The Net Benefits and Residual Cost from US Border Management of the Initially Inadmissible

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Abstract

Border management is a government activity affecting immigration and the economy. A benefit-cost and equivalent decision analysis model are used to evaluate US border management for 2017. Controversial issues arise. Among these are the issue of standing and the values of asylum, a criminal career, child custodial care, foreign deaths, fiscal and labor market effects, and distributional weighting. The results indicate a large present value net benefit per year from management of $46.4 billion, but also a large residual unmanaged cost of $21.4 billion. Significant uncertainty exists but estimated net benefits remain positive.

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1. Border management and economics

Border management is where the rubber meets the road of immigration economics. Government actions that determine who is allowed to visit, to stay, to work, to gain citizenship; and who enters without official permission are all initially resolved at the border. Border management has elements of standard economics where inputs are combined to produce multiple outcomes including screening and treatment among adults, families, children, criminals, get-aways and turn-backs-- some of whom who may try to re-cross the border. Different management technologies, including different policies, can affect probabilities and values of these outcomes. This research quantifies the flow of undocumented or illegal immigrants in a base year and values both outcomes and impact categories using benefit-cost valuation principles.

The broad picture of border management includes people approaching the border, legally or illegally, at Ports of Entry (POEs) and the typically undocumented or illegal attempts to cross between POEs. The vast majority of all of those approaching the border represent the admissible flows of travelers and workers with documentation, even if some later violate terms of their entry. Other cases can be more complex such as undocumented people seeking asylum and various categories of inadmissibility including criminals and illegal attempts to cross the border. This analysis focuses on the small proportion, about .3 percent of the total, who are initially identified as inadmissible, although some may later become admissible. That small proportion amounts to close to 1 million people in 2017, the base year of this analysis, but varies substantially by year. Many of these are at the southern US border that has a long history intertwined with immigration, legal and illegal work, and humanitarian policy involving refugees and asylum seekers.

The economics of border management synthesizes many literatures. Perhaps most directly related are studies of immigration economics such as those by the National Academy of Science (2017), Borjas (2014), West (2011), Karoly and Perez-Arce (2016) and CBO (2007) that look at outcomes inside a country or state and not uniquely at the border. These studies identify the generally positive contribution of immigrants to economic activity and growth while investigating distributional consequences in labor markets and fiscal impacts at the federal and state levels. The socio-economic demographics of immigrants also receive attention in this literature including education levels and multi-generational dynamics. Other literatures are important for this study such as those related to the costs of crime (Cohen and Piquero, 2009), the value of a statistical life (Viscusi and Masterman, 2017) and administrative data on border management including the treatment of children and families (e.g. GAO, 2020, 2021; DHS 2019, 2021; Humane Borders, 2021). In contrast to studies about all immigrants when in the US interior, a benefit-cost study of border management requires careful delineation of who has standing, that is whose benefits or costs are counted (Whittington and MacRae, 1990; OMB 1993, 2003). While this delineation may be offensive to some, it is designed to be consistent with current law and policy thus setting up the analysis of changes to law or policy. No comparable prior analysis appears to exist. As this study is essentially a quantitative literature synthesis, further literature details are discussed in the context of specific estimation issues.

The manuscript is organized with Section 2 presenting the analytical framework, Section 3 reviewing the frequency of the many outcomes and the base case for 2017, Section 4 presenting major estimation issues, their literature and valuation estimates, Section 5 reporting results for both the managed and unmanaged outcomes, Section 6 investigateing the sensitivity of results to key parameters

while Section 7 summarizes. Additional computational detail is provided in a supplemental appendix.

2. Analytical framework

Central to border management is screening that directs individuals into legally or policy identified categories and implements policy for those categories. There are analogies to policing in a city and to pollution control. With policing, the challenge is to not disturb legal activity while preventing or investigating potentially illegal actions and then taking policy consistent action. Benefits come from illegal activities interrupted and deterred, sorting occurs between the innocent and the guilty, sometimes with error, and implementation costs exist. The analogy to pollution control is based on trading off the costs of avoiding a bad outcome, typically health related, with the cost of control. Control is not expected to be complete as some residual outcomes occur (e.g. Shogren and White, 2000; Farrow, 2016). Border management is analytically simpler than pollution control in that the government carries out the actual control and does not act indirectly through firms.

At the border, legal entry on first approach is not investigated here nor are potential errors in screening individuals into management categories. Focusing on the potentially illegal activity, what appears to be illegal can become legal if the person is screened at a cost and found "innocent", analogous to those granted asylum. The benefits are the economic and security gains from the person newly entering the United States. An actual illegal entry that is stopped has a benefit of the costs avoided had the illegal activity continued. An illegal activity that is *not* stopped has a cost, but it is a residual social cost that would have occurred without policing. Deterrence avoids costs and occurs as a function of enforcement. These outcomes have impacts that may persist for years as when a person is granted

asylum with permission to work, or alternatively an illegal entrant removed across the border or to their home country may only be deterred for a short time.

This analysis computes the net benefits and residual costs of the border technology in place in 2017. The top-level outcomes of that year--the managed, unmanaged, and deterred as a function of the managed--represent the baseline from which changes are computed. In this "without" border management counterfactual, all the initially inadmissible individuals are assumed to enter the US successfully but illegally in 2017; the same laws would exist but there would be no enforcement. One might imagine dramatic dynamic changes in immigration if there were actually no enforcement but the use of a modeled quantity of those deterred in 2017 provides an analytical basis for this baseline. The actual outcomes in 2017 represent the "with" technology and policy alternative. Further applications of the model would be estimating incremental changes compared to the 2017 technology, not the current baseline.

The optimization problem consistent with benefit-cost analysis is to maximize net benefits, here comprised of the costs of border management, the benefits from costs avoided of those who are illegal and benefits from those determined to be legal asylees[1]. The optimal level of control balances the incremental costs of control with the incremental benefits of legal and avoided illegal activity. At the optimum, there is likely some illegal activity that is not controlled. That remaining illegal activity is a residual risk that defines the maximum potential for additional control actions. Unsurprisingly, the optimal level of control may not be

[1] This can be equivalently modeled as minimizing total social cost. In the pollution control context, see Hanley, Shogren and White, 2007, p. 83; Tietenberg, 2000, p. 338)

implemented leading to net beneficial effects if expanding from below the optimum and net costs if expanding beyond the optimum.

