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Estimating Illegal Migrant Inflow: The Repeated Trials Model (Presentation)

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Estimating Illegal Migrant Inflow: The Repeated Trials Model

WEAI 2015

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22 May 2015

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Outline

- Study Background
- Overview of the Repeated Trials Methodology
- IDA Repeated Trials Model
- Data
- Methodological Advances
- Conclusion and Future Work

Study Background

- IDA produced preliminary estimates of illegal migrant inflow in:
  - Land domain at ports of entry (POEs),
  - Land domain between POEs, and
  - Maritime domain between POEs.
- Today's focus will be on the methodology used for the land domains – The Repeated Trials Model (RTM)
  - Based on recidivist behavior observed in the inadmissibles/apprehension records combined with survey estimates of deterrence.
  - Inflow results are very preliminary – we will focus on methodological innovation rather than final estimates
  - Partial validation methods were also developed and will be covered in the following presentation.

Outline

- Study Background
- Overview of the Repeated Trials Methodology
  - Introduction
  - Simple Model
  - Literature Review
  - Contribution to the Literature
- IDA Repeated Trials Model
- Data
- Methodological Innovations
- Conclusion and Future Work

Introduction

- The *RTM* has been the core approach to modeling the process of illegal entry to the U.S. across land borders
  - Successful flow and the probability of apprehension are estimated based on the rate of crossers who are apprehended multiple times (recidivists)
- In the model: A border crosser makes an initial trip from their home to the border region and undertakes an initial border crossing attempt
  - If successful, no apprehension made
  - If unsuccessful, apprehension recorded and individual returned
    - Unsuccessful individuals who do not try again are said to be "deterred at the border"
    - If a person is never deterred, it is assumed the process will continue until the person successfully enters—this is the simplest form of the model

Simple Model

- The total number of apprehensions (T):

$$T = PN + P^2N + P^3N + \ldots;\ T = \left\{\frac{P}{1-P}\right\} * N$$

where:

  - N: The number of migrants attempting crossing
  - P: the probability of apprehension

- Total number of recidivist apprehensions (T_v):

$$T_v = P^2N + P^3N + \ldots;\ T_v = \left\{\frac{P}{1-P}\right\} * PN$$

- The recidivist ratio (T_v/T):

$$T_v/T = \left[\left\{\frac{P}{1-P}\right\} N\right]/\left[T_v \left\{\frac{P}{1-P}\right\} * PN\right] \Rightarrow T_v/T = P$$

$$F = \frac{T}{T_v} * (T - T_v)$$

The probability of apprehension is equal to the ratio of recidivist apprehensions to total apprehensions

Literature Review

- The RTM was first applied to illegal border crossing by Espenshade (1990)
  - $P = \frac{T_v}{T}$; $F = \frac{T}{T_v} * (T - T_v)$
  - Covered period of 1977–1988
  - P ranged between 25% and 40%
- Deterrence added to the model by Chang (2006)
  - $P = \frac{T_v/_T}{(1-D)}$; $F = \frac{T}{T_v} * ((1 - D) * T - T_v)$
  - Used biometric data; covered period of 2001–2005
  - Assumed constant low level of D
  - P was roughly 35%

Contribution to the Literature

- IDA innovations in producing the preliminary estimates include:
  - Using survey data to control for deterrence
  - Linking at-POEs and between-POEs data to include displacement
  - Linking border data with Immigration and Customs Enforcement (ICE) detention and removal data to include consequences

