White Paper on Relating the Size of Illegal Markets to Associated Amounts of Money Laundered

Submitted to the Cullen Commission on Money Laundering by

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1.0 Introduction

1.1 Background motivation and problem statement

The illegal drug trade is generally asserted to be the largest illegal market, in terms of both participants and revenues, in many individual countries and globally. Illegal market estimates are necessarily imprecise, even in the countries with the best data systems, so the figures should be treated as just order of magnitudes rather than specific numbers. The most systematic estimates have been done in the United States and those show a plausible range for heroin, to pick one of the big four drugs, of between $17 billion and $85 billion USD (Midgette et al., 2019). It is safe to say that the global market is worth hundreds of billions in US dollars; whether it is $200 billion or $600 billion is hard to say.

Some of the earnings from the drug trade are laundered. That is known from investigations as well as the occasional memoirs of drug dealers or their financial agents (e.g. Woolner, 1994; Schneider, 2004). Sometimes the laundering schemes are simple, such as smurfing—which involves making multiple deposits just under the limit at which the bank is required to report that cash transaction. Occasionally they are sophisticated, with multiple layering across different institutions and countries; Schneider (2004) offers a variety of Canadian examples.

What is distinctive about drug revenues as compared to other kinds of criminal earnings is that they are almost exclusively in cash, even at the highest level of the trade. Soudijn and Reuter (2016) analyzed the accounts of six enterprises in the Netherlands whose sole line of business was to transport the sales proceeds of Colombian cocaine smugglers back to Colombia. Each enterprise handled tens of millions in Euro notes each year for customers who needed to transport millions of Euros from each cocaine shipment. The first task was to convert the small and medium-sized bills into 500 Euro notes, to allow for concealment in specially constructed backpacks; each courier carried between 200,000 and 400,000 Euros. That initial conversion cost 3% of the value, and the total cost, including payments to couriers (airfare plus a modest cash payment) and the occasional loss, was well over 10% of the revenues,

perhaps as much as 15%. When HSBC was fined over $1 billion for laundering drug market revenues through its recently acquired Mexican affiliate, it was again the handling of currency that was so striking; Mexican drug dealers had developed cash boxes that fit the shape of the teller's windows in the HSBC branches (Taibbi, 2012). Schneider (2004) in his study of RCMP money laundering cases, of which more than three-quarters involved drug dealing, found cash to be central in 94 of the 149 cases. Cash is the curse of the drug trade.

Many, perhaps most, other forms of high-value crime generate earnings in more easily concealed forms. For example, cyber crime generates funds initially in electronic form. Yet, oddly enough, a common way of laundering those funds is to first convert them into cash. Describing a sample of malware cases. Custers, Pool and Cornelisse (2019) find "In many cases, criminals prefer to generate profits in cash or to quickly exchange their profits into cash, because using cash is the easiest way to conceal the illegal origin of the profits." (734). This will often involve use of "money mules" whose role is to set up accounts into which the malware profits can be deposited and then immediately cashed out and moved through a succession of similar transactions to other countries.

Kleptocrats in senior positions frequently receive their bribes in the form of transfers to their bank accounts, whether those are in the British Virgin Islands, New York or Jersey. For example, Benson (2020) provides a brief account of how a governor of a Nigerian province had $20 million transferred through a series of off-shore trusts and shell companies in Britain. Sani Abacha, a Nigerian dictator of the 1990s, and a few accomplices had the Central Bank of Nigeria transfer about $1.5 billion to accounts in his name in Jersey (Maton and Daniel, 2012). Cash was not a part of either the generation or the concealment of the proceeds of Abacha's wrongdoing.

1.2 Prior estimates of money laundering from the drug trade

The salience of the drug trade, both as a source of social harm and of criminal earnings, has made it a common subject of study for those interested in money laundering. Putting aside "mythical numbers", figures that are pulled out of the air with no evidence of any systematic foundation (Singer, 1971)[1], the literature contains at least twenty independent efforts to estimate the revenues from drug selling and then the amount laundered; most are national but some are global. They are discussed in section 3. Here we consider only efforts to estimate the money laundering consequences of drug expenditures.

Few studies give any attention to evidence on the share of the revenues that is laundered. F. Schneider (2010) states that he assumes all earnings generated by the drug trade are "by definition" laundered. Recent estimation in the United States by economists attempting to incorporate illegal markets into National Income and Product Accounts have been more nuanced but hardly better informed:

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[1] Such figures often come from prominent officials. Michael Camdessus' (Managing Director of the IMF) famously declared that others estimated money laundering to be equivalent to 2-5% of global GDP; no source for that statement has ever been found (Barone, dell Side and Masciandaro, 2017). More recently the head of the United Nations Office on Drugs and Crime claimed that during the great recession drug money were the only source of liquid capital for European banks, a statement supported by no other source. International Monetary Fund, SPEECH, Address by Michael Camdessus, February 10, 1998, available online at: <http://www.imf.org/external/np/speeches/1998/021098.htm>.

> Historically, the IRS estimated that 9 percent of cocaine and heroin dealers laundered their income (IRS 1983). This paper assumes that the 9 percent laundering rate on cocaine and heroin is fixed over time, and that same laundering rate applies to methamphetamine, miscellaneous drugs and alcohol during Prohibition. The paper also assumes that the 4 percent laundering rate for illegal marijuana dealers given by the IRS (1983) is fixed over time. (Soloveichik, 2019; 17)

There is no reason to believe that the share of drug revenues laundered is constant over time. That share is a function of many parameters both internal to the market (e.g. the share of revenues earned by low level retailers) and broadly economic (the extent of use of cash) which have surely varied over the last 40 years.

There are a few more sophisticated estimates, not necessarily more convincing. For example, Barone et al. (2017) develop a "dynamic model where the business cycle influences the criminal economy via two different channels. On the one side, illegal markets grow at variable rates, depending on the health of the legal economy. Second, a pass-through effect can exist, since the business cycle affects the legal markets which criminal operators use to launder their revenues." For our purposes though Barone et al. start with the assumption that "global money laundering phenomenon, which is mainly due to drug trafficking, at the best of our knowledge." (410). This claim of drug money dominating money laundering is inconsistent with the rest of the literature, which suggests that drug moneys account for no more than 25% of money laundering.

It is fair to say in summary that there has been no serious effort to model the relationship between drug market revenues and the demand for money laundering services in any country or globally.

We also do not attempt to estimate quantitatively the share of drug revenue that is laundered, but we do model the relationships. This provides a computational framework into which empirical estimates of key parameters can be inserted as they become available and some general sense of scale.

The next section addresses these ideas for illegal opioid markets in particular. Section 3 discusses what key parameters need to be estimated, and potential data sources. Section 4 addresses other illegal markets, including those for other drugs and more briefly those for human trafficking prostitution and wildlife smuggling. Section 5 concludes by looking forward, to consider some possible implications of a general move toward a cashless society.

2.0 Framework and Computational Model for an Illegal Opioid Market

This section works through numerical illustrations of the relationship between a drug markets' total retail sales and the resulting amount of money that criminals might wish to launder. The central insights are that: (1) Only a minority – perhaps between one-quarter and one-half – of what drug users spend would even need to be laundered and (2) Key parameters governing that proportion are prices and price markups at each level of the drug distribution chain and the level of everyday cash expenditures by dealers.

2.1 Simple numerical example for a classic heroin market

Consider a simplified model of the British Columbia heroin market before fentanyl became common with 10,000 heavy users[2] buying 0.4 grams per day at $160 per gram[3] from a market with three layers: retail sellers, wholesale dealers, and importers. Sellers at any given market level supply ten customers and mark up the drugs' price by 100%. (That is at the upper end of the typical range, but round numbers make it easier to convey the key concepts, and we explore the implications of lower—60% -- markups at each market level below.)

That implies there are 10,000 / 10 = 1,000 retail sellers who may purchase heroin an ounce at a time once a week for $80 per gram. Likewise, there are 100 wholesale dealers who could buy one-half of a kilo every couple of weeks for $20,000 ($40 per gram). Ten "kingpins" import 10-15 kilograms at a time once a month from foreign suppliers who charge $20,000 per kilogram.[4] Table 1 summarizes these market parameters and the implied net revenue at each market level.