Benefit-Cost, Decision Analysis or Both?

Both benefit-cost and decision analysis (BCA, DA) are core techniques to inform the welfare impacts and net benefits of government investment decisions (Boardman, et al., 2017, Weimer and Vining, 2017). BCA is most familiar to economists and identified in government guidance as the appropriate tool for US Government investments in general and for analyzing regulation (OMB 1993, 2003). The DA structure will be useful however to present results by outcome categories, such as removing an illegal immigrant or granting asylum. Presenting results in both formats increases the relevant metrics without changing the bottom-line.

3. Outcomes

Flows of people at the US border are large and variable over time. National and international economic, policy and political conditions affect business and leisure travel, migration, refugees, asylees, and so on. This section reports the size of the initially inadmissible portion of those flows in context of total flows and identifies major categories of the initially inadmissible. Percentages are provided for 2017, a year for which data are generally available, and prior to expanded family separation by the Trump Administration, Covid, and the initial policies of the Biden Administration which are here viewed as short-term shocks until border policy becomes more settled.

The initially inadmissible, here defined as those apprehended between POEs or deemed inadmissible at POEs but omitting illegal maritime flows, are a small

proportion of total presentations at the border, less than 1 percent[2]. The focus of this paper is about 800,000 events (some individuals are encountered more than once[3]) in 2017.

Three categories of events do not result in direct interaction with the border management system. The Get Away category, estimated at 21 percent of the total, is based on observation at the border and model estimates of total attempted crossings (DHS, 2019). These individuals are assumed to add to the population of illegal immigrants in the US. Turn Backs, based on indirect and direct observation (DHS, 2019), 12 percent of the total, illegally enter the US but return to their country without being apprehended or becoming a Get Away. Some of these will try to re-cross the border. Both Turn Backs and Get Aways are assumed to be a mixture of non-criminal and criminal individuals consistent with proportions from observed enforcement actions. DHS also reports on about 300 individual deaths within the United States that they investigate along the Southwest border, whether in the desert or along waterways. As DHS does not investigate all such cases, the number reported by DHS is adjusted by evidence in the Tucson sector. That evidence suggests that actual deaths are about 70 percent greater than the reported number of deaths (Humane Borders, 2021; GAO, 2021) such that mortality results for about .06 percent of the total cases.

Enforcement actions include those deemed Inadmissible by CBP and Apprehended by the Border Patrol (BP). Within these categories are humanitarian actions comprising about one-third of all cases in 2017. Humanitarian cases are those are people seeking asylum or are unaccompanied

[2] Total crossings are here based on total passenger crossings from cars and all other sources of transportation but excludes airport arrivals.
[3] An overview of definitions, data sources, and values is presented here but more detail is in the Technical Appendix, Section 1, Population Proportions.

children who are likely to be taken at least temporarily into custodial care, a controversial issue.

Those seeking asylum, either affirmatively as they arrive or defensively as they are in the process of being removed, must go through a complex process central to which is establishing "credible fear" if they were to be in their home country. Of these humanitarian cases, Unaccompanied Minors (UAM), Family Units (FU), and Adults (Other Humanitarian) were about 7 percent, 13 percent and 12 percent respectively of total cases in 2017 although there are somewhat ambiguous and overlapping sources of information (DHS, 2019). Each of these categories has three further sub-groups depending on the resolution of their case. Resolution can be: 1) achieve legal asylum status, 2) be removed from country after being denied asylum, or 3) can be Removed in Absentia (RIA) essentially becoming a Get Away. Pending improved information, these three outcomes for all Humanitarian categories are assumed to follow long run averages reported by the Department of Justice (DOJ, 2019) of 59 percent being removed, 27 percent Get Away/RIA, and 14 percent achieving legal asylum status.

The remaining non-humanitarian, enforcement actions resulting in removal account for 34 percent of the total cases (DHS/CBP, 2021). For valuation purposes, this category is further divided into non-criminal (32 percent of the total; 93 percent of this category) and criminal cases (2 percent of the total; 7 percent of this category). Information about the types of prior convictions among the criminals informs both the benefit of both removing a criminal or the cost of a Get Away criminal.

Total, managed, and residual outcomes. There are 16 unique outcomes for analysis as identified in Tables 1 and 2. Importantly, some of the outcomes will be identified as "managed" and others identified as "residual". Proportions of the managed are in Table 1 below showing the outcome proportions used as

probabilities for the estimated expected net benefits. For example, Removals at the border account for 43 percent of the total managed with three percent of those being criminals. Additional removals, in each of the humanitarian categories of Unaccompanied Minors (UM), Family Units (FU) and Other Humanitarian, account for 24 percent of those managed.

Table 1: Managed outcomes analyzed, 2017

Conditions	Sub-total managed	Proportions of managed
Removal, not criminal	248,670	40%
Removal, criminal	19,127	3%
Unaccompanied Minor		
UM Granted Asylum	8,053	1%
UM Removed	33,939	5%
UM Get Away/RIA	15,531	3%
Family Unit		
FU, Granted Asylum	14,672	2%
FU, Removed	61,833	10%
FU, Get Away/RIA	28,297	5%
Other Humanitarian	-	
OH, Granted Asylum	13,549	2%
OH, Removed	57,099	9%
OH, Get Away/RIA	26,130	4%
Turn Back, not criminal	85,427	14%
Turn back, criminal	6,571	1%
Death	506	0.08%

Source: author's calculations based on public DHS data

The residual or "unmanaged" outcomes are the basis for residual costs that are unchanged from the baseline with the existing technology. These most clearly include those who Get Away, whether criminal or non-criminal. Further, some humanitarian cases ultimately Get Away and are Removed in Absentia (RIA) from the asylum process as presented in Table 2. Note that the humanitarian RIA

cases appear in both Table 1 and Table 2 to facilitate tracking the different kinds of costs they impose on the system.

