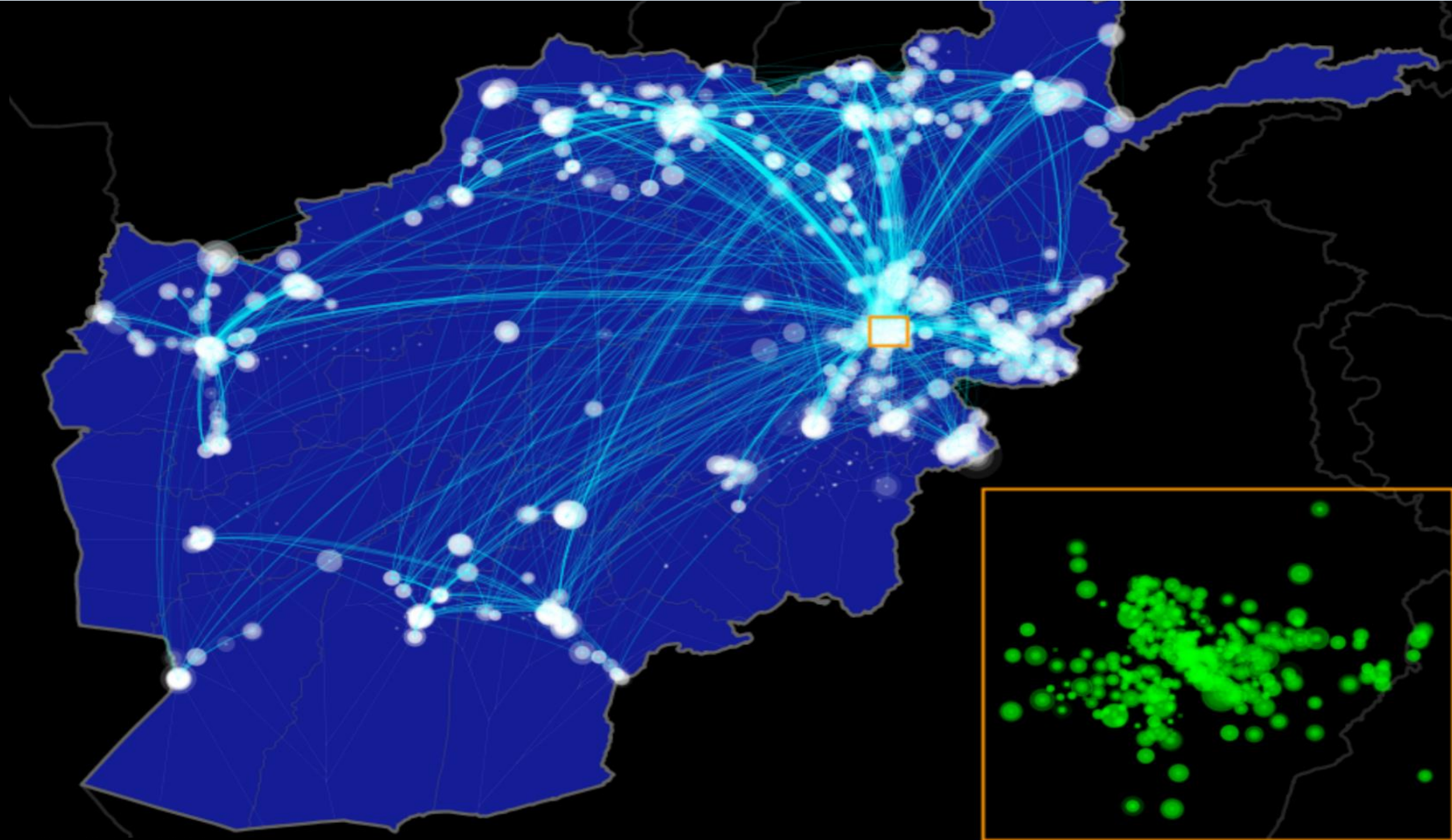


# “How Do Firms Respond to Insecurity? Evidence from Afghan Corporate Phone Records”

MeasureDev – 31 March 2020

Sylvan Herskowitz, IFPRI

with Joshua Blumenstock, Tarek Ghani, Ethan Kapstein, Tom Scherer, Ott Toomet



# Motivation: Insecurity & Economic Activity

## Insecurity is commonplace, but impact on private sector is not well understood

- 1.5 billion live in countries affected by fragility & conflict (WDR 2011)
- Strong negative relationship between insecurity and economic activity.  
Destroy physical capital, deter investment, disrupt livelihoods and human capital, weaken institutions.  
Collier et al. (2003), Blattman & Miguel (2010), Abadie & Gardeazabal (2003), Miguel & Roland (2011), ...
- Less known about effects on strategic behavior of firms.
  - Exceptions: Guidolin & La Ferrara (2007), Ksoll et al. (2016), Amodio & Di Maio (2017), Besley & Mueller (2017)
  - See also: Laeven & Woodruff (2007), Hsieh & Klenow (2010), Hsieh & Olken (2014), McKenzie (2017), Jensen & Miller (2017)