Of the $234 million per year that users spend purchasing the roughly 1.5 MT of heroin they consume each year, 87.5% ($204 M) becomes net revenues to drug dealers within Canada, and 12.5% ($29 M per year) is used to pay for the drugs that are imported. What surprises some is that most of the net revenues ($117M) are retained by retail sellers. That doesn't mean retail sellers are rich; dividing that $117M over the 1,000 retail sellers means that each one has net revenues of $117,000. Furthermore, these figures apply to people who work "full-time" selling drugs. As discussed below, many sellers at the retail level work only "part-time" so their actual cash earnings are even smaller.

In some sense almost all of this money gets laundered; indeed in some countries the mere possession of criminal earnings constitutes money laundering. It is all "dirty" and apart from a modest share seized by police, all gets used somehow. But probably the largest share of the revenue of drug dealers and their associates goes to spending cash on everyday living expenses, such as food, clothes, and rent.

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[2] As discussed further below, this means demand equivalent to what 10,000 heavy users would create, where multiple light users can produce demand equivalent to one heavy user. There are not many estimates in the literature of numbers of heroin users in British Columbia. Modeling studies have made various assumptions about numbers of *injection* drug users. Milloy et al. (2008) work with a figure of 4,700 PWID in Vancouver's DTES; Pinkerton (2011) uses 5,000. Pinkerton (2010) uses 13,500 IDU in greater Vancouver. Irvine et al.'s modeling of British Columbia's opioid overdose epidemic had posterior estimates of 27,000 active PWUD and 13,000 in treatment (Irvine et al. 2019). Bouchard et al. (2020) estimate based on data for 2017-2018 that there were 15,000 – 23,000 people in the province who used or were otherwise exposed to fentanyl, a figure which is consistent with 10,000 "heavy" users in a manner explained below.

[3] Stockwell et al. (2010) interviewed 1,606 recreational and street users in Vancouver and Victoria. The median quantity of heroin used "yesterday" was 0.4 grams, and they paid between $8 and $20 per 0.1 gram "point", but the median amount paid was $20. That suggests that the average amount paid was higher than that range's midpoint of $14, so we make the average price $16 per gram. No purity data are reported in the study.

[4] There are few published studies of the upper levels of drug markets. In particular, it is hard to find any study that includes systematic data on the quantities transacted at different market levels above retail. The US seizure data reported in STRIDE/StarLIMS is of questionable validity because undercover agents have an incentive to persuade a dealer to make larger transactions so that prosecutors can bring more serious charges. For example, Tuttle (2019) shows that changes in federal sentencing of crack dealers led to a notable change in the distribution of quantities associated with indictments; there was a pronounced bunching of quantities just above the new threshold for 10 year rather than 5 year sentences.

Table 1: Stylized Model of a Classic Heroin Market

Loosely Based on the British Columbia Market, circa 2010

	Heavy Users	Retailers	Wholesalers	Importers	Foreign suppliers
Number of Individuals or Organizations at that Level	10,000	1,000	100	10	
Amount bought in each purchase (kgs)	0.0004	0.028	0.5	12.5	
Purchases per year per individual/organization	365	52	29	12	
Amount Bought per Year (kgs)	1460				
Purchase price per gram	$160	$80	$40	$20	
Spending on Drugs, i.e., Market Size ($M)	**$234**				**Total ($M)**
Net Revenue at that Market Level ($M)	**NA**	**$117**	**$58**	**$29**	**$29**
Adjustment for cash purchases by dealers					
Cash spending per org. on necessities & hired help	NA	$100,000	$250,000	$500,000	
Total cash spending at that market level ($M)		$100	$25	$5	
Demand for Money Laundering at that Level ($M)	**NA**	**$17**	**$33**	**$24**	**$29**
% of Money Spent on Drugs that might be Laundered		**7%**	**14%**	**10%**	**12.5%**

	$ Millions	% of User Spending
Total Potential ML Demand ($M)	**$104**	**44%**
Potential "Savings" by Canadian-based Dealers	**$74**	**32%**
Potential "Savings" in Canada Above Retail Level	**$58**	**25%**

The lower portion of Table 1 explains how this could be. Suppose that criminals can spend $100,000 per year in (dirty) cash on living expenses. Although the 1,000 retail dealers collectively earn net revenues of $117 million, if they can each spend $100,000 per year, then they can spend $100M (86%) of the $117M they earn, leaving only $17M that might need to be laundered.

A portion of the net revenues of wholesalers and importers can also be spent on living expenses. There are fewer of them, but they have employees. Suppose that wholesalers work with one or two assistants and importers operate in a crew of five. Then organizations at those levels might spend $250,000 and $500,000 per year in (dirty) cash, respectively. Then those 100 wholesales and 10 importers can spend directly or via paying cash wages about one-third of their net cash revenues ($30M out of $87M).

So perhaps more than half ($130M out of $234M or 56% in this example) of the drug distribution network's gross revenues might be "laundered" just by dealers spending it on living expenses.

Furthermore, for at least four reasons, retailers rarely need to launder as much as this example suggests. First, some retail transactions are barter not cash transactions. For example, drug users may pay for drugs with sexual services or trading stolen goods.[5] The U.S. Office of National Drug Control Policy (ONDCP, 2001) estimated that the amount of drugs acquired in the United States was about one-eighth greater than the amount bought with cash. Thus, the retailers selling $234,000 worth of drugs a year in this example, may have average cash revenue of more like $208,000. After paying their suppliers

[5] See Boyle and Anglin (1993) for an early and poignant account of the trading of sex for drugs. ONDCP (2012) discusses systematic estimation of barter-based purchasing based on data from the Arrestee Drug Abuse Monitoring program.

$117,000 (likely all in cash; wholesalers are less willing to take in-kind payments), their net cash proceeds may be less than $100,000 per year.

Second, this example was effectively worked in terms of "full-time equivalent" individuals, but many low-level dealers work only part-time. Few studies attempt to estimate the total number of individuals who sell relative to the number of full-time equivalents, but it would only have to be six people per five full-time equivalents to let retail sellers spend all of their cash earnings in this example.[6]

Finally, many retail heroin sellers are themselves heavy drug users.[7] There is good economic logic for that because one of the perks of being a retail heroin seller is the ability to purchase one's own drugs at wholesale not retail prices, which in a sense gives heroin users a competitive advantage over non-users when it comes to retail selling (Caulkins and Reuter, 2006). That means many retail heroin sellers can spend more cash on current consumables than can the average person.

Hence, it seems likely that very little of the net revenues retained by retail sellers would need to be laundered in the formal sense of the word. If that is correct, then there remain three buckets of money that are candidates for laundering in the more formal sense.

First, wholesalers may have $33M in net revenues above and beyond living expenses and cash-wages paid, accounting for about one-seventh (14%) of what users spend on drugs. Second, importers similarly have net revenues beyond living expenses and wages of $24M, or 10% of what drug users spend. Third, the $29M (12.5%) owed to foreign drug suppliers would be laundered.

The laundering by wholesale dealers might be relatively simple. In this example, they have net revenues of $584,000 per year each, of which perhaps $250,000 could go for living expenses and employees' wages, leaving $334,000 per year to be disposed of. Inasmuch, as cash deposits of less than $10,000 per day do not have to be reported by banks, regular weekly cash deposits (simple "smurfing") might be all that is required.[8]

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[6] One study of crack sellers in Washington D.C. placed the ratio at three to two (Reuter et al., 1990). That same study found median earnings of street drug sellers in 1988 was roughly $725 per month; adjusting for inflation and the current exchange rate that is equal to less than $C30,000 per annum in 2020. These earnings figures are higher than the earnings reported in other US studies of drug dealers around the same time in the United States (Hagedorn, 1998; Levitt and Venkatesh, 2000).