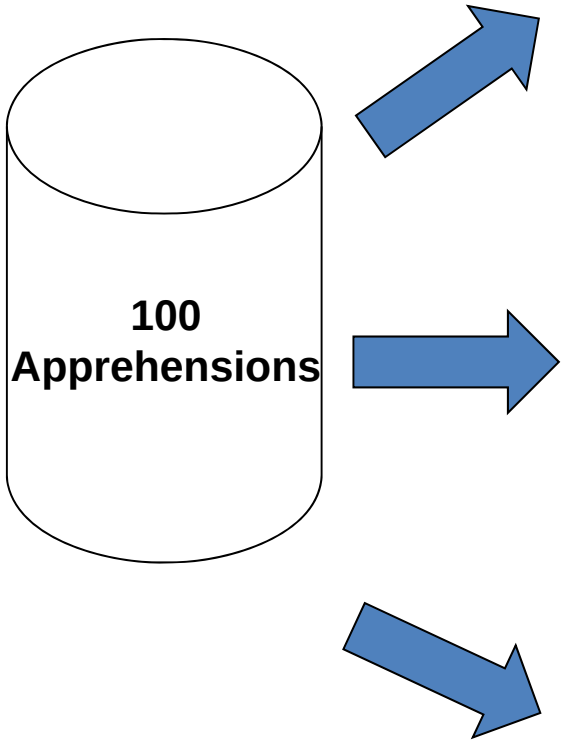
Outline

- Study Background
- Overview of the Repeated Trials Methodology
- IDA Repeated Trials Model
  - Population for Estimates
  - RTM Process
- Data
- Methodological Innovations
- Conclusion and Future Work

IDA Repeated Trials Model (RTM)

- The IDA RTM estimates successful flow and the probability of apprehension based on
  - The rate of crossers who are apprehended multiple times $(\frac{T}{T_v})$
  - The estimated rate that crossers who are apprehended are deterred (D)
- We estimate three populations
  1. The repeated trials population: subset of crossers who are seeking to make a single successful illegal entry per year into the United States
  2. Asylum seekers who intentionally seek out law enforcement
  3. The remaining crossers who are attempting to enter the United States illegally, but are not included in the RTM population
     - E.g., smugglers who may attempt to cross multiple times or other than Mexican nationals for whom we don't have a robust deterrence estimate
- The deterrence rate after apprehension is estimated from survey data
  - Estimates of D are used to estimate successful flow and the probability of apprehension for the repeated trials population
- The probability of apprehension is used to estimate successful flow for the remaining population excluding asylum seekers

Populations for Estimate



50 repeated trials population

- A subset of inadmissibles and apprehensions used in the RTM determined from USBP and OFO data
- Crossers who are seeking to make a “single” successful illegal entry per year into the United States
- Restricted to Mexican nationals due to available deterrence data

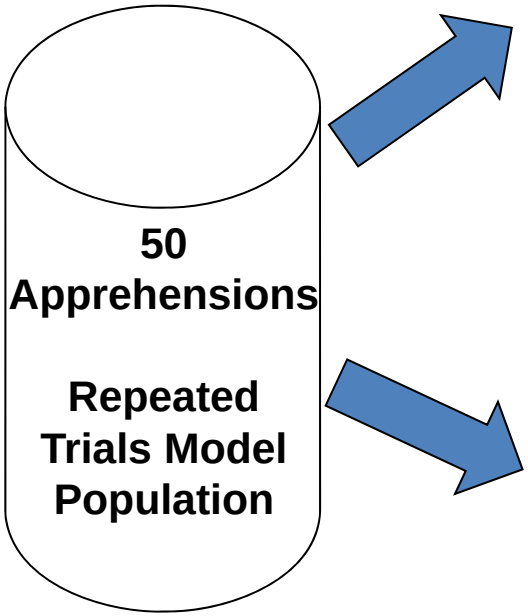
10 asylum seekers

- Estimate of individuals turning themselves in to law enforcement
- E.g., Unaccompanied Alien Children (UACs), credible fear claims

40 remaining population

- The remaining population attempting to enter illegally
- Successful flow is estimated from the probability of apprehension estimated from the RTM

RTM Process



30 deterred

- The deterrence rate after an apprehension is estimated from EMIF
- Survey adjusted to be representative of USBP, OFO, and ICE data on demographics and consequences

20 attempt again

10 apprehended

- Determined from fingerprint ID in USBP and OFO data

10 successful illegal entries

- The residual from the other estimates

P(Apprehension) = (10 apprehended)/(20 attempt again) = 50%

- The P(Apprehension) can be used to derive estimates of successful flow for the population not included in the repeated trials model and excluding asylum seekers
- E.g., smugglers and other than Mexican nationals

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- Overview of the Repeated Trials Methodology
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- Data
  - Data Sources
  - EMIF-N
- Methodological Innovations
- Conclusion and Future Work

