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Note that the same highlight colors for Mexico, Guatemala, Honduras and El Salvador will be used throughout.

The real questions for the new President of El Salvador and other leaders throughout the Americas are: (1) do current immigration systems work well now (2) could those systems and their economies function after a black swan event (3) can anything be learned from the European Union?

Introduction

Chess and professional football are two examples of what are known as zero-sum games. That means what is beneficial for one side is equally damaging for the other side. Viewed through the lens of the mathematical theory of games the issue of border security for the United States of America in the early part of this century is a very complicated problem. The late John F. Nash Jr. of Princeton University won the Nobel Prize in Economics in 1994 for work based on his 1950 doctoral thesis. One interpretation of the condition known as a Nash equilibrium is that some players in a game might do better by competing, but it might also be possible to obtain satisfactory results for everyone by cooperating.

For the particular game involving the southwestern border of the United States in the first quarter of this century that means satisfying the states of California, Arizona, New Mexico and Texas as well as the United States Federal government while at the same time satisfying the governments of Mexico, Honduras, Guatemala and El Salvador. It is not known how many immigrants transit those four American border states en route to other states as opposed to ultimately residing in those states. In a similar manner, the government of Mexico has two responsibilities: to Mexican residents who travel northward to the border and to residents of nearby countries – typically Guatemala, Honduras and El Salvador – who seek to travel northward through Mexico.

There are three modes for crossing a border: illegally (typically, without a visa); legally as a tourist, student, businessperson ... or with a change of status from legal to illegal.

There are usually two vectors: economic impacts are concerned with employment, poverty, and infrastructure support in the areas of education, healthcare and logistics, while human impacts are concerned with immigrants rejecting one country in favor of another for religious or cultural reasons. Two major challenges are (1) many national economic measures are not available at the state level and (2) measuring treatment of humans is difficult.

History of North American Immigration

Human immigrants have been journeying to North America for at least 20,000 years – perhaps even much longer. Today, Beringia is submerged; sugar cane is no longer a major crop in Hawaii; Asian railroad workers are not pouring into San Francisco; European sailing ships from Spain, France and England are no longer braving the North Atlantic; clippers no longer round Cape Horn and silicon has replaced gold in California. Instead, most tourists and immigrants arrive legally at more than 100 airports and more than 300 ports of entry.

One approach is to divide the borders of the United States into ten portions:

1. Hawaii and outlying Pacific islands including Guam and Saipan
2. the Arctic border – the western and northern coasts of Alaska
3. the western border with Canada including Alaska's eastern border
4. the continental western coast – California, Oregon and Washington
5. the continental eastern coast - from Maine to Miami
6. the southeastern or Gulf Coast – from Brownsville Texas to Miami
7. the southwestern border from San Diego to Brownsville and including southern borders of California, Arizona, New Mexico and Texas
8. the northern border with Canada
9. Puerto Rico
10. The United States Virgin Islands

For the most part, marine and Arctic border crossings are expensive, difficult and dangerous, so the vast bulk of pedestrian or vehicle crossings occur at the southwestern border with **Mexico** and the northern border with Canada.

In 2017 almost 400,000,000 people crossed the various United States borders – about 125,000,000 flew. In addition, there were almost \$2,400,000,000,000 (2.4 **trillion dollars**) in 33 million cargo entries of which over 80% were containers. In 2015, 2016 and 2017 the number of people arriving with I-94 documents was roughly 77 million. Of these, about 12 million and 15 million each year were pedestrian or vehicle crossings from Canada and **Mexico**, respectively.

Immigration and Tourism are bi-directional

Tallies for 2018 are still incomplete. But in 2017 forty percent of the 88 million Americans who traveled internationally went to Mexico. Roughly one in four flew. That means 35 million people from the United States have to recross the southwestern border by road, rail or ship to return home. In 2017 14 million Americans crossed the northern border, and, of those, 10 million did not fly. Large as these numbers are, they represent 10% of the crossings on these two borders.

Observations and Recommendations

1. For illegal immigrants the major divisor is whether they entered illegally or entered legally and became illegal by committing a crime, overstaying a visa limit or some other reason. We will refer to the second category as formerly legal entrants.
2. Despite there being data at the Customs and Border Patrol field office and month level, it is not obvious that there is any statistical relationship between legal entrants, formerly legal entrants and illegal entrants. This makes estimating the illegal entrants very difficult. In turn, that means determining if there is a problem, and, if so, where it might be is challenging.
3. It is not clear if refining removal and return data with a reason (convicted of a crime, overstayed a visa ...) would provide enough insights to justify the effort.
4. There is little or no point trying to sample one or more counties or even one or more states to in effect perform a census of illegal immigrants. It is likely politically impossible, but the only process that would obtain data would admit that the illegal immigrant had been successful and would almost certainly involve some sort of amnesty provided the illegal immigrant passed background checks and also provided a DNA sample and biometrics or fingerprints. It would be useful to be told where and when the immigrant arrived and resided.

Legal Permanent Residents less formally known as Green cards 2018 (two quarters only)

	A	B	C	D	E
1		Total	Percentage	Adjustments	New Arrivals
2	Total	542,011		287,666	254,345
3	Mexico	82,133	15.15%	41,258	40,875
4	Cuba	42,145	7.78%	39,205	2,940
5	China	37,286	6.88%	21,605	15,681
6	India	31,692	5.85%	20,310	11,382
7	Dominican Republic	25,871	4.77%	4,047	21,824
8	Philippines	22,853	4.22%	7,885	14,968
9	Vietnam	15,515	2.86%	3,707	11,808
10	El Salvador	13,246	2.44%	5,301	7,945
11	Haiti	10,358	1.91%	2,762	7,596
12	Jamaica	9,771	1.80%	3,733	6,038
13	Afghanistan	9,084	1.68%	1,005	8,079
14	South Korea	8,587	1.58%	6,247	2,340
15	Colombia	8,493	1.57%	4,997	3,496
16	Bangladesh	7,737	1.43%	778	6,959
17	Pakistan	7,651	1.41%	2,378	5,273
18	Guatemala	7,335	1.35%	3,045	4,290
19	Brazil	7,098	1.31%	5,239	1,859
20	Iraq	6,963	1.28%	5,914	1,049
21	Syria	6,778	1.25%	6,180	598
22	Nigeria	6,529	1.20%	3,215	3,314
23	Honduras	6,177	1.14%	3,181	2,996
24	Iran	5,877	1.08%	3,924	1,953
25	Ethiopia	5,688	1.05%	2,222	3,466
26	Nepal	5,599	1.03%	2,719	2,880
27	Ecuador	5,492	1.01%	1,991	3,501
28	United Kingdom	5,142	0.95%	3,925	1,217
29	Venezuela	5,135	0.95%	3,700	1,435
30	Canada	4,958	0.91%	3,913	1,045
31	Ukraine	4,930	0.91%	2,807	2,123

Adjustments are for people already in the United States. Adjustments plus new arrivals equals the total. 45 percent of new Legal Permanent Residents were immediate relatives of U.S. Citizens; 18 percent obtained status under a family preference category; 15 percent were refugees and 13 percent were employment-based preference. This sample was cut at 0.9% of the total.

