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COLLECTION: WHY THE DRUG WAR ENDURES: LOCAL AND TRANSNATIONAL LINKAGES IN THE NORTH AND CENTRAL AMERICA DRUG TRADES

RESEARCH

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Acknowledging Cocaine Capital in Central American Development

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ABSTRACT

Cocaine trafficking has a significant but understudied influence on Central American economies. The economic implications of this trade have repercussions for both regional development and drug control policy debates, and therefore deserve greater attention. Towards that end, in this paper we provide estimates of 1) the value of trade of primary cocaine movements that were delivered to Central America, by country (excluding El Salvador) between 2000 and 2018; and 2) the value added by the cocaine trade to Central American economies. Due to limits in data availability, we compare several estimation approaches to impute missing price and volume data using information available to us. We then use available and imputed figures to estimate the value of cocaine movements for each country over time, and the value added as a measure of difference between the Central American country of arrival and the source country of Colombia. In interpreting and discussing our findings we draw attention to the economic pressures, volatility, and development challenges faced by countries that have become important waypoints in the cocaine trade because of supply-side cocaine control efforts.

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INTRODUCTION

Cocaine transshipment has become an engine of dramatic socioeconomic and environmental change in Central America in the last decade and a half, as supply-side cocaine control efforts pushed trafficking routes further, and more often, into and through the isthmus (Arnson et al. 2011; Devine et al. 2018; Dudley 2011; Grandia 2012; McSweeney et al. 2014; McSweeney et al. 2017; UNODC 2012). The economic injection brought by cocaine trafficking into Central American countries has the potential to distort the development of relatively small local and regional economies, yet the scale of this distortion is unknown. Studies to-date highlight the distorting and corrupting power of illicit cocaine-generated funds, and their impacts on micro- and macroeconomic development by perverting wage, land, and product markets; generating corruption, violence, exploitation, and dispossession; and financing the socially and environmentally harmful growth of unregulated extractive and agribusiness sectors (McSweeney et al. 2017; McSweeney et al. 2018; OAS 2013; UNODC 2011; Wrathall et al. 2020). Missing from these important studies are reliable estimates of the value of trade represented by the movement of cocaine through the countries of Central America and the region as a whole, and the weight and impact of those estimates. These are vital to a more comprehensive appreciation of the economies of countries that have become waypoints in the drug trade. These figures are also vital to a greater appreciation of the economic ramifications of counterdrug policies in the region. Cocaine control efforts keep prices high, and traffickers shift their approaches to evade interruption, bringing inundations of cash to new places (Magliocca et al. 2019).

This study offers a preliminary corrective to this data gap, providing estimates of 1) the value of trade of primary cocaine movements (bulk shipments directly from South America) that were delivered to Central America, by country (excluding El Salvador),[1] over an eighteen-year period (2000–2018); and 2) the value added by the cocaine trade to Central American economies. We focus only on primary cocaine movements (shipments) arriving in Central America directly from South America, because data for secondary movements, i.e., movements between Central American nations (as when, for example, cocaine received in Guatemala has first transited Honduras) are relatively unreliable. Our analysis relies on data extracted from the United States' Office of National Drug Control Policy's Consolidated Counter Drug Database (CCDB), a source that provides demonstrably better estimates of cocaine flows than other data sources (GAO 2002; McSweeney 2020b), but which to date has not been used to estimate the value of trade represented by cocaine. Here we provide what is to our knowledge the first use of CCDB data for this purpose.

In what follows, we first review the state of the literature on estimating cocaine movement values, then explain the context that has contributed to the flow of cocaine into countries of Central America and describe some of the actors who capture rents from cocaine transshipment. We then present our data, methods, and findings, followed by a discussion of the implications of our findings for development in Central America.

ESTIMATING COCAINE MARKET VALUE

Empirical data on the value of drug markets have largely been absent from academic and policy literatures, due to the complexities and dangers associated with researching illicit processes and obtaining reliable data. Quantitative estimates of cocaine value and impact commonly use data from the value and volume of estimated coca production and transit routes, or from estimates of consumption in consumer countries. (e.g. Costa Sorti & De Grauwe 2009; Mejia & Restrepo 2016). However, to the extent that they exist, estimates of cocaine flow values and their economic impact during transit rely on problematic proxy data to measure the extent and impact of this lucrative market. For example, the volume of cocaine moving from sites of production into particular markets is often derived from the number of law enforcement seizures made in a given place, or through calculations involving the amount of land under

1 The wholesale cocaine price data for El Salvador was problematic given the prices reported for surrounding countries. We believe this is at least in part because according to the United States' Office of National Drug Control Policy's Consolidated Counter Drug Database there are relatively few primary movements and cocaine seizures to base price data on in that country. This lack of cocaine primary movements seen there can probably be attributed to militarization and a radar station on the coast.

coca cultivation and its productivity in the Andes, which are recognized to be crude at best. Furthermore, the methodologies used to obtain these estimates are typically vague or unstated (e.g., DEA 2021; UNODC 2012; see also UNODC World Drug Reports).[2] We suggest that the lack of reliable data is one explanation for the near silence of scholars and policymakers on the quantitative economic impact that cocaine flows have in Central American drug transit zones. This is a neglected area of research, despite the severity of political, social, and environmental consequences brought to these spaces by cocaine flows.

