RESEARCH PAPER

Finding a foothold

Assessing forecastability in transnational organised crime

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Summary

States and intergovernmental bodies increasingly recognise the threats transnational organised crime (TOC) poses to human wellbeing, state legitimacy and the global economy, but we do not have a clear understanding of its scale or scope. This paper outlines a conceptual background for understanding and quantifying the future in broad terms and in the context of TOC. It provides an overview of data estimation and modelling, and offers a framework for beginning to think about forecasting types of TOC. The paper offers an assessment of 'forecastability' in five TOC categories, reviewing research and data estimation in each category.

Key points

- Modelling and/or forecasting transnational organised crime (TOC) could provide a useful tool for governments and policy-makers to better understand and combat TOC.
- However, the illicit and hidden nature of TOC makes it difficult to define and accurately measure.
- Barriers to measurement and understanding of TOC mean that it is not possible to model and forecast at this juncture.
- It may, however, be possible to find a foothold in forecasting TOC by modelling illicit drug demand.
- Modelling illicit drug demand could provide insight into long-term trends within the international illicit drug trade.

This paper focuses on:

ALL REGIONS

Introduction

States and intergovernmental bodies increasingly recognise the threats transnational organised crime (TOC) poses to human wellbeing, state legitimacy and the global economy.[1] The United Nations Office on Drugs and Crime (UNODC) contends that TOC has become one of the most sophisticated and profitable markets in the post-Cold War context.[2] Consequently, TOC has become a more regular feature of international forums in recent years, increasing in prominence in the intergovernmental policy agenda. Further, Africa has featured more prominently in discussions of TOC. Since around 2004, for example, the number of UN resolutions that directly mention the need to tackle 'organized crime in Africa' has increased fourfold.[3] However, the majority of attention devoted to organised crime focuses on activities that disproportionately harm individuals and communities in developed states.

A better understanding of global patterns of TOC and how they may evolve in the future could help inform policymaking, coordination and planning across countries and international organisations, both in Africa and globally. But, to formulate policies that effectively address the damage caused by organised criminal networks, governments and international bodies need a solid evidence base on which to ground legal and regulatory responses. Unfortunately, we still do not have a clear understanding of the scale and scope of TOC or what drives its various forms at a national, regional or global levels. Further, given the paucity of data around TOC, it may not be possible to develop the understanding and tools required to create policies that are truly 'evidence based'.

Modelling and forecasting are tools to help policy-makers think more carefully about how the future might unfold. These approaches can shed light on evolving dynamics in the TOC space and help inform government and donor activity. More specifically, forecasting and scenario analysis in the TOC space could help governments plan policy interventions and frame possible outcomes of those interventions.

Our current knowledge and evidence base in the TOC space is sparse. There are some useful data on very specific aspects of certain types of crime (e.g. drug production and transit routes), but nothing that approaches a unified body of research. In other words, there are no reliable estimates of the scope of TOC on either a global or a national basis, which means we have little evidence to begin to assess drivers and patterns of TOC. That said, international efforts to improve data collection and estimation of different types of TOC have improved over the past 10 to 15 years. These efforts may provide a basis for attempting to gather data of sufficient quality to model different TOC types.

Finding a foothold in one type of TOC could help build a tool that can be used to create an evidence-based framework to analyse and model TOC more generally. Assessing the current data and understanding of TOC and its various forms in a systematic way can help identify areas for further research and measurement that can build to future forecasting activities.

The purpose of this research paper is to outline a conceptual background for understanding and quantifying the future, both in broad terms and in a TOC context, and to provide an overview of data estimation and modelling in the TOC space. We offer a framework for beginning to think about forecasting TOC and TOC crime types, providing a review of research and data estimation in each category and offering an assessment of 'forecastability'[4] in five TOC categories.

The Pardee Center specialises in long-term, integrated forecasting across social, human and natural systems. Our goal is to provide a systematic framework in which to think and plan for the future. Our approach and experience of modelling in the social sciences can help shed light on the challenges of forecasting in the informal and criminal realms. The Pardee Center has previously undertaken projects aimed at gathering data on human trafficking and general TOC activity at the cartel level, and has done research and modelling of the informal sector.

Using models to think systematically about the future

Whether we know it or not, humans construct models using observations and assumptions every day. An architect constructs a physical model to help plan and construct a building; a driver uses a mental model of road geography, time and other drivers' behaviour to choose the fastest route to a given location; a scientist uses mathematical models to try an explain changes in carbon dioxide in the atmosphere. We construct these models in an attempt to 'understand some aspect of the infinitely varied world',[5] but our models are based on a simplified set of observations about the world, sourced

from perceptions and past experience about how phenomena unfold within complex systems.

In this sense, models by definition cannot fully explain a given phenomenon. But, a well-constructed model can help provide a framework in which we can make better informed decisions. If our goal is to get to a given destination quickly, a good road map is simple and accurate enough to guide our driver to his destination. But, a road map is limited in its ability to accurately guide us because it cannot account for the varied phenomena that affect time to destination, such as traffic, construction and weather. Whereas, GPS navigation technology integrates a road map with information on traffic flows and construction to better direct us to our destination in a timely manner. In other words, it provides us better information and a more complete understanding of each of the complex systems that drive and affect our route, enabling us make a better-informed decision.

We can better organise and solve problems by thinking about how systems operate and interact

Every phenomenon occurs in systems, which are defined as a set of connected units or things. If our goal is to better model or forecast how a phenomenon will unfold, we must have an understanding of the phenomenon, the system(s) in which it operates and how they interact. Systems thinking and systems dynamics are tools we can use to better organise and operationalize how we think about and model the future within a complex and changing world. Systems thinking, in its most broad definition, is little more than 'thinking about systems, talking about systems, and recognizing that systems are important'.[6] In other words, it is simply acknowledging that we can better organise and solve problems by thinking about how systems operate and interact.

Epistemology of the future

Ultimately, our ability to forecast hinges on our understanding of both continuity and change of a given phenomenon over a given time period. Referring back to the road map example, a map can help us

understand continuity – an up-to-date map accurately represents the road network that we are navigating. But it cannot help us understand change, because it has no representation of traffic flows, road works or other dynamic phenomena. However, the GPS navigation system helps us measure and understand elements of both continuity (road network) *and* change (traffic, construction). In other words, the GPS system can more accurately forecast our time of arrival than a map or a mental model.

The degree of accuracy with which we can forecast continuity and change of any phenomenon depends on three key elements. First, we need a clear definition of the problem or variable to determine the level of analysis in both space and time. Second, we need to know how well we can actually measure the phenomenon in question. Third, we need to assess the accuracy of our conceptual model(s) of the variable and the system(s) in which the variable operates. Each of these elements build on each other. Without a clear definition and level of analysis it is very difficult to assess measurement accuracy; without measurement accuracy, it is difficult to assess conceptual clarity.

The first step in forecasting any variable is to establish a clear definition. Defining the problem or variable can help to shape the level and time horizon across which we want to establish our forecast. If we want to get from one destination to another in a timely manner at a specific time or on a specific day, a GPS system can help us forecast to better achieve that task. In other words, a GPS navigation system produces a forecast to help solve a problem over a short time horizon and relatively small spatial scale. But if we want to solve a problem on a larger scale or over a longer time horizon, our measurements and forecast must be built at a different level of space and time. City planners use models that incorporate long-term forecasts of economic and population growth, urbanisation, technological development to better understand and solve citywide road and public transportation needs. This type of forecast will not help a driver navigate to a destination today, but it can provide foundational assessments of how governments should be prioritising large-scale investments today to better understand the general path of transport networks and pressures over the next 20 years.

A second key to understanding how well we can forecast a phenomenon is assessing the accuracy of our empirical

measurements. Highly accurate forecasts require that we have data that: 1) accurately reflect the idea that we are measuring; 2) have been gathered using a sound methodology; and 3) have sufficient temporal coverage to assess patterns and volatility. We can attempt to forecast population growth across countries because national population statistics are some of the most comprehensive indicators we have at a macro level. The data approximate the indicator we are trying to measure or forecast (people) and the methods of gathering and estimating that data are methodologically sound (census and household surveys); and nearly every country reports population statistics on a regular basis. The robustness of population data across these areas allows us to confidently map trends over time and attempt to understand how the demographic system operates.

The robustness of population data allows us to confidently map trends over time

Finally, to accurately forecast a variable we need a conceptual framework of the system(s) in which that variable operates. Drawing on the definition of systems dynamics above, we need to understand the broader context in which the variable of interest sits. More specifically, for us to be able to understand both continuity and change over time, we need to know what drives our variable and what our variable drives. Because

we have a clear definition and accurate measurement of population across countries and time, we can identify and understand what drives population growth and what population growth drives (see Figure 1 below).

Forecasting and scenario analysis

When variables are represented with quality data and thorough conceptual frameworks we can begin to understand and forecast both continuity and change across time. Ideally, we would forecast a most-likely scenario (often referred to as a 'Base Case' scenario) as the starting point of analysis and develop scenarios around that baseline. However, for many issue areas – TOC included – it is difficult to formulate robust forecasts of the current path of development because we don't have enough data or a conceptual framework from which to build a Base Case. In these instances, the use of scenarios to frame uncertainty becomes crucial.

Scenarios are tools that can be used frame uncertainty, simulate change, and evaluate trade-offs to better understand the range of possibilities in which a phenomenon might unfold. Scenarios are 'coherent, internally consistent, and plausible descriptions of possible futures states of the world'.[8] Scenario construction and analysis are used in a variety of disciplines, from evaluating the impact of climate on agriculture to evaluating impacts of drug enforcement policy on drug use. However, for scenario analysis to be useful, we still need to have some conceptual framework, whether qualitative or quantitative, from which to begin to forecast or build scenarios.