Table 2: Residual outcome analyzed, 2017

Humanitarian: Get away or remove in absentia	Residual count	Proportion
UM RIA	15,531	6.8%
FU RIA	28,297	12.3%
OH RIA	26,130	11.4%
Get Away		
Get Away, not criminal	148,102	64.5%
Get away, criminal	11,392	5.0%

4. Assumptions and valuation data

The structure of a decision tree defines the probabilistic elements and branch outcomes similar for the analysis. The frequency-based probability of each outcome is from Table 1. Most attention is devoted here to valuing, using benefit-cost principles, each of the 14 managed outcomes and two (unique) residual outcomes. As there are also, by happenstance, 16 potential components to the aggregate value for any particular branch; each year of the analysis has the potential for 256 combinations of component values and outcomes (16x16). Fortunately, many of these hundreds of items are either zero or repeat estimates elsewhere, sometimes with opposite signs. This section highlights assumptions for some of the more controversial items.

4.1 Noteworthy issues in valuation

Standing: BCAs should clearly define the population whose benefits and costs count, the determination of standing. That population could be everyone in the world, a country, a state, a region, a city etc. although the determination is usually left as a policy matter to those who would use the analysis (e.g. Whittington and MacRae, 1990). Guidance on the topic sometimes takes the form of "social

constraints" as to what is legal in a jurisdiction. To that end, including only legal activity such that benefits and costs to a law breaker are *not* counted is common practice (e.g., Rowell and Wexler, 2014). Further, US Government guidance for conducting BCAs for both investment and regulatory purposes states that "Your analysis should focus on benefits and costs that accrue to citizens and residents of the United States." (OMB, 2003).

The implications of standing are central to this analysis. Regarding those initially inadmissible, all those whose activities are deemed illegal do not have their benefits and costs count, for example income earned by a Got Away within the US does not count. This results in many zero category entries for benefits or costs for those deemed illegal. However, benefits and costs do count for those whose activities are deemed legal, specifically those granted asylum. Further, costs borne by US taxpayers and residents do count when they are associated with a person without standing, there is no offsetting benefit to the person receiving those benefits. However, a person with legal status, such as a successful asylum seeker, receives a counter balancing benefit (transfer) to a cost borne by a US taxpayer with a net social impact of zero in some categories.

Benefit to successful asylum seekers: Successful asylum seekers are legally in the US and their benefits and costs are included. The reasons people migrate are many and varied. They often include expected improvement in their standard of living but a successful asylum application must also demonstrate "that there is a "reasonable possibility" that he or she will be tortured in the country of removal or persecuted on the basis of race, religion, nationality, political opinion, or membership in a particular social group." (American Immigration Council, 2021). This adds a security or "credible fear" dimension to the migration decision. Successful asylees come from all over the world through all types of entry including airports but in 2017, the top 5 countries from which asylees were

granted (affirmative) asylum were: Venezuela, People's Republic of China, Guatemala, El Salvador and Mexico (DHS, 2020). This report uses Mexico, and Central and South American countries as its statistical focus on external land borders.

The benefits to successful asylum seekers are quantified by their income over time and the value of improved security[4]. While the (legal) income benefit to successful asylees is clear, counting income as a benefit for the previously unemployed (in the United States) is somewhat unusual in a benefit-cost analysis. One argument is that in comparison to the base case, production is changed from a non-countable region--another country--to within the United States. This is the approach taken in a multi-market model (more below) of the impact of immigrants--newly legal labor expands the productivity capacity of the economy not only by the net gains of those who employ them but also by the income paid to those individuals (National Academy of Science, 2017).

The income estimate for successful asylees is based on evidence from Mexico. The record of Mexican immigrants, both legal and illegal, into the United States is among the most studied. Borjas (2014) depends heavily on evidence from those of Mexican origin. Recent immigration is from those with relatively lower skills. Such immigrants on average earn income at the17th percentile of the US income distribution and may only gradually reduce the gap compared to native born workers (Borjas and Katz, 2007). For the calibration year of 2017, an initial income per adult of $20,000 (rounded) and annual real growth in income of 1 percent is used as the gross income benefit to successful asylees.

The value of increased security for successful asylees who must demonstrate credible fear is based on differences in intentional homicide rates between the US

[4] Unsuccessful asylum seekers cannot legally work and are not eligible for a variety of programs.

and the country of emigration. Data from the United Nations (UN, 2021) are used to compute the difference in the homicide per capita rate in Mexico and the Northern Triangle countries of Guatemala, El Salvador and Honduras compared to the United States. In addition to the improvement in security based on average rates, a near arbitrary "credible fear" multiplier is used to increase the security improvement. This analysis uses a baseline multiplier of 3 meaning that those demonstrating credible fear for asylum have 3 times the average exposure to intentional homicide in their home country, but far short of the maximum multiplier[5]. As legal asylees, the US VSL is used to value the estimated change in homicide rates between the home country and the US. This leads to a rounded annual security benefit of $12,000 per successful asylee that includes the credible fear multiplier and persists over time.

Minor asylum seekers or unaccompanied children: Management of children is one of the most controversial decisions at the border. In general, children are treated under official and complex humanitarian protocols with policies that have changed over time (DHS, 2020 and earlier years). One classification with children is called a Family Unit (FU) in which a child under 18 is accompanied by a parent or a legal guardian. Children are generally not separated from at least one parent in this situation and an asylum process usually proceeds, with a low rate of granting asylum. Another classification is Unaccompanied Minors (or Child). Unaccompanied children less than 18 may in fact arrive unaccompanied. Other children of any age may have arrived with an adult but were separated due to a failure of the adult to establish parenthood or legal guardianship, or if the adult has a criminal record or from varying policy implementation. Although most popular and statistical attention is paid to those reported by the BP and

[5] The maximum multiplier is the value necessary to raise the average intentional homicide rate to 1 representing "certainty" of homicide, a value of about 2,500 in the countries studied.

arriving between ports of entry, about one-third in these categories arrive at ports of entry and are tabulated by the Office of Field Operations (OFO; GAO, 2020). Unaccompanied minors are remanded to the Department of Health and Human Services for housing until relatives, family or other housing is found. They must in general still go through asylum process.

Valuing outcomes for unaccompanied minors is highly uncertain. Different approaches were taken here for minors less than 15 and those between 15 and 18 who are granted asylum (the average age in 2017 was about 14). Children in a family unit (with parent or guardian) are assumed to have the same success rate at receiving asylum as adults and if granted asylum, and to begin work starting at age 18. Unaccompanied teenagers 15 or over are assumed to be avoiding a year of child-maltreatment elsewhere if they are accorded asylum as they must establish credible fear, and to begin earning income at age 18 as an adult. Child-maltreatment is valued at the US rate as a successful asylee is evaluated on a US basis (Miller, et al., 2021). Unaccompanied children less than 15 are assumed to incur a cost equal to an event of child maltreatment (Bouza, et al., 2018) and to start work at age 18. Detention costs are included for all in this category but for those who are not granted asylum, their own costs and benefits do not have standing although they may have certain rights.