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Data Sources

- Office of Field Operations (OFO) Inadmissibles Data
  - Estimate the number of inadmissible individuals intentionally seeking to enter the United States illegally and the repeat inadmissible individuals
  - Demographic and consequence information on the individuals who are inadmissible
- US Border Patrol (USBP) Apprehension Data
  - Number of apprehended crossers and the number of repeat apprehensions in a year
  - Demographic and consequence information on the apprehended crossers
  - These data are matched to the OFO inadmissibles data to estimate displacement
- Immigration and Customs Enforcement (ICE) Enforcement Data
  - Used to calculate the duration of DHS custody for individuals who were apprehended or inadmissible and removed by ICE
- Encuesta sobre Migración en las Frontera de México (EMIF) Survey Data
  - Used to estimate deterrence of the Mexican population
  - Used an EMIF module on Mexican nationals who were returned by law enforcement after attempting to enter the United States illegally
  - Adjusted these results to control for differences in demographics and consequences between the survey, OFO inadmissibles data, and USBP apprehension data
  - Used ICE data on duration of DHS custody to control for consequences

The EMIF-North Survey

- EMIF-North surveys those temporarily present in the Mexican border region
  - Partnership between Mexican academics and government since 1993
  - Methodology based upon techniques for sampling migratory populations
  - Four modules capture different flows:
    - "Returned by US migration authorities" is most useful for deterrence
    - Module samples intended to be representative of respective migrant flows
  - Each module contains questions on migration experiences

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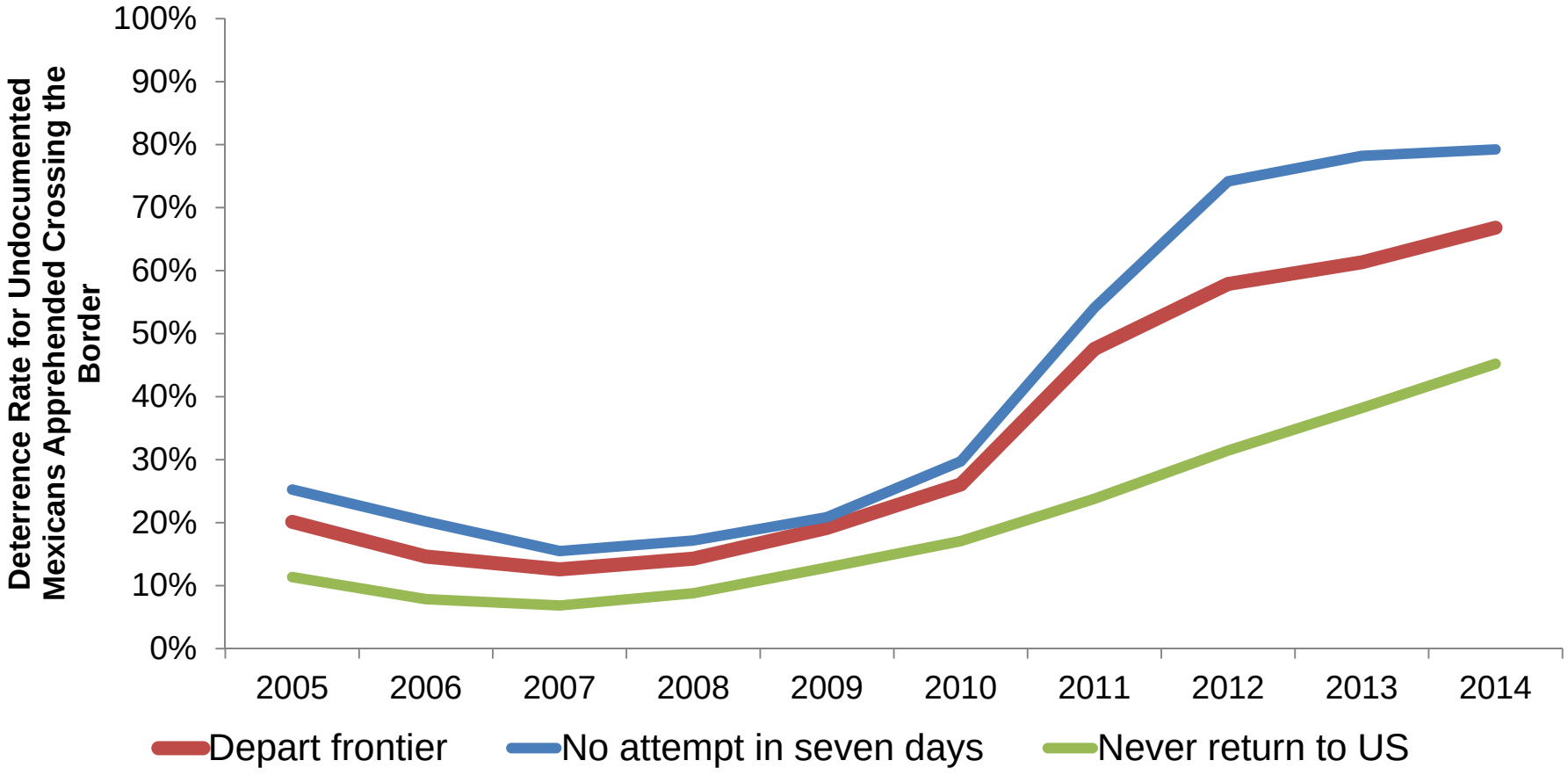
- Methodological Innovations
  - Estimating Deterrence in EMIF-N
  - Survey Estimates of Deterrence
  - EMIF to E3 Comparison
  - Adjustment Methodology
  - Accounting for Displacement
- Conclusion and Future Work