Figure 1: Conceptualisation of a demographic system
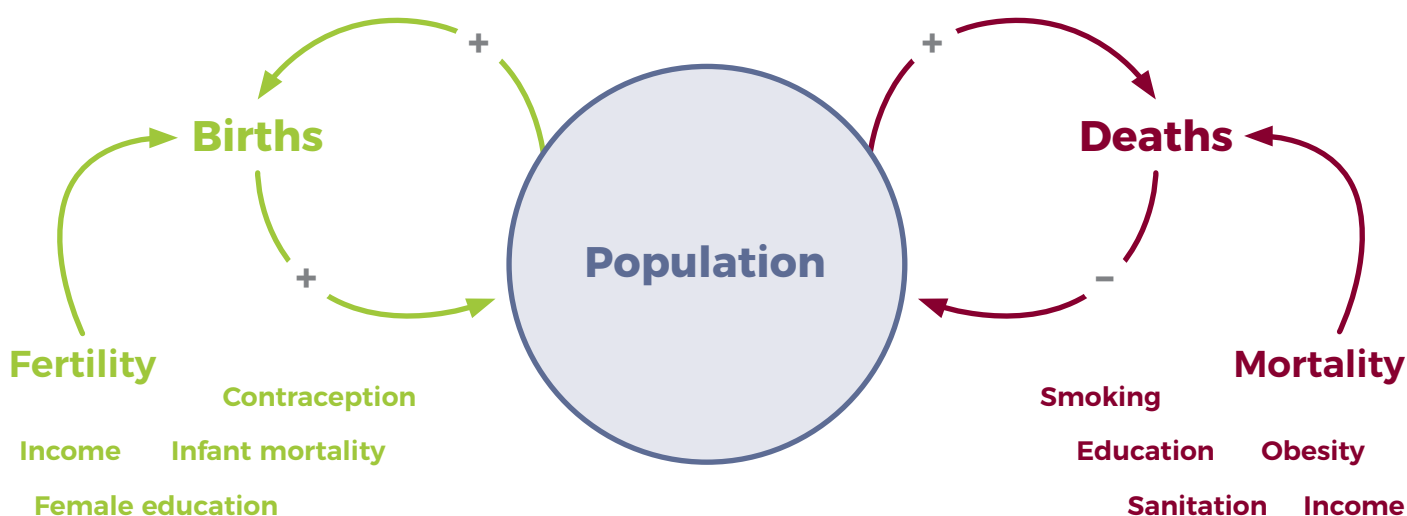
Source: As conceptualised for a presentation of 'Understanding and Forecasting Demographic Risks and Benefits'[7]

Modelling TOC: finding a foothold

TOC is, by definition, a global transnational phenomenon that requires policy and enforcement cooperation across countries. One of the key goals of the ENACT project is to build knowledge and offer 'evidence-based analysis of TOC in Africa, which will inform policy and enhance cooperation at the regional and continental level'.[9] Within that context, the project aims to offer a more holistic understanding of TOC phenomena and their impact to develop effective, long-term responses.[10]

If we want to develop effective, long-term responses to TOC, we must try to quantify the phenomenon and attempt to understand its long-term structural drivers within complex global systems. Following the structure outlined above, we need to clearly define the problem, decide a level of space and time, assess the accuracy of our TOC measurements, and assess how much we understand about the systems in which TOC operates. Given the context and goals of the ENACT project, the country/year level of space and time is a good starting point for analysis, but there are significant barriers to defining, measuring and conceptualising TOC.

Challenges of forecasting TOC

Understanding and forecasting TOC at the country/year level is challenging because: 1) there is lack of consensus on its definition; 2) variables that attempt to measure aspects of it lack rigour and/or conceptual alignment; and 3) the drivers and impacts of changing patterns of TOC are poorly understood at the macro level.

The problem with forecasting TOC begins with a lack of definitional clarity. There is no widely accepted definition of TOC. The UNODC, an authority on TOC, has itself used different definitions of TOC in different reports. In *The Threat of Transnational Criminal Organizations*, the UNODC defined TOC as 'virtually all profit-motivated criminal activities with international implications';[11] but in *The Globalization of Crime: A Transnational Organized Crime Threat Assessment (2010)*, it defines TOC as 'any serious transnational offence undertaken by three or more people with the aim of material gain'.[12] Without a clear definition of TOC, it is difficult to assess the measurement of TOC phenomena or conceptualise a framework in which to understand and forecast TOC.[13]

Second, sources of empirical measurement of TOC are lacking. Measuring illicit behaviour on any level is extremely difficult and very little data on TOC exist.

To forecast TOC at an aggregate level would require, at minimum, reliable data or estimates of TOC. But, by definition, illicit behaviour is largely unobserved, constraining our ability to gather reliable data on informal or criminal activity. Even if we had a clear definition of TOC, our inability to accurately measure the magnitude of any sort of illicit behaviour would be a significant barrier to modelling.

Third, the illicit nature of TOC activity, its poor empirical record and definitional discrepancies, lead to an opaque understanding of the conceptual drivers of the phenomenon. Existing research typically conceptualises TOC flows in one of two ways: either as market-driven criminal activities or as a function of the transnational criminal organisation (or syndicates) that facilitate their commission.[14] Much of the research in the TOC space has followed the syndicate approach in an attempt to explain TOC through criminal actors and international syndicates.[15] Research in TOC has illuminated the shortcomings of the syndicate approach from a theoretical standpoint. A central finding of the UNODC TOC threat assessment found that most trafficking flows are 'the product of market forces, rather than the plotting of dedicated criminal groups.'[16]

> Most trafficking flows are 'the product of market forces, rather than the plotting of dedicated criminal groups'

Yet, TOC operates within and across a number of systems in ways we do not fully understand. For example, why are there high levels of organised crime activity in Italy but not Portugal? Why are levels of organised crime very high in Bhutan but not Nepal?[17] Do changing patterns of government effectiveness reduce TOC activity? Or do they lead to increased competition between governments and syndicates? What do changing patterns of TOC activity do to levels of human development? Does TOC occasionally solve collective action problems for small groups of people that governments have overlooked?

Given these core definitional, conceptual and data challenges, it is currently not possible to forecast TOC activity at a country/year level over long time horizons.

There is too much that is unknown and unmeasured. Further, it is important to recognise that, while measurement methods and data availability for TOC has improved over the past 15 years, we may never be able to accurately measure transnational organised crime. That said, we may be able to gain a foothold in the TOC sphere by forecasting specific elements of TOC activity.

For the purposes of this brief we have identified specific crime types and relevant organisations that have already attempted to measure TOC activity in that area. These data fall into broad categories: 1) illicit financial flows; 2) human trafficking (and smuggling); 3) wildlife trafficking; 4) arms trafficking; and 5) drug trafficking. The remainder of this brief will delve into the definitions, data and conceptual framework across TOC categories to assess forecastability in each.

Review of research and data in TOC categories

The following sections provide an overview and assessment of current research and measurement of five TOC categories defined above. For each of these categories, we compiled data that measure the magnitude of either the quantity or cost of flows of TOC at a country/year level and then assessed the data and conceptual foundations of each.

Table 1 below provides a snapshot of the assessments of the measurement and conceptual validity across categories; the sections that follow delve into the definitional, methodological and conceptual foundations in detail. The table assesses each TOC category across aspects of 'data fidelity' and 'concept validity'. 'Data fidelity', which is meant to assess the accuracy of our empirical measurements, is assessed across three categories: 1) proximity of the measurement to the target concept (Proximity); 2) methodological transparency and soundness (Methodology); and 3) historical data coverage (Coverage). 'Concept validity', which is meant to evaluate the breadth of our understanding of the system dynamics of the variable in question, is measured by assessing our theoretical foundations and validation of those foundations. For details on the specific criteria see the annex for the rubric and scoring details.

There are a few key takeaways from this table and from our overview of current TOC research and measurement. First, most of the categories have average or below average scores on proximity. Current TOC measures of trafficking or trade rely heavily on reported cases or seizures. While these data often measure the right unit (quantity or count of the trafficked item or person), they only record cases that authorities identify. In this sense, seizure data largely reflect law enforcement activity

Table 1: Forecastability assessment across TOC types

TOC category	Definition	Data fidelity			Concept validity
		Proximity	Methodology	Coverage	
Illicit financial flows	*Illicit flows of money across borders*	2	7	9	3
Human trafficking	*Illicit flows of humans across borders*	6	6	6	2
Wildlife trafficking	*Illicit flows of wildlife across borders*	6	5	6	4
Arms trafficking	*Illicit flows of arms across borders*	6	5	5	3
Drug trafficking	*Illicit flows of drugs across borders*	6	9	7	5
Drug demand	*Demand for illicit drugs*	8	9	9	5
Drug supply	*Supply of illicit drugs*	7	8	9	5

Scale: 10 = highest score; 0 = lowest score

Source: Author's conceptualisation

rather than total prevalence or activity. This means that the data only represent a small portion of total trafficking and thus are not accurately measuring the magnitude of the phenomenon.

Second, all of the TOC categories score in the lower range of conceptual validity. Because the data on TOC categories only tend to capture a small portion of the size or trend of the phenomena, it is very difficult to build an evidence-based framework to explain what drives each and what each drives.

Current TOC measures of trafficking or trade rely heavily on reported cases or seizures

Lastly, there are a few important distinctions and differences in the TOC categories outlined in the table. 'Illicit financial flows' is the only category that could act as a measure for TOC as a whole; the rest of the categories serve as measures for specific forms of TOC. Drugs are the only category that also has explicit country/year level measures of demand and supply, and 'Drug demand' scores highest across our measures of data fidelity and concept validity.

Illicit financial flows

Overview

Since the publication in 2005 of Raymond Baker's decisive work *Capitalism's Achilles Heel*, illicit financial flows (IFFs) have received increasing attention and research in the economic and TOC domains. IFFs could serve as an indicator of global TOC, but estimating and forecasting them remains a significant challenge. First, there are little to no data on IFFs, and available estimates are largely based on extrapolations of misreporting of bilateral trade data. Second, while IFFs could serve as a proxy for total TOC (because it is a broad measure of illicit activity), that breadth would also make it very difficult to model or conceptualise the drivers of IFFs.

Definition/unit

As with TOC in general, no widely accepted definition of IFFs exists. According to Global Financial Integrity (GFI), one of the world's leading authorities on IFFs, they are

'illegal movements of money or capital from one country to another — such financial flows are considered to be illicit when the funds are illegally earned, transferred, or utilized.'[18] Similarly, the United Nations Economic Commission for Africa (UNECA) defines IFFs as 'money that is illegally earned, transferred or utilized'; whereas, Epstein (2005) defines IFFs as 'capital taken abroad in a hidden form, perhaps because it is illegal, or perhaps because it goes against social norms, or perhaps because it might be vulnerable to economic or political threat.'[19]

The GFI/UNECA definition of IFFs draws the line at legality, whereas Epstein's definition tries to encompass a more normative view of the term illicit. This more normative definition of illicit, which includes harm and vulnerability that isn't necessarily illegal in nature, is important because the end goal of research into TOC in general is to measure harm or damage to society. But, measuring and modelling an IFFs indicator that includes both illegal activity and generally illicit activity would be extremely difficult. In this sense, the term 'illicit' financial flows is somewhat misleading, as IFFs should be understood as 'illegal' financial flows.

Following the GFI/UNECA definition of IFFs, illicit flows fall into three general categories: 1) the act/flow is illegal (e.g. tax evasion); 2) the funds in the flow are the result of an illegal act (e.g. illegal arms trade profits); or 3) the funds that are used for illegal purposes (e.g. financing organised crime).[20] Under this definition, all TOC activity could be captured by a measure of IFFs, although it would also capture illegal activity that was not necessarily organised crime.

Even with some of the definitional caveats laid out above, a country/year unit of IFFs would be a good starting point from which to model or forecast TOC. The unit of analysis would ideally be the amount of monetary flows from illegal activities for each country in a given year.

Measurements and methodologies

GFI is the preeminent source of estimates of IFFs. It has published reports on IFFs to and from 148 developing countries since 2010. The *Global Illicit Financial Flows Report* is the organisation's global review of estimates of global IFFs. The most recent report, published in June of this year, covers IFFs from 2005 to 2014. There have been other attempts to measure IFFs in regions and specific countries,[21] but GFI is the only organisation that puts out global estimates.

Moreover, the methodologies other sources use (for developing countries) are slight variations on or combinations of the two methodologies GFI generally uses.

