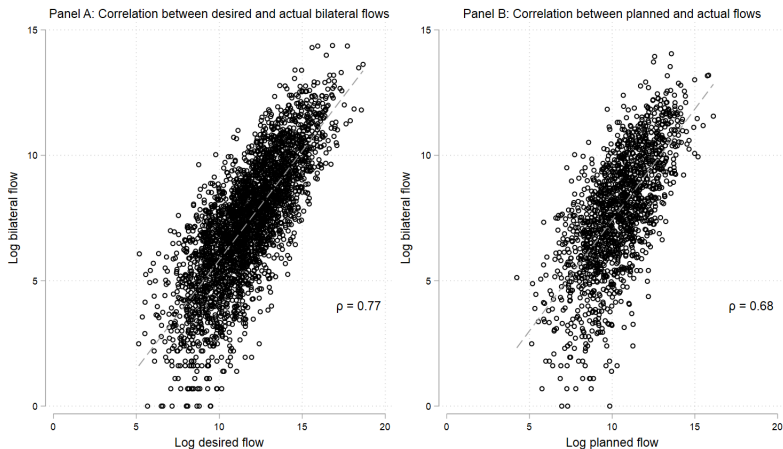


Changes in the desire to emigrate between early and late years (on the subnational level)



Migration Intentions and Realization

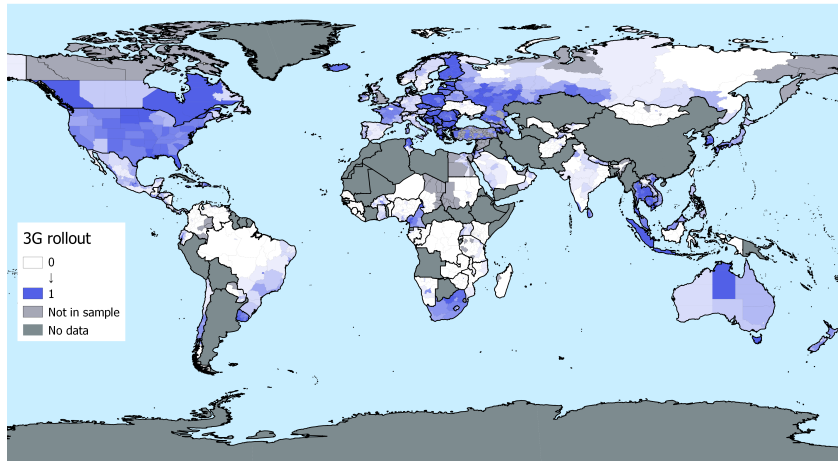
- ▶ Desire (plans) to migrate rates are on average a factor of 40 (8) higher than yearly bilateral migration rates, but strongly correlated



Population-averaged 3G coverage

- ▶ Collins Bartholomew Mobile Coverage Explorer: 1-by-1 km coverage data overlaid with Gridded Population of the World data from NASA's SEDAC and aggregated on subnational regions from GWP
- ▶ 2G and 3G coverage on the district-year level.
- ▶ Average 3G coverage was 13% in 2008, 46% in 2018
- ▶ Mobile internet is the first experience with the internet for many people, and increases usage intensity for many others.
- ▶ Our sample of interest: 617,402 individuals covered in GWP in districts with information on 3G coverage, collected over 11 years and 2,120 sub-national regions in 112 countries.

The rollout of 3G over subnational districts



Empirical Strategy

Staggered continuous diff-in-diff:

$$Outcome_{idt} = \beta_1 3G_{dt} + \alpha' \mathbf{X}_{idt} + \phi_d + \theta_t + \gamma_d \cdot t + \epsilon_{idt}$$

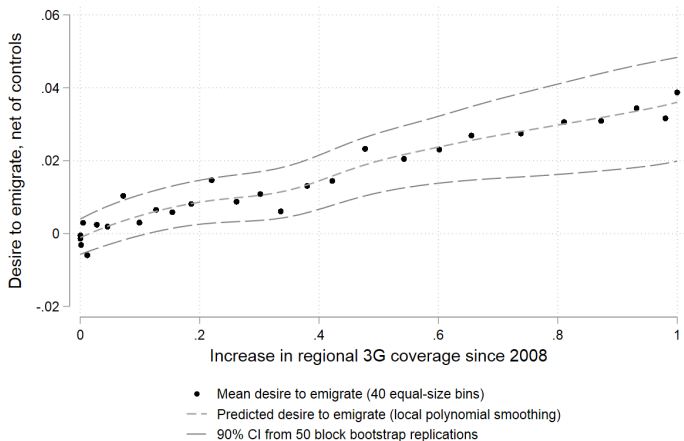
- ▶ $Outcome_{idt}$ is a binary migration aspiration/intention
- ▶ Individuals weighted with Gallup weights (to make it nationally representatives) and two-way clustered standard errors

X_{idt} contains:

- ▶ Basic demographics (age, gender, relationship status, children, income, born abroad) and regional development level
- ▶ Satisfaction with local amenities
- ▶ Country-level GDP, democracy (Polity), share of young people