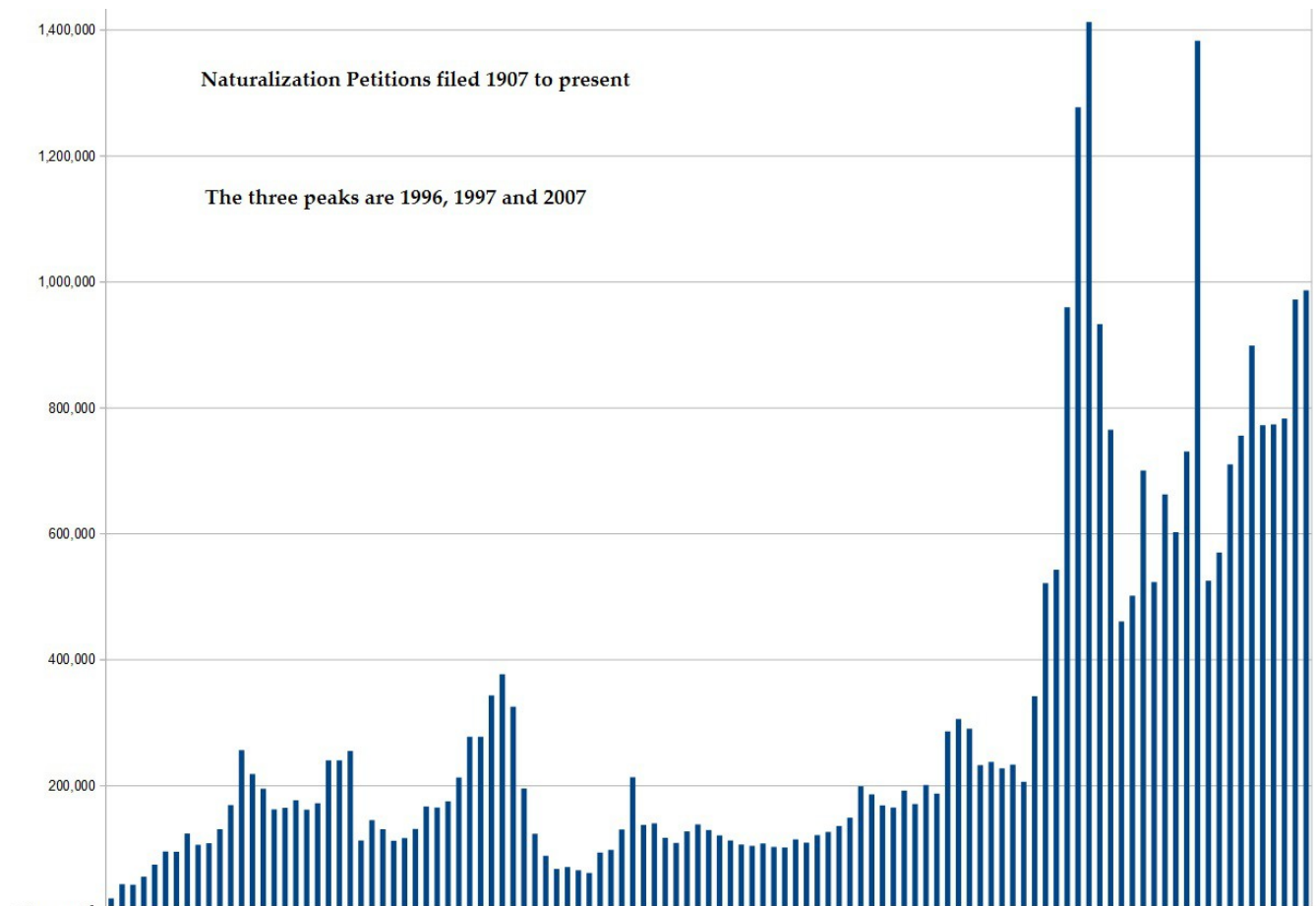
Historical Lawful Permanent Residents – selected countries

	A	B	C	D	E	F	
1		Total	Mexico	Guatemala	Honduras	El Salvador	
2	2010	1,042,625	138,717	10,263	6,381	18,547	
3	2011	1,062,040	142,823	10,795	6,053	18,477	
4	2012	1,031,631	145,326	9,857	6,773	15,874	
5	2013	990,553	134,198	9,829	8,795	18,015	
6	2014	1,016,518	133,107	9,871	8,025	18,964	
7	2015	1,051,031	158,619	11,466	9,071	19,487	
8	2016	1,183,505	174,534	12,548	12,996	23,449	
9	2017	1,127,167	170,581	12,792	11,147	25,109	
10	2018	542,011	82,133	7,335	6,177	13,246	
11							
12	2018 Q1 and Q2 only						
13							
14			Mexico %	Guatemala %	Honduras %	El Salvador %	
15	2010	1,042,625	13.30%	0.98%	0.61%	1.78%	
16	2011	1,062,040	13.45%	1.02%	0.57%	1.74%	
17	2012	1,031,631	14.09%	0.96%	0.66%	1.54%	
18	2013	990,553	13.55%	0.99%	0.89%	1.82%	
19	2014	1,016,518	13.09%	0.97%	0.79%	1.87%	
20	2015	1,051,031	15.09%	1.09%	0.86%	1.85%	
21	2016	1,183,505	14.75%	1.06%	1.10%	1.98%	
22	2017	1,127,167	15.13%	1.13%	0.99%	2.23%	
23	2018	542,011	15.15%	1.35%	1.14%	2.44%	
24							

In the context of millions of people changing status each year the increases from 2010 probably merit further attention but (1) a few thousand out of a population of over one million is largely irrelevant (2) probably half of green cards are for people who have been residing in the United States for years (3) it is not clear that green card applications are processed at a uniform rate (4) no one has asserted a correlation between the number of legal permanent residents and illegal immigrants.

No obvious emergency here.