GFI generally uses two methodologies in trying to quantify IFFs: 1) the trade mispricing method; which measures IFFs by looking at International Monetary Fund (IMF)'s Direction of Trade Statistics (DOTS) database for disparities arising from over-invoicing of imports and under-invoicing of exports after adjusting for ordinary price differences;[22] and 2) the hot money narrow method, which records IFFs through net errors and omissions in national payment balances.

Trade misinvoicing is a form of trade-based money laundering. Fraudulent manipulation of the price, quantity or quality of a good or service on a trade invoice allows criminals, corrupt government officials and commercial tax evaders to shift vast amounts of money across international borders quickly, easily and nearly always undetected.[23] GFI estimates of IFFs assume that all trade misinvoicing is organised criminal activity.

Leakages from the balance of payments are the net errors and omissions (NEO) term in the IMF's Balance of Payments Statistics (BOPS) database. This NEO term represents the unobserved or unreported flows in national balance of payments accounts. GFI assumes that those unreported flows represent illicit transactions.

GFI releases high and low estimates of IFFs based on these two methodologies. The high estimates use calculations of developed-developing trade misinvoicing using DOTS (where data is available) and estimates of developing-developing trade misinvoicing using a 'bilateral advanced economies calculation'. Where there are no bilateral data, GFI uses a 'world aggregation method' to produce estimates at country level.[24] GFI's low estimates are based on bilateral trade data between developing countries and advanced countries only. Where those data are unavailable, GFI uses a scaled version of the world aggregation method to produce estimates.[25] Because data are so sparse, both the high and low estimates rely heavily on one or both of the methods above for global country-level extrapolation and estimation – about two-thirds of GFI estimates are based on the world aggregation method.

According to GFI's estimates, trade misinvoicing is the primary measurable means for shifting funds out of developing countries illicitly. Over the 10-year time period of this study, an average of 83% of IFFs were due to fraudulent misinvoicing of trade, whereas only 17% were due to balance of payments leakages. Because balance of payments leakages are typically only a small fraction of total IFFs estimated by GFI, variations on that assumption are not likely to have a big effect.

UNECA also attempted to measure IFFs using similar methods for a report on IFFs out of Africa. Similar to GFI, the report combines trade misinvoicing and balance of payments leakages to get a measure of IFFs, but it also uses slightly different data and introduces a time lag component.[26] The UNECA estimates also disaggregate IFFs from Africa by subsector and destination country.

While the efforts to measure IFFs globally are innovative, using these estimates as a measure of total IFFs stretches definitional and methodological boundaries. First, the data from GFI and UNECA assume that discrepancies in trade reporting indicate illegal activity. But, trade misinvoicing also includes human error, inefficiencies due to poor government effectiveness, transaction costs and so on. Moreover, reporting varies widely between countries, meaning that errors could be a function of exchange rate discrepancies or unavailability of data. There is no attempt in these measures to estimate or correct for other, potentially licit, explanations for trade mispricing.

Second, the methodology for estimation for countries without bilateral trade data produces inconsistent, unexplainable results. The world aggregation method is subject to 'erratic swings in magnitude' and 'seemingly random drops to zero' on a country basis.[27] Because the method uses global trade to and from a country to get at country-level trade misinvoicing, it aggregates both over- and under-invoicing, which means that discrepancies cancel each other out.

These methodological problems would be less of an issue if they were only used for a small portion of IFFs estimates; but over two-thirds of the estimates use either the world aggregation method or the bilateral advanced economies method to produce data. This means that most of the estimates produced by GFI and UNECA are based on methodologies that may not accurately measure the scale IFFs.

Conceptualisation

These issues notwithstanding, IFFs is the only category outlined in this brief that could, theoretically, act as a

proxy for total TOC. IFFs could serve as a measure for the amount/cost of TOC in a given country and year in a similar way that gross domestic product (GDP) is used as a measure of total economic output in a given country and year.

There have been attempts or overviews of how to model or forecast IFFs or aspects of IFFs. Schneider (2011) offers the multiple indicators, multiple causes (MIMIC) method, which links unobserved variables to observed indicators and specifies causal relationships between the unobserved variables using factor analysis.[28] Schneider used this method to come up with estimates of the shadow economy and has attempted to model human trafficking using the same method.

Walker and Unger (2009) attempt to model money laundering using a gravity model. The gravity model for IFFs posits that size and direction of IFFs are largely a function of proximity and economic sophistication (gross national product per capita).[29] In other words, the size of an economy and its distance from another economy are likely to be the best predictors of the size and direction of illicit financial flows.

But, getting a clear understanding of the drivers of IFFs would still be a significant barrier to accurately forecasting IFFs. It would rely on our understanding of the drivers of the licit economy and patterns of IFFs between countries, rather than getting at core drivers of different types of TOC. In this sense, IFFs could be used as a rough aggregate measure of the size of the TOC economy, but would be unable to tell us much about the specific dynamics and drivers of TOC categories.[30]

Human trafficking (and smuggling)

Overview

The definitions of human trafficking and smuggling are fairly widely accepted, but there are no global estimates of human trafficking or smuggling on a country/year basis. There are global estimates of forced labour and slavery, but the forced labour estimates are taken over a 10-year period and based on media monitoring of reports of incidents and the Walk Free Foundation's Global Slavery Index is based on limited country surveys and vulnerability indices. Further, the conceptual framework for the human trafficking market is very weak – our understanding of the drivers of human trafficking is extremely limited.

Definition/unit

UNODC defines human trafficking as 'the acquisition of people by improper means such as force, fraud or deception, with the aim of exploiting them' and defines human smuggling as an act that 'involves the procurement for financial or other material benefit of illegal entry of a person into a State of which that person is not a national or resident.'[31] The distinction between human trafficking and smuggling is largely a matter of consent. Human trafficking usually involves coercion, while smuggled individuals are voluntarily involved in the process.[32]

There is general consensus that human trafficking and smuggling constitute inherently transnational crimes

While definitions vary somewhat between organisations, there is general consensus that human trafficking and smuggling constitute inherently transnational crimes. Thus, measuring human trafficking and smuggling amounts to measuring TOC in the area of human movement and exploitation.

The International Labour Organization (ILO) also uses and measures forced labour, which it defines as a situation in which people 'are made to work against their free will, coerced by their recruiter of employer'.[33] Forced labour is similar to human trafficking, but not identical in a legal sense – human trafficking is more a subset of forced labour. Forced labour does not technically include a transnational element, which means that it can include criminal activity that does not fall under a TOC categorisation. But the significant amount of overlap means that measures of forced labour can help get us closer to a measure of human trafficking.

Finally, the Walk Free Foundation measures worldwide slavery through the Global Slavery Index. The organisation defines global slavery as all human trafficking, forced labour, slavery and slavery-like practices, debt bondage, forced marriage and child labour. This measure encompasses an even larger scope than forced labour, but could provide insight into the scale of human trafficking within a broader framework.

Ideally, the unit of analysis would be the total number of trafficked and/or smuggled individuals in a country in a given year or the total cost of human trafficking and/or smuggling in a country in a given year.

Measurements and methodologies

Only a few organisations gather data on and produce estimates related to human trafficking on a global scale and no organisation currently estimates the number of people smuggled at a country level.[34] Further, the data and estimates on human trafficking are based largely on country incident and law enforcement reporting from various organisations and sources.

The UNODC, International Organization for Migration (IOM) and United States (US) Department of State all provide data on the number of recorded cases and/ or victims of human trafficking on a country and a world basis. But data on reported or recorded cases alone gives us very little insight into the scope of global human trafficking – reporting and case data rely heavily on the level of enforcement, and therefore cannot really get at the scale of human trafficking. The only data that attempts to measure anything close to the total (reported and unreported) levels of human trafficking is the ILO's estimates of the number of people in forced labour globally.

The ILO has estimates the number of people in forced labour by collecting reported cases of forced labour from various sources over the 2002–11 period globally and by region. It uses those data (and national surveys) to model the stock of reported and unreported forced labour. The ILO largely uses secondary sources, ranging from official statistics and non-governmental organisation (NGO) reports to newspaper articles, paired with four national surveys the organisation conducts with partners.[35]

The ILO estimates the number of cases and victims of forced labour using a technique called capture-recapture. Two teams of independent researchers collect data on reported cases of forced labour over the period, then compare them against one another to identify cases both teams have captured. The total number of cases is estimated by adding the known cases (those both teams captured minus the overlap) with an estimation of unknown reported cases. Unknown reported cases are estimated by multiplying the number of independent cases in the first sample by the number of independent cases in the second and dividing by the

number of cases found in both. To estimate the number of people trafficked, the estimate is multiplied by the average number of victims per reported case.[36]

This estimate represents the flow of reported forced labour in the period between 2002 and 2011. To get to an estimate of the stock of global forced labour, the ILO adds estimations of duration and unreported forced labour. The ILO attempts to estimate the stock of forced labour by adding an estimation of average duration of reported forced labour and adjusting for estimates of length of unreported forced labour (reported average duration = 17.7 months; total estimated duration 29.4 months).[37] Finally, it estimates unreported forced labour using the national surveys it has conducted with its partners. Based on these surveys, the ILO calculates an estimate of the proportion of reported to unreported cases. Using this method, the ILO calculates that 3.6% of total forced labour cases are reported.

Using the data captured by these methods and sources, the ILO estimates the number of reported cases of forced labour and the total number of victims of forced labour. The organisation has estimated that 20.9 million people were victims of forced labour globally 'at any given point in time' between 2002 and 2011, with a standard error of 7% (1.4 million people) and a 68% confidence level.[38] The ILO emphasises that this figure represents a conservative estimate, given the strict methodology employed, but not a minimum estimate.

The methodology for this calculation is well thought out and precise. But, the estimates are still predicated on gathering sparse and incomplete data on reported cases. The capture-recapture method tries to adjust for some of this error, but it is difficult to assess how much it can make up for sparse data reporting. Further, the estimation of the ratio of reported cases is predicated on only four national surveys of forced labour, which is a fairly low sample size to use as the basis for an estimate on a global scale. Further, this estimate of forced labour cannot give us a clear estimate of trafficking or TOC because it includes non-transnational forced labour.

The only other possible source of global estimates of the prevalence of human trafficking is the Global Slavery Index, which estimates that 45.8 million people worldwide are subject to some form of modern slavery.[39] For 25 countries, the Walk Free Foundation uses nationally representative random sample Gallup surveys to estimate prevalence. For 139 other countries, the foundation estimates prevalence by grouping them

together by vulnerability scores and estimating an average proportion of the population in modern slavery for each group (using the data from the existing 25 surveys).[40] Thus, most of the estimates in the data set (over 80%) are extrapolations of survey data based on a vulnerability score formulated from factor analysis of possible drivers of human slavery.

Finally, there are multiple sources of reported cases and victims of human trafficking globally. Since 2009, UNODC has published the *Global Report on Trafficking in Persons*, which records and analyses intergovernmental and national frameworks and legislation to combat human trafficking. The report covers data on victims and offenders identified by state authorities and other institutions for 155 countries. UNODC also maintains a database on human trafficking that contains data on people prosecuted for and/or convicted of human trafficking, and victims of human trafficking.