Current research on cocaine transshipment through Central America specifically, and its effects on development, has focused mainly on outcomes such as corruption, violence, market perversion, and investments (McSweeney et al. 2017; McSweeney et al. 2018; OAS 2013; UNODC 2011; Wrathall et al. 2020). While these studies have been vital to understanding the array of challenges likely to be faced by cocaine transit countries, missing are nuanced empirical data on the value of this cocaine, or the product of wholesale price per kilogram and volume in kilograms on landing in countries of Central America. One exception is the US Office of National Drug Control Policy's (ONDCP) (2012) report *Cocaine Smuggling in 2010*. This report estimates the amount of cocaine that traversed Central America in 2010 and its wholesale value. The UNODC (2012) reproduced the ONDCP's estimates as well as UNODC data to estimate the value of cocaine and its share of GDP for 2010.[3] In neither case, however, is the methodology used made clear. Without working estimates of these figures, and their changes over time, it becomes difficult to assess the economic impacts of cocaine transshipment on development. Many scholars are even skeptical that such calculations are possible (Thoumi 2005), in part due to lack of confidence in official statistics (Andreas & Greenhill 2010). Some of these concerns, however, are mitigated in the case of CCDB data (McSweeney 2020b), which we apply to this question for the first time here to provide a preliminary estimate of the value of cocaine primary movements moving through Central America from 2000–2018. As Reuter and Greenfield (2001) point out, this exercise is worthwhile, even if imperfect, because estimates of drug market value '… can provide useful information on the overall size or "scale" of the global drug trade, [and] the distribution of supply chain activities and value added across countries …' (Reuter & Greenfield 2001: 159).

COCAINE TRAFFICKING IN CENTRAL AMERICA

Central American spaces have long been enrolled in cocaine trafficking (Bunk & Fowler 2012; Senate Committee on Foreign Relations 1989). However, during the mid-2000s cocaine trafficking routes heavily concentrated through Central America's rural spaces in response to interdiction pressures pushing increasingly fragmented trafficking networks away from Mexico and the eastern Caribbean (Bagley 2015; Reuter 2014; UNODC 2007a; UNODC 2012). In consequence, 'the Western Hemisphere transit zone grew from 2 to 7 million square miles between 1996 and 2017' (Magliocca et al. 2019: 7784). To avoid their interdiction, Drug Trafficking Organizations (DTOs) began shipping primary cocaine movements from export zones in Colombia, Ecuador, and Venezuela first to remote spaces of Central American countries for secondary transit towards Mexico, the United States, Europe, and Asia. In 2000, for example, the US State Department only designated Guatemala and Panama as 'major' drug transit countries (INCSR 2001). By 2012, *all* Central American countries were designated as such (INCSR 2012).

Cocaine transport from producer and export countries in South America[4] to destination countries is achieved through the cooperation of a variety of actors (Table 1). It is often coordinated by transnational ('manager') DTOs that may oversee or work with smaller *transportista* (carrier) DTOs in countries of transit, sometimes through cooperation with narco-brokers and financiers (Dudley 2016c; Idler 2015; UNODC 2012). These national DTOs in turn work with 'middlemen' in primary movement arrival 'nodes,' or places of primary movement landing (Dudley 2011;

2 https://www.unodc.org/unodc/en/data-and-analysis/wdr-2021---previous-reports.html Accessed 7/8/2021.

3 It is worth noting that our estimates are lower than those of the UNODC in all cases except Panama and Belize (2012, p.43). We cannot reliably surmise why this might be the case as the UNODC and ONDCP have not made their data or methodological approach available to the public.

4 Colombia is the primary producer of northbound cocaine; northbound cocaine is exported mainly from Colombia, Ecuador, and Venezuela.

ACTOR	ROLE IN COCAINE TRANSSHIPMENT
Transnational 'manager' DTOs	Coordinate and/or oversee cocaine production & transport; may work with *transportista* groups, brokers, and financiers.
Transportista 'carrier' DTOs	Coordinate and/or oversee transport locally and nationally; work with 'middlemen.'
'Brokers'	Coordinating/networking role between all actors in the cocaine supply chain through direct contact.
'Financiers'	Broker connections and ensure supply of coca leaf and paste to processing groups.
'Middlemen'	Assist transport by enrolling local land and/or labor; local to/embedded in primary movement nodes.
Residents local to primary movement nodes	Not always by choice, enrolled and compensated by 'middlemen' for their silence and assistance with tasks such as manual labor and acting as lookouts.
Other: retail gangs, public servants, lawyers, law enforcement, military, businesspeople, politicians	Direct or indirect involvement: Operations support, logistical support, political support, money laundering services.

Table 1 Main actors and their role in cocaine transshipment (see citations in text above).

McSweeney et al. 2018; Plaza Pública 2011). The Central American nodes where planes and boats carrying cocaine first arrive from cocaine producing countries are often in remote rural areas far from law enforcement or military presence, and include forested regions, oil palm plantations, conservation zones, indigenous territories, mangrove coastlines, lagunas, and communal lands (Devine et al. 2018; Devine et al. 2020; McSweeney et al. 2017; PRISMA 2014; Sesnie et al. 2017). Once on the ground, cocaine shipments are transferred to new modes of transport that will carry the product to its next destination (secondary movements), by road, waterway, or air.

Rents are captured from the process of cocaine transshipment at various stages and by a variety of actors. Transnational DTOs, often from Mexico, capture rents through their work in overseeing cocaine production & transshipment. National *transportista* DTOs earn rents from overseeing transport locally and regionally, and pay middlemen local to the nodes of cocaine transfer who coordinate transit efforts by enrolling local land and/or labor (Dudley 2011; McSweeney et al. 2018; Plaza Pública 2011). These middlemen oversee payments to local residents in exchange for silence and the services those communities offer (often under duress, and in fear of violence), such as manual labor in carrying cocaine from one vehicle to the next, keeping landing strips clear of debris, and acting as guards along trails and riverways to prevent people from coming near a landing point (McSweeney et al. 2017; McSweeney et al. 2018).

Beyond rents earned by those who coordinate or support cocaine's movement directly, the rents from cocaine trafficking circulate much more broadly within transit country economies as costs of operations, political and logistical support, and money laundering activities: among retail gangs; among the innumerable public servants, lawyers, law enforcement, and military who are bribed; and among the many elite business people and politicians who profit from their involvement in the trade through kickbacks, election-financing, and direct involvement (Dudley 2016a; Farah 2010; Gutiérrez 2016; Wrathall et al. 2020).The currency of the drug trade is US dollars, usually in $20 notes. In some cases, payments are made in cocaine rather than in cash to locals or *transportista* DTOs, who then sell their 'earnings' to dealers in cities (Dudley 2011; Reuter 2014).