Estimating Deterrence in EMIF-N

- The “Returned” module surveys apprehendees on migration experiences and future intent once returned to Mexico
- Four questions on future intent relate to deterrence:
  - *“Do you intend to cross into the US again in the next seven days?”*
  - *“Do you intend to cross into the US again in the next three months?”*
  - *“Do you intend to return to your home or remain in the border region?”*
  - *“Do you intend to return to the US someday to work or look for work?”*
- Other questions help to identify relevant groups of apprehendees
  - E.g., those caught crossing the border without documents
  - These groups have similar demographics to USBP apprehension records
- Potential limitations of EMIF-N Returned Module
  - Survey nonresponse, question nonresponse, and deception
  - Flows outside of sampling frame (e.g., interior repatriations, notice to appear)

Survey Estimates of Deterrence over Time



- Substantial and consistent increase in deterrence starting in 2010–2011
  - EMIF methodology unchanged over this time
  - Coincides with border buildup, US recession, escalating Mexican cartel violence

EMIF-N to E3 Comparison

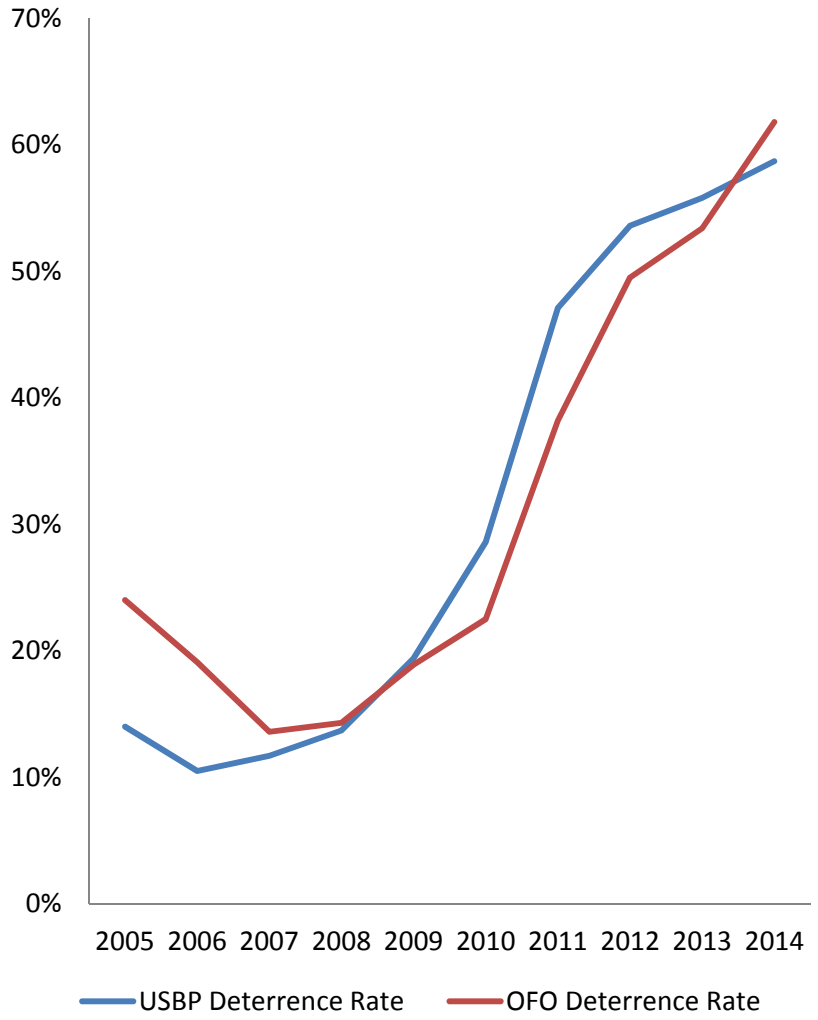
- After calculating raw deterrence rates, IDA evaluated what adjustments needed to be made for RTM framework