Marginal effect of 3G

The effect is relatively homogeneous in the intensive margin of 3G coverage



Main results: Desire to Emigrate

Table 1: Dependent variable: *Ideally, if you had the opportunity, would you like to move permanently to another country, or would you prefer to continue living in this country?*

Outcome:	(1)	(2)	(3)	(4)
		Desire to emigrate		
3G	0.027** (0.012)	0.026** (0.012)	0.028*** (0.011)	0.027** (0.011)
Observations	617,402	617,402	617,402	617,402
R ²	0.12	0.16	0.19	0.19
Average dependent variable	0.220	0.220	0.220	0.220
Demographic controls		✓	✓	✓
Life satisfaction-related controls			✓	✓
Income controls			✓	✓
Country-level controls				✓
District and year FEs	✓	✓	✓	✓
District-year trend	✓	✓	✓	✓

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses

The standard errors are clustered two-way: on the country-year and district level

Main results: Plans to Emigrate

Table 2: Dependent variable: *Are you planning to move permanently to another country in the next 12 months, or not?*

Outcome:	(1)	(2)	(3)	(4)
		Planning to emigrate		
3G	0.008** (0.004)	0.009** (0.004)	0.009** (0.004)	0.009** (0.004)
Observations	379,703	379,703	379,703	379,703
R^2	0.06	0.07	0.07	0.07
Average dependent variable	0.028	0.028	0.028	0.028
Demographic controls		✓	✓	✓
Life satisfaction-related controls			✓	✓
Income controls			✓	✓
Country-level controls				✓
District and year FEs	✓	✓	✓	✓
District-year trend	✓	✓	✓	✓

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses

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Alternative to TWFE

We use the estimator of de Chaisemartin and D'Haultfouille (2020) for three reasons:

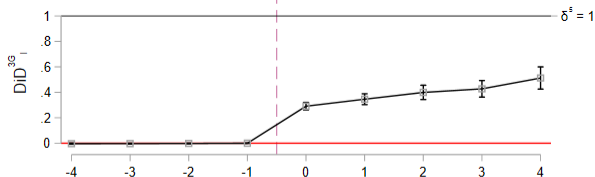
1. Two-way Fixed Effect regressions are problematic when treatment effects are heterogeneous and dynamic (see Goodman-Bacon (2021), Borusyak et al. (2021) and others)
2. Assessing pre-trends
3. Dynamic effects

Drawback:

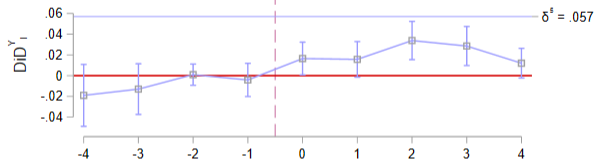
- ▶ Need to discretize treatment and set thresholds [Explanation](#)

de Chaisemartin-D'Haultfouille Estimates

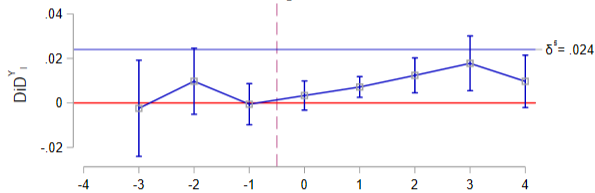
Panel A: Population-averaged 3G coverage



Panel B: Desire to emigrate



Panel C: Plans to emigrate in the next 12 months



Instrumenting 3G with pre-existing 2G networks

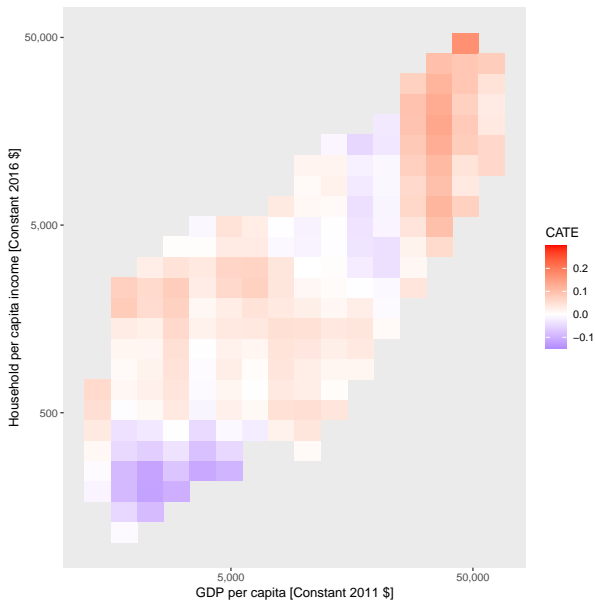
- ▶ Pre-existing 2G infrastructure facilitates subsequent 3G network expansion.
- ▶ *Relevance*: The roll-out of 3G is faster when 2G. We instrument 3G expansion with the share of population covered in the subnational region in 2006 $2G_{d,2006}$ interacted with a linear time trend.
- ▶ *Exclusion*: The *level* of 2G coverage in 2006 should be uncorrelated to *trends* in the desire to emigrate
- ▶ We use an extensive set of geographic and demographic controls, interacted with a linear time trend.
- ▶ We control for 2G coverage over time $2G_{d,t}$