Naturalized Citizens

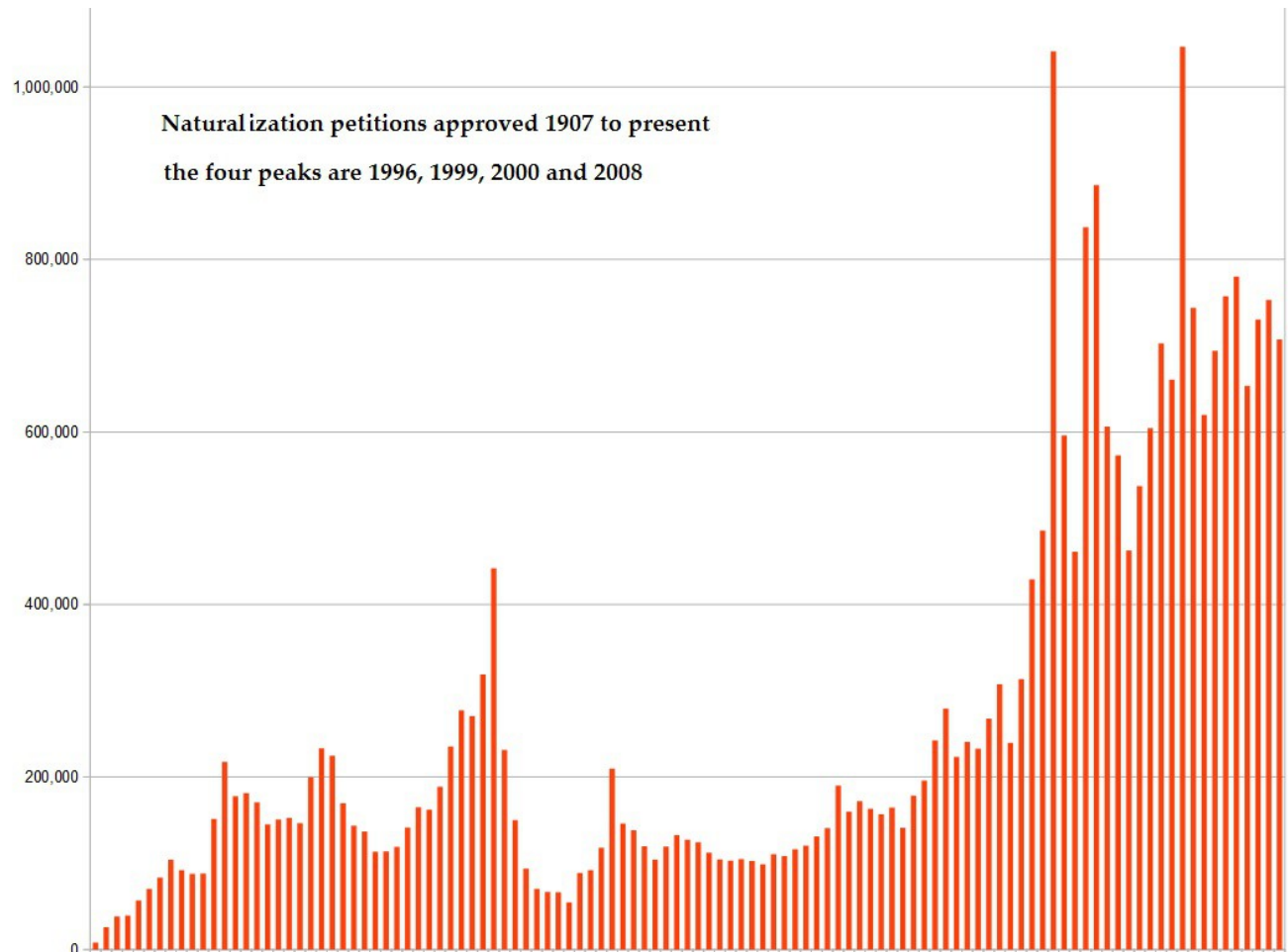


There has been a fairly substantial increase in naturalization petitions filed in the last two years as can be seen near the right edge of the chart.

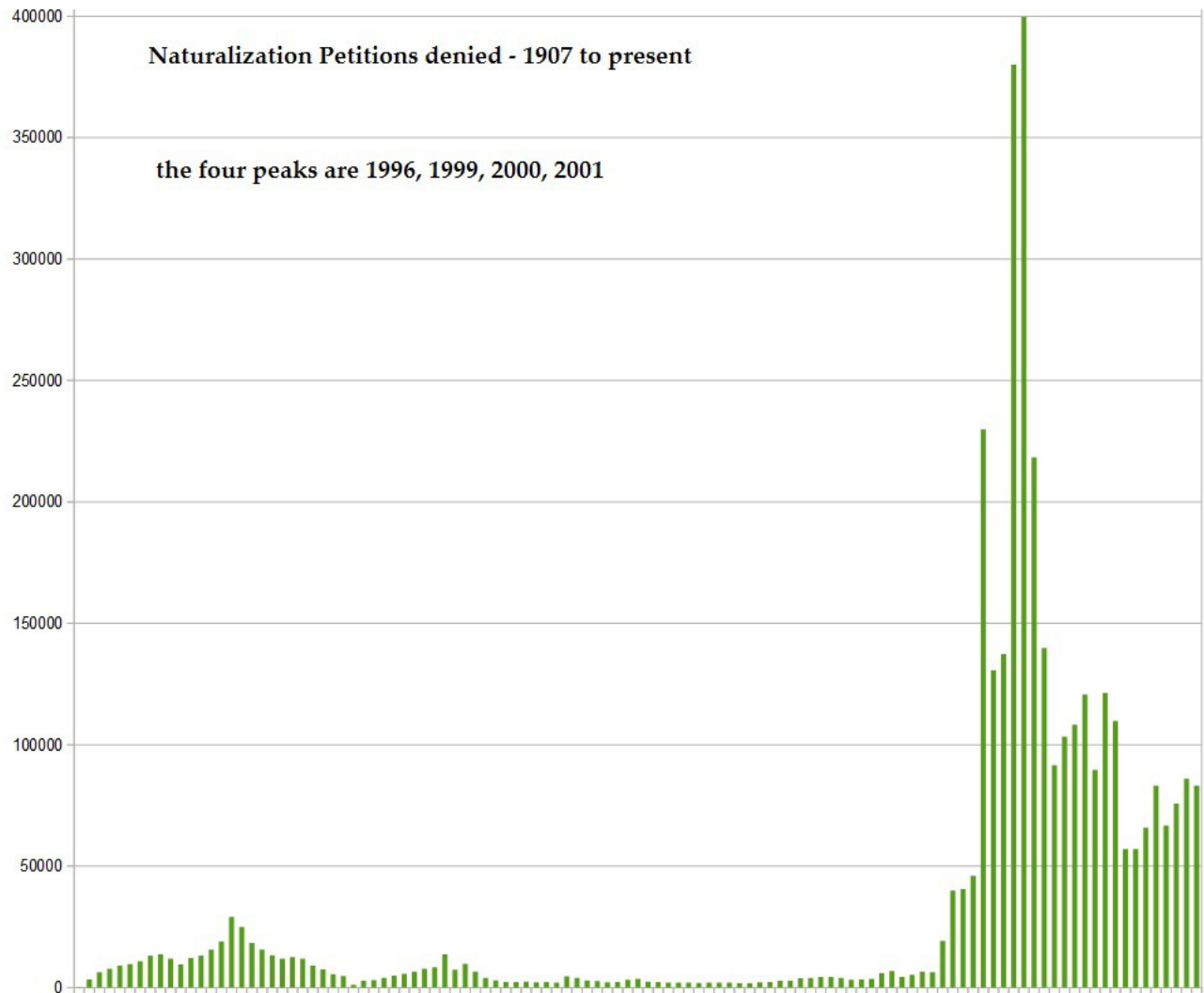
No one has asserted a correlation between the number of naturalizations residents and illegal immigrants.

No obvious emergency here.

Usually, the vast majority of naturalization petitions are approved. Accounting for activity is complicated by the fact that petitions can be filed in one year and approved the next year – sometimes even two years later even though the time from filing to approval was only 14 months.



There is currently no breakout of denial reasons. Recently, the trend is toward fewer denials despite greater numbers of filings.