The state therefore plays a crucial role in cocaine transport. It is no surprise that cocaine control policies have pushed transshipment routes into countries and regions characterized by weak state presence and/or accountability, like many of those in Central America (Yashar 2018). Authorities at all levels across much of the region have become increasingly implicated in cocaine movements whether by choice or force (e.g., Wrathall et al. 2020; Yashar 2018). The depth and breadth of narco-capitalized corruption in Central America, particularly in the 'Northern Triangle' countries of Guatemala, Honduras, and El Salvador, is well-known (Dudley 2011). Most famously in recent months, current Honduran President Juan Orlando Hernández was accused of accepting bribes and seeking to invest in a cocaine processing lab, and his brother was found guilty of cocaine trafficking in a US court and sentenced to life in prison (BBC News 2021; Palmer & Semple 2021). However, corruption, assistance with money laundering,

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and facilitation of cocaine movement take place through the support of lower-level state actors as well such as the police, armed forces, and local politicians and public servants (Bunk & Fowler 2012; McSweeney et al. 2017; Wrathall et al. 2020; Yashar 2018).

Given what we know about the variety of actors who benefit financially from cocaine transshipment through Central American countries, we assume that a large percentage of rents earned remain, are spent, or are invested or laundered in-country (e.g., McSweeney et al. 2017). However, due to the absence of data, we do not estimate total rents captured in-country; instead, we focus our estimates on the value of the cocaine trade, and the value added by the cocaine transport process in its trajectory crossing national boundaries toward consumer markets.

DATA SOURCES & LIMITATIONS

We combined three sources of data to develop our estimates: cocaine trafficking data from the US government's CCDB, United Nations Office on Drugs and Crime (UNODC) data on wholesale cocaine prices,[5] and Gross Domestic Product figures from the World Bank (2021c). The United States' Office of National Drug Control Policy provided us with data on the number of primary cocaine movements to countries of Central America over the period during which Central American countries became the principal destination of primary cocaine movements (2000–18), and on partial cocaine volume data for some countries and years. The CCDB data offers the most complete, valid, reliable, and conservative dataset available on cocaine smuggling movements through the Central American corridor (DOD 2018; McSweeney 2020b). These data have limitations, however: they may overrepresent cocaine flows through established trafficking zones, where interdiction assets (radar and other forms of surveillance) are focused, and correspondingly underrepresents flows through zones that are not being monitored as actively. In addition, the CCDB underrepresents smuggling in commercial vessels (such as container ships) and overland smuggling (McSweeney 2020b). The net effect is that the CCDB should be considered to overall underestimate all cocaine flows through the transit zone, including Central America.[6] Overall, while the CCDB data is the most comprehensive and reliable source of information on cocaine movements through the Central American transit zone, it is important to note that our estimates are conservative because of the conservative nature of the CCDB inclusion criteria (see McSweeney 2020b).

Available data on wholesale cocaine prices for each included Central American country over the study period, and Colombia, come from the United Nations Office on Drugs and Crime (UNODC) (UNODC: 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2017, 2020). The UN Economic and Social Council (ECOSOC) collects wholesale cocaine price information directly from governments annually, and so depends upon those governments to self-report prices accurately (see, e.g., ECOSOC 2015; ECOSOC 2020). The wholesale prices allow for better comparisons across countries than street prices, which reflect a greater number of pricing factors related to the nature of local retail practices, purity, consumption patterns, country risks, local distribution costs, competition, and market segmentation. It is important to note that we exclude El Salvador from our analysis due to suspect pricing data reported for that country. To estimate value added as a percentage of Gross Domestic Product (GDP) we use the World Development Indicators' GDP figures (World Bank 2021c).

ESTIMATION OF THE TOTAL VALUE AND VALUE ADDED OF PRIMARY COCAINE MOVEMENTS THROUGH CENTRAL AMERICAN COUNTRIES

VALUE

In this section we discuss how we use available data on movements, volumes, and wholesale prices to estimate annual country-level total values and value added of cocaine movements. The Appendix discusses our estimation strategy in greater detail. Values of cocaine arriving in

5 Where 'wholesale price' is defined as 'The level of an illicit drug market at which the drug is sold in bulk, to be sold on to consumers at a later stage' (ECOSOC 2015: 17).

6 While false movements' inclusion in the CCDB are not impossible, they are unlikely given the stringent criteria—including corroboration by intelligence—that must be met in order for a trafficking event to be included. For example, from FY2013-FY2017 of an average of 5,000 alerts of suspicious movements out of South America alerts, only 53.3% on average met the CCDB criteria for inclusion (McSweeney 2020b).

each country each year are important because movements alone do not paint a full picture of the economic effects of illicit cocaine transshipment, as prices and volumes of cocaine in a given shipment differ across countries and over time (see Figure 1 below).

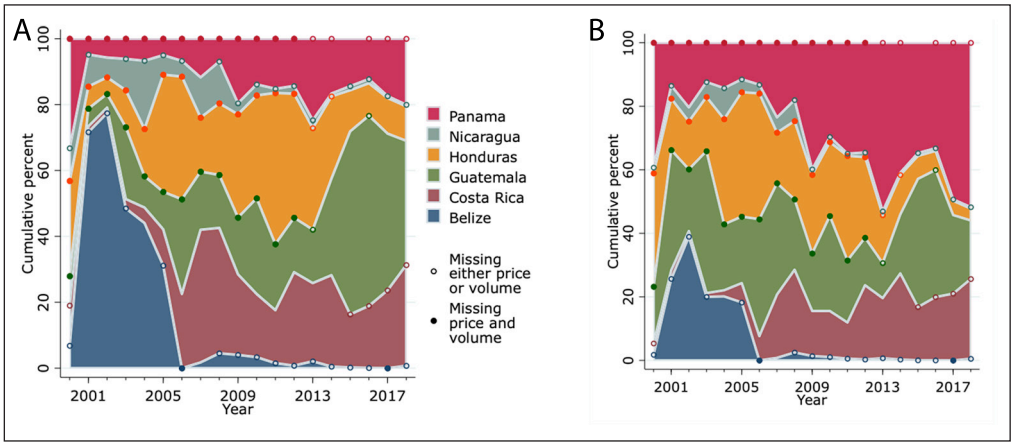

Figure 1 Composition of the total value of cocaine transshipments by country over time A, and composition of primary movements by country B.