Infrastructure IV results

Table 3: 2G Infrastructure IV Results

	(1)	(2)	(3)	(4)
Dependent variable:	Desire to emigrate			3G
	Baseline	Reduced	IV: second stage	IV: first stage
3G	0.027** (0.011)	0.028*** (0.006)	0.098** (0.040)	
<i>Anderson-Rubin 95% Confidence Interval</i>			[0.019, 0.201]	
2G ₂₀₀₆ × year				0.041*** (0.000)
First-stage F-statistic				42.88
Observations	617,402	617,402	617,402	617,402
R ²	0.188	0.177	0.177	0.884
Average dependent variable	0.223	0.223	0.223	0.371
District-level time trends	✓			
IV-related controls		✓	✓	✓
Control for 2G	✓	✓	✓	✓
Baseline controls	✓	✓	✓	✓
District and time FEs	✓	✓	✓	✓

Heterogeneity of the effects over GDP and household income



Robustness checks

- ▶ Not driven by spurious TWFE ✓
- ▶ Absence of pre-trends ✓
- ▶ IV using pre-existing infrastructure ✓

Robustness checks

- ▶ Not driven by domestic migration ✓
- ▶ 2G mobile networks and leads of 3G coverage insignificant ✓
- ▶ Additional controls: networks, financial support, employment status and other measures of regional development ✓

Robustness checks

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- ▶ 2G mobile networks and leads of 3G coverage insignificant ✓
- ▶ Additional controls: networks, financial support, employment status and other measures of regional development ✓
- ▶ Alternative specifications: omitting district-level time trends or quadratic time trends ✓
- ▶ Alternative weights: by country-year level population or not at all ✓
- ▶ Alternative standard errors: cluster on the country level ✓
- ▶ Panel of balanced districts ✓
- ▶ Removing single years ✓ or global regions ✓
- ▶ Omission of high- and low migration regions ✓ – poor 3G data ✓ – telephone interviews ✓
- ▶ Results are unlikely driven by omitted variable bias ✓ and robust to Multiple Hypothesis Testing ✓

Information and migration costs

- ▶ No effect on only local migration ✓
- ▶ No effect of 2G expansion (internet access is important) ✓
- ▶ **Effect driven by those without close network abroad ✓**
- ▶ **Preferred destinations become more diverse ✓**

Mobile internet substitutes for prior networks

Additional question: do you have someone to rely on abroad?

Table 4: Baseline Results of 3G Internet Expansion for 2008 – 2015 for Those With and Without Close Personal Network Abroad

	(1) All respondents	(2) No	(3) Yes
Those with people to rely on abroad:			
3G	0.030** (0.015)	0.044*** (0.016)	0.016 (0.025)
Demographic controls	✓	✓	✓
Amenities, satisfaction, and income controls	✓	✓	✓
Country-level controls	✓	✓	✓
Observations	388,368	252,172	136,130
R^2	0.19	0.18	0.21
Average dependent variable	0.209	0.161	0.298

Bilateral Desires

Table 5: Gravity Model of Country-Level Desired Bilateral Migration Rates and the Effect of 3G and Pre-existing Migrant Networks (estimated by PPML)

	(1)	(2)	(3)	(4)	(5)	(6)
	Desired bilateral emigration					
$3G_{ot}$	0.291*** (0.059)	0.654*** (0.116)	0.065 (0.113)			
$3G_{ot} \times \ln(\text{Stock}_{od,2005}+1)$ (Standardized)		-0.173*** (0.061)		-0.262*** (0.059)		-0.301*** (0.072)
$3G_{ot} \times \ln(\text{GDPpc}_{dt})$ (Standardized)			0.205** (0.104)		0.010 (0.102)	0.218* (0.117)
$3G_{ot} \times \ln(\text{Distance}_{od})$ (Standardized)						-0.004 (0.053)
$3G_{ot} \times \text{Polity IV}_{dt}$						-0.006 (0.013)
$3G_{ot} \times \text{Common language}_{od}$						0.035 (0.123)
Observations	64,977	64,977	64,977	64,977	64,977	64,977
Origin-year-level controls	✓	✓	✓	-	-	-
Origin-destination FE	✓	✓	✓	✓	✓	✓
Destination-year FE	✓	✓	✓	✓	✓	✓
Origin-year FE				✓	✓	✓

Migration from Spain

- ▶ Registry data (EVR) from the Spanish statistical office (INE)
- ▶ Records migration on the individual level for municipalities with population exceeding 10,000 inhabitants
- ▶ We merge the 3G data to the municipalities d and estimate:

$$m_{dt} = \beta_1 3G_{d(t-1)} + \phi_d + \theta_t + \epsilon_{dt} \quad (1)$$

- ▶ Where m_{dt} is the emigration rate of Spanish nationals
- ▶ Using data from 2010 to 2020