2017 Naturalizations by Country of origin

	A	B	
1	Total	707,265	
2	Mexico	118,559	
3	India	50,802	
4	China	37,674	
5	Philippines	36,828	
6	Dominican Republic	29,734	
7	Cuba	25,961	
8	Vietnam	19,323	
9	El Salvador	16,941	
10	Colombia	16,184	
11	Jamaica	15,087	
12	South Korea	14,643	
13	Haiti	12,794	
14	Pakistan	10,166	
15	Peru	10,014	
16	Brazil	9,701	
17	Guatemala	9,131	
18	United Kingdom	9,049	
19	Bangladesh	8,629	
20	Iran	8,324	
21	Iraq	7,875	
22	Canada	7,829	
23	Ecuador	7,748	
24	Nigeria	7,652	
25	Ethiopia	7,370	
26	Burma	6,825	
27	Ukraine	6,644	
28	Venezuela	6,463	
29	Poland	5,840	
30	Ghana	5,777	
31	Bhutan	5,557	
32	Russia	5,534	
33	Honduras	5,310	
34	Egypt	5,154	

Estimates of Illegal Immigrants

Population Estimates

ILLEGAL ALIEN POPULATION RESIDING IN THE UNITED STATES: JANUARY 2015

DECEMBER 2018



**Homeland
Security**

Office of Immigration Statistics
OFFICE OF STRATEGY, POLICY & PLANS

Table 3.

Illegal Alien Population by State of Residence: 2015 and 2010

Country of Birth	Estimated population size in January				Percent Increase
	2015		2010		
	Number	Percent of Total	Number	Percent of Total	
All countries	11,960,000	100	11,590,000	100	3
California	2,880,000	24	2,910,000	25	-1
Texas	1,940,000	16	1,780,000	15	9
Florida	810,000	7	730,000	6	10
New York	590,000	5	690,000	6	-15
Illinois	450,000	4	550,000	5	-18
New Jersey	440,000	4	440,000	4	-1
Georgia	390,000	3	430,000	4	-9
North Carolina	390,000	3	390,000	3	-1
Arizona	380,000	3	350,000	3	6
Virginia	310,000	3	220,000	2	43
Other states	310,000	3	220,000	2	10

Note: Detail may not sum to totals because of rounding.

Source: U.S. Department of Homeland Security.

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DHS Office of Immigration Statistics

Note the same numbers for Virginia and Other states (red rectangle). If the Virginia numbers are correct the Other states numbers are in error.

	A	B	C
1		2015	2010
2	All countries	11,960,000	11,590,000
3	Mexico	6,580,000	6,830,000
4	El Salvador	750,000	670,000
5	Guatemala	620,000	520,000
6	India	470,000	270,000
7	Honduras	440,000	380,000
8	Philippines	370,000	290,000
9	China	320,000	300,000
10	South Korea	230,000	220,000
11	Vietnam	170,000	190,000
12	Ecuador	150,000	210,000
13	Other	1,870,000	1,720,000
14			
15	All US states	11,960,000	11,590,000
16	California	2,880,000	2,910,000
17	Texas	1,940,000	1,780,000
18	Florida	810,000	730,000
19	New York	590,000	690,000
20	Illinois	450,000	550,000
21	New Jersey	440,000	440,000
22	Georgia	390,000	430,000
23	North Carolina	390,000	390,000
24	Arizona	380,000	350,000
25	Virginia	310,000	220,000
26			
27	Other states	3,380,000	3,100,000
28			
29			

Corrected figures are in the red rectangle. The percentage growth for Arizona should be 8%, not 6%, for the figures given. Depending on the actual figures, estimated growth in Arizona was probably between 5 and 6 thousand per year. Estimated growth in Florida was probably about 15,000 per year, while estimated growth in Texas was about 27,000 per year. Texas added almost 400,000 people last year alone while Florida added over 350,000 people last year alone and Arizona added nearly 80,000 people last year alone. **No obvious emergency here even at the state level. Perhaps at the county level.**

Refugees

The numbers are fairly small and the four countries of interest do not have significant numbers of refugees. Mexico and Guatemala are missing completely

Total	84,989
Congo, Democratic Republic	16,370
Syria	12,587
Burma	12,347
Iraq	9,880
Somalia	9,020
Bhutan	5,817
Iran	3,750
Afghanistan	2,737
Ukraine	2,543
Eritrea	1,949
Sudan	1,458
Ethiopia	1,131
Burundi	694
Pakistan	545
Colombia	529
Moldova	465
Russia	462
Central African Republic	401
El Salvador	364
Cuba	354
South Sudan	189
Belarus	185
Rwanda	140
Kazakhstan	91
Sri Lanka	91
Honduras	84

Refugee arrivals

	A	B
1	2010	73,293
2	2011	56,384
3	2012	58,179
4	2013	69,909
5	2014	69,975
6	2015	69,920
7	2016	84,989

No obvious emergency here – unless refugees from the Democratic Republic of the Congo and neighboring countries are NOT being screened for Ebola

No one has asserted a correlation between the number of refugees (accepted or rejected) and illegal immigrants.

Asylum seekers

	A	B	C	D
1		Total	Affirmative	Defensive
2	2010	19,755	11,236	8,519
3	2011	23,570	13,432	10,138
4	2012	28,010	17,435	10,575
5	2013	24,997	15,230	9,767
6	2014	23,296	14,624	8,672
7	2015	25,971	17,787	8,184
8	2016	20,455	11,729	8,726

Again, the numbers are very small. There are two types of asylum – affirmative and defensive.

Affirmative asylum seekers 2016

Total	11,729
El Salvador	1,404
China, People's Republic	1,382
Guatemala	1,317
Honduras	885
Egypt	690
Syria	660
Iraq	611
Mexico	455
Iran	381
Venezuela	328
Ethiopia	304
Pakistan	268
Eritrea	255
Nepal	236
Russia	209
India	174
Ukraine	125
Haiti	100