[7] The literature on drug use and drug selling at the individual level extends over more than 50 years (Preble and Casey, 1969), covers a number of countries (including Canada, United Kingdom and the United States) and is consistent in its findings. For example, Sherman and Latkin (2002) studying a sample of 1288 heroin and methamphetamine users in Baltimore in 1999 found that 44% were in some way involved in drug selling. Two British Columbia studies (Kerr et al, 2008 and Werb et a., 2011) report high levels of drug selling among the drug using cohorts that they have followed for many years. Moyle and Coomber (2015) studying a sample of UK user-dealers, classified them into three groups, ranging from those who are essentially part of the dealer's organization to those who in effect bought on behalf of a group of purchasers who received part of the purchase quantity for his own use.

[8] While there is no systematic data on the laundering techniques of drug dealers, many investigations from Canada, Netherlands, the United States and the United Kingdom show a considerable variety of techniques but few that are sophisticated. The Dutch literature is perhaps the richest and suggests that most drug dealers launder money in quite simple ways such as via purchase of local real estate or transfer of currency to the dealer's home country (Kruisbergen et al, 2019; van Duyne, Soudijn, 2016). For Canada, S. Schneider (2004) analyzed closed money laundering cases from 1993 to 1998, three quarters of which involved drug dealing. Schneider found that

By contrast, the 10 importers would each have almost $3M per year to dispose of, and so may need more professional money laundering services.

In summary, although in some sense all of the money spent on drugs is "dirty":

- The largest share can be laundered just by paying with cash for everyday living expenses, primarily of retail sellers but also by hired help of higher level dealers.
- First-level wholesalers may have to dispose of roughly $330,000 per year in excess cash, quantities that they might be able to place without recourse to highly skilled specialists (e.g., by having a number of associates serve as "smurfs")[9].
- The relatively small number of people at the top of British Columbia's drug distribution networks do earn amounts that require more formal approaches to money laundering, but that may not be much more than one-tenth of what users spend on drugs.
- A comparable amount needs to be paid to foreign suppliers. In some drug markets that is done by smuggling the cash out of the country (cf Soudijn and Reuter (2016), in which case the placement step of laundering happens elsewhere. But inasmuch as these funds are due to foreign creditors, they are prime candidates for laundering through the "Vancouver Model" (German, 2018, 2019).

The numbers in this stylized example are fictional, but they illustrate the types of information one would need to know in order to estimate money laundering demand as a proportion of money users spend on drugs. In particular, it is extremely important to understand how prices increase from one market level to the next. Fortunately, undercover purchases, wire taps, court documents, and interviews with higher-level traffickers are all viable sources of insight into prices along the drug distribution chain, and there is a substantial literature on how best to measure and interpret data on drug prices – a literature to which we have contributed (e.g., Reuter and Kleiman, 1986; Caulkins and Reuter, 1996, 1998; Caulkins et al., 2004; Reuter and Calkins, 2004; Caulkins, 2007).

2.2 Sensitivity analyses for key parameters in the classic heroin market model

One of the key conceptual points made by the example above is that the proportion of money spent on illegal drugs that needs to be laundered depends on drug distributors' ability to spend cash on goods and services that they consume. In short, the more cash that drug distributors can spend, the less they need to launder. This subsection explores that relationship in more detail. In technical jargon, we consider various "sensitivity analyses" elucidating how sensitive are the key outcomes – namely,

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"deposit institutions, the insurance industry, motor vehicles, and real estate are the four most frequent destinations for the proceeds of crime in Canada." Reading the brief descriptions provided by Schneider, the general impression is of unsophisticated schemes, though these data are from twenty five years ago. Seven out of eight cases involved self-laundering, though perhaps as many as 25% also involved use of a professional (p.15). It is of course important to note that investigators are less likely to find assets laundered in more professional ways...assuming professionals know their business.

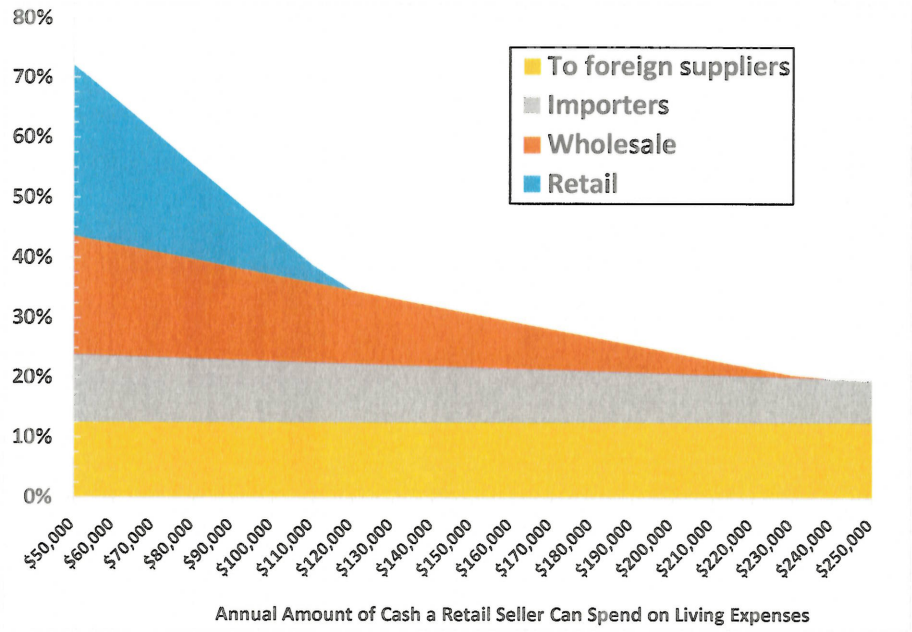
[9] An associate can deposit up to $10,000 within a 24-hour period without having prompting a large cash transaction report (LCTR), and if they are otherwise-law abiding, there may be no reason for suspicious transaction report (STR). However repeated deposits between, say, $7,000 and $9, 500 at risk of attracting attention.]

proportions of drug spending that must be laundered – to assumptions about dealers' abilities to spend cash.

Recall that in the example above, we assumed that retailers (treated as Full Time Equivalents) could spend $100,000 per year in cash, a wholesaler could spend $250,000 (including on wages for his or her small crew of workers), and an importer could spend $500,000 (again including cash wages for staff). In that case, and with other parameters at their base case values (e.g., that prices double when moving from one distribution layer to the next), dealers at those three markets levels had excess cash revenues equal to 7%, 14%, and 10% of what users spend on drugs, and another 12.5% of that amount had to be sent offshore to pay international suppliers; just under half of total expenditures needed laundering.

Figure 1 explores how those proportions change if the amount dealers at each level can spend in cash each year varies, while always maintaining that 1:2.5:5 ratio across market levels. The horizontal axis is labeled as the amounts retail dealers can spend each year in cash. At the far left hand side of the graph, when retailers can only spend $50,000 per year, then wholesalers are assumed to only be able to spend 2.5 times that much (namely, $125,000 per year), and importers can only spend 5 times that much (namely, $250,000 per year). At the far right, where retailers can spend $250,000 per year, then wholesalers are importers are assumed to be able to spend $625,000 and $1.25 million per year, respectively.

Figure 1: Proportion of Money Users Spend on Drugs that Remains as Dirty Cash in the Hands of Various Parties as a Function of the Amount of Cash Criminals Can Spend on Living Expenses



That the blue wedge (corresponding to retailers) starts out so large but tapers away quickly means this: If drug dealers can't spend much cash on the things they consume, then retailers (collectively) will have

the greatest excess cash to deal with, because the escalation of prices at each market level means the most money stays in the lower distribution levels. However, there are so many retail sellers, that if they can each spend more, that spending can quickly provide an outlet for all of the "hot cash" made by retailers. In particular, the blue wedge would disappear completely if retailers could spend $117,000 per year in cash.

At the other extreme, the share of drug users' spending that must be shipped abroad to pay overseas suppliers (the orange layer that is 12.5% in the example above) is not affected at all by domestic dealers' ability or inability to spend cash.

The grey wedge for the high-level domestic dealers who import the drugs is not affected by cash spending abilities much more than is the orange layer for importers. Even when importers can spend $1.25 million in cash per year, that doesn't matter much because there are only 10 of them. So that $12.5 million in spending only takes care of about one-third of the $29 million in net revenues earned by those importers.