Mobile internet and realized emigration: Evidence from Spain

Table 6: The effect of 3G Rollout on Emigration of Spanish-born individuals from Spain

Dependent variable:	(1)	(2)	(3)
		Emigration rate ($\times 100$)	
Population in 2008:	All	$\leq 200,000$	$> 200,000$
3G Coverage _{t-1}	0.016** (0.007)	0.014*** (0.005)	0.018 (0.028)
Observations	6,570	6,280	290
R ²	0.873	0.838	0.951
Average emigration rate ($\times 100$)	0.094	0.093	0.105
Municipality and year FE	✓	✓	✓
Provincial unemployment	✓	✓	✓

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Conclusion

- ▶ An increase of 10 p.p. of 3G internet coverage leads to an increase of 0.27 percentage points in the desire to emigrate and 0.09 p.p. in plans to emigrate
- ▶ We suggest an **information cost channel**

Conclusion

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- ▶ We suggest an **information cost channel**
- ▶ Implications and outlook:
 - ▶ 3G internet may redirect migration flows towards less popular destinations, increasing birthplace diversity in destinations and boosting trade links and knowledge remittances.
 - ▶ Is actual migration also affected? Spain

We want more!

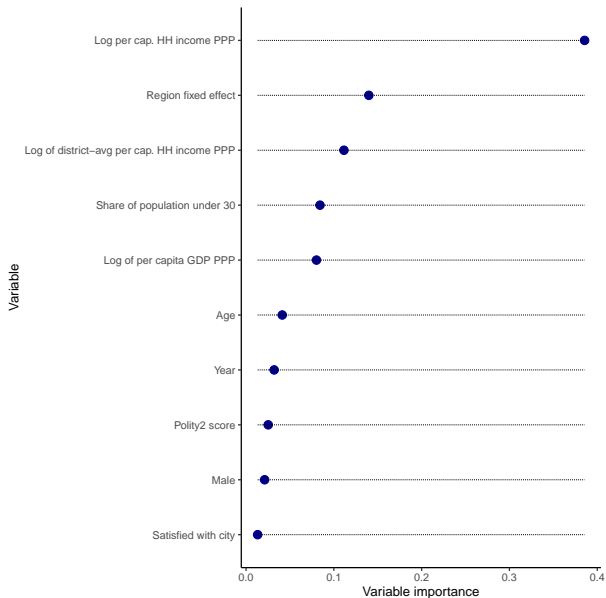
Heterogeneity: Causal Forest

- ▶ Novel method for finding heterogeneity in a data-driven way (Athey et al., 2019)

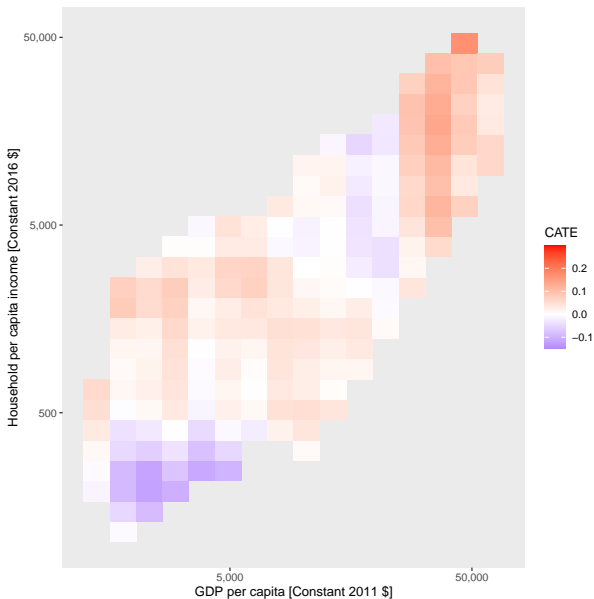
$$Y_{ict} = \alpha_i(X'_{it}) + \tau_i(X'_{it})D_{d,t} + u_{idt}$$

- ▶ X'_{it} includes all baseline covariates
- ▶ Causal forest is based on regression trees that maximizes treatment heterogeneity
- ▶ Output: variable importance and Conditional Average Treatment Effects (CATE)

Heterogeneity: What matters



How the effects depend on GDP and household income



Household income and perceived material well-being

Table 7: The effect of 3G on Possible Mediators

Panel A: Material well-being				
Dependent variable:	(1) Household income (log)	(2) Material prospects first principal component	(3) Job climate index	(4) Financial well-being index
3G	-0.026 (0.035)	-0.030** (0.014)	-0.036** (0.018)	-0.114* (0.067)
Observations	617,402	569,708	614,435	172,653
R^2	0.71	0.24	0.19	0.23