Fiscal costs and net receipts from illegal immigrants: Much attention on illegal immigration is devoted to costs paid by US taxpayers on behalf of illegal residents through their use of the health care, education, effect on the justice system, and so on (National Academy of Science, 2017; FAIR, 2017; Karoly and Perez-Arce, 2016). This study uses data from the 2017 edition of a periodic report prepared by the Federation for American Immigration Reform (FAIR, 2017), a group that seeks to tighten immigration. The FAIR report is a relatively thorough compendium of the individual components of Federal, State and Local

expenditures from public documents resulting from the presence of about 12 million illegal immigrants in the US. The categories are reasonably consistent with Karoly and Perez-Arce (2016). FAIR reports they are unable to estimate some costs such as fraudulent access to programs intended to be limited to US citizens or residents. Their report has been criticized for various assumptions (Nowrasteh, 2017). This analysis makes some adjustment to the FAIR estimates, the primary one is excluding their estimated costs associated with US children born to illegal immigrant parents. These children are US citizen by law and so have standing in a benefit-cost analysis. Consequently, fiscal costs to support this group are transfers from US taxpayers to other US citizens with the usual BCA outcome of a zero net effect[6]. With that exclusion, cost estimates from FAIR are included in the categories listed in Table 3 below.

Table 3: FAIR fiscal categories excluding US-born children and zero value

Federal			**State**	
Education	**Justice system**		**Education**	**Justice system**
Primary & Secondary Ed.	Federal Incarceration		Public schools: Illegal minors	Policing
Limited English III	DHS Enforcement & Removal		Post-secondary tuition Assist.	Judicial
Migrant Schooling	DHS Customs & Border Protection			Corrections
Head Start	Other DHS/ICE			State Border Costs
Medical	State Criminal Alien Assistance		**Medical**	Fed SCAAP reimbursement
Uncomp. Hospital Expenditure	DOJ/Exec Immigration Review		Uncomp. Hospital Expenditure	
Medicaid births	HHS/Alien Minors		Medicaid births	

[6] Acknowledging standing to US born children reduces FAIR costs of Public Education by three-quarters. The remaining FAIR estimated is included as the foreign-born undocumented children are neither citizens nor legal residents although a court case has required states to educate them.

Improper Medicaid Payments	State Byrne Grants		Improper Medicaid Payments	
	Welfare			**Welfare** (none)
	Women, Infants & Children			

FAIR cost estimates most directly associated with border management were computed per person attempting to cross the border or an appropriate sub-population. In particular:

- average border control cost--Customs and Border Protection (excluding Customs) per illegal crossing attempted. This was the per person cost for all outcomes except those granted asylum[7].
- average child management cost--the HHS/Alien Minor program that houses and manages children in the asylum process per annual child entering the program (FAIR, p. 17). This was part of the per person cost for unsuccessful child asylees.
- average asylum judicial process—a portion of the DOJ Executive Office of Immigration budget per total number of asylees. This is part of the per person cost for unsuccessful asylees and assumes the office operates at a steady state although a significant backlog exists.

Costs most associated with the total (cumulative) illegal immigrant population were analyzed separately using the estimated total (cumulative) population of illegal immigrants in the country (DHS, 2018). These costs were used, for example, as a cost of a Got Away into the country, or as an avoided cost or

[7] As above, costs for successful asylees are modeled as a tax transfer with zero impact.

benefit from a removal. Offsetting tax income including sales taxes are also estimated by FAIR and are their own impact category.

Costs and Duration of Criminality: A small proportion of enforcement actions are identified by DHS as criminals and the same proportion is assumed to be a part of Turn Backs and Get Aways. Identification of an illegal immigrant "criminal" can be complex and reporting varies across components of DHS involved in the detention and removal process. Here the definition of criminal is based on a prior conviction and not a "pending" or "no known" criminal charge (DHS/CBP Enforcement Statistics, 2018). None-the-less, a large proportion of these prior convictions result from immigration cases with a restriction on illegally retrying to enter the country (DHS/BP Non-citizen Criminal Statistics, 2018). The exact proportion is not known due to multiple criminal counts for many cases.

For the purposes of this forward-looking analysis, what crimes might be committed if the individual is allowed into the country[8] or its inverse, the benefit from crimes prevented when not allowed entry? Costs of criminal events are highly variable, and the benefit-cost literature tends to develop costs based on the type of crime (Boardman, et al., 2018). For instance, this analysis eventually reports the initial year cost of a non-criminal "Got Away" at about $5,000 putting the first-year cost about equivalent to that of a Police Reported Burglary (Cohen and Piquero, 2009; Miller, et al., 2021). However, a second literature exists on the costs of a lifetime criminal who may engage in a variety of criminal activity from low cost to high cost (Cohen and Piquero, 2009). The approach used here for the most likely value is based on the prior conviction record of those

[8] A separate and evolving literature investigates whether immigrant communities have higher or lower rates of criminal activity. In general, they find that immigrants commit fewer crimes per capita than the native population (Farley, 2018) while numerous crimes are still committed by illegal immigrants.

apprehended at the border (ICE, 2019). Essentially, if a criminal gets away into the US they are assumed to duplicate their prior career, with an empirical multiple for estimated crimes that did not result in convictions (Cohen and Piquero, 2009). The average multiplier for non-homicide crimes from three surveys reported in Cohen and Piquero (2009) is used[9]. Each crime type is valued at the US value with categories approximating the 29 conviction types reported by ICE. Crimes are assumed to be spread out over 10 years and a present value computed[10].

Deterrence: At-border and distant deterrence effects are an important but difficult to quantify element of border management. They play an important role in this analysis as a function of those managed but which also imply a total number of border crossing attempts for the baseline.