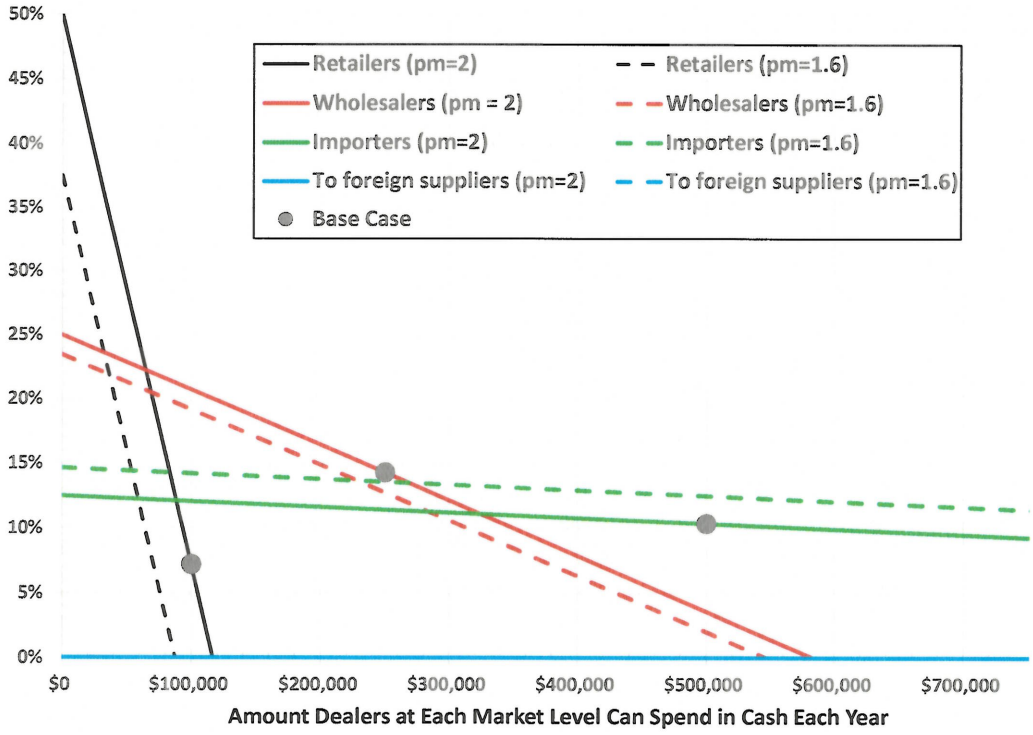
The situation for the red wedge corresponding to first-level wholesale dealers lies somewhere in between the wedges for retailers and importers. Over the range shown in the graph (i.e., $50,000 to $250,000 per retail dealers, which translates to $125,000 to $625,000 per wholesale dealer), the proportion of all spending on drugs which wholesale dealers must launder or otherwise deal with falls from 19.6% to 0%. So wholesale dealers' capacities to spend cash can greatly diminish the demand for money laundering, but it is only at quite large spending rates that they can dispose of all of their net revenues via spending.

In short, the punchline of Figure 1 is that if criminals have trouble spending cash, then most of the demand from money laundering services will come from the large number of lower-level dealers (and staff). However, if it is easy to spend cash, then only the relatively small number of higher-level dealers will make so much money that they need to purchase money laundering services.

All of that discussion maintained the 1 to 2.5 and 5 ratios of cash spending by dealers at the three market levels. Those ratios have no scientific basis. They strike us as being plausible, but to the best of our knowledge there are no serious estimates of those ratios in the scientific literature. So the solid lines in Figure 2 display a similar sensitivity analysis, but in a way that invites the reader to supply independent judgments of cash spending capacities at each market level. It is a complicated figure to read, even leaving aside the dotted lines, which we will describe shortly.

The shares for each market level are depicted in different colors: retail (black), wholesale (red), importer (green), and foreign suppliers (blue). The horizontal axis indicates the amount of cash each "firm" can spend. Firm is in quotes because retailers are mostly sole proprietors. But wholesalers and importers are typically the leaders of small crews of people, and the cash spending of the principal ("owner") of those operations includes cash wages paid to workers.

Figure 2: Proportion of Drug Money that Dealers at Each Market Level Retain as Dirty Cash as a Function of How Much They Can Spend on Living Expenses



The (black) line for retailers slopes down steeply because there are 1,000 retailers. So for every $1,000 in additional spending per "firm", that reduces by $1 million the amount of excess cash that would need to be laundered. The (red) line for wholesalers is the next steepest because there are 100 firms at that market level. The (green) line for importers barely slopes down because there are only 10 importers, and the (blue) line for foreign suppliers is flat because payments to them are not affected by cash spending within BC.

The three dots correspond to the base case assumptions in the previous subsection, namely spending of $100,000, $250,000, and $500,000 per firm at the retail, wholesale, and importer level. With those base case values, all three domestic distribution levels have excess cash that amounts to 7-14% of drug spending.

The steep black line shows that if retailers were able to dispose of $117,000 per year in cash, then they would not need to purchase any formal money laundering services. We intentionally switched the language in that sentence from "spend" to "dispose of"; the latter phrase can encompass ways of depositing cash that do not require employing professional money launderers. For example, if a retail dealer spent $81,000 per year in cash and had a friend who was willing to make a $3,000 cash deposit once a month, that would dispose of the entire $117,000, since $81,000 + 12 * $3,000 adds up to $117,000.

For two reasons we would guess that retail sellers probably do not often need to purchase professional money laundering services. The first is the observation that upward social mobility via retail drug dealing seems to be uncommon; indeed, at least in the U.S. the lore is that when retail drug dealers are arrested they are usually represented in court by public defenders, not private attorneys. If those dealers had squirreled away $500,000, one might expect them to use it to hire more dedicated legal representation.

The second is that the solid lines are calculated with the assumption that drug prices double each time they move one step down the distribution chain. That can happen, and it is convenient for explaining the arithmetic, but in many U.S. drug markets the price increase is actually a bit shy of a true doubling. The dotted lines show the outcomes when prices only increase by 60% from one market level to the next.[10] Naturally if the price increases from one market level to the next are smaller, then less money remains at lower market levels. In particular, if the wholesale to retail price markup is only 60%, then retail sellers only earn revenue net of COGS of $88,000 per year, not $117,000.

There is no sense speculating whether retail sellers do or do not regularly earn more cash than they can readily dispose of. That is an empirical question that can be addressed with ethnographic research, and British Columbia is unusually well-endowed with ethnographers who can investigate such matters. So the contribution here is just to point out that a surprisingly large part of the overall equation governing money laundering demand depends on this question that can be, but to our knowledge has not yet, been studied empirically.

The situation with wholesale dealers is broadly similar, just with somewhat larger numbers. Each wholesale dealer earns about $550,000 net of COGS. (If prices double at each market level (solid red line), it is $584,000; if prices increase by 60% at each market level, then it is $547,500.[11]) Some of that goes to pay employees. Some of it may go to living the high life. Retail dealers may spend most of their cash on food, rent, and perhaps drugs for their own use. It's not so easy to spend $550,000 per year on basic necessities, but as we all know, it's easy enough to spend considerably more if one throws large parties, or buys expensive jewelry and sports cars.[12]

We do not even want to guess at what proportion of wholesaler dealers net revenues are left over after buying necessities, indulging in luxuries, and exploiting available low-tech smurfing possibilities. That is also an empirical question. It is harder to address than the corresponding question for retailers. Wholesale dealers are harder to locate and probably are more heterogeneous in their finances. But that just makes it a harder project; there is no barrier in principle to commissioning studies of wholesale dealers operations and finances. There are a few such studies in the literature (Reuter and Haaga, 1989; Dorn et al., 1992; Adler, 1993; Dorn et al., 2005).

The green lines in Figure 2 for importers are quite flat. Whether importers can spend $500,000 or $1,000,000 per year in cash matters relatively little to their demand for money laundering services,

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[10] That is, retail prices of $160 per gram correspond to wholesalers selling at $100 per gram, importers selling at $63 per gram, and importers buying from foreign sources at $39 per gram ($39,000 per kilogram).