The value of cocaine primary movements (henceforth 'movements' or 'transshipments') is the product of wholesale price per kilogram and volume in kilograms. Restricting our attention to only complete cases, where both variables are available to us, we would be limited to 28 or about a quarter of 114 possible observations representing 19 years and 6 countries. A common issue with data on illicit activities is limited data availability and the partiality of available data (Reuter & Greenfield 2001; Robinson & Scherlen 2014). Table 2 summarizes the availability of information on prices and volumes, as well as information on the number of movements, which are available for all 114 observations.

		VOLUME				TOTAL	
		NOT AVAILABLE		AVAILABLE			
		N	%	N	%	N	%
Price	not available	29	25.4%	46	40.4%	75	65.8%
	available	11	9.6%	28	24.6%	39	34.2%
	Total	40	35.1%	74	64.9%	114	100.0%

Table 2 Data availability and the extent of imputation.

Our strategy for estimating the total value of cocaine shipments is based on imputation of missing values of prices and volumes using available information on the number of primary movements, prices, and volumes. The estimation is carried out following these steps:

1. We impute the data on volume per movement and prices by selecting the model with the best fit to the data available to us.
2. We estimate the total value of drug movements by multiplying the price with the average volume per primary movement and the number of movements. Volume per primary movement in a given country and year is more accurate than estimating volumes alone, as volumes per movement are often tied to transportation use patterns (e.g., go-fast boats, fishing boats, single or twin aircraft) tied to geography and DTO preferences. We accomplish this estimate sequentially by using all available information and imputed values only when necessary.
    - First, we calculate value based on complete cases where volume and prices are known (28 country-year data points).
    - Second, we use observed volumes and predicted prices for 46 country-year data points where volume is available, but price is not.
    - Third, we use observed movements and prices with predicted volume per movement to predict 11 country-year values.
    - Finally, we use known movements multiplied with the predicted volume per movement and predicted prices to predict 29 additional country-year data points.

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Our approach to imputing the missing values recognizes that the missing data arise from a process that shares common components with the observed values, while allowing for an idiosyncratic component. The estimation process uses statistical techniques to estimate those common components recognizing the presence of idiosyncratic country-year components.

$$x_{cy} = f\left(\alpha_{cy}, \alpha_c, \varepsilon_{cy}\right)$$

where captures the time component, is the country effect, is the idiosyncratic error component that cannot be estimated for the missing data, and is the function of parameters and the error term. The imputed values are then based on the estimated time and country components without the idiosyncratic term.

$$\hat{x}_{cy} = f\left(\hat{\alpha}_{cy}, \hat{\alpha}_c, 0\right)$$

We compare several estimation approaches to recover the common components: using a linear model, logarithmic model, and a Poisson model. For each model we estimate four different versions of the common time component: year effects, deterministic common linear trend, country specific linear trend, and country specific trends with year effects.

Our preferred model for prices is a model that includes country-specific trends estimated by the pseudo maximum likelihood Poisson. The preferred model for volumes per movement is a model that includes country-specific trend and year effects estimated by the pseudo maximum likelihood Poisson. See the Appendix for more details on the procedure.

In order to provide a measure of reliability for the imputed values we calculate standard errors of the predictions relative to the predicted values. For our preferred pseudo maximum likelihood Poisson models the standard errors of predictions are on average far less than 1% of the predicted values (see Appendix Table A1). Despite this high precision the usual caveats for diagnostics of reliability of the imputations remain, as aptly reviewed for example in Abayomi et al. (2008).

The stacked shares comparison in Figure 1 illustrates that while the decrease in the shares of primary movements to Belize and Nicaragua turned them into insignificant transshipment nodes, Honduras remains significant in terms of cocaine value entering the country, despite quick decline in its share of movements. Comparing these two panels highlights the importance of the imputation exercise, as more movements do not necessarily translate into larger economic values due to price and the average size of movement differences—a product of geographic location and interdiction practices over time/space (Magliocca et al. 2019). Table 3 summarizes our estimates of the value of cocaine transshipments by country and year, and totals per country, in Millions of US dollars. Figure 2 presents a time series visualization of the value of primary movements.