## Fundamental challenge: Measurement

“A paucity of firm-level data during or immediately after... conflict”

Besley, Mueller, and Singh (2011), p.4

# This Paper: Firm Response to Violence

## Primary questions and contributions:

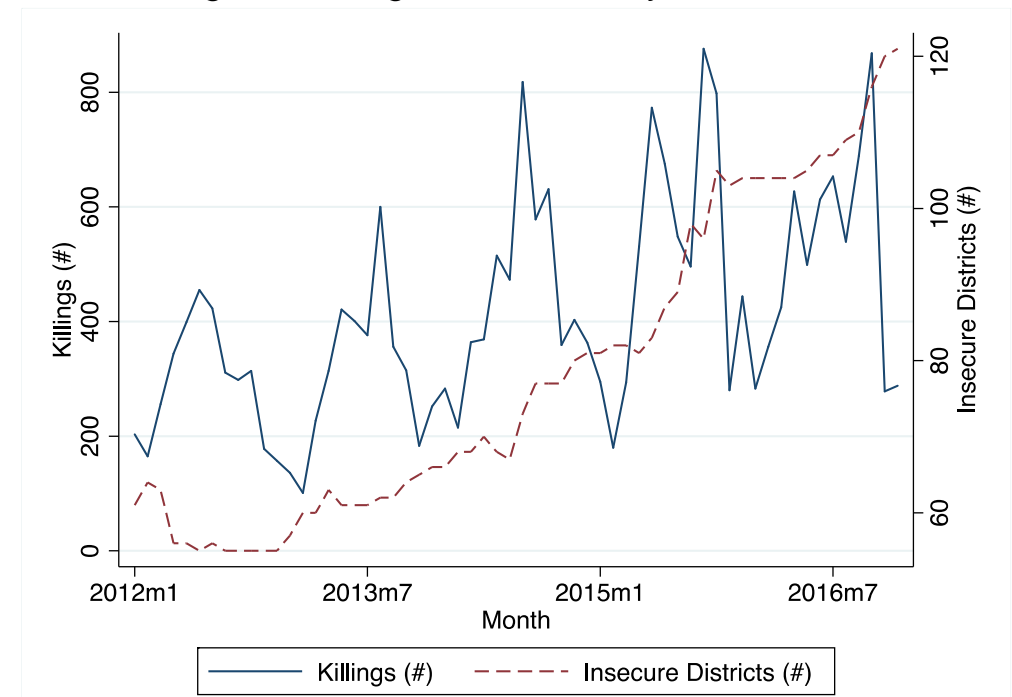
1. Methodological: How can we measure private sector activity in fragile and conflict-affected settings?
  - New measurement of firm/employee activity/presence based on corporate mobile phone records
2. Substantive: How does insecurity affect firm location choice?
  - **R1: Local Effects**
  - R2: Spatial Spillovers – Negative spillovers of events in capitals on surrounding rural areas
  - **R3: Employee Movement Following Events**
  - R4: Firm Geography Heterogeneity – Responses stronger when firms outside “headquarters”
  - R5: Size Heterogeneity – Larger firms relatively more responsive to major events

# This Paper: Empirical Setting

## Afghanistan, 2013-2016

- Up to 2009, there had been steady growth
- Drawdown of US troops 2012-2014
- Rising insecurity, volatile growth
- 183 of 190 in “Doing Business” rankings