[11] The difference in price multipliers – whether prices double or increase only 60% at each market level – makes a very big difference to how much money stays with retailers. When the multiplier is smaller, less money stays with retailers and more goes to highest levels of the distribution chain. Wholesalers are in between. A smaller multiplier reduces wholesalers' revenues net of COGS, but not by as much as it does for retailers.

[12] Desroches (2005) provides details of the earnings and consumption patterns of 70 Canadian dealers.

because each has revenues net of COGS of about $3 million per year ($2.9 million if prices double at each market level; $3.4 million if they only increase by 60%).

The 10 importers each earn enough that they may need to do something more than just smurfing. They could be prime customers for more sophisticated schemes, such as buying houses with cash, and/or buying them with clean money but sinking $500,000 into renovations whose labor and materials can be paid in cash – activities that are complicated enough to warrant retaining the services of (crooked) lawyers, accountants, and others professionals.

If the 10 importers each had $3 million in net cash revenues and could spend only $500,000 per year on necessities and luxuries, that would leave $25 million per year that needs laundering, or about 11% of the $234 million users spend on heroin each year.

If the green lines for importers are relatively flat, the blue ones for payments to foreign suppliers are completely flat. However, the heights of the two blue lines depend sharply on assumptions about price multipliers, just as they do for retailers, but in the opposite direction. If prices double at each market level, then most of the money remains with retail sellers, and foreign suppliers only receive one dollar in eight that users spend (12.5%). However, if prices only increase by 60% at each market level, then heroin that retails for $160 per gram is imported for just under $40,000 per kilogram, and foreign suppliers' share doubles to just shy of 25%.

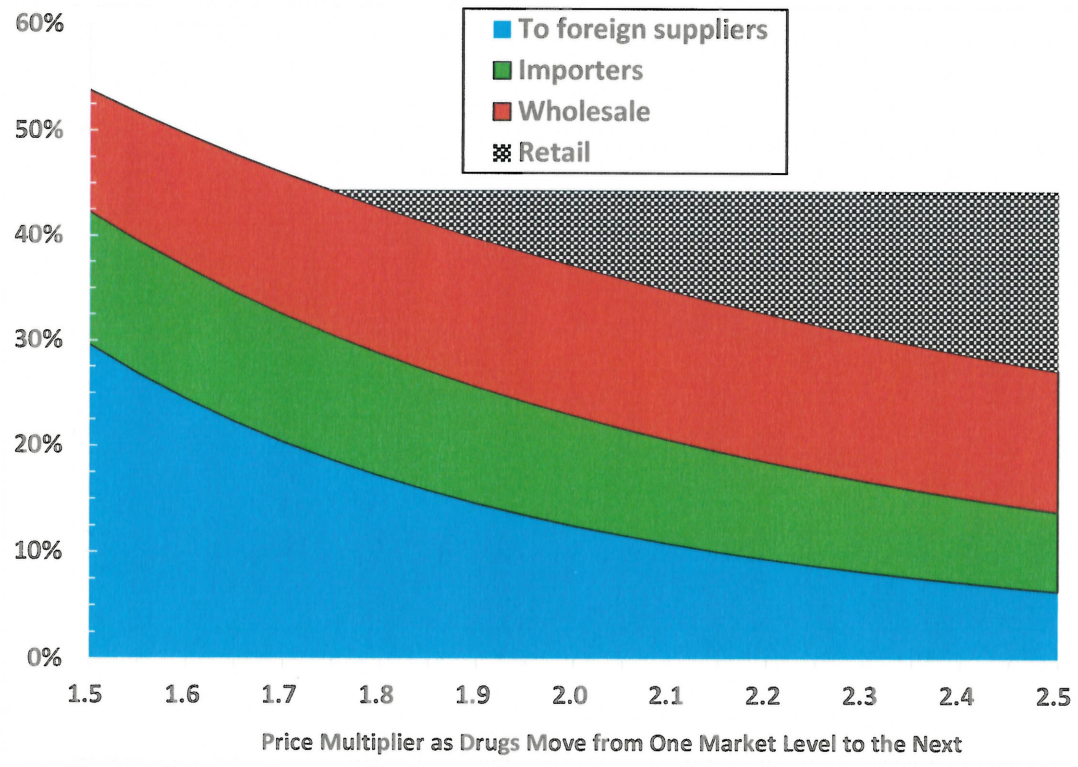
Figure 3 shows how the share of net revenues retained at each market level varies depending on the price multiplier (assuming cash spending per firm of $100,000, $250,000, and $500,000 at each of the three market levels). The shares for high-level domestic dealers vary a bit as the price multiplier increases (up for wholesalers and down for importers), but the big changes are for retailers and foreign suppliers

The money importers have to pay foreign suppliers is a prime candidate for professional money laundering. It is possible, as noted above, to carry backpacks of cash back to the drugs' source countries. Indeed, one of us (Reuter) co-authored a study of exactly that behavior with large amounts of 500 euro bills being physically shipped to cocaine dealers in Colombia (Soudijn and Reuter, 2016). However, the German reports (2018, 2019) identify multiple ways in which cash in British Columbia can be exchanged for deposits into bank accounts in China without requiring the cash to be moved physically. For instance, Chinese gambling "whales" who wanted to move capital out of China were happy to accept big bags of cash outside casinos in exchange for payments from their Chinese bank accounts via informal banking systems. The casinos were happy to let them cash-in with those highly suspicious wads of cash and cash-out a few hours later with a bank cheque from the casino.

If out of the $234 million that users spent on heroin, somewhere in the vicinity of $30 - $60 million needed to be credited to Chinese bank accounts via such laundering, that is probably a relatively small amount compared to the sums that Chinese nationals wanted to move out of China.[13]

[13] Estimates of the total funds leaving China illegally, labeled "illicit financial flows" have a weak conceptual and empirical foundation. Global Financial Integrity is the source of the most cited estimates; see e.g. Kar and Freitas, 2013. The estimates are in the hundreds of billions of dollars. For a critique see Nitsch (2016).

Figure 3: Proportion of Drug Money that Dealers at Each Market Level Retain as Dirty Cash as a Function of How Much Prices Increase from One Market Level to the Next



There is a big difference between $30 million and $60 million, but the good news is that the figure can be pinned down fairly easily. "All" that is needed is a better understanding of what heroin importers in BC pay their foreign suppliers. Snippets of such price quotes may be available when drug enforcement operations tap importers phones, and more could be gathered by questioning convicted traffickers – not (only) for tactical information to make cases against confederates but also general information to inform estimates of demand for money laundering.

More generally, a modest research program to better understand prices at each market level can pay big dividends in terms of improved understanding of how much money is retained at each market level (cf., e.g., Caulkins et al., 2016). That in turn sheds light on how much money might need to be laundered, and how much could be laundered in fairly informal ways (for retailers and wholesalers) vs. more professional ways (sums accruing to higher-level operators).

Here, since we lack such price data, we have described the market in terms of price multipliers that apply at each market level. In reality, there is no reason the multiplier need be the same when moving from import to wholesale level, as when moving from wholesale to retail. So in the long run a more empirical and more straightforward approach would be to routinely monitor prices at the various market levels. That is not an easy thing to do, but high precision is not needed, and in some important respects, monitoring market prices is actually easier than is monitoring demand or quantities consumed (Caulkins and Reuter, 1996; Caulkins, 2007).

2.3 The economic logic determining who needs to launder funds

The previous section used an algebraic model to explore considerations governing how much money needs to be laundered by drug dealers at different market levels. Here we consider the same question but at a conceptual level with a theoretical model of what determines equilibrium prices in drug markets.

That model, known as the "risks and prices" (Reuter and Kleiman, 1986) model of drug prices, rests on a few economic principles.

- Mature drug markets are typically in equilibrium, meaning that prices at each market level are reasonably stable (they do not bounce around wildly from year to year) and moderately uniform (meaning that all dealers at any given market level pay roughly the same amount, at least after adjusting for product quality).
- Those prices are "justified" in the sense that the increments in prices when drugs are moved from one level to the next represents fair compensation for the effort and risks involved in that activity.
- An important part of that justification for big price markups is monetary compensation for non-monetary costs such as the risks of arrest and violence. Another way to say that is that drug dealers enjoy high "accounting profits" (dollar revenues that greatly exceed dollar costs) but their "economic profits" are "normal" (justified); otherwise, other people ("wannabees") would enter the market and bid down prices.