At the border deterrence: CBP explicitly incorporates concern for deterrence into their policy which adjusts consequences to deter various types of illegal activity (CBP/NDAA, 2019). CBP reports varying annual rates of re-apprehension given the type of punishment. CBP further reports one measure of deterrence based on surveys conducted in Northern Mexico that asks about expectations to attempt to re-enter the US. While variations exist depending on when the survey is taken and the time period that is being questioned, about one-third of those removed to Northern Mexico planned to attempt re-entry within 90 days in 2017 (DHS, 2019). This effect is modeled in the first year as a lack-of-deterrence in that a full year's benefit of removal is first estimated for two-thirds of those removed but the remaining one-third are credited with only three months of avoided costs. When the analysis is extended for the present value analysis, the result is that in each

[9] A large source of uncertainty is the multiple for homicide which has a high cost. No survey reported a multiple different than 1 for homicides, perhaps because there is no statute of limitations for homicide in the US inhibiting revelation of additional homicides in the data set based on prisoner responses.

[10] The category "immigration" crime uses data internal to this analysis.

future year only about 75 percent of the potential benefit is achieved when a non-criminal person is removed at the border. The time path of outcomes for a criminal is assumed to be different. A criminal removed is always assumed to retry after the first year but is entirely deterred for the first year while a criminal Turn Back is assumed to retry almost immediately[11].

Distant deterrence: A potentially more significant deterrence effect is one that keeps individuals from ever leaving their home locations. This effect may result from expected consequences if caught at the border or might also result from improvements in conditions in the home country. A statistical analysis by Roberts (2017) is used to estimate the effect of border management on deterring illegal border crossing at a distance after accounting for economic factors. Roberts estimates that illegal attempts from working age, male Mexican nationals would have been about 50 percent higher in 2015 without the border management policy of the time. When adjusted here for the assumed causes of the deterrence --removal or death--the adjusted estimate is about .9 males deterred per person removed or turned-back.

Further, the deterrent effect of agents and consequences on those from other countries, other ages, genders, and purposes is unknown. These other groups are assumed to be more difficult to deter such that the overall deterrence effect is adjusted to one-half that estimated for Mexican males. The result is an estimate that about .45 of a person is deterred in their home country per removed or emigrant dying in the US. That distant deterrence is valued as the border control and interior fiscal costs avoided. The magnitude of the effect is significant but not

[11] CBP reports the first year annual recidivism rate by the type of consequence, noting that they target subjects with more than 6 apprehensions. They identify some weaknesses in their metrics resulting from a focus on an annual basis (CBP, 2019). This issue of repeat attempts is at the core of some evaluation differences between CBP and the Institute of Defense Analysis (CBP, 2019).

dramatic, valued at about $7,500 in additional benefits per removal although the benefits do not persist over time unless border removals continue.

Valuing the statistical life of foreigners: Perhaps the most controversial aspect of standing is valuing the statistical life of those who die having illegally crossed into the US, an outcome that happens hundreds of times each year. They are not citizens and are carrying out an illegal activity. The valuation usually accorded mortality in BCAs, the Value of a Statistical Life (VSL), would not be included due to lack of standing and so could result in a value of zero in the analysis for lives lost. However, DHS spends a modest but observable sum to rescue border crossers in dire trouble (CHS/BP, 2016) indicating that the US value for lost foreign and here illegal lives is not zero. Nor do surveys indicate that US citizens value foreign lives at zero (Dana, 2009). This analysis follows an increasing concern that values for another's well-being are sometimes legitimate to include in BCAs. The value to be included for a lost foreign life on US soil is based on an observable trail of funding from US citizens through US Government aid to impute values for the lives of foreign individuals. Kopczuk, Slemrod and Yitzhaki (2005) quantitatively estimate how the US Government implicitly values the lives of foreigners through its pattern of foreign aid and the varying conditions, including mortality, around the world. Values for foreigners from Mexico, Central and South America (most of the population of concern) are less than 10 percent of the value that the US places on its own citizens--the US VSL that is currently about $10 million (Viscusi and Masterman, 2017). The proportional value estimated by Kopczuk, Slemrod and Yitzhaki for US citizens to reduce mortality for Mexican citizens, 6.84 percent or $684,000, is used here as a central measure. This estimate is clearly a useful topic for later sensitivity

analysis while noting that the value is larger than some estimates of foreigner's own VSL[12].

Impact on US labor market, company owners and consumers: A common channel of multi-market effect is through the impact of migration on the labor market. The effect of illegal immigrants on wages in the aggregate labor market is thought to be close to zero. That result masks an uncertain negative effect, here estimated at 8 percent, on US native born workers with a high school education or less and slight positive effects on other workers (National Academy of Science, 2017; Borjas, 2014, Karoly and Perez-Arce, 2016). This analysis carries through, on a per person basis, the loss in income to native born, lower income workers resulting from the income of those who illegally Get Away. A somewhat larger gain accrues to consumers and owners of capital (Borjas, 2014, p. 163). These counterbalancing effects, while carried through in an expanded version of the analysis, have little overall effect on the results although they point to important distributional aspects of illegal immigration[13].

Equity distributional adjustment/Welfare weighting: The current administration seeks implementable methods to include "equity" or "distributional weighting" into government decisions (White House, 2021). Equity is incorporated here as a sensitivity analysis of the base case. While there can be many dimensions to equity, this analysis weights benefits and costs for differences in income rather than population characteristics such as race. The welfare weights used increase benefits or costs for those in the lower part of the

[12] Technical Appendix, Mortality Value, contains an extended discussion of additional literature and issues.

[13] Dixon and Rimmer (2009) use a CGE analysis to investigate both issues considered here as well as additional elements such as occupational mix, household capital and the structure of prices.

income distribution and reduce benefits or costs for those in the upper part of the distribution. The weights applied are those consistent with the income elasticity of the value of a statistical life and policy pronouncement of the DHS keeping the VSL constant for policy purposes (Farrow, 2021). The implication of holding the VSL constant can imply a weight of 2.1 for the lower quintile and .75 for the upper quintile and 1 for all others. The weights are applied here only to income flows to low-income legal immigrants and native-born workers in the US (increased weights), and to owners of capital (reduced weights).

Timing and Duration for Present Value: Numerous impacts have a time dimension. For the impact duration of illegal immigrants, DHS estimates the time in residence of the unauthorized immigrant population (DHS, 2018). At any given point in time, unauthorized immigrants have been resident for varying periods of time. The median duration (50th percentile) is between 16 and 20 years but that median is changing over time compared to 2007 (DHS, 2018). For the purposes of this analysis, a maximum 20-year duration of impact is used in the present value analysis for those impacts that persist.