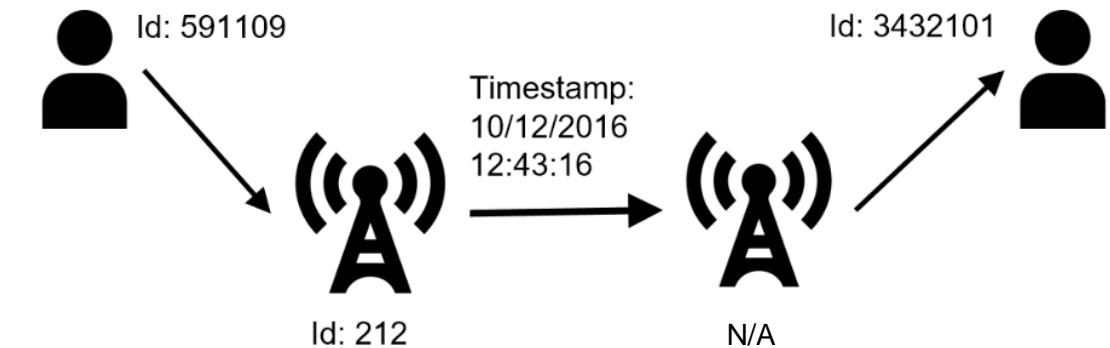
Regional killings and insecurity, 2012-2016



# Methods: Measuring Firm Activity

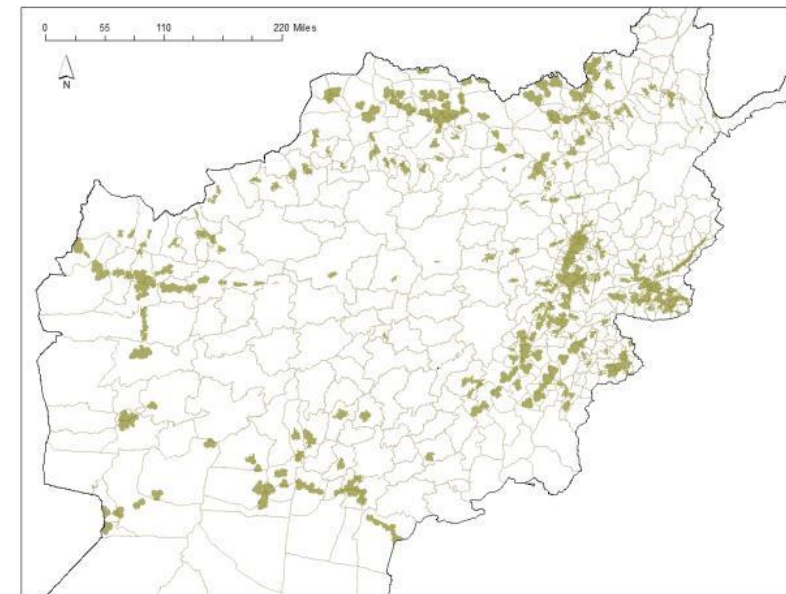
## Call Detail Records

- Each call and text message is timestamped and geotagged
- We observe: Caller ID (SIM), Sending tower, receiving caller ID, and time stamp.
- We know: GPS coordinates of cell phone towers