Institutional satisfaction

Table 8: The effect of 3G on Possible Mediators

Panel B: Institutional satisfaction				
Dependent variable:	(1) Law and order index	(2) Corruption index	(3) Community basics index	(4) Trust in government first principal component
3G	0.015 (0.009)	-0.017 (0.014)	0.010 (0.010)	-0.037** (0.015)
Observations	616,783	588,979	617,402	486,283
R^2	0.19	0.22	0.25	0.23

Additional null results:

- ▶ Life satisfaction [here](#)
- ▶ Banking and Remittances [here](#)

Life Satisfaction

Table 9: The effect of 3G on Various GWP Outcomes

Panel C: Life satisfaction and optimism				
Dependent variable:	(1) Optimism index	(2) Daily experience index	(3) Life evaluation index	(4) Life purpose index
3G	-0.018 (0.014)	-0.005 (0.007)	-0.030 (0.021)	-0.046 (0.073)
Observations	617,220	615,880	580,644	172,467
R^2	0.22	0.12	0.21	0.20

back

Banking and Remittances

Table 10: The effect of 3G on Various Gallup GWP Outcomes

Panel D: Mobile banking and remittances				
Dependent variable:	(1) Owns a bank account	(2) Used cellphone to receive cash in last 12 months	(3) Received money or goods from friend/ family from same country	(4) Received money or goods from friend/ family from another country
3G	-0.020 (0.038)	0.003 (0.026)	-0.009 (0.015)	0.004 (0.008)
Observations	169,581	161,081	566,956	566,956
R ²	0.40	0.21	0.12	0.10

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Main results: Likelihood to Emigrate

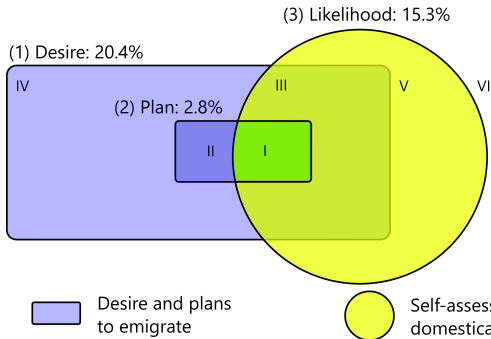
Table 11: Dependent variable: *In the next 12 months, are you likely or unlikely to move away from the city or area where you live in?*

Outcome:	(1)	(2)	(3)	(4)
	Self-assessed likelihood to migrate			
3G	0.027** (0.010)	0.026** (0.010)	0.027*** (0.010)	0.027*** (0.010)
Observations	547,758	547,758	547,758	547,758
R^2	0.10	0.13	0.16	0.16
Average dependent variable	0.17	0.17	0.17	0.17
Demographic controls		✓	✓	✓
Life satisfaction-related controls			✓	✓
Income controls			✓	✓
Country-level controls				✓
District and year FEs	✓	✓	✓	✓
District-year trend	✓	✓	✓	✓

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses

The standard errors are clustered two-way: on the country-year and district level

Venn Diagram of GWP questions



Mutually exclusive regions:

- I: Planning likely emigrants (1.8%)
- II: Planning dreamers (1.1%)
- III: Domestically mobile dreamers (4.7%)
- IV: Dreamers (12.9%)
- V: Only domestically mobile (8.9%)
- VI: Likely stayers (70.7%)

Other outcomes

Table 12: The Effects of 3G Internet on Alternative Outcomes Variables

Outcome:	(1)	(2)	(3)	(4)
	Any desire or plans to migrate (I-V)			
3G	0.041*** (0.014)	0.040*** (0.014)	0.042*** (0.013)	0.041*** (0.013)
	Preparing or planning likely emigrant within 12 months (I)			
3G	0.010*** (0.003)	0.011*** (0.003)	0.011*** (0.003)	0.011*** (0.004)
	Likely internal migrant within 12 months (V)			
3G	0.009 (0.008)	0.009 (0.008)	0.009 (0.008)	0.008 (0.008)
District and year fixed effects	✓	✓	✓	✓
District-year trends	✓	✓	✓	✓
Demographic controls		✓	✓	✓
Life satisfaction-related controls			✓	✓
Income controls				✓