Attempts to conceptualise and model human trafficking have focused on identifying push and pull factors

The IOM also tracks human trafficking cases and victims through its Global Human Trafficking Database, but it faces the same limitations as the UNODC data. Also, the database only includes cases and victims that the IOM itself has assisted, which means that the data is skewed toward areas where the IOM is more active.[41] This means that the IOM data alone cannot give an indication of the scope of human trafficking.

The US Department of State annually publishes *Trafficking in Persons Reports*, which reports on the nature and scope of human trafficking worldwide and assigns tier rankings to each country. In the report, the Department of State provides country-level analyses of the scope of human trafficking and efforts to prevent it. It also provides estimates on global and regional prosecutions, convictions, victims and legislation of human trafficking. However, the Department of State provides very little information on its methodologies, saying only that 'estimates derived from data provided by foreign governments and other sources and reviewed by the Department of State'.[42]

Conceptualisation

The conceptual framework for understanding the drivers of human trafficking is weak. Attempts to conceptualise and model human trafficking have focused on identifying push and pull factors.

On the pull side, a number of factors could be driving human trafficking. In an attempt to model human trafficking flows, Rudolph and Schneider (2013) and Seo-Young (2012) suggest that higher GDP per capita is a significant pull factor for human trafficking. In other words, richer countries with more economic opportunity are likely have greater human trafficking inflows than other countries. Other pull factors the studies identified range from economic factors, such as size of foreign direct investment flows and agricultural and service employment, to migration and crime rates.

On the push side, GDP per capita again seems to be a significant factor – poorer countries generally have more human trafficking outflows. Other possible push factors include: fertility rates; size of service industry; crime; percentage of young population; being a native of an Eastern European, Middle Eastern or North African country; rule of law; and corruption.[43]

While these are all plausible causes of human trafficking, there is not enough evidence to say that they are robust determinants. Because the data needed to measure and model human trafficking are difficult to gather on a global level, confirming the hypotheses of drivers of human trafficking is extremely difficult. The best data that we have on human trafficking rely heavily on surveys (or perceptions) and reports of recorded cases.

Wildlife trafficking

Overview

Most data on wildlife trafficking relate to: 1) seizures of illegal wildlife-derived specimens or products; or (2) the poaching or harvesting of species protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). While both seizure and poaching data provide snapshots of where and how wildlife crimes are occurring, neither fully represent the extent of wildlife crime at local, national or regional levels. In addition, access to most databases of wildlife seizure and poaching data is governed by CITES and thus restricted to the appropriate bodies or individuals. However, UNODC, wildlife trade

monitoring network TRAFFIC and other entities produce analyses of wildlife crime based on these restricted databases, which often provide detailed information on data collection and analysis methods and wildlife crime trends.

The inherent limitations of seizure and poaching data, and the inability to access most wildlife crime databases, mean that this TOC market is particularly challenging to measure. Significant progress will have to be made in the conceptualisation of and data collection on wildlife crime in order for forecasting to be possible.

Definition/unit

There is no clearly established definition of wildlife crime.[44] CITES defines wildlife as all fauna and flora, and wildlife-related crime as 'acts committed contrary to national laws and regulations intended to protect natural resources and to administer their management and use.'[45] As such, wildlife crime comprises the illegal poaching or harvesting of a CITES-listed animal or plant species, the processes that may precede the entry of the animal, plant or derivative product into international trade (e.g. the 'working' of ivory or the drying of an animal skin) and the actual trade of that item. Further, UNODC asserts that it is 'nearly impossible' to estimate the monetary value of the international illegal wildlife trade.[46]

Identifying a common unit is critical to forecasting because it allows cross-country comparison and aggregation over time

The absence of a common unit of analysis compounds the many challenges associated with conceptualising and modelling wildlife crime. Identifying a common unit is critical to forecasting because it allows cross-country comparison and aggregation over time. However, doing so is no easy task, given that research on wildlife crime revolves around numerous variables, such as seizures, poaching and illegal harvesting of endangered fauna and flora, and the identification, arrest and/or conviction of perpetrators.

The UNODC is currently attempting to construct a conceptual framework for measuring wildlife crime by assigning monetary value to illegal wildlife products.[47]

Underpinning this approach is the established argument in the literature that TOC is inherently profit motivated, unlike other illegal non-state activity, such as terrorism.[48] From this perspective, all TOC has a corresponding monetary valuation.[49] While this is a work in progress, it is an important step forward in wildlife crime research and TOC research more broadly.

Measurements and methodologies

The gravity of the threats wildlife crime poses to environmental and social stability has triggered numerous attempts to track, measure and analyse wildlife crime. Most of these attempts have been carried out under CITES and derive data from mandatory reports that member states have submitted.

The UNODC created and maintains the World Wildlife Seizures Database (World WISE), which contains data on over 164,000 seizures of more than 7,000 species from 120 countries from 1999 to 2005. While the database itself is not publicly accessible, its data form the foundation of numerous reports on wildlife crime, including UNODC's seminal World Wildlife Crime Report (2016).[50] The database is valuable because it offers country-level data on the illegal trade of CITES-listed species; many databases only provide data on a single species. Furthermore, the data demonstrate that nearly every country in the world is implicated in world wildlife crime, shedding light on the scope of wildlife crime and its potential implications for international relations.[51],

The CITES Elephant Trade Monitoring System (ETIS) is a specialised database containing country-level data with global coverage on seizures of elephant-derived specimens (primarily ivory), covering the years 1989 to 2016. Like World WISE, ETIS is not publicly accessible. However, in a 2013 report, statisticians applied a Bayesian hierarchical latent variable model to ETIS data to reduce the biases inherent in the seizure data, offering a potential method of making seizure data a viable source of wildlife crime data.[52]

CITES Monitoring the Illegal Killing of Elephants (MIKE), a sister programme of ETIS, collects data on the number of elephants that have been poached, tracking 89 sites in Africa and Asia from 2002 to 2016. UNODC uses MIKE data to calculate the Proportion of Illegally Killed Elephants (PIKE), which is 'the number of illegally killed elephants found divided by the total number of elephant carcasses encountered by patrols or other means, aggregated by year for each site.'[53] MIKE,

however, is not intended to be representative of national – or even regional – trends in elephant poaching.[54] Nonetheless, it is a valuable source of information relating to the poaching of an Appendix 1[55] CITES species. While neither ETIS nor MIKE data are publicly available, UNODC and independent researchers have published numerous reports using their data.[56]

The CITES Trade Database is the most comprehensive source on legal international trade in CITES species, containing over 13 million records of trade in wildlife derived from the reports of 178 countries, covering the years 1975 to 2016. Each record represents a legal imported, exported or re-exported shipment of CITES flora and fauna.[57] While this database does not have data on the illegal wildlife trade, the insight it grants into the legal wildlife trade could prove useful to analyses of illegal wildlife trade.

Finally, GFI has attempted to calculate the value of world wildlife crime, estimating that the illegal wildlife trade (not including fish and flora) was worth between US$7.8 billion and US$10 billion in 2009. GFI arrived at this number by adopting TRAFFIC Europe's estimate of the value of the legal wildlife trade of US$22.8 billion in 2005,[58] and the estimate that the illegal wildlife trade comprises one-third of legal wildlife trade, a claim that was set forth in a 2003 article for Inter Press Service.[59] GFI bolstered its claim by citing the now-defunct Coalition Against Wildlife Trafficking's 2009 valuation of the illegal wildlife trade at US$10 billion.[60] While a commendable attempt to estimate the value of this TOC market, the study demonstrates the incredible difficulty of producing accurate estimates based on scarce data.

Conceptualisation

We have a tenuous understanding of push and pull factors in the illegal wildlife trade. Core push factors are likely to include to be geographic and environmental: supply of wildlife, and therefore illegal wildlife products, is largely determined by how much of a species exists in the world and where. However, other drivers of the illegal harvesting or killing of and trade in this base supply of wildlife are ill-defined. Government capacity, poverty and the presence of armed conflict, for example, have implications for where, when, how and why poachers target certain wildlife species. The exact nature of these implications remains unclear.

Meanwhile, demand for certain wildlife specimens and derivative products is even more tenuous. Global economic dynamics, countries' implementation of CITES, government corruption and trends in fashion and medicine, for example, may all affect demand for illegal wildlife products. Modelling demand for pangolin scales in a given country and year, for example, would be difficult, given that any number of domestic and international variables may increase or reduce a population's desire and ability to pay for the scales.

Wildlife crime is a specialised market in itself and an activity that involves numerous other markets

In addition, wildlife crime is a specialised market in itself and an activity involving numerous other markets, which makes creating a conceptual framework for it especially challenging. UNODC, for example, conceptualises the international illegal wildlife trade as a set of seven interrelated but distinct industrial markets, which have their own drivers and dynamics: seafood; pets, zoos and breeding; food, medicine and tonics; art, décor and jewellery; cosmetics and perfume; fashion; and furniture.[61] Given the diversity of these markets, and because each has distinct push and pull factors, there is neither an established conceptual framework explaining the stocks and flows of wildlife crime nor a common unit of analysis.

Arms trafficking

Overview

Data on the international illegal arms trade is scarce, with most data relating to 1) seizures of illegal arms or 2) transfers of illegal arms between states and/or non-state groups. Due to the intrinsic limitations of seizure data and necessarily hidden nature of the illegal trade in arms, neither of these types of data are fully representative of the size and scope of this category of TOC.

There are, however, several sources of data on the legal arms trade that may contribute to research on its illegal counterpart. This is because legal and illegal trade in arms are closely linked: while some arms are illegally manufactured, the large majority of illegal arms have either been diverted from legal trade or smuggled

across borders in very small quantities by individuals or small groups (also known as the 'ant trade').[62] But, research on the relationship between the legal and illegal arms trade is not sufficiently robust to derive data on or calculate estimations of the illegal arms trade based on the legal trade.

The large majority of illegal arms have either been diverted from legal trade or smuggled across borders

Despite the existence of data on the legal arms trade, lack of data on the illegal arms trade has made efforts to assess the magnitude of this TOC category quite difficult. That most of the data that exist on illegal arms is based on seizures has further complicated these efforts. Moreover, conceptualisations of the drivers of arms trafficking are ill-defined. While the illicit market for arms theoretically operates similarly to the licit market for arms, there is little evidence concerning the drivers of illegal arms trafficking.

Definition/unit

Unlike the other TOC categories, we explore in this paper, the illegal arms trade is relatively clearly defined. In the Protocol against the Illicit Manufacturing of and Trafficking in Firearms, their Parts and Components and Ammunition (Firearms Protocol), the UN defines illicit trafficking in firearms, their parts and components and ammunition as:

> ...the import, export, acquisition, sale, delivery, movement or transfer of firearms, their parts and components, and ammunition from or across the territory of one State Party to that of another State Party if any one of the States Parties concerned does not authorize it...or if the firearms are not market in accordance with article 9 of this Protocol.[63]

Despite the clarity this definition grants to research on the illegal arms trade, there is no single unit of analysis on which current research focuses. To create a model for and potentially forecast international trade in illegal arms, we would need data measuring either the quantity or monetary value of illegal weapons traded between countries over time.