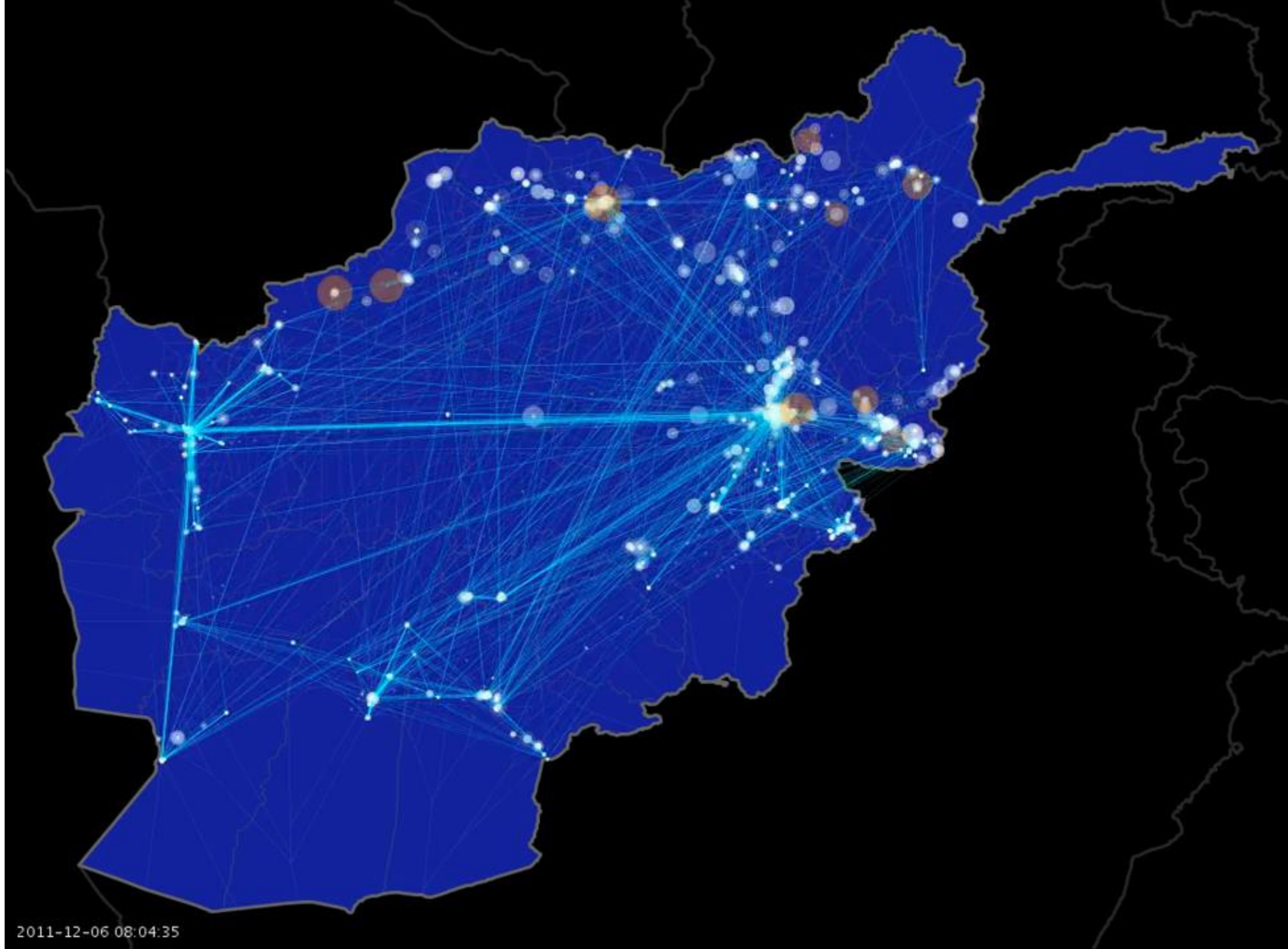


Timestamp	Id_out	Id_in	Cell_out	Cell_in	Dur	Hour
10-12-16 12:34:16	591109	3432101	212	N/A	103	12

Example Call Detail Record (CDR)



Cell towers in Afghanistan, 2012



# Methods: Measuring Firm Activity

## Measuring private sector activity from call data

- Remove public/education/health
- 200m corporate account calls
  - 125k subscribers (SIMs) → 2300+ firms
  - 1200+ towers → 266 districts
- Drop districts without complete tower coverage during all months
- Two data structures:
  1. firm-district-month panel
  2. Subs (MSISDN/individual)-month panel

org 2245, segment: Others, HQ in 2001 (Hirat) , total 5 msisdns; 2013-04





# Methods: “Validation”

What are we measuring?