The concept of "free entry" bidding down prices runs contrary to journalistic accounts and casual references to drug "cartels". And indeed, markets for niche drugs may not be competitive in this sense, and importation in particular may be a business that requires specialized skills or contacts, but the remarkable thing about domestic drug distribution is that it really doesn't take much in the way of specialized skills. It basically involves buying a big bag of white powder, repackaging that into smaller bags and selling those smaller bags. Nor does it turn out to be easy to develop the coercive power to deter competitors. So in the "risks and prices" view of the world, there are always people waiting in the wings ready to try their hand at drug dealing if the price markups are high enough to compensate them for the risks.

Not everyone believes in this model of drug markets (e.g. Cunliffe, Decary-Hatu and Aldridge, 2017; Childs, Coomber and Wall, 2020), and like all models (including the algebraic one above), it is a simplification. However it is useful for providing fresh insights on how to think about the origins of the demand for money laundering services.

The risks and prices model recognizes that participants in drug distribution incur three primary kinds of costs: (1) monetary costs, notably the cost of buying the drugs that are resold, (2) the opportunity cost of time spent dealing, and (3) compensation for risks, particularly the risks of arrest, and other government imposed penalties and of violence from other participants. When dealers face monetary costs – such as the need to pay workers – they almost always pay with cash. So that means that net cash revenues are explained, or caused by, compensation for dealers' time and risks.

A simple calculation suggests that compensation for time is the smaller share. In our model above, there were about 1,300 full-time equivalent workers supplying the $234 million in heroin: 1,000 retail

sellers, 100 wholesalers working in crews of 2-3, and 10 importers with crews of five. None of those categories of workers tends to be highly educated or skilled in ways that would command unusually high incomes in the legal labor market. Suppose we generously assumed that they could, on average, make $40,000 per year in legal employment. Then compensation for their time would sum to 1,300 * $40,000 = $52 million out of the $234 million.

As discussed, another $30 to $60 million is sent abroad to pay for the imported drugs. Other monetary costs incurred by dealers tend to be quite small (Caulkins et al., 1999; Babor et al., 2018). Guns can be expensive, but they are durable goods. Packaging, diluents and adulterants are quite cheap compared to the drugs themselves. And so on.

That means that according to the risks and prices model, the majority of the excess cash that dealers receive, above and beyond what goes to cover their normal business expenses and labor, represents compensation for risks.

This is a very useful perspective for both explaining why so much of the money remains at retail levels, and for prompting thinking about ways of changing the demand for money laundering services. Consider the risk of violence for retailers and importers. Importing drugs is a risky business. People are sometimes killed and their drugs are often stolen. But in many respects, the life of a drug kingpin who arranges electronically for one large drug delivery every week or month, with the actual transfer handled by couriers, may involve less risk than is suffered by a retail seller who meets daily – or even multiple times per day – with dependent drug users who may be desperate for drugs and short of cash. And there is a certain honor among (high-level drug trafficking) thieves. Rip-offs occur, of course, but there is plenty of money to be made to keep both parties to a high-level transaction happy, and often the maintenance of good business relations with a valued connection is more important than the one-time windfall that could come from ripping them off (Bouchard, Soudijn and Reuter, 2020). By contrast, rip-offs are common in lower levels of the drug market, e.g., when drug-dependent retailers use drugs they have been fronted by their wholesale supplier. In that situation, the supplier is left in the awkward situation of "needing" to exercise some violence in order to preserve "cred" and avoiding becoming a "target" for swindles by other customers[14]. And even if the wholesaler has the upper hand, enforcing sanctions for "contract violations" via street justice is more dangerous than pursuing business claims in civil courts. That is, risky, violent interactions are commonplace at lower market levels.

Even if one believes that the death risk per year is higher for an individual importer than it is for a single retailer, it is important to remember that there may be nearly 100 times more retail sellers than importers (in our simple model, 1,000 vs. 10). Almost certainly the aggregate risk of violence summing across all 1,000 retailers is quite a bit greater than the aggregate summing across the 10 importers, even if the (wealthier) importers demand greater compensation per unit of risk.

Likewise, even though the risk of arrest and incarceration may be higher for drug importers than for retailers, it is surely not 100 times greater. In prisons in the U.S. and many other countries, one finds

[14] Scott Jacques and Richard Wright have published a number of studies of how street dealers in a US city handle disputes, typically around cheating. Many are resolved without violence; see e.g. Jacques and Wright (2011) and Jacques, Allen and Wright (2014).

more low-level dealers than kingpins, even though enforcement targets higher-level dealers, just because there are so many more lower-level dealers, and they are easier to catch and convict.

So thinking of excess cash as risk compensation explains why the previous section concluded that so much remains at lower market levels. It also explains why most of that cash retained at lower market levels does not require professional money laundering services. Namely, each of the thousands of low-level dealers or hired guns of high-level dealers tends to have few lucrative alternatives in legal employment and few specialized skills. So their "wages" get bid down by competition from "wannabes"; so even if their risks are high, the market clearing amount of cash compensation for incurring those risks is not large enough to produce cash compensation that requires professional money laundering services.

Rather it is the smaller number of wealthier high-level dealers with specialized access to international suppliers who can demand levels of individual compensation that create a need for formal money laundering, but the total sums accruing at those market levels are limited because the aggregate amount of risk is not as great as it is at lower market levels.

2.4 The effect of pharmaceutical opioid diversion on demand for money laundering

Opioid markets in North America were more or less stable from around 1980 through the turn of the last century. Stability is a relative thing. The heroin source zones for the United States changed over time from Southeast Asia to Southwest Asia to Mexico. And there were brief periods of relative scarcity amidst a long-term trend toward lower prices and greater use. But there was stability in the sense that heroin was the dominant opioid being sold illegally, and that heroin was imported from foreign lands and distributed through supply chains that resembled the stylized model introduced above.

Two important changes since then affect the how much spending on black market opioids needs to be laundered. This subsection addresses the widespread diversion of prescription opioids. The next section discusses the arrival of illegally produced synthetic opioids, most notably fentanyls.

For most of the 20th century, doctors around the world thought that opioids were too dangerous to let patients take them on an ongoing basis without supervision. Opioids were largely restricted to treating acute pain, use within a healthcare facility (e.g., in anesthesiology), and for those with terminal diseases or other very serious illnesses, notably cancer.

Canada (and to an even greater extent the United States) broke from that consensus in the late 1990s. Prescribing of opioids rose markedly, including for chronic use at home, which carries a high risk of dependency. That launched many people into an extended period of escalating doses, tolerance, and dependence.

The expansion of opioid prescribing was accompanied by reassurance that very few people who take PO become dependent. That statement may be true overall, because most people only take PO for *acute* pain, and they are at low risk of progressing to OUD, but the statement turned out not to be true for those taking PO for *chronic* pain.

This is illustrated by Edlund et al.'s (2014) study using claims data for 568,640 people with a new diagnosis of chronic, non-cancer pain who had no opioid use or OUD in the previous six months. Going from no opioids to "acute" supply – defined as prescriptions for 90 or fewer days – tripled the risk of developing OUD regardless of dose, but the corresponding odds ratios for chronic use were 15, 29, or 122 times baseline depending whether the daily dose was low, medium, or high, respectively. In raw, unadjusted terms, 6.1% of those prescribed high doses for more than 90 days developed OUD.

Over time, some who abuse PO turn to the black market, first buying pills from others who might have obtained them in various ways, including "doctor shopping" or diversion by healthcare workers (Cummings et al., 2011). That in itself likely creates next to no additional demand for money laundering because there are almost no high-level drug dealers involved in PO diversion. Those obtaining the pills are like retailers, with net revenues low enough to dispose of informally. And they are buying from legitimate pharmacies, not criminal organizations.