YEAR	COUNTRY						
	BELIZE	COSTA RICA	GUATEMALA	HONDURAS	NICARAGUA	PANAMA	TOTAL
2000	3.6 *	6.5 *	4.7 °	15.3 °	5.3 *	17.6 °	53.0
2001	137.5 *	3.3	10.4 *	12.9 °	18.6 *	9.2 *	191.9
2002	304.4 *	6.6	16.4 °	19.8 °	23.6	22.5 °	393.3
2003	259.9 *	15.2	116.9 *	60.2 °	51.0 *	32.8 °	536.0
2004	246.9	26.4	53.3 °	80.3 *	116.0 *	37.5 °	560.4
2005	274.2 *	96.8	100.1 *	313.0 *	52.2 *	43.8 *	880.0
2006	0.0	154.6	197.3 *	255.4 °	32.8 *	46.0 °	686.1
2007	23.3	539.8	236.5 *	219.9 °	163.6	157.1 °	1340.3
2008	115.3 *	973.4	411.0 *	556.1 °	324.7 *	176.3 °	2556.8
2009	118.0 *	717.1	505.3 *	918.8 °	98.1 *	574.3 °	2931.6
2010	116.3 *	665.8	1009.7 °	1085.4 °	115.9 *	481.5 °	3474.6
2011	50.1 *	534.5	666.6 °	1524.6 °	42.0 *	504.8 °	3322.5
2012	38.3 *	1399.9	816.7 °	1858.1 °	116.4 *	707.1 °	4936.4
2013	134.1 *	1530.0	1045.7 *	1985.0 *	155.1 *	1593.9 *	6443.7
2014	34.6 *	1964.9	2075.5	1769.3 *	61.3	1177.9 *	7083.5
2015	26.3 *	1894.1 *	6531.3	1468.3	145.8 *	1693.5	11759.4
2016	21.2 *	4477.7 *	13762.0*	2349.0	304.1 *	2915.1 *	23829.1
2017	0.0 *	4050.0 *	8159.9	1853.0	102.5 *	2983.3 *	17148.6
2018	100.6 *	4186.4 *	5158.8	1434.5	66.7 *	2742.4 *	13689.2
Total	2004.5	23243.1	40878.0	17778.8	1995.6	15916.4	101816.5

Table 3 Value of cocaine transshipments by country and year, and country and year totals, in Millions of US dollars. *Notes*: * denotes values based on imputed prices and volumes per movement, ° denotes values imputed based on either predicted prices or observed volumes per movement.

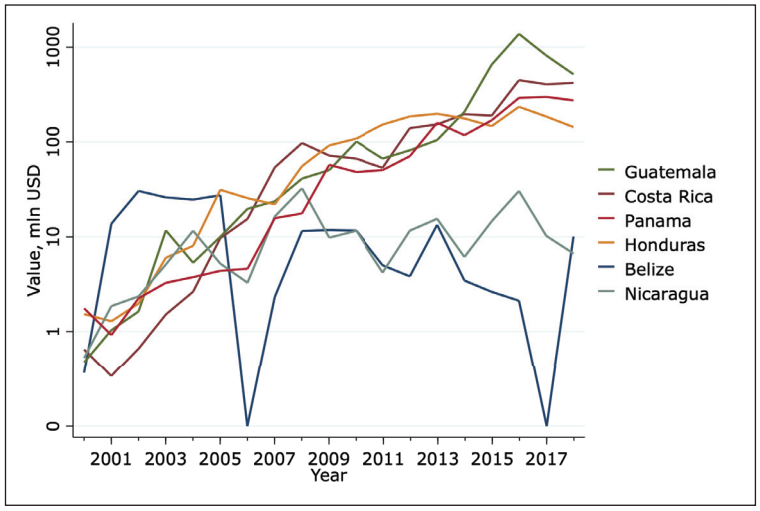

Figure 2 Time series of the value of cocaine movements.

In addition to the changes in the relative importance of cocaine transshipment to countries' economies over time, our data also points to significant volatility of the value of cocaine movements. This volatility can be explained by the ephemeral nature of primary movement nodes and transportation routes, resulting from interdiction efforts that constantly push trafficking routes into readily available new spaces in nearby countries, as noted above (e.g. Magliocca et al. 2019). Figure 3 shows the distribution of year-to-year changes in total values of transshipments within a country. Note that the year-to-year changes in values on the horizontal scale are expressed as multipliers to capture substantial amount of variation for some countries in some years.

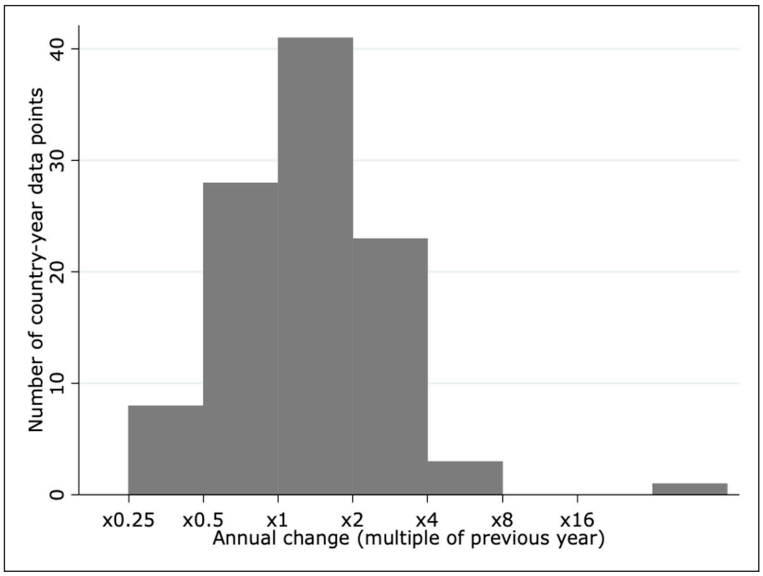

Figure 3 Distribution of year-to-year changes in total values of cocaine movements. Note: x8 means that the value increased 8 times from one year to the next for the same country. An annual change of greater than one means an increase, and a number that is smaller than one means that there is a decrease, in total value.

We also report the coefficients of variation of the de-trended values of movements in Table A3 of the Appendix. These calculations confirm substantial volatility of the values, with Guatemala exhibiting the largest amount of variation over time. This comparison reveals that variation in movements is substantially larger than variation in prices.

VALUE ADDED

Central American economies are affected by the overall increase in the value of cocaine primary movements since the early 2000s coupled with the sudden changes in values. Any calculation of the economic or developmental impact of these movements needs to begin with an estimation of how much of that money actually remains in activities associated with transiting the country. Calculating the portion of the value that is staying in the transit country would be an extremely data demanding exercise given the illicit nature of cocaine transshipment. For example, we would need comprehensive data on the specific payments to participants in the delivery process, which is not recorded reliably across the entire region. However, we

can estimate the increase in the value of the shipments associated with the transshipment of cocaine from the difference in wholesale value between the source country of Colombia and the country of arrival. This calculation estimates total value added associated with the transshipments of cocaine to primary destination countries (see Table A4). Value added is key to understanding effects of the drug transshipments on development because they represent the total payments for the country's 'resources' used (including 'costs' of transport) in the process of transshipment and could be used for development enhancing activities. Even though this integrated approach does not allow for a precise understanding of financial flows, it gives a credible approximation of the total value added that is associated with transshipment activities.