No obvious emergency here

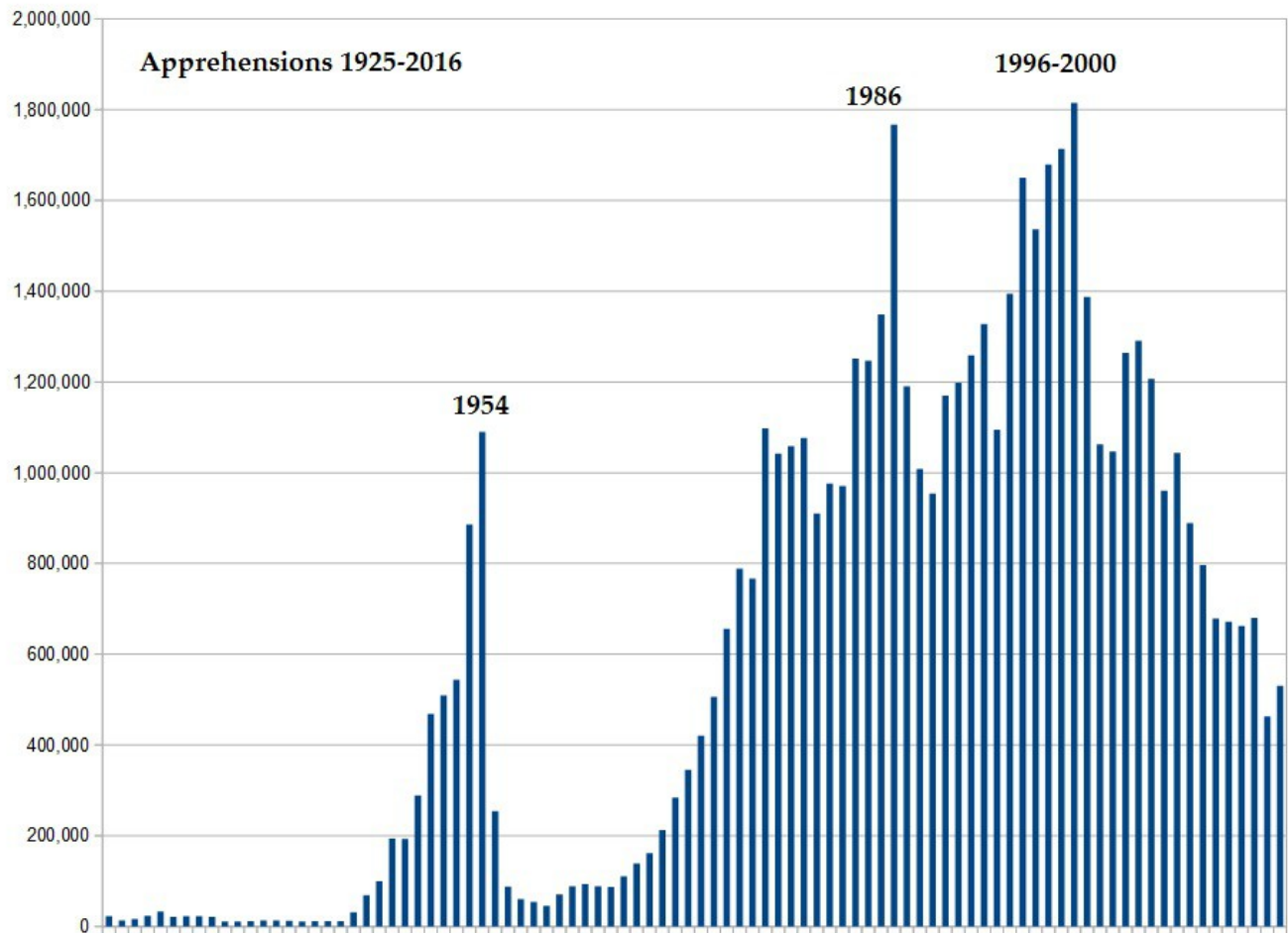
Defensive asylum seekers 2016

102	Total	8,726
103	China	3,103
104	El Salvador	753
105	Guatemala	632
106	Honduras	620
107	Mexico	464
108	India	309
109	Nepal	265
110	Ethiopia	181
111	Somalia	153
112	Eritrea	152
113	Egypt	149
114	Soviet Union	129
115	Cameroon	113
116	Albania	95

No obvious emergency here

No one has asserted a correlation between the number of asylum seekers of either kind (accepted or rejected) and illegal immigrants.

Apprehensions



Hard to make much sense of this (at least for us) – does the chart demonstrate a clear decline in the last sixteen years because less officers were tasked with making apprehensions or because apprehensions have become much more difficult or because the number of people available to apprehend was dramatically fewer. There is nothing to suggest that locations have changed and that, for example, Kentucky, Rhode Island or Wyoming are suddenly being flooded with illegal immigrants.

Apprehensions in 2016 by nationality – 92.51% from four countries

	A	B	C	
1	Total	530,250		
2	Mexico	265,747	50.12%	
3	Guatemala	84,649	15.96%	
4	El Salvador	78,983	14.90%	
5	Honduras	61,222	11.55%	
6	India	4,123	0.78%	
7	Brazil	3,738		
8	Ecuador	3,472		
9	China	3,197		
10	Cuba	3,061		
11	Dominican Republic	2,770		
12	Romania	2,167		
13	Nicaragua	1,756		
14	Colombia	1,209		
15	Haiti	1,113		
16	Jamaica	1,012		

Note the dramatic decline between Mexico and Guatemala and between Honduras and India. There are more than 100 countries not shown.

Recent apprehensions – Central America

It is hard to understand the dramatic decline for **Mexico** (red arrow) and the peak for other countries in 2014 (purple rectangle)

	A	B	C	D	E
1		Mexico	El Salvador	Guatemala	Honduras
2	2007	854,190	19,697	23,908	28,258
3	2008	884,017	27,150	33,691	33,766
4	2009	731,225	27,744	35,000	32,897
5	2010	632,034	29,911	39,050	32,501
6	2011	517,472	27,652	41,708	31,189
7	2012	468,766	38,976	57,486	50,771
8	2013	424,978	51,226	73,208	64,157
9	2014	350,177	79,321	97,151	106,928
10	2015	267,885	51,200	66,982	42,433
11	2016	265,747	78,983	84,649	61,222
12					

Declared Inadmissible

Determination of admissibility is usually done when a non-citizen physically enters the United States. It can also be applied after a non-citizen has been resident if there was no determination at entry (presumably because the entry was illegal). There are many exemptions and waivers but among the reasons for being judged inadmissible

1. until 1990 "paupers, professional beggars, or vagrants"
2. until 1990 homosexuals
3. terrorists
4. engaged in money laundering
5. not properly vaccinated
6. communicable disease of public health significance (AIDS, leprosy, syphilis ...)
7. "physical or mental disorder and behavior associated with the disorder that may pose ... a threat to the property, safety, or welfare of the alien or others."
8. a drug addict or abuser
9. a variety of crimes
10. previous violations of immigration law or procedures
11. likely to become a public charge

Year	Determined inadmissible
2010	229,575
2011	213,345
2012	195,804
2013	205,623
2014	225,016
2015	254,714
2016	274,617

No obvious emergency here – although it is unclear what these people do next

Year	Mexico	Guatemala	Honduras	El Salvador	Total
2010	75,485	1,770	1,301	1,100	229,575
2011	67,590	1,627	1,084	862	213,345
2012	58,945	1,783	1,457	1,040	195,804
2013	56,504	1,934	2,197	2,198	205,623
2014	63,805	4,637	5,922	3,160	225,016
2015	74,473	6,278	3,235	2,828	254,714
2016	73,338	13,490	7,996	9,738	274,617

While the numbers for Guatemala, Honduras and El Salvador are small, those appear to be significant increases

Inadmissible 2016 – by leading nationalities

Total	274,617
Mexico	73,338
Cuba	54,226
Canada	22,120
Philippines	15,842
Guatemala	13,490
China	12,083
El Salvador	9,738
Honduras	7,996
India	7,115
Haiti	6,974
Ukraine	2,612
Brazil	2,537
Spain	2,494
Colombia	2,419

These figures really need to be broken out by at entry versus in-country as well by reason.

Returns and Removals

Year	Returns	Removals	Mexico Returns	Mexico Removals
2009	582,584	391,283	468,661	276,537
2010	474,166	381,593	353,791	272,486
2011	322,073	385,778	205,110	286,731
2012	230,333	415,900	131,935	301,255
2013	178,663	433,034	88,209	308,828
2014	163,223	405,589	72,312	266,165
2015	129,429	326,962	40,528	235,087
2016	106,167	340,056	37,190	245,306

Without more data it is difficult to make much sense of the dramatic decline in returns, especially by Mexico. Note that annual returns were consistently over 1,000,000 for the period 1985 to 2006.