There are occasional examples of organized crime stealing large quantities of PO, e.g., by hijacking a delivery truck, but that is uncommon, at least in the U.S. Before recent reductions, on the order of 15 *billion* dosage units of PO were disbursed each year in the U.S., yet at that time in the entire country only 9.1 *million* dosage units were lost to diversion from the supply chain (e.g., from robberies of pharmacies) and another 1.9 *million* dosage units were "lost in transit" (NASEM, 2017).

However, over time, some proportion of people who develop OUD on PO "trade down" to black market opioids that are cheaper than pharmaceutical pills per morphine equivalent dose (Cicero et al., 2014; Mars et al., 2014). Trading down's impact on heroin demand can be large (Cicero and Kuehn, 2014). That impact is sometimes under-appreciated because by the time people die of a heroin (or fentanyl) overdose, they may no longer be taking (the more expensive) PO. Yet in the U.S., at one time as many as 80% of those initiating heroin reported having previously abused prescription pain killers, and perhaps one-third were already dependent on them when they first tried heroin (Peavy et al., 2012; Muhuri et al., 2013). Smolina et al. (2019) argue that PO-mediated pathways drive less of the opioid problem in British Columbia, since only about half of OD decedents had filled a prescription for opioid pain relievers within the five years before their overdose death, and even fewer (14% of men and 20% of women) had used opioids chronically for pain within the last five years.

Hence, the expansion of PO abuse and dependence probably has very little direct effect on demand for money laundering, and although its indirect effect via increasing demand for black market opioids may be large, that is subsumed within black-market opioid market models such as the one above, and so probably does not merit substantial separate consideration.

2.5 The effect of fentanyl and other synthetic opioids

The latest chapter in the opioid epidemic has been the arrival of illegally-produced fentanyl as an adulterant of street heroin, and also of counterfeit pills (DEA, 2016) and other drugs, including cocaine (Ciccarone, 2015; Klar et al., 2016). Fentanyls' spread has been primarily confined to North America and even here has been uneven, as of 2019 affecting primarily western Canada and eastern United States (Pardo, 2019; Zoorob, 2019), with increases in fentanyl-related deaths in British Columbia dating to 2014 (Jafari et al., 2015). In certain jurisdictions, including British Columbia, fentanyl moved beyond a heroin

adulterant to all but replace heroin in illegal opioid markets (Tupper et al., 2018). The transition appears to have been quite rapid in Vancouver (Jones et al., 2018), and fentanyl use is increasingly intentional or "known use", as opposed to fentanyl being a disguised adulterant within heroin (Karamouzian et al., 2020).

The spread of illegal fentanyl could plausibly have at least three distinct effects on the demand for money laundering, which we discuss in increasing order of importance.

The least important effect on money laundering comes from the most important effect on public health. Where illegally-produced fentanyls' penetrate opioid markets, deaths rates soar (Pardo et al., 2019), including in British Columbia (Baldwin et al., 2018). This appears to be primarily because of an increase in the death risk per person-year of opioid use, not because of an increase in numbers of people using frequently. Even before fentanyl, people struggling with opioid use disorder had abnormally high death rates, perhaps 10 times what would be expected after adjusting for age and gender. With fentanyl, those death rates can easily double or triple to the point that over time deaths erode the population base of high-frequency users. Eventually that reduction in the user population would depress overall market sales and, hence, demand for money laundering services.

Counteracting that is the tendency for people to use fentanyl more times per day than in the past, when the black market opioids were heroin. Recent U.S. studies find that fentanyl is associated for most users with a more intense but shorter lasting high (Ciccarone, Ondocsin and Mars, 2017). In the short-run, that results in an increase in the demand for illegal opioids, measured in Morphine Equivalent Doses. In the long-run, it is not clear whether the combination of these first two effects produces a net increase or decrease in demand for black market opioids.

The most important potential effect of black market fentanyl stems from the fact that fentanyl is much, much cheaper per morphine equivalent dose at the wholesale level, apparently at least 90% if not even 99% cheaper (Pardo et al., 2019).

At this point it is entirely unclear how this radical change in costs upstream in the distribution system will affect prices further down the distribution chain. It is a special case of a general phenomenon which has been of considerable interest for over 30 years, but remains unresolved, even with regard to cocaine whose price chains are more widely studied (cf., Caulkins and Reuter, 2010).

In brief, a "multiplicative" model of price transmission would suggest such a sharp decline in prices in high-level markets will eventually translate into proportional reductions at lower market levels, effectively shrinking the entire pie of drug spending that produces demand for money laundering services.

The alternative view is that the new equilibrium will involve declines that are the same, in dollars per morphine equivalent dose, at all market levels. Under that theory, a 90% decline in import prices would translate to a roughly 10% decline in retail prices, since retail prices are 8 times import prices, if prices double at each market level.

Table 2 illustrates how this might possibly affect revenues net of the COGS if firms at the three market levels can spend $100,000, $250,000, and $500,000 in cash per year, and for the two scenarios of prices

doubling across each market level (first four rows) and increasing by 60% at each market level (last four rows).

For each scenario, the amounts users spend on illegal opioids and the proportions of that spending that accrue net of cash spending to each group of market participants is given: (1) in the base case, before fentanyl arrives, (2) immediately after import prices decline by 90% but before those effects have been transmitted to lower market levels, and after that transmission according to both the (3) additive and (4) multiplicative models.

Table 2: Exploration of Some Possible Effects of a Fentanyl-Induced 90% Decline in the Import Price of Illegal Opioids

	Market Value ($M)	Retail	Wholesale	Importers	To foreign suppliers	Total Potential ML ($M)
Price multiplier = 2.0						
Base case	$234	7.2%	14.3%	10.4%	12.5%	$104
Immediately after import prices fall	$234	7.2%	14.3%	21.6%	1.3%	$104
Additive model price decline	$207	8.1%	16.1%	11.7%	1.4%	$77
Multiplicative model price decline	$23	0.0%	0.0%	0.0%	12.5%	$3
Price multiplier = 1.6						
Base case	$234	0.0%	12.7%	12.5%	24.4%	$116
Immediately after import prices fall	$234	0.0%	12.7%	34.5%	2.4%	$116
Additive model price decline	$182	0.0%	14.3%	14.1%	3.1%	$58
Multiplicative model price decline	$23	0.0%	0.0%	0.0%	24.4%	$6

The immediate effect of a collapse in import prices is that importers enjoy a windfall since they send a much smaller share of their revenues abroad to pay international suppliers (contrast between lines 1 and 2 under each scenario).

After the import price decline gets passed down through the distribution chain, according to an additive model all other proportions return close to base case levels. Indeed, according to the additive model the *amounts* laundered by each of the three distribution layers within Canada are exactly the same; the proportions rise slightly just because when retail prices fall, for a fixed quantity sold, total spending on drugs declines by 11% (from $234M to $207M).

So under the additive model, fentanyl – or anything else – that dramatically drives down import prices greatly reduces the need to launder cash in ways that facilitate paying foreign suppliers, but otherwise the effects are modest.

If the multiplicative model truly held, by contrast, then all prices up and down the supply chain would fall by 90%, and dealers at all levels would make so much less money that they could spend all their net revenues as cash, and no one within Canada would need to purchase money laundering services. The

foreign suppliers would once again command 12 – 25% of what users spend on drugs, but that would be 12 – 25% of a much, much smaller total market.[15]

Drug price data are weak, and the arrival of fentanyl poses special challenges for market monitoring, but there is as of yet no indication of price collapses of the sort predicted by the multiplicative model.

So although all of the numbers in Table 2 are totally speculative, they do suggest a tentative conclusion that a principal effect of fentanyl and other cheap but powerful synthetic opioids in the short- to medium-term is to reduce the amount of drug money that must be laundered in preparation for its being sent overseas.

3.0 Identification of Key Parameters and Ways They Might Be Estimated

The previous section described models for estimating the demand for laundering of money criminals earn from supplying drugs. The next subsection describes four key types of information those models need. Subsequent subsections describe options for gathering that information.