Measurements and methodologies

UNODC maintains a database of illegal arms seizure data derived from surveys that 48 states parties to the Firearms Protocol completed from 2010 to 2013. It obtains data relating to the tracing of seized firearms, trafficking routes and transportation methods, offenses associated with the seizures, and the nationalities of identified firearms traffickers.[64] Although the database is not publicly available, it informed the *UNODC Study on Firearms* (2016), which provides detailed analyses of trends in the international trade of illegal firearms.[65] However, among other problematic factors, as with all seizure data the database is subject to variations in law enforcement and reporting capabilities.

The Small Arms Survey (SAS) also collects seizure data on the illegal arms trade, but focuses on the illegal trade in small arms and light weapons, specifically, and conducts comprehensive, country-based case studies. SAS has published reports measuring illicit arms flows in Honduras, Ukraine, Niger and Somalia, deriving data from national crime statistics and extensive fieldwork.[66] While these reports provide neither the geographic nor temporal coverage needed for modelling and forecasting, they grant insight into how the illegal trade in arms impacts levels of violence within specific populations and influences state policy.

The SAS also maintains a database on deaths by firearms. Created and maintained with the Global Burden of Armed Violence, the database has global coverage on homicide deaths by firearms, which differs from the UNODC database – and most other databases on the international illegal firearms trade – because deaths are the unit of analysis. Although these data are not likely to contribute to efforts to model and forecast the illegal arms trade, they aid efforts to measure the harm the trade causes to people.

The Norwegian Initiative on Small Arms Transfers (NISAT), which the Peace Research Institute Oslo (PRIO) manages, maintains a database on the legal arms trade with global coverage. The data is derived from the United Nations (UN) COMTRADE database and covers the years 1962 to 2011. The publicly accessible database contains more than one million records of transfers between approximately 250 states and territories, and is publicly available.[67]

The Stockholm International Peace Research Institute (SIPRI) Arms Transfer Database contains country-level

data on all major transfers of conventional weapons for the years 1950 to 2016.[68] SIPRI includes data on legal and illegal arms transfers, deriving the majority of its data from open sources including news media, annual reference publications and TV broadcasts. SIPRI also sources information from governmental reports such as defence white papers and budget documents, Pentagon notifications and the UN Register of Conventional Arms.[69]

Conceptualisation

The factors that drive the illegal arms trade supply may be linked to the factors that drive the legal arms trade supply.[70] For the most part, governments manufacture the majority of arms that enter into international trade, some of which are then diverted by either state or non-state actors. It thus follows that the countries that export the largest quantities of legal arms may also be the largest suppliers of illegal arms.[71] But, because these arms are often diverted from legal shipments, it may be that the illicit trade in arms also emanates from the recipients of legal arms.

Meanwhile, high levels of social violence, armed conflict and weak rule of law are all factors that could drive demand in the illegal arms trade.[72] Illegal arms transfers are likely to be concentrated in, but not restricted to, conflict-afflicted countries or regions. However, it is important to note that, like all TOC, illegal trafficking of arms occurs within complex institutional, political and social environments. Reaching concise explanations of what facilitates the illegal arms trade is therefore quite challenging. That the illegal arms trade remains largely unobserved further compounds endeavours to design an accurate conceptual framework and, in turn, will remain a significant obstacle to measuring it.

Drug trafficking

Overview

Data related to drug trafficking are the most comprehensive and robust of the TOC categories outlined in this brief. UNODC publishes data on drug seizures, use, prevalence, supply, prices and health consequences on a global country/year basis. While there are still significant gaps across these areas and there is still no legitimate measure of the drug trade, UNODC estimates provide a good snapshot of the drug market through both a supply and a demand lens. The conceptual frameworks for drug demand and supply

are still incomplete, but research across a number of disciplines (economic, behavioural, social, medical) has highlighted possible drivers of drug demand, and assessments of drug plant yields have shed light on the drivers of drug supply.

Definition/unit

The definition of drug trafficking seems to be more consistent across organisations and researchers than other the other forms of TOC outlined in this report. UNODC defines drug trafficking as, 'a global illicit trade involving the cultivation, manufacture, distribution and sale of substances which are subject to drug prohibition laws.'[73] In other words, UNODC considers trade of illicit drugs in any form to be drug trafficking.

Research across a number of disciplines has highlighted possible drivers of drug demand

On the demand side, UNODC uses annual prevalence of drugs to indicate overall demand. While definitions vary between countries and age groups, UNODC standardises the measure of prevalence to estimate the portion of the adult population (over 15 years of age) that has used illegal drugs in the past year. On the supply side, UNODC estimates potential production (of cultivated drugs), which is defined as the number of harvests per year multiplied by the yield of the harvests.[74]

Measurements and methodologies

UNODC is the main source of global drug statistics. The UNODC crime database holds standardised data on drug seizures, use, prevalence, supply, prices and health consequences. Most of the data for each of these categories are sourced from the UN annual report questionnaire (ARQ) and supplemented by data from national reports, various NGOs and other sources.

UNODC publishes data on annual drug seizures by type, quantity and unit, as reported by governments and ARQs. However, as outlined in the sections above, seizure data misrepresent overall prevalence or trade because they rely heavily on varying reporting on enforcement across countries. But UNODC also supplies estimates of demand- and supply-side indicators of drug trafficking.

Demand-side estimates of drug markets are largely derived from surveys – whether household and school surveys or hospital and prison surveys – of drug use, prevalence and health consequences. Constructing estimates from these surveys requires assumptions about under-reporting and problem versus recreational users of drugs. Supply-side estimates largely rely on satellite imagery and yield estimates to arrive at levels of poppy and coca production globally, and assumptions concerning conversion and seizure rates to estimate manufacturing and distribution.[75]

UNODC collects and curates the most comprehensive database on global drug prevalence, which looks at various drug types, regions and demographics. It provides low, best and upper estimates of annual prevalence of youths who inject drugs; annual prevalence of adults who inject drugs; annual prevalence of substance use by region/sub-region; and annual prevalence of substance use by country for amphetamines, cannabis, cocaine, ecstasy-type substances, opioids, sedatives and tranquilisers.

Estimates for each of these categories are provided on a country/year basis. For 2015, 98 countries reported drug prevalence data in the ARQs, with 67% of those countries completing over 50% of the questionnaire. Where survey data is missing, the UNODC uses other sources from national governments, NGOs and so on, and standardises or adjusts to fit ARQ reporting groups.[76] Where no data are available, UNODC estimates prevalence based on countries from the same sub-region. UNODC arrives at global prevalence estimates by rolling up all the country data and estimates outlined above.

As with much survey data, key problems lie in level of accuracy and standardisation across countries. Estimates from supplementary sources may not follow sound epidemiological practices and definitions and sampling groups often vary. To try and adjust for these margins of error, UNODC transforms prevalence data into annual prevalence in the general population aged 15 to 64. This indicator is the most widely used and represents 'the number of people who have consumed an illicit drug at least once in the twelve months prior to the study'.[77] The assumption is that general patterns apply to all countries, although adult drug use levels vary between countries.[78] The annual prevalence measure is also a compromise between using lifetime use data and data on current use. Moreover, UNODC uses indirect estimation methods (capture-recapture, multiplier and multivariate) to supplement estimates of regular users of opium, injecting drug use and cocaine, because surveys tend to underestimate the prevalence of these users.

UNODC drug prevalence survey data have drawbacks and caveats, but provide a snapshot of statistics at the country/year level. Moreover, the data generally standardised across countries, whereas other organisations that collect prevalence data have less coverage and often use dissimilar methodologies and definitions.

Seizure data misrepresent overall prevalence or trade because they rely heavily on varying reporting on enforcement across countries

UNODC also provides estimates of prices (in USD) of cocaine, opioids, cannabis, and amphetamine-type stimulants based on ARQs. Further, Kilmer and Pacula (2009)[79] extend country-level prevalence data with estimates of quantity consumed and prices to arrive at retail expenditure estimates for cannabis, heroin, cocaine and amphetamines for a large number of countries over time. The study emphasises the significant uncertainty in quantity and price data by providing high and low estimates of retail expenditure, concluding that while the information is inadequate to generate credible estimates, the exercise is nonetheless a useful starting place.

In addition to prevalence and price estimates, UNODC provides country-level estimates of supply-side data on cultivation and production. These series are largely pulled from national monitoring systems for the major coca- and opium-producing countries (Afghanistan, Myanmar and Laos for opium; Colombia, Peru and Bolivia for coca) supported by UNODC through the Global Illicit Crop Monitoring Program (ICMP). While they vary from country to country, the systems generally track and provide data on location of cultivation, potential production and socioeconomic factors in rural areas.[80] For countries that cultivate opium but do not do illicit crop surveys, UNODC uses a mix of data on data on the area of land from which poppy growing has been eradicated and poppy

plant seizure data to estimate. Taking it a step further, UNODC estimates potential production – a measure of production that assumes all illegal drugs grown are processed – by combining the cultivation estimates above with yield and conversion factors.[81]

The US Department of State also provides estimates of illegal drug cultivation, production and processing using satellite imagery and crop yield studies. While the methods and estimates are not fully transparent, cultivation estimates are gathered by imagery surveys based on past years' cultivation and eradication areas; yield estimates are based on limited scientific information on productivity; and potential processing is estimated by combining the two estimates.[82]

Conceptualisation

From a UNODC perspective, the drug trade operates as a global market, which means units are likely to operate along the lines of traditional economic measures of supply and demand.[83] On the pull side, drug inflows are largely viewed as a function of the demand for illicit drugs in a given country or region. On the push side, drug outflows are largely viewed as a function of production of illicit drugs in a given country or region.

While drug demand likely can be conceptualised as a market force, the nature of drug use and prevalence present challenges to understanding drug demand as a purely market phenomenon. In other words, the demand for drugs fits into an economic or market model, but the core drivers of drug use are likely to relate to a range of biological, behavioural, social and economic factors. Further complicating our understanding of drug prevalence are differences in drug users and drug types. Overall drug use includes many types of drugs, each of which may have differing drivers. Meanwhile, types of drug users range from problem or habitual users to recreational users, which complicates our ability to estimate total quantity of drug use. Economic, behavioural and societal approaches to explaining drug use illuminate different aspects of these micro-economic elements of drug markets.[84] These approaches help us to distinguish between types of drug use and to understand the drivers of drug use and prevalence across countries at a macro level, but our conceptual framework for broad drug use is still incomplete.

On the supply side, a range of environmental and governance factors are likely to drive the cultivation and manufacture of drugs. Cultivation of drugs such as opium or coca depends heavily on geographic factors and climate. For example, it is estimated that Afghanistan produces the vast majority of the world's opium and the northern Andean region of South America (Colombia, Bolivia and Peru) produces the largest amounts of coca, because these regions are conducive to the cultivation of these crops.[85] However, synthetic drugs (such as ecstasy and amphetamines) have no such agricultural constraints. Thus, the drivers of supply are much less clear. It is likely that governance and law enforcement play a role in the levels of synthetic drug production, but more research in this area is needed.

Introduction to drug demand modelling

In attempting to find a foothold in modelling and forecasting TOC, the above discussion suggests that among the five categories, illicit drugs offers the strongest empirical foundation at this time. Nevertheless, the obstacles associated with modelling any phenomenon that operates outside the regulated economy and away from official surveys and censuses are many. From cultivation to consumption, the drug trade is present in all countries, yet is very difficult to observe and measure. Lack of data (particularly data that are fairly comprehensive at the country level) severely limits the modelling of activity and mechanics of the cultivation–consumption process.