Further, the duration of any specific outcome may vary. The initiating phase of many effects, the direct impacts, occur in an initial time period and some, but not all, persist depending on the outcome or impact category. For instance, the benefit-cost (BC) categories of Border Expenditures and the impact of Criminal Removal are assumed to only exist for the first year and do not persist. The BC category of security benefits for successful asylees and the impact of those who Get Away persist at a steady level for 20 years. Another example is that the income of adult and child successful asylees increases over time, but children begin earning at a later date as they reach age 18.

The present value over time of each impact is based on standard discounting using a real discount rate of 3 percent, one of the currently recommended rates for US government BCAs (OMB, 2003).

4.3 Summary per person, conditional values

After quantifying as above the individual categories for each outcome, the categories are summed to compute the conditional per person point estimate[14]. The conditional values reported in Table 4 are the base analysis that includes direct effects, deterrence and multi-labor market effects but exclude equity weighting. The values are the present value per person for the year of attempted entry and for impacts as described up to 20 years thereafter. The values are arranged in descending order of costs and benefits. For instance, if a person is a successful Other Humanitarian asylee (OH, not family unit or unaccompanied minor), the value is about $518,000 of positive, present value net *benefits* over 20 years[15]. In contrast an OH who is removed in absentia after entering the asylum process results in managed *costs* of about $14,000 and residual costs (see Table 5) of about $78,000. Looking ahead, the total PV net benefits of a technology can be estimated by multiplying the unit values in Table 4 by the total number of outcomes in each category, or the expected value can be computed by multiplying the expected value per managed person by the total number of managed attempts.

Table 4: Ranked, point estimates of conditional PV per managed person

[14] Numerous other details exist in the analysis that can be found in the Technical Appendix and available from the author.

[15] Although values are presented "to the dollar" there is significant imprecision that is investigated in sensitivity and uncertainty analysis in later sections.

OH, Granted Asylum	$ 517,992
FU, Granted Asylum	$ 483,487
UM Granted Asylum	$ 472,530
Removal, criminal	$ 103,888
FU, Removed	$ 75,042
OH, Removed	$ 72,163
UM Removed	$ 64,830
Removal, not criminal	$ 56,163
Turn Back, not criminal	$ 37,236
Turn back, criminal	$ (9,636)
FU, Get Away/RIA	$ (13,678)
OH, Get Away/RIA	$ (13,678)
UM Get Away/RIA	$ (27,451)
Death	$ (686,083)

The conditional values for the residual cost outcomes are presented in Table 5. By far the largest residual conditional cost outcome is a criminal Get Away, estimated to cost almost $500,000, who is assumed to continue a criminal career for years as discussed above. A non-criminal Get Away is still costly, about $75,000, but much less than a criminal. The Humanitarian Get Away categories appear in both Tables 4 and 5 as there is some management cost for these individuals with the current technology, but if they Get Away they cause additional residual social costs. Humanitarian Get Away/Remove in Absentia outcomes are in the neighborhood of $100,000 in estimating the residual present value cost. In comparing Table 4 with Table 5, note that removing a criminal generates positive net benefits, but not as large as the cost of a criminal Get Away. This is because the benefits for a criminal who is removed are based only on the first year of removal and any illegal goods confiscated, in essence assuming the criminal is not deterred from activity in later years.

Table 5: Residual, ranked conditional PV per person

Get away, criminal	$ (590,455)
UM, Get Away/RIA	$ (84,728)
FU, Get Away/RIA	$ (81,167)
OH, Get Away/RIA	$ (78,288)
Get Away, not criminal	$ (60,952)

5. Results: Total expected net present value and its decomposition

Alternative models of increasing scope are presented along with several decompositions of the total. Two models compare the immediate effects with the present value effects for a one-year cohort in Table 6 below. Each row identifies the impacts that are included in the metric starting with the most restrictive, the Direct impacts, and adding additional elements with the complete set including multi-market, deterrence, and equity elements[16]. The highlighted metric that includes Direct, Multi-Market and Deterrence is referred to as the base case unless otherwise identified. In that case, the point estimate of the immediate expected value is $1,871 per person. The expected values are taken across the entire set of managed outcomes and their conditional values. The present value (PV) per person is much higher, $74, 961. Also reported for some results are the intermediate elements of the expected value of enforcement outcomes and the expected value of Get Ways

Several major insights emerge from the results in Table 6 for the expected value per person:

1. Immediate versus present value result: The immediate compared to the present value results change substantially and sometimes change sign. This indicates that the multi-year effects are central to understanding border management.

2. Adding labor multi-market effects to direct effect--the income gains of relatively unskilled native workers from removals and the losses of owners of capital and consumer, is relatively small. These results highlight distributional impacts within the aggregate.

[16] The details of each category are clearer in the benefit-cost presentation format to follow.

Table 6: Summary of expected value per person model results, 2017

Impacts Included: EV/Person	Immediate First Year Value for Cohort	Present Value for Single Cohort
Direct	$ (2,687)	$ 71,066
Enforcement: Expected Value	$ (1,868)	$ 78,389
Turn-back	$ (4,790)	$ 33,332
Direct + Multi- Market	$ (2,932)	$70,157
Direct + Multi-Market + Deterrence	$ 1,871	$ 74,961
Enforcement: Expected Value	$ 3,473	$ 82,863
Turn-back	$ (3,517)	$ 33,888
Direct + Multi +Market + Deterrence + Equity	$ 3,498	$ 88,171

3. Adding deterrence changes the sign of the immediate impact from the from negative to positive and improves the present value by about seven percent compared to the direct plus multi-market model. This relatively larger effect in the short run is because "deterrence" is a single year effect in that people must be "re-deterred" each year. Consequently, the immediate effect is relatively large but its relative importance diminishes in the present value metric.

4. Equity weighting: Weighting leads to the largest shift in the present value numbers among the metrics, a gain in present value per person of about 18 percent.

5. Residual expected value: The unmanaged residual is substantial (not in Table 6). The per-person expected value in the base case is a cost of $ -93, 317. In other words, the cost of a person avoiding management is larger than the net benefit gained of those being managed but ultimately, more individuals are managed that unmanaged.