In order to calculate the relative importance of the estimated value added for the country's economy we express it relative to that country's GDP, because GDP is also a measure of value added from all economic activity in that country, providing for a meaningful reference point for the estimated value added. Specifically, we use Gross Domestic Product expressed in current US dollars (to match the data on prices) from the World Development Indicators from the World Bank (World Bank 2021c). Value added expressed as a percentage of GDP presented in Table 4 draws attention to the striking impact of the cocaine trade on Central American countries' macroeconomic development.

YEAR	COUNTRY					
	BELIZE	COSTA RICA	GUATEMALA	HONDURAS	NICARAGUA	PANAMA
2000	0.25	0.02	0.02	0.14	0.06	−0.02
2001	10.73	0.01	0.08	0.12	0.23	0.01
2002	21.87	0.02	0.06	0.18	0.29	0.01
2003	19.12	0.07	0.39	0.56	0.67	0.05
2004	16.79	0.09	0.19	1.11	1.38	0.05
2005	16.86	0.38	0.24	1.69	0.53	0.02
2006	0.00	0.40	0.45	1.83	0.35	0.07
2007	1.29	1.25	0.78	1.32	1.50	0.12
2008	6.03	1.93	0.71	2.96	2.54	0.12
2009	6.93	1.65	1.05	5.01	0.87	0.75
2010	6.21	1.03	1.94	5.19	0.91	0.40
2011	2.75	0.86	1.17	7.02	0.33	0.63
2012	1.93	1.95	1.30	7.83	0.80	0.58
2013	6.62	2.10	1.59	8.46	1.03	1.28
2014	1.70	2.96	2.93	7.34	0.40	1.10
2015	1.32	2.72	9.26	6.24	0.95	1.95
2016	1.06	6.34	18.41	9.00	1.96	3.36
2017	0.00	5.76	10.49	7.16	0.65	3.42
2018	4.83	5.68	6.75	5.62	0.44	2.97

Table 4 Value added as a percentage of GDP.

INTERPRETATION OF FINDINGS

ESTIMATED COCAINE PRIMARY MOVEMENT VALUES

Our estimates of the value of cocaine primary movements into Central American countries (Figures 1 and 2; Table 3), and estimates of the value added to Central American economies this Century (Table A4 of the appendix), demonstrate the importance of the cocaine trade to economic development in this region. While previous studies have noted the violent and destructive effects of cocaine movements into the region as a result of drug policy pressures (see above), our study offers the first reliable quantitative estimates of potential macroeconomic development impacts in dollars over time. In addition, this exercise has made clear the importance of including cocaine prices and volumes in order to arrive at a more comprehensive

understanding of the phenomenon over time and place and different countries' relative importance over time (see Figure 1), and to understanding the specific development challenges brought by cocaine movements to Central America.

It is important to note that not all rents from the cocaine trade are inherently problematic and may even be used toward providing important financial resources in rural nodes of cocaine transfer (e.g., Blume 2021; Gillies, Collins & Soderholm 2019). However, the size of our estimated values in these historically poor countries has engendered problematic economic distortions at local and national scales as described elsewhere (McSweeney et al. 2017; Sohnen 2012). Furthermore, as we show, cocaine movement values are highly volatile over time, which brings further distortion to economies (see Figure 2). Boom and bust cycles have traditionally had serious implications for development in small resource dominated economies (Venables 2016). Our research therefore provides a clearer picture of how so much social, environmental, economic, institutional, and governmental change has been facilitated in the region. In other words, with a conservative estimated value of cocaine movements at $101.8 billion across the region (excluding El Salvador; Table 3) during the study period, and with significant volatility in values over place and time (Figure 2), it is no wonder the region is witnessing unprecedented corruption, violence, land grabs, deforestation, land speculation, and wage inflation (see above).

Examining Figure 1, we see changes over time in countries' composition of the total value of cocaine movements, highlighting shifts in relative importance of different countries over time, in terms of overall primary movement values. In particular, we see that the relative importance of Panama, Honduras, Guatemala, and Costa Rica as a share of total value of primary movements has grown especially since 2006. Figure 1 also highlights the economic importance of cocaine movements to three of the six countries in particular since the 2006 diversion of cocaine movements into Honduras, Guatemala, and Costa Rica in response to counternarcotic actions in Mexico and Columbia.

Table 3 breaks down the wholesale value of cocaine movements by country over time. Of particular note is the estimated $40.88 billion total for Guatemala over the period 2000–2018. Two thousand sixteen saw cocaine values of $23.83 billion across all six study countries—the highest total in our study. Even Nicaragua, which according to the CCDB received the fewest primary movements over the study period, saw an estimated approximately $2 billion of cocaine wholesale value enter its borders.

In Figure 2 we see that value changes by country typically fell between .25 and 8 times from one year to the next. This illustrates high inter-annual variations, suggesting regional and local economies that are likely subjected to wide swings in potential economic stimulus (See also Table A3). Highlighting this volatility and the drastic changes that shifts in primary movement values might mean for a given country, we estimate Belize went from seeing $3.6 million to $274.2 million in cocaine movement values in just five years (2000–2005). For Guatemala we estimate primary movements of cocaine valued at approximately $16.4 million arriving to the country in 2002, then jumping to a value of $116.9 million by 2003, back down to a value of $53.3 million in 2004, with an anomalous high value of $13.76 billion in 2016. In the case of Panama, in just one year (2012–2013) we see just less than a $1 billion increase in estimated value.