Among the five categories, illicit drugs offers the strongest empirical foundation

As discussed above, various methods are used to better understand the dynamics of the drug trade. Many of the more quantitative models are built with data with limited geographic coverage, or are built on assumptions that are difficult to apply to a global study. Nevertheless, UNODC's database on drug use provides us with harmonised definitions and broad geographic coverage.

The relative inelasticity of drug demand suggests that it could be one of the stronger candidates to use in modelling and forecasting some element of TOC. In its 2012 *World Drug Report*, UNODC forecast that

the number of people using drugs would increase by a quarter by 2050 (relative to 2010 levels). These forecasts were based on the assumption that the annual prevalence of illicit drug use would remain at 5% percent of the population aged 15 to 64. UNODC acknowledges that, all other things being equal, this assumption is flawed, since a number of external factors influence prevalence.

Preliminary analysis suggests that the dynamics underpinning prevalence rates might differ by drug type. Therefore, as a starting point, we intend to forecast country-level drug use of opiates, cocaine and amphetamine-type stimulants using separate models. UNODC (2012)[86] lists a number of sociodemographic, sociocultural, socioeconomic and legal variables that could explain changing patterns in drug use, including age distribution, gender gap, level of urbanisation, polarisation of youth culture, orientation towards a Western way of life, migration rates, traditional value systems, violence and instability, income, social inequality, unemployment, availability and perceived risk. We will build these models into the International Futures (IF) forecasting platform, allowing us to use the extensive IF database and existing forecasts, the result of which will be long-range forecasts of drug prevalence for all countries.

Moving forward

This report has highlighted the policy relevance of systems thinking and forecasting, offered a framework for assessing forecastability in the TOC space and presented a systematic evaluation of the forecastability of TOC in general; and of five specific types of TOC. There are significant barriers, each building upon the other, to modelling TOC and/or TOC types both globally and on the African continent. These are: 1) definitions of TOC and TOC types are non-uniform and difficult to pin down; 2) current indicators of TOC fail to capture the scale and scope of the phenomenon; 3) our conceptual framework for understanding what drives TOC and what TOC drives is weak.

That said, much work can be accomplished in this complicated conceptual and empirical space. Our assessment of the forecastability of various types of TOC activity has identified drug demand as a possible entry point into the TOC space. While drug demand is just one aspect of a single TOC type (the illicit drug trade), it has indicators with relatively clear and uniform definitions,

a clear and sound measurement methodology and significant data coverage. A robust model of drug prevalence at the country/year level would enhance our understanding of how drug demand may unfold over time. Further, understanding and modelling the pull factors of the international drug trade could help us conceptualise and model other aspects within that system (e.g. supply, manufacture) down the line.

It is likely that the global balance of the drug users will shift towards Africa in the near future

Drug demand modelling and forecasting is particularly pertinent to the African context. UNODC forecasts that rapid population growth across Africa will drive a significant increase in drug demand on the continent over the next 30 years. Following this, it is likely that the global balance of the drug users will shift towards Africa in the near future.[87] But, as outlined above, demographics is likely to be one of a number of drivers of different types of drug demand rather than the sole driver. If we can add nuance to the UNODC forecast, in terms of drug types and drivers, we may get a clearer picture of the possible evolution of drug demand across Africa (and the globe).

That said, the relationship between overall drug demand and TOC activity is tenuous. First, we cannot measure actual drug use associated with TOC. Second, the relationship between drug demand and TOC varies widely across countries (depending on national drug laws, domestic prices, etc.). Third, there are still significant data and conceptual limitations associated with forecasting drug demand across countries and time.

Lastly, this assessment shows the continuing need for innovative ways to measure TOC activity. The creation of data series, whether it be through new event data gathering, more comprehensive survey methods or other data innovations, can help researchers better approximate TOC activities and begin to build an evidence base from which to model and forecast TOC activity. These new data-gathering efforts represent the foundation of a long-term effort to comprehensively measure and forecast the current and future burden of TOC activities across the globe.

Annex: A framework for assessing 'forecastability'

The authors developed the rubric outlined below (Table A.1) to establish a framework in which to systematically assess each important aspect of data and conceptual validity. Scoring of each component and sub-component in the rubric and explanations (Table A.2) was informed by research into each source and aspect of data and concept validity for each TOC category in this report (Table A.3).

We separated data fidelity into three core components (proximity, methodology and coverage) and each

of those components into two sub-components. Similarly, we separated the conceptual validity measure into two sub-components. We created a five-point scale for each sub-component; each value on the scale is guided by either a qualitative or quantitative threshold. For example, a score of (1) on methodological transparency means that neither the data-gathering methodology nor the data are publicly available. For some of the qualitative thresholds, a greater degree of judgement was necessary depending on the sub-component. Deciding whether an indicator is a partial proxy (2) or half proxy (3) necessarily involves a higher degree of subjectivity that number of countries.

Table A.1: **Rubric and scoring for 'forecastablility' assessment table**

RUBRIC							
Proximity		**Methodology**		**Coverage**		**Conceptual validity**	
Intersection		*Transparency*		*Country*		*Conceptual foundation*	
How well do the data reflect the magnitude of the phenomenon?		1) Is the methodology explained well and reproducible? 2) is the resulting data publicly available?		How many countries does it cover?		Does this conceptual framework have well-understood causal drivers and linkages?	
Accuracy		*Rigour*		*Year*		*Validation*	
Is this data actually measuring what we want to measure?		1) Is this method analytically sound (collection and extrapolation)? 2) Has this method been cross-validated with another method?		How many years does it cover?		Has the conceptual framework been validated at any level?	
SCORING	**Scale: 0 to 5**						
Intersection		*Transparency*		*Country*		*Foundation*	
1	Captures very little to none	1	Closed methodology and no public data	1	Few countries or no disaggregation	1	Little understanding of drivers and linkages
2	Captures a quarter	2	Partially public data and methods	2	A quarter of global countries	2	Partial understanding, some drivers
3	Captures more than half	3	Public data, no public method (vice versa)	3	Half of global countries	3	Good understanding, some drivers
4	Captures three-quarters	4	Mostly public data and methods	4	More than three-quarters global coverage	4	Good understanding, most drivers
5	Captures the entirety	5	Fully available methods and data	5	Global country-level coverage	5	Full understanding of drivers and linkages
Accuracy		*Rigour*		*Year*		*Validation*	
1	No/little proxy	1	Not analytically sound, not validated	1	One or no historical data points	1	Has not been validated
2	Partial proxy (25%)	2	Partially sound and validated	2	At least 2 historical data points	2	Partial validation
3	Half proxy (50%)	3	Analytically sound, not validated (vice versa)	3	At least 5 historical data points	3	Validated by at least one source
4	Partial proxy (75%)	4	Largely sound and mostly validated	4	At least 10 historical data points	4	Validated by multiple sources
5	Accurate (100%)	5	Analytically sound, validated	5	At least 20 historical data points	5	Validated by multiple sources, methods

Table A.2: Detailed breakdown of 'forecastablility' assessment

| Indicator | Data fidelity | | | | | | | | | | | Conceptual validity | | |
| | Proximity | | | Methodology | | | Coverage | | | | | | | |
	Intersection	Accuracy	Explanation	Transparency	Rigour	Explanation	Country	Year	Explanation			Foundation	Validation	Explanation
Illicit financial flows	1	1	Trade-mispricing data do not exclusively capture or accurately reflect IFFs	5	2	Data calculation is straightforward; extrapolation methods make tenuous assumptions on the nature of trade	5	4	World aggregate totalled up from country-level estimates; 15-year historical coverage			2	1	Motivation of international money laundering is understood to be important to TOC, but empirical studies tend to begin with mis-invoicing data
Human trafficking	2	4	Most series capture super-set of human trafficking and only record reported cases	3	3	Transparency varies depending on source: data gathering is sound, but extrapolation methods more tenuous	3	3	Only global level of forced labour over 10-year period; other sources have broad coverage			1	1	Very weak framework in which to conceptualise push and pull factors of human trafficking; few studies examining broad drivers
Wildlife trafficking	1	5	Wildlife seizure data proxy wildlife trafficking; but most data only capture a sub-set of the flow of illegal wildlife	2	3	Largest database is not publicly available; data gathering methods (largely media, country reports, NGOs) are likely sound	3	3	World WISE (not public) has broad country/year coverage; public sources have less coverage			2	2	Basic conceptual framework for push factors, but a much less clear framework for pull factors
Arms trafficking	1	5	Arms seizure data proxy arms trafficking, but are not representative of the flow of illegal arms	2	3	Largest database is not publicly available; data gathering methods (country reporting) are likely sound	2	3	Coverage of legal arms trade is wide, but that of illegal trade records is much narrower or not available			2	1	Basic framework for supply, but framework for understanding demand is murky
Drug trafficking	1	5	Drug seizure data proxy arms trafficking, but are not representative of the flow of illegal drugs	5	4	Transparent and available; data gathering through country reports and surveys	4	3	Wide country-level coverage and significant historical coverage			3	2	Reasonable framework for push and pull factors based on research and modelling of demand and supply
Drug demand	4	4	Drug prevalence data closely proxy drug demand and covers most types of illicit drugs	5	4	Transparent and available; data gathered from country-level UN surveys, extrapolation techniques clear and sound	5	4	Broad country level coverage and historical data			3	2	Drug prevalence has been shown to be influenced by many socioeconomic, biological, and behavioural factors in particular cases
Drug supply	3	4	Potential production data proxy production of cultivated drug crops, but excludes non-cultivated drugs	5	3	Transparent and vailable; estimates produced through satellite imagery and yield analysis techniques	5	4	Broad country-level coverage and historical data			3	2	Basic framework for production of cultivated crops validated by crop analysis; less clear framework for non-cultivated

Based on research into the definitions, methodologies, coverage and concepts, we scored each sub-component for each TOC category based on the rubric above. We then aggregated these across each sub-component to develop a total score for each component (as seen in Table 1 of this report). For example, we calculated the coverage score for drug demand by combining the scores *country coverage* (5) and *year coverage* (4). See Table A.2 for details.

Each of these scores represents an assessment of aspects of the data and conceptual foundations from various sources in the TOC category. In this sense, it is a general representation of prominent data and research sources and may not reflect the full nuance of each source. Information on and details of each source of data and research are expanded upon in Table A.3.