Returns 2010 and 2016 – by country

Country	2010	2016
TOTAL	474,166	106,167
Mexico	353,791	37,190
Canada	29,142	18,410
Philippines	21,413	13,601
China	16,449	8,632
India	4,695	2,421
Ukraine	4,415	2,059

Myanmar	3,951	1,444
Turkey	1,802	982
South Korea	1,561	898
Russia	3,189	886
Guatemala	2,314	868
United Kingdom	1,774	860
Spain	460	791
France	968	651
Honduras	1,382	646
Colombia	777	594
Nigeria	461	569
Italy	771	532
Iran	433	521
Jamaica	508	475
Australia	431	466
El Salvador	949	452
Peru	460	442

The dramatic decline in returns to **Mexico**, or at least of Mexicans, merits study.

Removals 2016 – by leading countries

Country	Total	Criminal	Non-criminal
Total	340,066	135,570	204,486
Mexico	245,306	102,349	142,957
Guatemala	33,729	10,545	23,184
Honduras	21,891	8,536	13,356
El Salvador	20,127	6,681	13,446
Colombia	2,052	746	1,306
Dominican Republic	1,949	1,461	488
Brazil	1,485	321	1,164
Ecuador	1,399	459	940
Jamaica	1,089	609	460
Nicaragua	872	386	486
China	729	100	629
Venezuela	701	55	646
Canada	688	247	441
India	688	95	593

Note the huge decrease from **Mexico** (72% of the total) to **Guatemala** and from **Honduras** and **El Salvador** to other countries. There are 145 other countries not shown.

Population Demographics

In the abstract, logistical systems typically operate in one of three modes:

1. any to any – one example of this would be the United States Postal Service which accepts and delivers mail and packages everywhere
2. remote to urban – one example of this would be mining coal. Coal is moved from the Powder River Basin in Wyoming to fuel power plants near or in cities throughout the western United States
3. urban to urban - one example of this is airlines and airports

In the case of immigration one shortcoming is that it is not clear what the granularity of the sending and receiving geographical regions should be. Someone can fly from 1200 international airports in virtually every country on the planet to almost 100 international airports in the United States. Note that the passenger need not be a resident or citizen of the country he or she departed from. Likewise, once inside the United States the passenger can travel anywhere. The two major categories here would be misrepresentation (the passenger is not who or what he or she claims to be) and overstaying time-limited visas.

For immigrants arriving by vehicle or on foot the three major categories are whether they crossed the borders legally (seeking asylum, refugee status, or otherwise have a visa), whether they departed in a timely manner if applicable, or whether they crossed the borders illegally. One can summarize the United States northern borders situation as Canadian or people who traveled to Canada trying to cross into a dozen US states. Even in years without a polar vortex immigration is very limited in the winter. One can summarize the United States southern borders situation as Mexicans or people who traveled to Mexico from Honduras, El Salvador or Guatemala trying to cross into four US states: California, Arizona, New Mexico and Texas. At present marine immigration to Texas, Louisiana, Mississippi, Alabama and Florida is not judged to be common.

Source countries – Central America

Country	Population	Growth Rate	Urbanization	Area (square miles)
Mexico	126,675,325	1.09%	80.20%	758,500
Guatemala	17,263,239	1.72%	51.10%	42,042
Honduras	9,112,867	1.56%	57.10%	43,278
El Salvador	6,344,722	0.25%	72.10%	8,124

Immediate Target US states – southwestern land border

State	Population	Growth Rate	Urbanization	Area (square miles)
California	39,557,045	0.78%	95.00%	163,696
Texas	28,701,845	1.77%	84.70%	268,581
Arizona	7,171,646	1.53%	89.80%	113,990
New Mexico	2,088,070	0.16%	72.40%	121,699

Urban Concentrations

It should be noted that among all urban areas in the United States, 21 of the densest 25 are in California. Debate rages among demographers about what exactly a city is and how urbanization is to be measured. An alternative methodology used in place of the the one that produced the figures above utilizes the legal definition of cities (as opposed to metropolitan areas, census regions and so on) where the cities have over 100,000 people. This is not entirely satisfactory either: the resident population of Manhattan in New York City is about 1.6 million but the weekday daytime population approaches four million.

California – cities with over 100,000 people and percentage of the population

City	Population	City	Population
Los Angeles	4,054,400	Santa Rosa	178,488
San Diego	1,419,845	Ontario	177,589
San Jose	1,051,316	Oceanside	177,362
San Francisco	883,963	Garden Grove	176,896
Fresno	538,330	Rancho Cucamonga	176,671
Sacramento	501,344	Elk Grove	172,116
Long Beach	478,561	Corona	168,574
Oakland	428,827	Hayward	162,030
Bakersfield	386,839	Salinas	161,784
Anaheim	357,084	Lancaster	161,485
Santa Ana	338,247	Palmdale	158,905
Riverside	325,860	Pomona	155,687
Stockton	315,103	Sunnyvale	153,389
Irvine	276,176	Escondido	151,478
Chula Vista	267,503	Torrance	149,245
Fremont	235,439	Pasadena	144,388
San Bernardino	221,130	Fullerton	144,214
Santa Clarita	216,589	Orange	141,952
Fontana	212,000	Thousand Oaks	139,196
Moreno Valley	207,629	Roseville	137,213
Oxnard	206,499	Visalia	136,246
Glendale	205,536	Santa Clara	129,604
Huntington Beach	202,648	Concord	129,159

City	Population	City	Population
Simi Valley	128,760	Vista	103,381
Victorville	123,701		
Berkeley	121,874	TOTAL	19,840,808
Vallejo	119,252		50.16%
El Monte	117,204		
Fairfield	116,156		
Costa Mesa	115,296		
Carlsbad	114,622		
Downey	114,146		
Clovis	113,883		
Inglewood	113,559		
Murrieta	113,541		
Temecula	113,181		
Antioch	113,061		
Santa Buenaventura	111,269		
Richmond	110,967		
Santa Maria	108,470		
West Covina	108,245		
Daly City	107,864		
Norwalk	107,546		
Burbank	107,149		
Rialto	107,041		
Jurupa Valley	106,054		
El Cajon	105,557		
San Mateo	104,490		

Texas – cities with over 100,000 people and percentage of the population

City	Population	City	Population
Houston	2,312,717	Waco	136,436
San Antonio	1,511,946	Denton	136,268
Dallas	1,341,075	Midland	136,089
Austin	950,715	Carrollton	135,710
Fort Worth	874,168	Round Rock	123,678
El Paso	683,577	Abilene	121,885
Arlington	396,394	Pearland	119,940
Corpus Christi	325,605	Beaumont	119,114
Plano	286,143	Odessa	116,861
Laredo	260,564	Richardson	116,783
Lubbock	253,888	The Woodlands	116,278
Irving	240,373	College Station	113,564
Garland	238,002	Lewisville	106,021
Amarillo	199,826	Tyler	104,991
Grand Prairie	193,837	League City	104,903
Brownsville	183,299	Wichita Falls	104,747
McKinney	181,330	Allen	100,685
Frisco	177,286	San Angelo	100,119
Pasadena	153,520		
Killeen	145,482	TOTAL	13,310,464
Mesquite	143,949		46.37%
McAllen	142,696		

Arizona – cities with over 100,000 people and percentage of the population

City	Population
Phoenix	1,626,078
Tucson	535,677
Mesa	496,401
Chandler	253,458
Scottsdale	249,950
Glendale	246,709
Gilbert	242,354
Tempe	185,038
Peoria	168,181
Surprise	134,085
Yuma	95,502
TOTAL	4,203,433
	59.03%

New Mexico – cities with over 100,000 people and percentage of the population

City	Population
Albuquerque	558,545
Las Cruces	101,759
Rio Rancho	96,028
TOTAL	756,332
	36.22%

Mexico – cities with over 100,000 people and percentage of the population
The figures are from the 2014-5 estimates of urban localities, "localidades" published by Instituto Nacional de Estadística Geografía e Informática, México.