ESTIMATED VALUE ADDED OF COCAINE TO CENTRAL AMERICAN ECONOMIES

The economic influence of cocaine trafficking through Honduras and Guatemala, as compared to Foreign Direct Investment (FDI), offers an illustrative comparison. In 2014 FDI flows into Guatemala amounted to approximately $1.4 billion (ECLAC 2015) compared with the estimated value of primary cocaine movements of approximately $1.7 billion value added (Table 3); in the same year FDI flows into Honduras reached a record of approximately $1.1 billion (ECLAC 2015), compared to approximately $1.5 billion in cocaine movements' value added.

Estimations of value added for each country over time are impressive in and of themselves (Table A4). However, our estimates of value added as a percentage of GDP are astonishing (Table 4). Some noteworthy figures: the value added of cocaine movements represented 21.87% of Belize's GDP in 2002; 18.41% of Guatemala's GDP in 2016 (Central America's largest economy throughout the study period); and 9% of Honduras' GDP in 2016.

In Table 5 we compare country averages and 90th percentile values to country averages of other economic indicators also expressed as percentages of the GDP, for the period of 2000 to 2018 (World Bank 2021a; 2021b; 2021d; 2021e; 2021f; 2021g). The relative importance of cocaine primary movements exceeds or is comparable the first four economic indicators in Table 5 and is also substantial even if compared to such aggregates as the last two indicators. Tax revenue can be used as a measure of government size; we see here that some years for Guatemala cocaine movements approach (or exceed; see Table 4) average tax revenue as a percentage of GDP. The same is true of Belize.

COUNTRY	VALUE ADDED AS % OF GDP		ECONOMIC INDICATORS AS % OF GDP					
	AVERAGE	90TH %	GOV'T EXPENDITURE ON EDUCATION	DOMESTIC GENERAL GOV'T HEALTH EXPENDITURE	MILITARY EXPENDITURE	TOTAL NATURAL RESOURCES RENTS	AGRICULTURE, FORESTRY, & FISHING, VALUE ADDED	TAX REVENUE
Belize	6.64	19.11	6.34	3.21	1.08	2.51	12.58	22.38
Costa Rica	1.81	5.56	5.95	5.10	0.00	1.19	6.75	13.48
Guatemala	3.05	10.49	2.99	2.10	0.53	1.88	12.05	11.10
Honduras	4.15	8.46	6.36	3.12	1.12	1.57	12.39	15.20
Nicaragua	0.84	1.96	3.61	3.46	0.65	1.96	16.39	13.64
Panama	0.89	3.36	3.92	4.44	0.00	0.15	4.40	10.14

Table 5 Cocaine primary movement value added as a percentage of GDP in relation to other economic indicators (averaged for the years 2000–2018).

DISCUSSION: IMPLICATIONS FOR DEVELOPMENT & RENT CAPTURE

IMPLICATIONS FOR NATIONAL DEVELOPMENT PROSPECTS

In addition to the obvious deleterious effects stemming from the criminal nature of cocaine transshipments, the revenues from these transshipments have the potential to distort economic activities and hinder economic development. To understand the implications for development, we draw on the insights from the literature on the 'resource curse' that focuses on economic development in resource dependent economies. The revenues from cocaine transshipments share important characteristics with natural resource revenues in that the magnitude and the timing of both of these revenues are determined to a large extent by global forces external to the national economy. Van der Ploeg (2011) and Frankel (2012) survey this literature and identify channels for possible distortions. Relevant here is that the resources employed in facilitating cocaine transport are diverted from other sectors of the economy, possibly causing such undesirable outcomes as deindustrialization, inflation, and rent grabbing. Van der Ploeg (2011) also points out that the 'resource curse' is worse in countries with poor institutions; this is especially pertinent because cocaine transshipment is associated with the deterioration of institutions and increased corruption, potentially causing a vicious cycle of self-perpetuating decline in a country's development prospects.

Furthermore, the reallocation of resources away from the legitimate sectors of the economy can distort incentives to accumulate physical or human capital (see Stijns 2006). The case of human capital is especially worrisome because of its central role in development. And further compounding the problem, although the economic literature on the 'resource curse' identifies several policy tools to mitigate its effects (see Frankel 2012 for a comprehensive list of tools), the illicit nature of cocaine trade revenues renders those tools ineffective. The tools include taxation of production, production subsidies, price controls, hedging, and other tools that implicitly rely on the traceability of the revenue.

Needless to say, the severity of these distortions depends on the weight of these revenues and the associated value added in the rest of the economy. Our measures of the value added created by primary cocaine transshipments relative to the GDP provide a measure of their importance. In addition to the magnitude, the revenue volatility we found is by itself detrimental to development as volatility makes planning and investments difficult. Van der Ploeg, and Poelhekke (2009) conclude that volatility is a 'quintessential feature' of the resource curse. The effects of volatility are especially worrisome for smaller and less diversified economies like those of Central America (see Koren & Tenreyro 2007).

RENT CAPTURE AND DEVELOPMENT

It is impossible to know with precision how much of the value of trade and value added we estimate remain in-country. However, it is not negligible based on in-country asset seizures, US government prosecutions of drug 'kingpins' and related court testimony about rent capture by national *transportista* DTOs. For example, top members of the Cachiros, one of at least five major Honduran transit organizations, were apprehended in 2013—reports of their seized, Honduras-based assets ranged from $300 million to over $1 billion, making them one of the richest families in Honduras (Dudley 2016b; La Prensa 2018; Parkinson 2013). US court documents confirmed that during approximately thirteen years of transporting drugs they earned between $2,000-$2,500/kilo for their services shipping drugs from South America into Honduras and onto Guatemala (*United States v. Lobo* 2018), much of which would have had to be laundered. This example suggests approximately 25% of cocaine value added was captured in country, which may give us some idea of cocaine dollars remaining in place region-wide.