Indicator	Value	Border Patrol	EMIF	OFO
Gender	Male	85%	82%	57%
	Female	15%	18%	43%
Age	15-19	17%	14%	10%
	20-29	45%	49%	35%
	30-39	26%	25%	28%
	40-49	9%	9%	16%
	50+	2%	2%	11%
Birth State	Largest State	Michoacán	Oaxaca	Michoacán
	Second Largest	Oaxaca	Michoacán	Jalisco
	Third Largest	Guanajuato	Chiapas	Chihuahua
Crossing Location	Rio Grande Valley	10%	10%	7%
	Laredo	7%	7%	9%
	Del Rio	3%	3%	1%
	Marfa	1%	0%	0%
	El Paso	7%	5%	9%
	Tucson	43%	41%	8%
	Yuma	6%	1%	1%
	El Centro	7%	7%	11%
	San Diego	17%	25%	52%

Note: OFO statistics provided for a subset of inadmissibles deemed to attempt illegal entry without detection.

Adjustment Methodology

- IDA adjusts EMIF-N sample deterrence values to the E3 population
  - Model deterrence based on variables reported in both EMIF-N and E3 records
    - Coefficients applied to actual apprehension data
    - Fitted deterrence rate generated and aggregated into overall annual deterrence rates



Accounting for Displacement

- We estimate flow for between-the-POEs and at-the POEs separately using apprehension/inadmissible records and EMIF-based deterrence series
- However, we must account for people who use both methods
  - first attempt at POE followed by attempt between POEs
- Our flow estimates adjusted for such movements
  - More common to have first attempt at POE -1 to 2% per year

Conclusion and Future Work

- We have estimated the flow of illegal migrants in the land domain using RTM model with deterrence
- Important areas that remain for improvement:
  - Dealing with non-representativeness challenges in the survey
  - Completing the ICE data integration
  - Developing a control for voluntary return versus expedited removal
  - Disaggregating estimates to the sector level
  - Fully developing the validation methodologies

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Backups

Recidivism Accounting

	Recidivism Accounting for Cohort N			
	(A) Number who attempt	**(B)** Number who are caught	**(C)** of which: Number who are deterred	**(D)** Number who successfully enter
Round 1	N	PN		(1-P)N
Round 2	PN	P^2N		(1-P)PN
Round 3	P^2N	P^3N		(1-P)P^2N
Round 4	P^3N	P^4N		(1-P)P^3N
….				
Round t	$P^{(t-1)}N$	P^tN		(1-P)$P^{(t-1)}$N

	Recidivism Accounting for Cohort N			
	(A) Number who attempt	**(B)** Number who are caught	**(C)** of which: Number who are deterred	**(D)** Number who successfully enter
Round 1	N	PN	DPN	(1-P)N
Round 2	(1-D)PN	(1-D)P^2N	D(1-D)P^2N	(1-P)(1-D)PN
Round 3	$(1-D)^2P^2N$	$(1-D)^2P^3N$	$D(1-D)^2P^3N$	$(1-P)(1-D)^2P^2N$
Round 4	$(1-D)^3P^3N$	$(1-D)^3P^4N$	$D(1-D)^3P^4N$	$(1-P)(1-D)^3P^3N$
….				
Round t	$(1-D)^{(t-1)}P^{(t-1)}N$	$(1-D)^{(t-1)}P^tN$	$D(1-D)^{)t-1)}P^tN$	$(1-P)(1-D)^{(t-1)}P^{(t-1)}N$