Table A.3: Detailed breakdown of sources of transnational organised crime and data

ILLICIT FINANCIAL FLOWS									
Database/ report title and publisher	Proximity			Methodology			Coverage		
	Legal/ illegal	Unit	Type	Public	Data methodology	Details	Geography	# of units	Years
GFI (2017)	Both	US$	Trade misinvoicing; residual capital flows	Y	Trade misinvoicing* and balance of payments	The trade misinvoicing method is based on the IMF Direction of Trade Statistics (DOTS) and is reproducible. The balance of payments (BOP) method is based on balance of payments statistics and is reproducible	Countries	186	2005–2014
Source: http://www.gfintegrity.org/wp-content/uploads/2017/05/GFI-IFF-Report-2017_final.pdf									
GFI, Kar and Cartwright-Smith (2015)	Both	US$	Residual capital flows; trade misinvoicing	Y	Residual adjusted for trade misinvoicing	The residual adjusted for trade misinvoicing method draws from the World Bank and IMF data and is reproducible	Continents	1	1970–2008
Source: http://www.gfintegrity.org/storage/gfip/documents/reports/gfi_africareport_web.pdf									
GFI, Kar and Freitas (2013)	Both	US$	Residual capital flows	Y	Residual, net recorded transfers	For the residual method, see above. The Net recorded transfers model is based on recorded balance of payments items, and is also reproducible	Regions	7	1980–2009
Source: http://www.gfintegrity.org/report/report-net-resources-from-africa/									
GFI, Kar and Freitas (2012)	Both	US$	Trade misinvoicing	Y	Trade misinvoicing	See above	Countries	1	2000–2010
Source: http://www.dragon-report.com/Dragon_Report/Corp_China_files/gfi-china-oct2012-report-web.pdf									
UNECA (2016)	Both	US$	Trade misinvoicing; residual capital flows	N	Trade misinvoicing and residual	UNECA modified the trade misinvoicing model by calculating insurance and freight costs using the COMTRADE-based BACI database and applying a time lag. It is reproducible. For the BOP model, see above. UNECA also conducted consultations with more than 200 representatives from 48 African countries, numerous non-African countries, and several intergovernmental and non-governmental organisations	Countries	50	2000–2010
Source: https://www.uneca.org/sites/default/files/PublicationFiles/iff_main_report_26feb_en.pdf									
Ndikumana and Boyce (Sub-Saharan Africa) (2012)	Both	US$	Trade misinvoicing; residual capital flows	Y	Trade misinvoicing and residual	See above	Countries	33	1970–2010
Source: http://www.peri.umass.edu/fileadmin/pdf/ADP/SSAfrica_capitalflight_Oct23_2012.pdf									
Boyce and Ndikumana (North Africa) (2012)	Both	US$	Residual capital flows; trade misinvoicing	Y	Residual and trade misinvoicing	See above	Countries	4	1970–2010
Source: http://www.peri.umass.edu/fileadmin/pdf/ADP/NAfrica_capitalflight_Oct2012.pdf									

UNDP (2011)	Both	US$	Residual capital flows; trade misinvoicing	Y	Residual adjusted for trade misinvoicing	UNDP employs the residual method adjusted for trade misinvoicing, based on the gross excluding reversals method. It is reproducible	Countries	48	1990–2008
Source: http://www.undp.org/content/undp/en/home/librarypage/poverty-reduction/trade_content/illicit_financialflowsfromtheleastdevelopedcountries1990-2008.html									
Claessens and Naude (1993)	Both	US$	Residual capital flows	Y	Residual and Dooley	For the residual method, see above. The Dooley method is similar to residual, assessing IFFs through private foreign assets reported in BOP statistics that do not produce income (GTAP 2013, Section 3.1.1). Both methods are reproducible	Countries	84	1971–1991
Source: http://documents.worldbank.org/curated/en/878311468739518251/Recent-estimates-of-capital-flight									

* Also referred to as trade mispricing.

DRUG TRAFFICKING									
Database/ report title and publisher	Proximity			Methodology			Coverage		
	Legal/ illegal	Unit	Type	Public	Data methodology	Details	Geography	# of units	Years
UNODC, Annual Drug Prevalence by Region (Adults)	Illegal	Count/%	People	Y	Country reporting, surveys	Annual Drug Prevalence (for 2015 only) derives data from national statistical systems, Annual Report Questionnaires, Individual Drug Seizure Reports, and other sources	Regions	6/10	2015
Source: https://data.unodc.org/									
UNODC, Annual Drug Seizures	Illegal	Weight/ count	Drugs (all types)	Y	Country reporting, surveys	Annual Drug Seizures data derives from national statistical systems, Annual Report Questionnaires, Individual Drug Seizures reports, and other sources	Countries	161	2011–2015
Source: https://data.unodc.org/									
UNODC, Individual Drug Seizures	Illegal	Weight/ count	Drugs (all types)	Y	Country reporting, surveys	Individual Drug Seizures derives data from national statistical systems, Annual Report Questionnaires, Individual Drug Seizures reports, and other sources. Different from Annual Drug Seizures data in that data on producing, transit and destination countries are provided where available	Countries	161	2010–2015
Source: https://data.unodc.org/									
UNODC, Cocaine-Type Prices	Illegal	US$	Cocaine	Y	Country reporting, surveys	Drug prices derived from Annual Report Questionnaires and Individual Drug Seizures reports	Countries	138	2004–2015
Source: https://data.unodc.org/									
UNODC, Opioids Prices	Illegal	US$	Opioids	Y	Country reporting, surveys	Drug prices derived from Annual Report Questionnaires and Individual Drug Seizures reports	Countries	132	2004–2015
Source: https://data.unodc.org/									
UNODC, Amphet-amine-Type Stimulants Prices	Illegal	US$	Amphet-amines	Y	Country reporting, surveys	Drug prices derived from Annual Report Questionnaires and Individual Drug Seizures Reports	Countries	130	2004–2015
Source: https://data.unodc.org/									
US Department of State, International Narcotics Control Strategy Report	Illegal	Tons/ hectare	Drugs (cultivated)	Y	Agricultural surveys, scientific studies	Agricultural surveys conducted via satellite and scientific studies of crop yields and likely illicit drug production	Countries	75	2016
Source: https://www.state.gov/documents/organization/268025.pdf									

WILLIFE TRAFFICKING									
Database/ report title and publisher	Proximity			Public	Methodology		Coverage		
	Legal/ illegal	Unit	Type		Data methodology	Details	Geography	# of units	Years
UNODC, World WISE (World Wildlife Seizures Database)	Illegal	Weight/ count	Wildlife products (all types)	N	US seizure reporting, CITES party reports, and other national and regional reports	World WISE contains data on more than 164,000 seizures of more than 7,000 CITES-protected flora and fauna species. Between 2005 and 2014, World WISE derived: 1) 43% of their data from the Law Enforcement Management Information System of the US Fish and Wildlife Service; 2) 34% from CITES Annual, Biennial and Special Reports; 3) 17% from EU-TWIX; 4) 3% from other national reports; 5) 2% from WCO-CEN or 'other'; and 6) 1% from other regional bodies and operations. To create the analyses presented in the World Wildlife Report (2016), significant effort was made to convert seizures items into a common unit (either kilograms, whole animal equivalents, or US$ value). Whether a seizure was converted into a common unit and analysed varies across the species and case studies presented in the report	Countries	120	1999–2005 (few countries reporting), 2005–2015 (all 120 members states reporting)
Source: Report on database: https://www.unodc.org/documents/data-and-analysis/wildlife/WLC16_Chapter_2.pdf									
UNODC, CITES ETIS (Elephant Trade Information System)	Illegal	Weight/ count	Elephant products	N	CITES party reports	CITES parties are mandated to communicate information on elephant ivory and other elephant product seizures to TRAFFIC via the CITES Secretariat	Countries	Unknown, but global coverage	1989–2016
Source: https://cites.org/eng/prog/etis/index.php									
UNODC, MIKE (Monitoring the Illegal Killing of Elephants); PIKE (Proportion of Illegally Killed Elephants)	Illegal	Count	Elephant carcasses	N	MIKE data are derived from law enforcement patrols	Law enforcement patrols collect data on elephant carcasses (age, sex, cause of death, status of ivory, etc.) at designated MIKE sites. Proportion of illegally Killed Elephants (PIKE) is then calculated as the number of illegally killed elephants found divided by the total number of elephant carcasses encountered by patrols or other means, aggregated by year for each site	Sites	89	2002–2016
Source: https://www.cites.org/eng/prog/mike/data_and_reports									
Boston's Children Hospital, HealthMap Wildlife Trade	Illegal	Wildlife crime-related events	Seizures, arrests, convictions, etc.	Y	Automated online media monitoring	HealthMap is an automated tool that monitors online media for wildlife seizures and records relevant data	Global	N/A	2017
Source: https://www.wired.com/2015/06/using-news-reports-track-wildlife-black-markets/									
US Fish and Wildlife Service (FWS), LEMIS (Law Enforcement Management Information System)	Illegal	Weight/ count	Wildlife products	N	Law enforcement reports	LEMIS data originate from FWS Form 3-177 (Declaration for Importation or Exportation of Fish or Wildlife). 'This form is used to declare all wildlife species entering the US at ports of entry. Wildlife is broadly defined in this report as live animals that are either captured from the wild, raised or bred in captivity for legal export to the US, and may include native, non-native (exotic) species, or laboratory animals. Although LEMIS data do not routinely undergo rigorous validation by FWS, the Centers for Epidemiology and Animal Health (CEAH) has reviewed the data and worked with FWS to correct data entry error. Occasional changes in taxonomic classifications may also be a source of error in these data.' USDA (2011) Descriptive analysis report of wild mammal imports to the United States (2004–2009), August, USDA: APHIS: VS: CEAH: Center for Animal Information and Analysis, Fort Collins, CO, p.1	Global	N/A	2003–2013
Source: http://wildlifetradetracker.org/?db=lemis									

HUMAN TRAFFICKING

Database/report title and publisher	Proximity			Methodology			Coverage		
	Legal/illegal	Unit	Type	Public	Data methodology	Details	Geography	# of units	Years
ILO, Global Estimates of Forced Labor	Illegal	Count	Victims of forced labour	Y	Media, national reports, non-governmental (NGO) reports, others	ILO derived data from media reports, intergovernmental organisations, NGOs, government documents, academic reports, and other sources. ILO collected 8,132 reported cases of forced labour and used capture-recapture method to produce 2012 estimate	Global	N/A	10-year estimates for 1995–2004 and 2002–2011
Source: http://www.ilo.org/wcmsp5/groups/public/---ed_norm/---declaration/documents/publication/wcms_182004.pdf									
IOM, Global Human Trafficking Database	Illegal	Count	Victims of human trafficking	N	Case data	Data derived from IOM case data where the organisation has been involved in providing direct assistance to a trafficked person in the context of an IOM counter-trafficking project	Countries	137	2000–2010
Source: https://bluehub.jrc.ec.europa.eu/catalogue/dataset/0050									
GSI; Walk Free Foundation	Illegal	Count	Victims of modern slavery	Y	Surveys	Surveys of individuals, governments and government responses to modern slavery	Countries	167	2013, 2014, 2016
Source: https://www.globalslaveryindex.org/findings/									

ARMS TRAFFICKING

Database/report title and publisher	Proximity			Methodology			Coverage		
	Legal/illegal	Unit	Type	Public	Data methodology	Details	Geography	# of units	Years
UNODC	Illegal	Count	Trafficked arms	Y	Country reports	Data derived from country reports of seizures of illegal arms	Countries	48	2004–2013
Source: https://www.unodc.org/documents/firearms-protocol/UNODC_Study_on_Firearms_WEB.pdf									
NISAT/PRIO	Legal	Count	Trafficked arms	Y	Country reports, trade data	Data derived from country reports, COMTRADE, and other sources of trade data	Countries and territories	250	1962–2011
Source: http://nisat.prio.org/Trade-Database/Researchers-Database/									
SIPRI	Both	Count	Trafficked arms	Y	News sources, trade data, media monitoring, national reports	Data derived from various news sources, trade data, government reports, and other sources	Countries and organisations	130 exporting; 253 importing	1950–2016
Source: https://www.sipri.org/databases/armstransfers/sources-and-methods									
PRIO and Igarapé, MAD (Mapping Arms Data)	Legal	Count	Trafficked arms	Y	Government reports	Data derived from NISAT/PRIO reports	Countries	262	1992–2014
Source: http://nisatapps.prio.org/armsglobe/index.php									

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Notes

1   L Shelley, Transnational Organized Crime: An Imminent Threat to the Nation-State?, Journal of International Affairs Vol. 48, No. 2, 1995, 464.