It is widely recognized that money laundering in general leads to perverse development—distorting prices, consumption and investment; undermining traditional economic activities, diminishing competitiveness and engendering corruption (Ferwerda 2013; OAS 2013). The development implications would be felt differently depending on the size of the economy in question. In addition to distortionary impacts on the macroeconomy, money laundering in Central America—particularly in Honduras and Guatemala—is achieved through rural land acquisition and investments in land-based enterprises such as mining, cattle ranching, and African oil palm production, which has led to the displacement of rural and indigenous peoples from their lands and the destruction of tropical ecosystems (McSweeney et al. 2017; Sesnie et al. 2017; Devine et al. 2018). Furthermore, recent reports of narco-corruption reaching the presidential offices in El Salvador, Nicaragua, Honduras and Guatemala illustrate the overall challenges to governance and economic stability caused by narco-capital entering these relatively small economies.

As cocaine moves through remote transit spaces, dollars also flow into some of the region's most impoverished communities. We have some knowledge about rent capture by local middlemen, and other people living in spaces that become cocaine movement nodes, from the previous ethnographic work of authors KM, EAN, and ZP (e.g., McSweeney et al. 2017; McSweeney et al. 2018; McSweeney & Pearson 2013; Wrathall et al. 2020). In McSweeney et al. (2018) we cite a conservative estimate of $70,000 local payments per primary cocaine movement delivery in Honduras based on fieldwork and other independent sources (i.e., Dudley 2011; Jackson 2015). These payments represent just a small subset of services required to move drugs, injecting a flow of $20 bills into some of the most impoverished spaces in Latin America. Still, they illustrate the potential of cocaine transshipment to stimulate local development. For example, one region of Honduras received 100 cocaine transshipment flights in 2011, which represents an injection of an estimated $7 million to an area that is home to just approximately 5,000 people. The populations receiving such payments are some of the poorest and most isolated of already-poor populations in Central America. Rural poverty in Honduras, defined as earning less than $3.10 USD/day, was 65% in Honduras in 2015. Extreme poverty, defined as those earning less than $1.90/day, was 53% that year (CEPALSTAT 2019). Rents entering rural communities like the ones we have investigated are likely to be spent and invested locally and nationally and are thus significant for poor rural communities and individuals, greatly affecting possibilities for local agricultural, economic and household development. The dollars that end up in remote waypoints of the cocaine commodity chain in the form of payments to middlemen and local residents may be durable or fleeting injections into local, rural economies, because cocaine transport nodes are highly dynamic and ephemeral in response to interdiction efforts, becoming 'inactive' relatively quickly (Magliocca et al. 2019). Nonetheless they too can have important negative and positive development impacts (cf. Blume 2021; McSweeney et al. 2017).

CONCLUSIONS

Our estimates demonstrate the overall value of trade and value added of primary cocaine movements entering countries of Central America this century, and the potential economic distortions and opportunities these represent. These estimates are, to our knowledge, the first to utilize what is the best existing source of available data on cocaine trafficking movements, and the first to quantify the value and value added of cocaine movements through Central American trafficking routes, adding a more nuanced economic context for the corruption, crime, power,

and social and environmental change that has long been described qualitatively (see above). The conservative estimates we present here demand an appreciation of the development challenges faced by Central American states and their citizens, and furthermore, demand renewed attention to yet another measure of failure for business-as-usual counternarcotic policy norms.

It is worth repeating: the development impact of cocaine transshipment on Central America is not incidental or natural: it is a direct result of drug control policies, and should therefore be considered a factor in evaluating the effectiveness and collateral damages of those policies. This is a drug policy issue in the sense that cocaine prohibition keeps its prices high—as with any illicit good. And continued support for supply-side policies like interdiction keeps traffickers nimble, which is why they were driven to shift the bulk of their trafficking operations into Central America in the first place (Magliocca et al. 2019). Legitimate economic activity is disadvantaged in competition with potential rents earned through cocaine trafficking; that effect is magnified in the rural spaces through which most cocaine moves first (McSweeney et al. 2017). At the same time, according to the UNODC, less than 1% of drug trade-generated proceeds are recovered globally by law enforcement while the majority of efforts are focused on drug supply interdiction (May 2017).

More research estimating the flow of illicit goods and their implications for economic development in Central America is needed. We encourage others to continue this line of research on quantitative estimates of the illicit narcotic trade to encourage a greater appreciation of the economic pressures and distortions faced by involved states, governments, and individuals, and to contribute to a more holistic picture of counterdrug policy outcomes. In addition, we encourage the use of our findings to explore the relationship between the cocaine economy and licit industries: Is there evidence of economic distortions that can be explained by cocaine value of trade? Do some industries prosper, and others fail, in direct relationship to cocaine flows? Do pricing, supply, and/or demand for some goods change in relationship to the cocaine trade through these countries?

Cocaine-generated dollars, drug control approaches, and the corruption they foster at multiple scales of governance—in concert with often compatible licit political economic processes of enclosure and state- and corporate-led resource extraction—are transforming Central America. Resulting environmental and social change dovetail with or exacerbate migration patterns, food insecurity, and climate-induced insecurities (see McSweeney 2020a). More research is needed to deepen our understanding of the role of the cocaine trade in licit and illicit forms of development, as well as the role of contemporary counternarcotic policies in this development (cf. Paley 2015).

ADDITIONAL FILE

The additional File for this article can be found as follows:

- **Supplementary File 1: Appendix.** Details of the estimation procedure. DOI: https://doi.org/10.31389/jied.110.s1

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COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

ZP: Designed research; performed research; data collection; interpreted data; wrote the paper; revised the paper.

AS: Designed research; analyzed data; wrote the paper; revised the paper.

KM: Designed research; performed research; acquired data; data collection; wrote sections; revised the paper.

EAN: Designed research; performed research; data collection; wrote sections; revised the paper.

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