Population at the POEs

- All populations are restricted to
  - POEs on the southwest land border according to the Site field
  - At entry, null, and not applicable for the Time in US field
- Repeated Trials Population
  - Restricted to Mexican nationals who are inadmissible Excludes all professional crossers (e.g., smugglers) and asylum seekers
  - Excludes inadmissible individuals without a fingerprint ID in the data
  - Includes inadmissible individuals with disposition reinstatement
  - Includes inadmissible individuals with the dispositions of withdrawal, withdrawal in lieu of expedited removal, and expedited removal with the following charges
    - Fraud or willful misrepresentation
    - False claim to U.S. citizenship
  - Includes inadmissible individuals with the dispositions withdrawal in lieu of expedited removal and expedited removal with the following charges
    - Immigrant without an immigrant visa
    - Public charge
    - Alien present without admission or parole (PWA)
  - Includes inadmissible individuals in 2005 and 2006 with the disposition voluntary return and the charge of alien PWA
- Asylum seekers
  - UACs
  - Cubans
  - Inadmissible individuals with disposition expedited removal/credible fear
  - Asylum code in Status at Entry field
- Illegal flow estimated from the probability of apprehension and excluded from the repeated trials population
  - Professional crosser population
    - An individual who has one of the following charges at some time:
      - Suspected controlled substance trafficker
      - Alien smuggling
      - Controlled substance trafficker with a conviction
      - Controlled substance traffickers
      - Unlawful activity (security & related grounds)
      - Trafficker in controlled substance
      - Significant traffickers in persons
      - Beneficiaries in trafficking
  - The population of other than Mexican nationals satisfying the charge and disposition criteria for the repeat trials population
  - Includes inadmissible individuals without a fingerprint ID who satisfy the criteria for the repeated trials population
  - Includes inadmissible individuals who are not in the repeated trials population, but have the following charges:
    - Fraud or willful misrepresentation
    - False claim to U.S. citizenship
- The remaining inadmissible individuals are estimated to be unintentionally attempting to enter the country illegally or inadmissible after entry (e.g., at exit)

Population between the POEs

- All populations are restricted to individuals apprehended in the nine Border Patrol sectors on the southwest land border
- Repeated Trials Population
  - Restricted to apprehended individuals who are Mexican nationals
  - Excludes apprehended individuals who have been in the United States for 4 or more days according to the Time in US field in E3
  - Excludes apprehended individuals who have a missing fingerprint ID number
  - Excludes apprehended individuals who are estimated to be professional crossers (e.g., drug smugglers or alien smugglers)
    - Only includes records with an event role field of participant
    - Excludes apprehended individuals who are associated with a drug seizure
    - Excludes targeted smuggler apprehension and suspected smuggler apprehension from the classification field
  - Excludes family units as defined by the classification field
  - Includes only apprehended individuals who are 18 years old or older
  - Includes only apprehended individuals with a disposition of voluntary return, expedited removal, and reinstatement
- Asylum seekers
  - Apprehended Mexican national UACs who are 13 years old and younger
  - Apprehended individuals from countries other than Mexico who are 17 years old and younger
  - Apprehended family units from countries other than Mexico
  - Apprehended individuals with disposition expedited removal/credible fear
- Illegal flow estimated from the probability of apprehension and excluded from the repeated trials population
  - Includes all apprehended individuals except
    - The repeated trials population
    - Asylum seekers
    - Apprehended individuals who have been in the United States 4 days or longer according to the Time in US field
  - This population includes
    - Apprehended individuals from countries other than Mexico who are not asylum seekers
    - Apprehended Mexican nationals who are age 14-17
    - Apprehended Mexican family units
    - Apprehended individuals who are excluded from the repeated trials model as professional smugglers
    - Apprehended individuals with dispositions other than those included in the repeated trials model