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Appendix A1

Summary Statistics

Table 13: Summary Statistics and the Data Sources

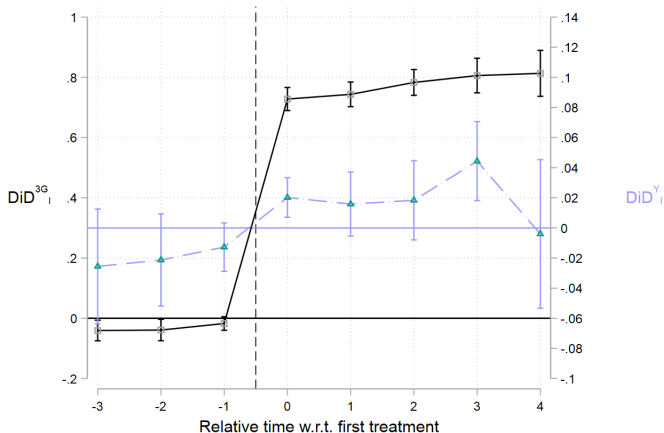
Panel A: Baseline					
	Mean	S.D.	Observations	Source	Level
Desire to emigrate	0.22	0.42	617,402	GWP	Individual
Plan to emigrate	0.03	0.16	376,801	GWP	individual
Likely to move	0.17	0.37	544,022	GWP	Individual
Regional 3G coverage	0.37	0.39	617,402	Collins Bartholomew	District-Year
Regional 2G coverage	0.77	0.30	617,402	Collins Bartholomew	District-Year
Male	0.46	0.50	617,402	GWP	Individual
Age	40.10	17.02	617,402	GWP	Individual
Urban	0.39	0.49	617,402	GWP	Individual
Partner	0.58	0.49	617,402	GWP	Individual
Separated/divorced	0.06	0.24	617,402	GWP	Individual
Presence of children	0.56	0.50	617,402	GWP	Individual
Secondary education	0.53	0.50	617,402	GWP	Individual
Tertiary education	0.15	0.36	617,402	GWP	Individual
Born in country of interview	0.96	0.19	617,402	GWP	Individual
Log of per capita income	7.74	1.51	617,402	GWP	Individual
Log of district per capita income	8.15	1.15	617,402	GWP	District-Year
Log of GDP per capita	8.44	1.40	617,402	World Bank	Country-Year
Polity 2	5.44	5.01	617,402	Center for Systemic Peace	Country-Year
Share of respondents below 30	0.32	0.13	617,402	GWP	Country-Year

Appendix A2

Robustness

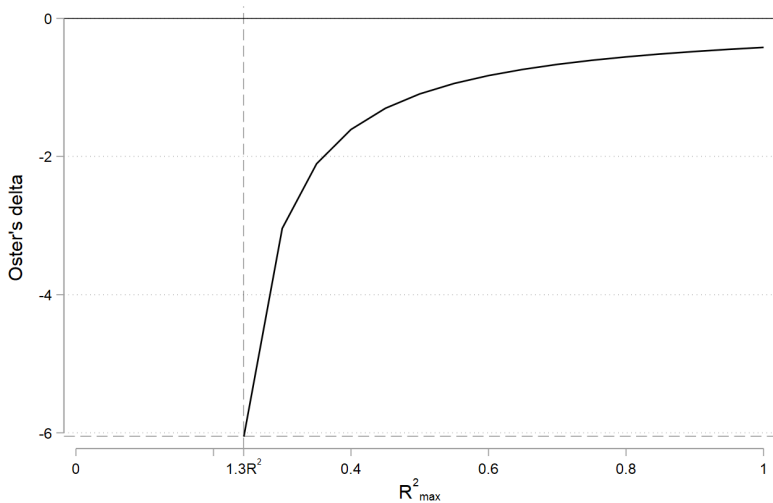
Event Study around sharp changes

Figure 1: Event study estimates including lags and leads w.r.t. event (50% increase of 3G coverage in 1 year)



Robustness to Omitted Variable Bias

Figure 2: Oster's δ for increasing values of maximally admissible R_{max}^2



Effect on Internet Access

Table 14: The effects of 3G expansion on Access to the Internet

Outcome:	(1)	(2)
	Internet Access	
3G	0.049*** (0.015)	0.051*** (0.014)
Baseline controls, FEs and district-level time trend	✓	✓
Broadband subscription rate		✓
Observations	614,945	606,541
R^2	0.52	0.52
Average dependent variable	0.435	0.435

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. See notes to Table ?? for details on the specification. Standard errors are clustered two-way: at the district and country-year level.

back

Additional controls

Table 15: Additional controls based on baseline for regional development, amenities and life satisfaction, employment status and others.

Outcome:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Desire to emigrate						
3G	0.029*** (0.011)	0.027** (0.011)	0.028*** (0.011)	0.024** (0.011)	0.027** (0.011)	0.029*** (0.011)	0.030*** (0.012)
Nightlight luminosity	-0.000 (0.001)						
Log median HH income		0.003 (0.005)					
Log mean HH income			0.003 (0.003)	0.002 (0.003)	0.003 (0.003)	0.004 (0.003)	0.004 (0.003)
Demographic controls	✓	✓	✓	✓	✓	✓	✓
Country-level controls	✓	✓	✓	✓	✓	✓	✓
District-level trends	✓	✓	✓	✓	✓	✓	✓
Can count on friends	✓	✓	✓	✓		✓	✓
Satisfaction with amenities	✓	✓	✓		✓	✓	✓
Satisfaction with life	✓	✓		✓	✓	✓	✓
Employment status						✓	
Received money/goods							✓
Observations	617,402	617,402	617,402	617,402	617,402	579,507	566,873
R ²	0.19	0.19	0.18	0.17	0.19	0.19	0.19