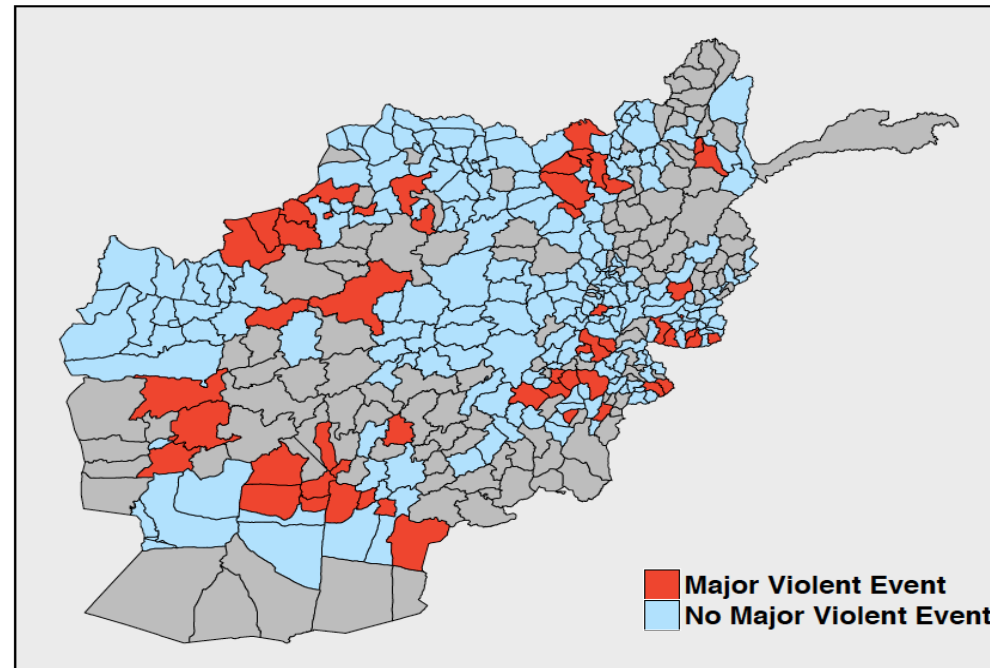
We validate/contrast with four existing datasets and a new firm survey:

1. Firm **characteristics** (World Bank Enterprise Survey,  $N=416$ )
  - Size/sector/regions comparable to “representative” national survey [[results](#)]
2. Firm **locations** (Original surveys,  $N=406$ ; official firm registry)
  - Firm HQ & office locations match “modal” districts in call data [[results](#)]
3. Firm **size** (IBES microdata; and original surveys)
  - For matched firms, official employee count correlates with subscriber count [[results](#)]
4. Aggregate economic **activity** (NOAA)
  - Increases in # corporate calls associated with increases in nightlights [[results](#)]

# Data: Violence

## Global Terrorism Database (GTD)

- Data set of geo-coded news records of conflict events
- We focus on killings – most objective measure
- Use “major events” as treatment
  - district-months in the top 1% of violence: >20 kills



# R1: Local Response to Major Violent Events

**Data Structure:** Firm-District-Month unbalanced panel ~16 million obs

*How do major violent outbreaks affect local firm presence?*

$$Activity_{idt} = \beta \mathbb{1}\{\text{MajorEvent}\}_{dt-1} + \theta_{id} + \delta_t + \tau_{m(t)d} + \gamma_d \times t + \mu_d \times t^2 + \varepsilon_{idt}$$

- $Activity_{idt}$ : Firm  $i$ , “active” in district  $d$ , in month  $t$  – “any” or “modal”
- $\mathbb{1}\{\text{MajorEvent}\}_{dt-1}$ : “Major Event” in previous month
- $\theta_{id}$ : Firm-District Fixed Effects
- $\delta_t$ : Year-month Fixed Effects
- $\tau_{m(t)d}$ : Season Fixed Effects
- $\gamma_d \times t + \mu_d \times t^2$ : District linear and quadratic trends

# R1: Main Local Effect

Table 2: Firm Activity After Major Violent Events

	(1)	(2)	(3)	(4)	(5)	(6)
	Firm Active in District (=1)					
Major Violent Event (1 lag)	0.1305 (0.1059)	-0.0099** (0.0048)	-0.0077* (0.0045)	-0.0100** (0.0050)	-0.0024*** (0.0007)	-0.0019*** (0.0006)
Mean Outcome	0.0499	0.0499	0.0499	0.0499	0.0499	0.0499
Beta/Mean	2.6150	-0.1993	-0.1546	-0.2008	-0.0478	-0.0375
District-Firm FEs	No	Yes	Yes	Yes	Yes	Yes
Month FEs	No	No	Yes	Yes	Yes	Yes
District-Season FEs	No	No	No	Yes	Yes	Yes
District Linear Trends	No	No	No	No	Yes	Yes
District Quadratic Trends	No	No	No	No	No	Yes
Observations	15823272	15821023	15821023	15821023	15821023	15821023
Adj R2	0.0031	0.5802	0.5813	0.5818	0.5835	0.5835