Border Patrol Apprehension Model Results

Category	Variable	Odds Ratio	Standard Error	Z Score	P Value
Demographics	Male	0.73	0.05	**-4.84**	0.00
	Born in border state	0.77	0.07	**-2.93**	0.00
Apprehensions in 12 months	Two	0.65	0.05	**-5.76**	0.00
	Three	0.64	0.08	**-3.41**	0.00
	Four or more	0.35	0.06	**-5.99**	0.00
Time in U.S.	Days if time <= 1 week	1.09	0.02	**5.67**	0.00
	One month or less	3.29	0.41	**9.61**	0.00
	One year or less	4.27	0.65	**9.61**	0.00
	More than one year	1.16	0.16	1.06	0.29
Crossing Sector	Tucson + Yuma	0.34	0.17	**-2.22**	0.03
	El Paso + Marfa	0.62	0.18	-1.67	0.09
	Del Rio	0.14	0.10	**-2.71**	0.01
	RGV + Laredo	0.44	0.11	**-3.41**	0.00
Quarter	Q2	1.07	0.07	1.11	0.27
	Q3	1.15	0.08	1.93	0.05
	Q4	1.31	0.09	**3.84**	0.00
Year	2006	0.45	0.09	**-4.02**	0.00
	2007	0.49	0.10	**-3.58**	0.00
	2008	0.43	0.08	**-4.59**	0.00
	2009	0.64	0.12	**-2.47**	0.01
	2010	0.85	0.17	-0.81	0.42
	2011	1.27	0.29	1.02	0.31
	2012	1.72	0.36	**2.57**	0.01
	2013	1.51	0.35	1.81	0.07
	2014	1.58	0.50	1.46	0.15
Constant	Constant	0.47	0.08	**-4.66**	0.00

Note: Model contains fixed effects for crossing location interacted with year, not shown here.

OFO Inadmissible Model Results

Category	Variable	Odds Ratio	Standard Error	Z Score	P Value
Apprehensions in 12 months	Two	0.62	0.04	-6.72	0.00
	Three	0.67	0.08	-3.26	0.00
	Four or more	0.39	0.06	-6.46	0.00
Time in U.S.	Days if time <= 1 week	1.05	0.01	3.64	0.00
	One month or less	3.97	0.42	13.18	0.00
	One year or less	3.99	0.55	10.08	0.00
	More than one year	1.10	0.14	0.79	0.43
Quarter	Q2	1.03	0.06	0.53	0.59
	Q3	1.14	0.07	1.96	0.05
	Q4	1.33	0.10	3.66	0.00
Year	2006	0.59	0.09	-3.59	0.00
	2007	0.42	0.05	-6.71	0.00
	2008	0.51	0.07	-4.67	0.00
	2009	0.71	0.09	-2.82	0.01
	2010	0.95	0.12	-0.41	0.68
	2011	2.30	0.32	5.93	0.00
	2012	3.12	0.41	8.69	0.00
	2013	3.65	0.49	9.68	0.00
	2014	5.09	0.82	10.11	0.00
Constant	Constant	0.29	0.03	-10.43	0.00

Methods

- At-ports methods:
  - Repeated trials model (RTM): Baseline estimates use this method.
  - Survey methods: Used as a validation tool.
  - Econometric analysis of inadmissibles records: Can be used as a validation tool.
  - Randomized enforcement (e.g., COMPEX): Explored, but not used because of sample concerns.
  - Residual method: Method used for resident undocumented population estimates. Explored but not used because of insufficient precision.
  - Red teaming: Could be a valuable tool for future development.
- Between-ports methods:
  - RTM: Baseline estimates use this method.
  - Survey methods: Used as a validation tool.
  - Econometric analysis of inadmissibles records: Used as a validation tool.
  - Technology-based measures: May be the most promising future technique. May also be able to use existing unmanned aerial vehicle (UAV) data to provide additional validation of baseline estimates.
  - Residual method: Method used for resident undocumented population estimates. Explored but not used because of insufficient precision.

Simple Model

The total number of apprehensions (T):

$$T = PN + P^2N + P^3N + \ldots$$

$$T = \left\{\frac{P}{1-P}\right\} * N$$

The number of recidivist apprehensions (T_v)

$$T_v = P^2N + P^3N + \ldots$$

$$T_v = \left\{\frac{P}{1-P}\right\} * PN$$

The recidivist ratio ($\frac{T_v}{T}$):

$$T_v/T = \left[\left\{\frac{P}{1-P}\right\} N\right] / \left[T_v \left\{\frac{P}{1-P}\right\} * PN\right]$$

$$T_v/T = P$$

$$F = \frac{T}{T_v} * (T - T_v)$$

Variables:

where:

- **N** is number of migrants attempting crossing, and
- **P** is probability of apprehension

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14. ABSTRACT

This briefing presents the Repeated-Trials Model (RTM) methodology used to estimate the inflow of illegal migrants for the Southern Border and Approaches (SB&A).

15. SUBJECT TERMS

Border Security, Performance Management, Repeated Trails Model

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