City	Population	City	Population
Mexico City (1)	8,555,500	Acapulco	708,100
Ecatepec de Morelos	1,742,000	Guadalupe	690,600
Guadalajara	1,500,800	Chimalhuacán	688,800
Puebla	1,498,300	Tlalnepantla	682,200
Juárez	1,398,400	Torreón	652,100
Tijuana	1,386,100	Reynosa	649,800
León	1,277,700	Querétaro	642,100
Zapopan	1,202,900	Morelia	607,500
Monterrey	1,173,600	Tlaquepaque	605,000
Nezahualcóyotl	1,158,,100	Tuxtla Gutiérrez	585,400
Naucalpan	962,800	Durango	565,300
Chihuahua	887,600	Veracruz	562,300
Mérida	827,000	Ciudad López Mateos	527,700
Hermosillo	778,000	Ciudad Apodaca	524,700
Aguascalientes	766,400	Toluca	520,800
Saltillo	762,200	Cuautitlán Izcalli	517,200
San Luis Potosí	761,700	Total - over 500,000	38,565,500
Culiacán	743,200	87 cities over 100,000	18,965,200
Mexicali	730,800	TOTAL	57,530,700
Cancún	722,800		45.42%

1 = Metropolitan area population is 20,892,724

Honduras – cities with over 100,000 people and percentage of the population

City	Population
Tegucigalpa	1,126,534
San Pedro Sula	638,259
Choloma	222,828
La Ceiba	174,006
El Progreso	131,125
TOTAL	2,292,752
	25.16%

Guatemala – cities with over 100,000 people and percentage of the population

City	Population
Guatemala City	1,110,100
Mixco	473,080
Villa Nueva	406,830
Petapa	141,455
San Juan Sacatepéquez	136,886
Quetzaltenango	132,230
Villa Canales	122,194
Escuintla	103,165
TOTAL	2,625,940
	15.21%

El Salvador – cities with over 100,000 people and percentage of the population

City	Population
San Salvador (1)	540,989
Santa Ana	280,000
Soyapango	262,975
San Miguel	218,410
Apopa	217,733
Mejicanos	211,878
Ciudad Delgado	174,825
Santa Tecla	164,171
Ilopango	159,232
San Martin	144,722
Cuscatancingo	117,313
Ahuachapán	110,511
Sonsonate	110,501
Total	2,602,759
	41.02%

1 = Metropolitan area population is 2,290,000

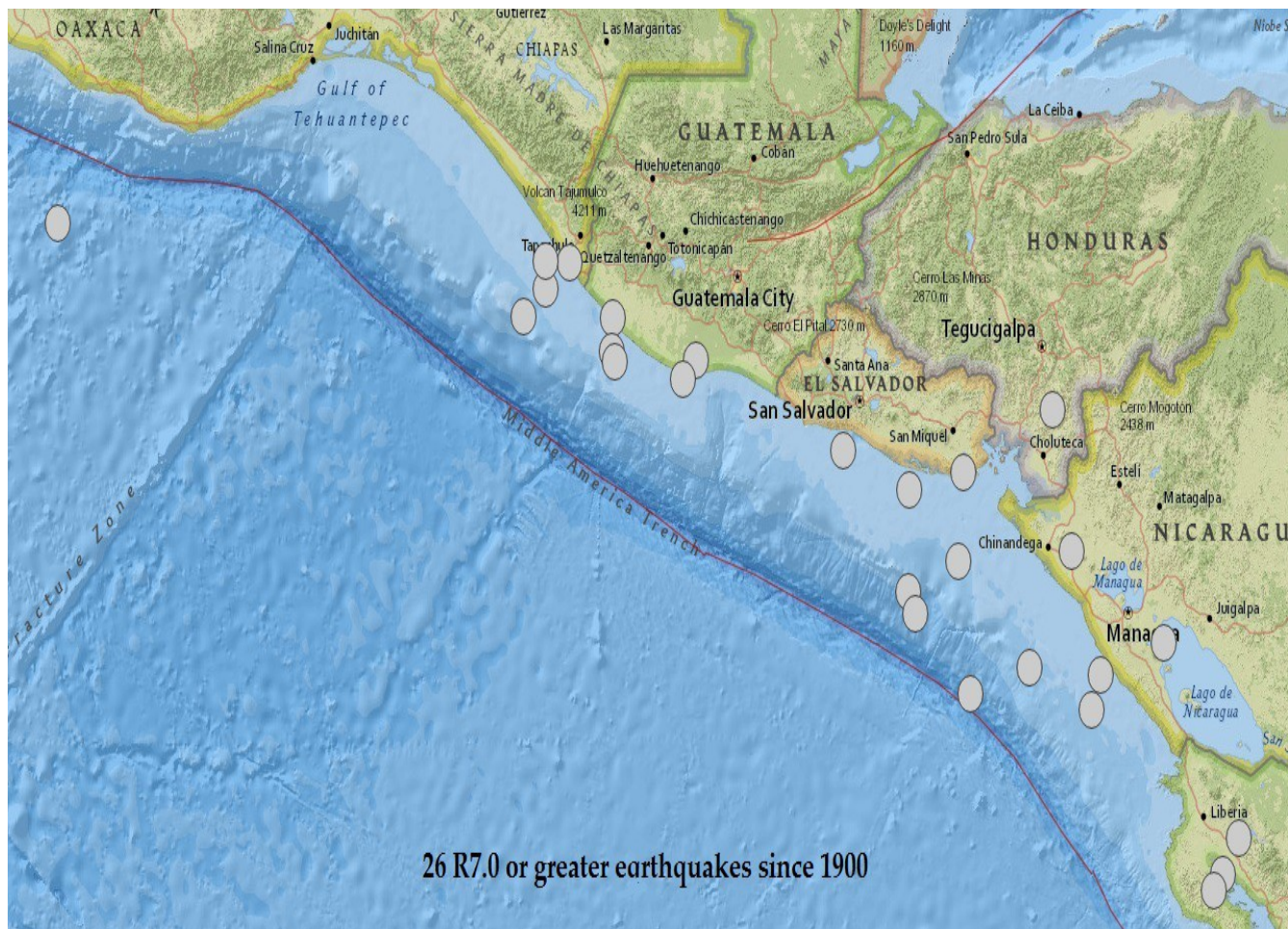
Black Swan events

Usually, the current population of a city of 100,000 changes by 3 or more people per day between deaths, births, people moving in and people moving out. So all populations tallied in the contemporary manner are estimates. In the normal course of events it does not matter if the population of a city is 101,000 or 102,000. Exact, real-time populations do matter when the normal course of events is disrupted by some sort of black swan. In Mexico, Guatemala, Honduras, El Salvador and the United States these can be a large earthquakes greater than Richter 7.4 or a volcanic eruption greater than VEI=5. Note usually marine or near-coastal earthquakes of that strength will usually be accompanied by one or more tsunami waves. There are considerable meteorological differences between the Atlantic and Pacific coasts, but a hurricane above category 3 on the Saffir-Simpson scale would likely qualify as a black swan. A category 3 hurricane typically has winds in excess of 130 miles per hour which will cause well-built framed homes to sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed – these will isolate residential areas. There will be power outages that will last weeks to possibly months – these tend to make the area uninhabitable. Life on the Pacific Ring of Fire.