*Notes:* Observation is a firm-district-month. Major Violent Event =1 if previous month in top 1% of killings distribution. Standard errors clustered at district level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

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**Main effect:** drop in firm activity by ~4% of mean district presence.  
**Without district trends...** ~20% drop

# R1: Main Local Effect

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## Also (not shown):

- Entry (-7%) and Exit (+5%) [[here](#)]
- Robust/stronger for “modal” firm presence (-6%) [[here](#)]
- Event study: Effects primarily on first lag, some persistence to lags 2+ [[here](#)]

# R3: Where do firms (or employees) go?

Change Data Structure:

1. SIM-Month Panel
2. Assign primary location for each SIM
3. Define treatment as being present in district of a major event

New Specification:

$$Y_{sdt} = \beta ME_{dt-1} + \theta_s + \delta_t + \tau_{m(t)d} + \varepsilon_{i(s)dt}$$

- $Y_{sdt}$ : move, new location for SIM, s, in district, d, at time, t.
- $\theta_s$ : SIM fixed effects
- $ME_{dt-1}$ : Major event in previous period in district of primary location



# R3: Where do firms (or employees) go?

<i>Panel A:</i>	Destination				
	Move (1)	Kabul (2)	Same Prov Capital (3)	Same Prov Rural (4)	Other Prov (5)
Major Event - Lag	0.236*** (0.090)	0.646*** (0.176)	0.385 (1.048)	0.056 (0.053)	0.088 (0.062)
Sample	All	¬ Kabul	Rural	All	All
Mean Outcome	8.009	2.360	4.253	2.287	3.125
Scaled Effect	0.029	0.274	0.091	0.024	0.028
Observations	1320919	626360	233690	1320919	1320919
Adjusted R2	0.239	0.268	0.282	0.201	0.231

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- Recently experienced major events increase likelihood of moving by ~3%

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# R3: Where do firms (or employees) go?

- Recently experienced major events increase likelihood of moving by ~3%
- Increase likelihood of moving to Kabul (among those not in Kabul) by ~27%

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# R3: Where do firms (or employees) go?

- Disguises heterogeneity...

<i>Panel B:</i>	Destination				
	Move (1)	Kabul (2)	Same Prov Capital (3)	Same Prov Rural (4)	Other Prov (5)
Major Event x Kabul	0.069 (0.090)			0.033 (0.052)	-0.007 (0.062)
Major Event x Capital	2.298*** (0.394)	0.790*** (0.197)		0.363 (0.223)	1.160*** (0.296)
Major Event x Rural	0.170 (1.382)	-1.011* (0.578)	0.385 (1.048)	-0.186 (0.770)	1.268 (1.005)
Sample	All	¬ Kabul	Rural	All	All
Kabul Mean	3.824	-	-	1.296	6.786
Cap Mean	8.719	2.430	-	3.008	7.879
Rural Mean	14.483	2.262	4.253	3.205	10.495
Observations	1320919	694835	301817	1320919	1320919
Adjusted R2	0.239	0.294	0.289	0.201	0.231

# R3: Where do firms (or employees) go?

- Disguises heterogeneity...
  - Movements primarily from Capitals
  - Who either move to Kabul (~33%) or leave the province entirely (~17%).

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# Discussion/Conclusion

**Contribution:** One of the first papers able to look at firm behavior *during* active conflict. Enabled by access to passively-collected, high-frequency spatial data.

## Implications:

1. Shifting security affects firm activity and location choice – micro-mechanism conflict-econ link
2. Capitals are critical – More responsive, rural spillovers
3. May affect which firms are able to operate in different locations.

## Future Work:

1. Infrastructure / Road Networks
2. Calling Networks
  - i. Across Firms – Information sharing
  - ii. Within Firms – Firm structure

Thank you slide

**THANK YOU!**

Please feel free to contact me with any additional questions/thoughts/suggestions:

[s.herskowitz@cgiar.org](mailto:s.herskowitz@cgiar.org)