5.1 Decomposition: Outcomes

The results presented in Table 6 aggregate impacts over outcomes. Table 7 ranks the individual outcomes by their EV per person for the base case, the conditional value times its probability. Hence a large conditional value can be small in expected value due to low probability (e.g. death), or a modest conditional value can be large if associated with high probability (e.g. removal of a non-criminal). The residual EVs at the bottom of the table are similar, the largest expected value cost is for a non-criminal Get Away as that has a high probability even if a medium conditional value.

Table 7: Ranked Expected Value by Outcome per Person, 2017

Managed outcomes		
Removal not crim	$	22,548
FU Granted Asylum	$	11,453
OH Granted Asylum	$	11,331
FU Removed	$	7,491
OH Removed	$	6,652
UM Granted Asylum	$	6,144
Turn Back not crim	$	5,136
UM Remove	$	3,552
Removal crim	$	3,208
Turn back crim	$	(102)
Death	$	(561)
OH Get Away*	$	(577)
FU Get Away*	$	(625)
UM Get Away*	$	(688)
Residual outcomes		
UM RIA	$	(5,735)
OH RIA	$	(8,915)
FU RIA	$	(10,010)
Get away, crim.	$	(29,314)
Get Away, not crim	$	(39,342)

5.2 Total value of the Managed and Unmanaged

Results that aggregate from the per person results of Table 4 can be informative for investment decisions. Calibrating to the year 2017, with about 620,000 cases

managed[17], the base case of about $75,000 in expected value per person yields annual (PV) net benefits of $46.4 billion (2017) dollars based on the number of cases in each category. Incorporating equity effects yields annual net (PV) benefits of about $55.1 billion.

For comparison, the total EPV for a one-year cohort of unmanaged cases is $21.4 billion, 46 percent the size of the net benefits from 2017. Like the analogy to residual pollution, there is substantial cost avoided benefits to be gained if supported by the cost of a new technology.

It is worth noting that the net present annual value of one cohort does not represent the lifetime of a technology. For major structures the lifetime of the technology might be 20 years, for other technologies a shorter time. While there are alternatives on how to treat salvage value beyond an illustrative 20 years, if one truncates net benefits of cohorts extending beyond 20 years, it can be shown that the resulting 20-year present value is about 9.5 times the initial, single year present value. A different approach is to include the future value that would lead to a higher life-cycle value although these lifetime impacts are not included here.

5.3 Decomposition: Benefit and cost categories

Presenting results in a BCA format provides complementary information on the value of impact categories and their importance. Aggregating results for impacts rather outputs for the base metric (Direct, Multi-Market and Deterrence) yields the benefit and cost categories in Table 8. The bottom-line net benefit per person is exactly equal to the outcome-based value from Table 6; $74,961.

This alternative breakdown informs some of the more contentious debates surrounding border management. On the benefits side, the largest benefit

[17] There are about 225,000 cases in the residual cost analysis.

category is avoided Federal, State and Local fiscal costs as shown in Table 8. The next largest benefit accrues to successful asylees based on their income and improved security. The indirect effect on native born unskilled labor resulting from removing potential immigrant labor is also a significant benefit while drug and human trafficking benefits are relatively small in expected value. Distant deterrence is a mid-sized benefit. Total expected benefits per person are about $112,000.

Table 8: BCA format of results by impact category, per person expected PV

Benefits			**Costs**		
Fiscal costs avoided-interior	$	65,938	Net tax impact	$	(13,328)
Asylee income	$	16,381	Border operations	$	(11,795)
Asylee security	$	11,182	Indirect capital owners	$	(5,002)
Indirect Native-born Labor	$	9,094	Indirect consumers	$	(5,002)
Distant Deterrence-costs avoided	$	5,790	Border Lack of Deterrence-benefits lost	$	(986)
Crime avoided	$	1,562	Mortality	$	(559)
Drug capture	$	1,535	Environment de minimus	$	(3)
Trafficking avoided	$	154			
Total	**$**	**111,635**		**$**	**(36,674)**
Net Benefits			**$ 74,961**		

Regarding costs, the present value of taxes lost is the largest cost item, an offsetting item to the benefits from fiscal costs avoided. The costs of border operations and processing are of similar size. Also, somewhat larger than the benefits to native born labor from managing the border, are the indirect costs to owners of capital and consumers whose costs are higher with less immigrant

labor. The equality of these two indirect effects is by assumption of relative supply and demand elasticities that define the incidence of price changes. The expected mortality costs of those trying to cross the border is relatively small, in part due to the low probability but also the lower valuation placed on foreign rather than US lives. Finally, environmental costs appear small, primarily due to the limited impact that is included, only that of trash along migrant trails in the US. However, some technologies may have a larger environmental impact, such as building a wall, and so this category remains as a potentially important placeholder. Total costs per person are about $37,000 leading to net benefits of the current system of $74,961: the same as the DA result.

6. Sensitivity/ Uncertainty and Accuracy

The previous results are subject to many types of uncertainty. There are individually uncertain parameters, uncertain sets of the parameters, and the model may incompletely capture the full border management context. This section investigates: 1) selected individual parameter uncertainty, 2) scenario uncertainty affecting multiple variables, and 3) simulation of aggregate uncertainty. Consequently, the focus of the uncertainty analysis is on parameters affecting the value estimates. These explorations suggest caution in the use of exact values, although the qualitative results are not changed.

Individual parameter sensitivity. The expected values of outcomes in Table 4 provide the sensitivity of the result from a proportional change in each value (say due to mismeasurement) due homogeneity of degree one of the expected value equation. An equi-proportional change in all the values would retain the same ranking as in the table but change by the proportional amount.

A more detailed sensitivity is based on five factors: the top four conditional outcome values in Table 4--mortality, crime, asylee income and security, and

fiscal cost, the largest consequence in the BCA analysis of Table 8. These five values are all uncertain and each is a function of a key parameter for that value.

The incremental uncertain effect for each variable is investigated by computing the slope and the elasticity of the aggregate EPV in the neighborhood of the base case value[18]. Table 9 presents these slopes and their units, each of which is approximately linear in the range studied, and the (arc) elasticity.