Placebo treatments

Table 16: Effect of 2G on the desire to emigrate

Outcome:	(1)	(2)	(3)	(4)	(5)	(6)
	Desire to emigrate					
$2G_t$	0.019 (0.014)	0.018 (0.013)				
$3G_t$		0.027** (0.011)			0.027** (0.011)	
$3G_{t-2}$			0.017 (0.012)			
$3G_{t-1}$				0.001 (0.012)		
$3G_{t+1}$						0.010 (0.013)
Baseline controls, FEs and district-level trend	✓	✓	✓	✓	✓	✓
Observations	617,402	617,402	551,021	581,401	617,402	548,152
R^2	0.19	0.19	0.19	0.19	0.19	0.19
Average dependent variable	0.214	0.214	0.214	0.214	0.214	0.214

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Leaving one year out at a time

Table 17: Leaving out years, one at a time

Outcome:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Omitted:	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
3G	0.028** (0.011)	0.024** (0.012)	0.018 (0.012)	0.040*** (0.011)	0.025** (0.012)	0.030*** (0.012)	0.031*** (0.012)	0.031*** (0.012)	0.028** (0.012)	0.031** (0.012)	0.016 (0.011)
Obs.	590,636	586,273	565,156	551,182	558,148	565,846	562,549	547,900	546,699	541,586	558,045
R ²	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Av. DV	0.222	0.221	0.222	0.221	0.223	0.221	0.220	0.221	0.218	0.218	0.215

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Leaving one region out at a time

Table 18: Leaving out mutually exclusive regions, one at a time

Outcome: Global region omitted:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Europe	Former USSR	AUS+CAN+ ISR+JPN+ KOR+NZL+ TUR+USA	Middle East	Rest of Asia	Americas without CAN+USA	Africa
3G	0.022* (0.011)	0.027** (0.012)	0.024** (0.012)	0.032*** (0.012)	0.036*** (0.013)	0.022** (0.011)	0.027** (0.012)
Observations	509,276	539,645	575,734	523,460	498,829	609,016	448,452
R^2	0.19	0.19	0.19	0.19	0.19	0.19	0.17
Average dependent variable	0.229	0.224	0.225	0.211	0.245	0.220	0.183

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Omission of high and low migration regions

Table 19: Robustness to Excluding Countries with Many Refugees and High and Low Share of Respondents Desiring to Migrate

Outcome: Excluding countries:	(1)	(2)	(3)
	Top 10 refugee	Desire to emigrate $\geq 40\%$ desire to emigrate	$\leq 10\%$ desire to emigrate
3G	0.026** (0.011)	0.023** (0.011)	0.036*** (0.013)
Observations	599,017	565,042	515,940
R^2	0.19	0.16	0.17
Average dependent variable	0.216	0.194	0.251

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. See notes to Table ?? for details on control variables. Standard errors are clustered two-way: on the district and the country-year levels. Column (1) omits respondents in Afghanistan, Sudan, Democratic Republic Congo and Venezuela. Column (2) omits countries where, on average, more than 40% of GWP respondents desires to migrate. Column (3) omits countries where, on average, less than 10% of respondents desire to migrate.

Omission of potentially poor quality 3G data

1. (1) Districts with a more than 10 p.p. drop in 3G coverage between 2008 and 2018
2. (2) Countries where first-reported 3G coverage exceeds 20%
3. (3) Countries where 3G coverage is less than one-quarter of the number of mobile broadband subscriptions in 2015
4. (4) All of (1)-(3)

Table 20: Robustness to Dropping Observations with Potentially Poor-quality 3G Data

Outcome:	(1)	(2)	(3)	(4)
	Desire to emigrate			
3G	0.031** (0.012)	0.031** (0.012)	0.032*** (0.012)	0.037** (0.014)
Observations	580,253	522,958	501,979	427,062
R^2	0.19	0.18	0.18	0.18
Average dependent variable	0.224	0.221	0.231	0.219

Balancing Test

Table 21: Balancing Test of 3G on
Baseline Demographic Covariates

Outcome:	3G × 100
Male	0.008 (0.032)
Age	-0.001 (0.006)
Age-squared	0.000 (0.000)
Urban	0.028 (0.147)
With partner	-0.102* (0.053)
Separated/divorced	-0.170* (0.099)
Presence of children	0.100 (0.064)
Secondary education	-0.032 (0.087)
Tertiary education	-0.101 (0.121)
Not born in country of interview	-0.015 (0.142)
Log of personal income	-0.009 (0.050)
Log of district-year mean per capita HH income	-0.063 (0.555)
N	617,402
R2	0.932

Multiple Hypothesis Correction

Table 22: Robustness to Randomization Inference and Multiple Hypothesis Testing

Outcome:	(1) Desire to emigrate	(2) Plans to emigrate	(3) Likelihood to migrate	(4) Joint test of irrelevance
3G <i>Young(2019)</i> <i>Randomized p-value</i>	0.027** (0.020)	0.009** (0.023)	0.027*** (0.004)	(0.014)

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Young (2019) randomization inference p-values in parentheses, based on 500 bootstrap replications.