A less familiar but potentially more deadly black swan would be a pandemic. This would likely take the form of a massive outbreak of a hemorrhagic fever caused by an arenavirus such one of the six that are causes of Ebola.

Historical Earthquakes Richter 7.0 or greater

Readers should be aware that reasonably accurate measurement of earthquakes did not start until 1970 and, in some respects, not really until 1995. The Richter scale is logarithmic – a 5.0 is ten times more powerful than a 4.0. Richter values are not the only measure - location and depth matter a great deal – and it has been argued that Richter is not really useful for powerful earthquakes. Moving from north to south



Nearly one Richter 7.0 or greater earthquake per year – note the concentration on the Pacific (western) coasts. In 1900 the combined population of Mexico, Guatemala, Honduras and El Salvador was 16 million. Today it is nearly 160 million.

Similarly, the population of the United States was 76 million in 1900 and is now approaching 330 million. The number, population and density of cities have all increased so for natural disasters the area is target-rich.

An additional complication is that San Diego is really the last (southernmost) major port on the Pacific coast – it is very unclear how bulk supplies for a recovery could be delivered especially if a tsunami slammed into adjacent sections of coast. The experience of Ecuador and Chile is that roads and bridges are often damaged as well.

Volcanic Eruptions

The Volcanic Explosivity Index (VEI) is, like the Richter scale, logarithmic, so a VEI=5 eruption is ten times more powerful than a VEI=4. However, it has gradually been realized that pyroclastic flows, lahars and lava, while photogenic and sometimes deadly, are only some of the effects of a large volcanic eruption. The amount of gases and rock, often in the form of dust, shot into the atmosphere can have far-reaching effects. A typical problem is that airplanes in flight must avoid the ash clouds and even that airplanes on the ground have to be covered lest exposed surfaces be damaged. A VEI=4 explosion usually devastates the immediate local area and dust that lingers in the upper atmosphere provides colorful sunsets and sunrises. Some VEI=5 events and virtually all VEI=6 events will change the climate of the planet, often for years. The problem is volcanoes are very difficult to predict.

Honduras has four volcanoes but none have had recent eruptions.

Guatemala volcanoes

Acatenango has a minor eruption in 1972

Fuego had important eruptions in 1974 and 2012 and minor eruptions in 2013 and 2018

Pacaya has had 23 mostly minor eruptions since 1969.

Santa Maria has had 6 relatively minor eruptions since 2008. The 1902 Santa Maria eruption was a VEI=6 and one of the most powerful of the 20th century. Thousands were killed and **Guatemala**'s coffee industry was devastated for year. It is estimated that 5,000 people were killed in the 1922 eruption.

20 other volcanoes without any recent eruptions

El Salvador volcanoes

Santa Ana had a huge ash cloud (14 kilometers high), explosions and later lahars in 2005.

San Miguel has had six eruptions since 1995.

The eruption of Ilopango in about 450 AD was a VEI=6 and the largest in **El Salvador** in the past 10,000 years. It was probably as powerful as Pinatubo 1991 which is now regarded as being a very high VEI=5 (so 5.8 or 5.9) or even a VEI=6 event. Ilopango ejected 18 cubic kilometers of tephra, and covered 10,000 square kilometers with 50 centimeters of ash. Pyroclastic flows and airfall deposits probably killed every person with an area of 1000 square kilometers. The damaged areas did not recover for two centuries.

17 other volcanoes without any recent eruptions

Mexico volcanoes

Although quiet since 2008, Colima is surrounded by more than 20 towns with a total population of over 300,000. Colima is often considered one of the five most dangerous volcanoes on Planet Earth. There have been 11 eruptions since 1900 and 13 known eruptions before that. The 1818 eruption was especially powerful.

Popocatepetl has erupted seven times between 1994 and 2013.

El Chichón erupted several times in 1982 but has been quiet since

39 other volcanoes without any recent eruptions

Note that ash from at least two Nicaraguan VEI=6 events caused crop failures, famines and epidemics in Europe.

Appendix A Economic Measures

figures from 2018; amounts in billions US\$

Measure	Mexico	Guatemala	El Salvador	Honduras
Population	126,675,325	17,263,239	6,344,722	9,112,867
Unemployment (1)	2,180,000	152,720	194,180	209,160
Poverty (2)	47%	60%	33%	30%
Infant mortality	1.13%	2.33%	1.63%	1.67%
HIV adult %	0.3	0.4	0.6	0.3
Living with AIDS	230,000	46,000	25,000	22,000
AIDS deaths	4,000	2,000	1,000	1,000
Doctors	280,980	15,000	11,520	10,995
Imports	\$420	\$17.11	\$9.51	\$11.32
Exports	\$410	11.12	\$4.66	\$8.68
Trade Balance (3)	-\$10	-\$5.99	-\$4.85	-\$2.64
Currency	peso	quetzales	US dollar	tempiras
Exchange rate	18.26	7.32		23.74
2017 rate	18.66	7.6		23
Inflation	6.00%	4.40%	1.00%	3.90%
GDP – PPP (4)	\$2,463	\$138.00	\$51 (5)	\$46
External debt	\$445	\$22.92	\$15.51	\$8.63
Foreign reserves	\$175	\$11.77	\$3.56	\$4.71
Cellular phones	115,000,000	20,000,000	10,000,000	8,200,000
Internet users	73,000,000	5,200,000	1,800,000	2,700,000

Measure	Mexico	Guatemala	El Salvador	Honduras
Revenues	\$261	8.16	\$5.89	\$4.66
Expenses	\$273	9.16	\$6.52	\$5.26
Deficit (6)	-\$12	-\$1.02	-\$0.62	-\$0.60
% of GDP	-1.10%	-1.31%	-2.50%	-2.07%
Migration	-0.18%	-0.19%	-0.80%	-0.11%
Displaced	345,000	242,000	72,000	190,000
Refugees	33,000 (7)			
US immigrants				

Notes:

1. Governments go to great lengths to understate unemployment. Under-employment is someone is working full-time and still is living at or below the poverty level.
2. Governments also have a tendency to redefine poverty to reduce the number of their people living in it.
3. Trade balance is exports minus imports. Usually, when imports are greater either external debt increases or reserves of gold and foreign currencies decrease.
4. Gross Domestic Production – purchase price parity
5. “20% of El Salvador's population lives abroad. The remittances they send home account for close to 20% of GDP and are the second largest source of external income after exports”
6. Deficit is government revenues minus government expenses. Governments

that chronically overspend typically print more money and increase inflation.

7. supposedly, almost all are Venezuelans

8. If Nayib Bukele, the former mayor of San Salvador, is elected President of **El Salvador** today or in a run-off we would certainly suggest a lot of attention get paid to

A. building out solar power on individual houses

B. growing bio-fuels for both domestic consumption and for export

C. surveying which significant buildings – churches, schools, hospitals and government structures - need seismic upgrades

D. getting an honest tally on AIDS and HIV

E. training and retaining more doctors