2   United Nations Office on Drugs and Crime (UNODC), *The Globalization of Crime: A Transnational Organized Crime Threat Assessment*, 2010, ii.

3   S Ellis and M Shaw, *Does Organised Crime Exist in Africa*, 2015, 512.

4   The term forecastability will be used throughout this report. It is defined here as the ability to formulate an accurate representation of given variable and the system in which it operates.

5   Meadows et al., *Limits to Growth*, Universe Books, 1972.

6   J Forrester, *System Dynamics, Systems Thinking, and Soft OR*, System Dynamics Review Vol. 10, Issue 2–3, 1992.

7   D Bohl, B Hughes an S Johnson, *Understanding and Forecasting Demographic Risks and Benefits*, Zurich Insurance and Atlantic Council, 2016.

8   Intergovernmental Panel on Climate Change, Climate Change: Radiative Forcing of Climate Change, 1994.

9   *ENACT Brochure*, 2017, https://enact-africa.s3.amazonaws. com/site/uploads/enact-brochure-eng.pdf.

10 Ibid.

11 UNODC, *The Globalization of Crime: A Transnational Organized Crime Threat Assessment*, 2010.

12 Ibid.

13 Further, the above definitions do not explicitly state that TOC must involve cross-border flows, leaving the door open to include domestic flows of TOC. For instance, TOC could include a crime committed entirely in one county but perpetrated by a foreign actor(s). This would not necessarily involve a cross-border flow of goods and/or services and even if the foreign actor were to move profits by illicit means, the actor may not move all of the profits across borders, and there could be a lag between crime and transfer.

14 Numerous intergovernmental and nongovernmental agency reports focus on market-oriented TOC literature, examples include: UNODC, *The Globalization of Crime: A Transnational Organized Crime Threat Assessment*, 2010, 1, https://www.unodc.org/documents/data-and-analysis/tocta/TOCTA_Report_2010_low_res.pdf; UNODC regional and thematic transnational organized crime threat assessments, https://www.unodc.org/unodc/data-and-analysis/TOC-threat-assessments.html; World Customs Organisation's annual Illicit Trade Reports, https://www.google.co.za/search?q=world+customs+org anisation+illicit+trade+resport&oq=world+customs+orga nisation+illicit+trade+resport&aqs=chrome..69i57j69i61j 69i60l4.4375j0j7&sourceid=chrome&ie=UTF-8. Examples of TOC literature that focus on transnational criminal organizations include: L Shelley, Identifying, counting and categorizing transnational criminal organizations, Trends in Organised Crime, 1999 Vol. 5, 1, https://doi-org.du.idm. oclc.org/10.1007/s12117-999-1000-y; J Ayling, Criminalizing Organizations: Towards Deliberative Lawmaking, Law and Policy, 2003, Vol 33, 2, http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9930.2010.00333.x/abstract; A Nicaso, L Lamothe, Angels, Mobsters and Narco-Terrorists: The Rising Menace of Global Criminal Empires, John Wiley & Sons, 2010; N P Jones, Mexico's Illicit Drug Networks and State Reaction, 2016; P B E Hill, The Japanese Mafia: Yakuza, Law, and the State, Oxford University Press, 2003, http://www.oxfordscholarship.com/view/10.1093/0199257523.001.0001/acprof-9780199257522.

15 The Pardee Center previously undertook research to measure and model TOC by measuring activity of syndicates. But, barriers to measurement undermined the ability to draw robust conclusions concerning the drivers of TOC.

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17 WEF, *Global Competitiveness Index – Organized Crime component (1.15)*, 2014 http://reports.weforum.org/global-competitiveness-report-2014-2015/rankings/.

18 Global Financial Integrity (GFI), *Illicit Financial Flows to and from Developing Countries: 2005–2014*, 2017.

19 Ibid.; UNECA, *Illicit Financial Flow: Report of the High-Level Panel on Illicit Financial Flows from Africa*, 2011; G Epstein,

Capital Flight and Capital Controls in Developing Countries, 2005.

20 World Bank, *Illicit Financial Flows Brief*, 2017, www. worldbank.org/en/topic/financialsector/brief/illicit-financial-flows-iffs.

21 United Nations Development Program, *Illicit Financial Flows from the Least Developed Countries: 1990–2008*, 2011; J Ndiumama and L Boyce, *Capital Flight from Sub-Saharan African Countries: Updated Estimates, 1970–2010*, PERI Research Reports, 2012; S Claessens and D Naude, Recent Estimates of Capital Flight, World Bank, 1993; UNECA, *Illicit Financial Flow: Report of the High-Level Panel on Illicit Financial Flows from Africa*, 2015.

22 In this model, imports are generally recorded after adjusting for the cost of insurance and freight, while exports are usually valued free on board (Kar and Cartwright-Smith, Illicit Flows from Developing Countries 2002–2006, GFI, 2008).

23 GFI, *Illicit Financial Flows to and from Developing Countries: 2005–2014*, 2017.

24 GFI estimates developed-developing trade misinvoicing by subtracting reported import and export values to and from the developing country and advanced economies. If the value is negative, it indicates under-invoicing (illicit inflows) and if the value is positive, it indicates over-invoicing (illicit outflows). When comprehensive bilateral trade data with advanced economies are available for the full 10-year period, GFI uses what it calls the 'bilateral advanced economies calculation'. This calculation scales up the estimated developed–developing country trade misinvoicing to a global level for each country with available data by estimating developing–developing trade misinvoicing volumes based on volumes of developed–developing misinvoicing. The assumption here is that developing–developing country trade misinvoicing follows a similar pattern to developed–developing country trade misinvoicing. When comprehensive bilateral trade data are not available for the full 10-year period, GFI uses what it calls the 'world aggregate calculation'. This method estimates trade misinvoicing by subtracting countries' global imports from global exports. This method produces significantly less accurate results; aggregation issues from this method cause unexplainable swings in magnitude of trade misinvoicing. Because of significant data gaps, GFI calculates nearly two-thirds of country-level estimates of trade misinvoicing in this manner.

25 For countries with bilateral trade data this is straightforward; estimates are based on the original calculation without estimation of developing–developing country flows. For countries that have no reliable bilateral data for trade with advanced economies, the world aggregation is scaled down by the country's estimated propensity to trade with advanced economies.

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27 GFI, *Illicit Financial Flows to and from Developing Countries: 2005–2014*, 2017.

28 F Schneider, *The Financial Flows of the Transnational Crime: Some Preliminary Empirical Results*, Economics of Security Working Paper Series, 2011.

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30 P Reuter (2017), *Illicit Financial Flows and Governance: The Importance of Disaggregation*, World Bank World Development Report Background Paper, 2017, http://documents.worldbank.org/curated/en/538841487847427218/pdf/112973-WP-PUBLIC-WDR17BPIllicitFinancialFlows.pdf.

31 UNODC, *UNODC on human trafficking and migrant smuggling*, 2017, www.unodc.org/unodc/human-trafficking/.

32 IOM, *IOM's Immigration and Border Management Programmes: People Smuggling*, 2011.

33 ILO, ILO Global Estimate of Forced Labour: Executive Summary, 2012.

34 IOM, *Migrant Smuggling Data and Research: A global review of emerging evidence base*, 2013. The IOM provides estimates of total migrant fatalities from 2014 to date: https://missingmigrants.iom.int/.

35 ILO, ILO Global Estimate of Forced Labour: Executive Summary, 2012.

36 ILO, ILO Global Estimate of Forced Labour: Results and Methodology, 2012.

37 Ibid.

38 ILO, ILO Global Estimate of Forced Labour: Executive Summary, 2012.

39 Walk Free Foundation, *Global Slavery Index*, 2016.

40 A multiple system estimation method was used for the two other countries in the estimation set. For more information on the GSI methodology see: Walk Free Foundation, *Global Slavery Index*, 2016 .

41 IOM, IOM Case Data Global Figures & Trends Human Trafficking, 2011.

42 US Department of State, *Trafficking in Persons Report*, 2017.

43 A Rudolph and F Schneider, *International Human Trafficking: Measuring Clandestinity by the Structural Equation Approach*, Institute for Labor Study Discussion Paper no. 7867, 2013; C Seo-Young, *Modeling for Determinants of Human* Trafficking, Economics of Security Working Paper, No. 70 2012.

44 UNODC, *World Wildlife Crime Report: Trafficking in protected species*, 2016, 16.

45 CITES, *What is wildlife crime?* https://cites.org/prog/iccwc.php/Wildlife-Crime.

46 UNODC, World Wildlife Crime Report: Trafficking in protected species, 2016, 21.

47 Ibid.

48 L Shelley and J Picarelli, *Methods Not Motives: Implications of the Convergence of International Organized Crime and Terrorism*, 2002, 305–309.

49 Ibid.

50 Available at: www.unodc.org/documents/data-and-analysis/ wildlife/World_Wildlife_Crime_Report_2016_final.pdf. See also N D'Cruze and DW Macdonald, Tip of an iceberg: global trends in CITES wildlife confiscations, *Nature Conservation*, 15, 2016, 47–63, https://doi.org/10.3897/ natureconservation.15.10005.

51 UNODC, World Wildlife Crime Report: *Trafficking in protected species*, 2016, 13.

52 F Underwood, R Burn and T Milliken, Dissecting the illegal ivory trade: an analysis of ivory seizures data, PLoS ONE8(10): e76539, 2013.

53 CITES, *About MIKE Data*, https://cites.org/eng/prog/mike/ data_and_reports.

54 Ibid.

55 'Of the 35,000+ species of animals and plants listed under CITES, less than 3% are included under CITES Appendix I. These are the species that are threatened with extinction, such as for most elephants and rhinos, as well as tigers and great apes, and commercial trade in them is generally prohibited.' CITES, *Press Release*, 2015, https://cites.org/eng/ cites_trade_db_passes_15million_records.

56 For a full list of MIKE reports, see: https://cites.org/eng/ prog/mike/data_and_reports; see also: G Wittemyer, et al, Illegal killing for ivory drives global decline in African elephants, *PNAS*, 111:36, 2014, 13117–13121, www.pnas. org/content/111/36/13117.abstract?tab=author-info.

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ENACT builds knowledge and skills to enhance Africa's response to transnational organised crime. ENACT analyses how organised crime affects stability, governance, the rule of law and development in Africa, and works to mitigate its impact.

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