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Alternative Standard Errors

Table 23: Robustness to Alternative Variance-Covariance Matrix Structure

Outcome:	(1) Desire to emigrate	(2)
3G	0.027*** (0.009)	0.027* (0.014)
Baseline controls, FEs and district time trend	✓	✓
Observations	617,402	617,402
R^2	0.19	0.19
Level of clustering	Country-Education-Gender	Country
Number of clusters	658	112

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

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Balanced panel of observations

Table 24: Baseline result for a balanced sample on the country and district level

Outcome:	(1)	(2)
	Desire to emigrate	
3G	0.047*** (0.018)	0.059*** (0.020)
Baseline controls, FEs and district time trend	✓	✓
Observations	202,378	179,138
R^2	0.16	0.15
Average dependent variable	0.156	0.164
Level of balancing	Country	District

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. See notes to Table ?? for details on control variables. Standard errors are clustered two-way: on the district and the country-year levels.

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Using no and country-level population weights

Table 25: Baseline result for different choices of weights

	(1)	(2)	(3 ⁴)
3G	0.033*** (0.010)	0.027** (0.011)	0.039*** (0.013)
Baseline controls, FEs and district time trend	✓	✓	✓
Observations	617,402	617,402	617,402
R ²	0.19	0.19	0.22
Average dependent variable	0.222	0.222	0.222
Weights	Unweighted	Gallup only (baseline)	Population and Gallup

Standard errors in parentheses.

Standard errors are clustered two-way: on the District and the Country-year level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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⁴India represents 35% of the weights in the population-weighted regression

Alternative specifications

Table 26: Effect of 3G on desire to migrate on the full sample for different specifications

	(1)	(2)	(3)
3G	0.027** (0.011)	0.018* (0.009)	0.032*** (0.012)
Baseline controls	✓	✓	✓
Observations	617,402	617,402	617,402
R^2	0.19	0.18	0.20
Average dependent variable	0.222	0.222	0.222
Specification	Baseline	No district-level trend	Quadratic trend

Standard errors in parentheses.

Standard errors are clustered two-way: on the District and the Country-year level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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No Telephone Interviews

Table 27: Robustness to Omission of Telephone Interviews

	(1)	(2)	(3)
3G	0.027** (0.011)	0.028** (0.013)	0.029** (0.012)
Demographic controls	✓	✓	✓
Amenities, satisfaction, and income controls	✓	✓	✓
Country-level controls	✓	✓	✓
Observations	617,402	506,326	514,637
R^2	0.19	0.19	0.19
Average dependent variable	0.231	0.231	0.231
Telephone Interviews	All	No	No (country)

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Effect Size over Time

Table 28: Interaction of 3G with Time Period Dummy

Outcome:	Desire to emigrate
$3G \times I(\text{Year} < 2014)$	0.029** (0.012)
$3G \times I(\text{Year} \geq 2014)$	0.024* (0.012)
N	617,402
R2	0.19

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are clustered two-way: on the district and the country-year level.

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Appendix A3

de Chaisemartin-D'Haultfouille Estimator

- ▶ We use the estimator of de Chaisemartin and D'Haultfouille (2020), which allows for a multilevel treatment
- ▶ Calculates diff-in-diffs for units receiving treatment for the first time (since we observe 3G in 2006)
- ▶ Similar to an event study around a binary treatment, we can assess trends in migration intentions before and after a first increase in 3G coverage

de Chaisemartin-D'Haultfouille Estimator

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- ▶ Calculates diff-in-diffs for units receiving treatment for the first time (since we observe 3G in 2006)
- ▶ Similar to an event study around a binary treatment, we can assess trends in migration intentions before and after a first increase in 3G coverage

However, we do not exploit all variation and observations

- ▶ We calculate diff-in-diffs within the "baseline treatment groups" that have $d = 0$ or those with $d \neq 0$ in 2006 and aggregate those
- ▶ As many units increase treatment gradually, we set a threshold for treatment of 3 percentage points

de Chaisemartin-D'Haultfouille Estimator

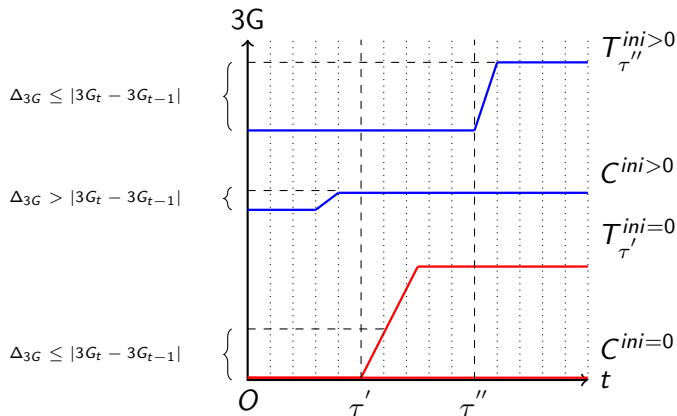


Figure 3: Relevant Treatment and Control groups for the de Chaisemartin and D'Haultfouille Estimator