The EPV per person results are most sensitive to the fiscal costs avoided that can occur over a period of years. If such annual costs increase by $1,000 (from a base of $6,800), then the EPV increases by $9,509 and vice versa for reduced fiscal costs. Asylee security, the second largest slope, depends importantly on the comparative intentional homicide rate between the home country and the US and a resulting multiplier[19]. If the multiplier increases by 1 from a base of 3, then the EPV per person goes up by $3,590 primarily because security benefits accrue over time. Asylee income is an important determinant of benefits because it also continues and grows slightly over the 20-year time horizon. The base case income is about $20,000 per year. The estimated slope is $841 per increase of $1,000 in asylee annual income. The slope for income implies an equivalency of about $4,000 in annual income to a unit change in the security multiplier.

Table 9: Sensitivity of EPV to parameters of highest value metrics

Paramater (X)	Slope Δ ENPV/Δ X	Unit of change	Elasticity
Fiscal costs avoided	$ 9,509	per $1,000	0.84
Asylee security	$ 3,590	per unit homicide multiple	0.74
Asylee income	$ 841	per $1,000	0.28
Cost of career criminal	$ 362	per $100,000	0.02
Proportion of US VSL	$ (817)	per 10 percent	-0.06

[18] Calculations are done using one variable sensitivity analysis in Treeplan/Sensit .
[19] See Technical Appendix on Security for more detail.

The final sensitivity is the US citizen and resident Value of a Statistical Life for an initially illegal foreign national (see section 4.2). The base case uses a value of about 7 percent of the value of a US citizen. The estimated slope indicates that for each 10% increase in the proportion of a US VSL, e.g. from .07 to .17, then the aggregate EPV decreases by $817. If the US VSL is used as a cost for mortality (changing from .07 to 1), then the aggregate EPV decreases by about 10 percent as the EPV per person would be about $67,000.

All elasticities are less than unitary, meaning that the EPV changes by less than one percent for a one percent change in the variable. However, there remains large variation among the parameters in part due to the probabilities affecting the expected value. For instance, the fiscal costs avoided enter many outcomes while the cost of a career criminal affects a limited number of outcomes even though its conditional effect is large.

Scenarios and Macro-Simulation: Many variables can be simultaneously uncertain. A common approach is to attach a statistical distribution to each uncertain variable and use simulation methods to obtain a distribution for the outcome. This approach is not possible at this stage of data availability and model development. Instead, two scenarios representing sets of parameter assumptions are defined as "Bad for EPV" and "Good for EPV" cases. Not all variables are adjusted as shown in Table 10 while focusing on parameters representing the largest impact categories (see also the technical appendix).

The scenario results indicate that the Bad scenario reduces the per person EPV by about 83 percent, although the metric remains positive. The Good scenario more than doubles the already positive per person EPV. These results indicate the robustness of the positive EPV finding while providing information about the range of the base case result from parameter uncertainty.

Table 10: Scenarios used to define extreme cases of EPV

Scenario Summary	Current Values	Bad EPV case	Good EPV case
Changing Cells:			
Fiscal Cost	$ 6,799	$ 3,400	$ 10,200
Share of US VSL	0.0684	1	0
Asylee Income	$ 20,060	$ 15,000	$ 35,000
At Border Deterrence	0.66	0.33	1
Career Criminal Cost	$ 431,569	$ 200,000	$ 2,000,000
Distant Deterrence	0.46	0.00	1.00
Asylee Security Multiplier	3	1	10
Result Cells:			
Net PV per Person	$ 74,961	$ 13,099	$ 178,925

An illustrative distribution for EPV can be derived using a triangular distribution defined by the point estimate as the most likely value and increasing the two extreme cases by five percent to offset behavioral biases and variables not included in the scenarios. The distribution from 10,000 trials of the per person EPV is skewed to the right indicating that parameter values in the Good scenario increase the EPV by more than the Bad scenario decreases it. Consequently, the simulated mean (about $89,000) and median (about $86,000) are larger than the base case point value of $74,961 indicating that the uncertainty captured in the scenario tends to increase the point estimate. All simulated outcomes were positive.

7. Discussion and Policy Conjectures

The border management cup can be viewed as both half full and half empty. The existing management system, the half full part, is estimated to yield large net benefits on a per person and total net benefit basis although uncertainty exists. At the same time, there is significant potential to improve net benefits as there are large residual costs. Whether or not an actual new technology can yield positive net benefits depends on its effect on the proportions of outcomes, total number of outcomes, and the cost of the technology or the value of consequences.

Numerous intermediate results appear consistent with expectations. Identifying outcomes, quantifying values and computing explicit expected values provides greater specificity than is believed to currently exist in the discussion about border management. For instance, public concern with criminals and asylees—whether minors or adults--and fiscal impacts are all shown to be central elements of the analysis. At the same time, the highest expected value (outcome) component is the non-criminal, non-humanitarian population even though one criminal is much more damaging than one non-criminal. Note that this discussion merges two types of expected values, those associated with outcomes such as the criminal, population; and those associated with impact categories, such as fiscal impacts. The decision analysis presentation monetizes the outcomes; the BCA presentation monetizes the impact categories. Both are informative and have the same aggregate expected value.

Structural assumptions regarding who has standing and time duration are central to the analysis. More clearly stated, laws that define legal immigration are the primary determinants of values. For example, fiscal costs, the largest category, would become transfers with no net impact on the bottom line under a different set of immigration and residency laws. However, traditional "crimes" would retain their costly impact. Further examples of the importance of law in defining this analysis is that successful asylees generate substantial benefits by earning income, while Get Away non-criminals create costs by using services over time, but their income is excluded from benefits.

Equal welfare weighting in the base case is revealed as an important assumption. Welfare (equity) weighting substantially increases the expected present value although its sign does not change.

There are many suggestions for improvement, which is to suggest there are weaknesses. The modeled outcomes, processes, and impacts may not be fully

consistent with real world practice as known by subject matter experts within DHS or elsewhere. The analysis investigates relatively new topics in areas such as: security benefits, deterrence, applying the career criminal concept, child maltreatment, valuing the lives of foreign nationals and welfare weighting. Further discussion and investigation on these topics could improve the analysis. The current uncertainty analysis yields insight but could be expanded.

What uses might be made of this analysis? The results quantify and communicate why some types of initially inadmissible individuals are either costly or beneficial. The aggregate results indicate that border management is generating large net benefits for the country although there are also large residual costs that could be reduced with appropriately targeted investments. The individual outcome and impact information could also inform new policy choices regarding asylees and criminals by using the shadow prices as provided here.

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