3.1 Types of information needed

#1: Estimates of the total dollar value of the drug market

The model above estimated the proportion of money spent on drugs that needs to be laundered, but the starting point is the total drug spending which is multiplied by that proportion. Estimating the total value of a drug market is a difficult but well-studied problem. The U.S. Office of National Drug Control Policy has commissioned a series of studies along those lines (Kilmer et al., 2014; Midgette et al., 2019), and Kilmer and Pacula (1998) describe the two main approaches: supply-side and demand-side estimates. For British Columbia, demand side estimates are probably more feasible. Traditionally they multiply estimates of the numbers of users by estimates of spending per user per year, as Bouchard et al. (2020) did in recent work for this Commission. That approach is feasible because Vancouver in particular, and British Columbia in general, has an excellent community of scholars who study problem drug users.[16] Ethnographers who study heavy drug users can also help estimate spending. In recent years there have also been efforts to convert measurement of drug metabolites in wastewater into population-level estimates of quantities consumed. See Zuccato et al. (2008) for an early example. Efforts are now widespread outside of North America. Australia's Criminal Intelligence Commission has commissioned widespread wastewater monitoring covering more than half of the country's population; see O'Brien et al., 2019 for a description.

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[15] If the decline in retail prices led to greater consumption, that would not affect proportions laundered if the market expansion were accommodated by increases in the numbers of dealers at all levels, but could if dealers at each level began to sell more and so make more.

[16] Heavy users dominate demand; there may be more light than heavy users, but heavy users consume so much more per capita that they tend to dominate consumption.

#2: Prices at various market levels

The price markups along the drug distribution chain determine what proportion of the money users spend buying drugs end up in the hands of dealers at various market levels. For example, if retail dealers buy drugs from wholesalers at $60 per gram and then sell them to users at a retail price of $100 per gram, then $40 of every $100 dollars users spend stays at the retail market level. And if those wholesale dealers paid importers $35 per gram, then $60 - $35 = $25 of every $100 users spend remains at the wholesale dealers' market level. And so on. There is also a large literature on estimating drug market prices (see, e.g., Caulkins, 2007), as well as various estimates published by enforcement agencies (e.g., WSIN, 2018).

#3: Cash spending by dealers

Dealers only have to launder what they do not spend. Understanding their spending patterns generally requires interviewing them, whether through ethnographic studies of retail sellers (e.g., Mieczkowski, 1992), interviews with incarcerated dealers (e.g., Caulkins et al., 2009a; Marsh et al., 2012; Tzvetkova et al., 2016), or in the course of investigation or exploitation of court documents (e.g., Bright et al., 2012). Often the main business cost besides purchasing drugs is paying employees; other supplies (diluents, adulterants, packaging material, guns, etc.) usually account for a small share of revenues (Caulkins et al., 1999). The biggest gap in the literature for present purposes is estimates of how much dealers spend on their non-business costs.

#4 Branching factors and other data on drug dealing "cycles"

Once one knows total revenue net of COGS at a market level and the cash spending per dealer or organization, the last puzzle piece is estimating the number of dealers or organizations that are active at each market level. That is governed by the drug distribution network's "branching factor", meaning how many people at the next level down are supplied by one person at the current market level (Caulkins, 1997). The example in the previous section assumed a 10:1 branching factor at each level, so to supply the 10,000 users, there were 1,000 retailers, 100 wholesalers, and 10 importers. Branching factors need not be the same at each level; nor are the market levels always so neatly defined. But interviewing drug dealers about their drug dealing "cycles" can provide the information necessary to roughly estimate how many operate at each market level (c.f., Caulkins et al., 2009b).

We turn next to a discussion of the sources of data that can shed light on these quantities.

3.2 Harnessing undercover purchases and forensic laboratory data

Drug users can provide some information on retail prices, and they are surveyed in various ways (e.g., Stockwell et al., 2010). Some household surveys ask about prices, as the US NSDUH has for cannabis (e.g., Davenport and Caulkins, 2016), but online convenience samples such as the Global Drug Survey are more common (e.g., Barratt et al., 2017). Users also voluntarily report prices to web sites such as the Price of Weed (e.g., Ouellet et al., 2017). The greatest limitations to user surveys are selective non-response (the heaviest users may be hard to interview) and ignorance of quantities obtained. That is, the user might know they spent $50 on their last purchase but have a highly imprecise estimate of how many grams they obtained. The Dutch Drugs Information Monitoring System (DIMS) overcomes that by

inviting users to bring purchased samples in for laboratory testing (van der Gouwe et al., 2017). That data collection requires specific legal agreements exempting both the provider and recipient of the sample from prosecution for possession of a prohibited drug.

One challenge when estimating retail prices is "conventional pricing" in retail markets, so the standard retail unit always costs the same number of dollars. For example a "dime bag" of heroin in New York always costs $10, and a "point" of heroin in British Columbia traditionally cost $20. In such markets, price changes manifest through changes in the purity or sometimes the weight of the material in the bag, not the bag's sticker price. In those cases, retail prices can be monitored by dividing the standard retail unit price by an estimate of the pure quantity of drugs in a bag that is obtained from forensic laboratory analysis of seizures (Caulks et al., 2010; Scott et al., 2015).

For higher market levels, a primary source of price information is law enforcement agencies. Official reports often cite broad ranges of prices, but individual transaction data can be obtained from undercover purchases made by law enforcement agents, or their confidential informants. Perhaps the best-known example within the research community is the Drug Enforcement Administration's STAR-LIMS data (formerly known as STRIDE). For example, Ciccarone et al. (2019) used STRIDE data to estimate that for every $100 increase in the price per gram for heroin, there was a 3% decrease in the rate of heroin-related skin and soft tissue infections seen in nationwide inpatient data. That relationship is consistent with the common presumption that higher prices suppress use, at least to a degree; for example, Ouellet et al. (2017) estimate that the elasticity of demand for cannabis products in Canada is roughly -0.5, indicating that a 10% increase in price would lead to a 5% reduction in use.

The typical finding is that import prices – meaning the price that the highest-level dealers within a final market country pay to their foreign suppliers – are a very small fraction of the retail price (e.g., Kilmer and Reuter, 2009). That is, most of the price markup happens within the final market country.

3.3 Ethnographic studies of retail drug sellers

It should be entirely feasible to gather whatever information is needed about retail sellers.

As alluded to above, there is a long and storied history of academic scholars doing ethnographic studies of lower-level drug dealers. Preble and Casey (1969) were pioneers in this work, studying heroin dealers in New York City, but it is now done for various drugs and markets around the world. Indeed, Vancouver hosts some of the most active ethnographic work on retail drug markets (e.g., Small et al., 2006). Often the focus is on drug users, not sellers, but those populations are not distinct, and the same researchers who study drug users can also study retail drug sellers, as was done for crack sellers in New York in the 1980s and 1990s. Bruce Johnson and Eloise Dunlap have written about how that can be done based on their experiences (Dunlap and Johnson, 1998).

We have some experience working with ethnographers and their data on retail sellers, e.g., converting interview transcripts into estimates of operational practices and costs for retail selling (e.g., Caulkins et al., 1999). One primary observation/suggestion is that sometimes ethnographers need to be prompted to gather information on prices, costs, and business operations. Those variables are often not the ones of the greatest interest to ethnographers; but there is no reason why such questions/topics cannot be investigated in that way.

Not only are there methods and traditions for studying retail sellers, the amount of information needed, and level of detail, is likely modest. As alluded to above, our expectation is that relatively few retail sellers are large purchasers of professional money laundering services.

3.4 Ethnographic studies and interviews with higher-level traffickers

Gathering information on wholesalers and other higher-level dealers is both harder and more important for present purposes than is gathering information about retail sellers.

There is some tradition of academic studies of wholesale dealers, but it is much thinner. Examples include Reuter and Haaga (1989), Dorn et al. (1992), Adler (1993), and Dorn et al. (2005). Desroches (2005) collected such data in Canada. Higher-level dealers are harder to locate, more reticent about sharing information, and more diverse in their business practices than are retail sellers. We would guess that if British Columbia commissioned ethnographic or other research on high-level dealers in the province, much would be learned, but it would be a slow, expensive, and selective process; worthwhile, but likely not sufficient. The British Home Office study (Matrix, 2007) provided interesting information but also points to the limits of trying to do this kind of research on a large scale.

Whereas academics encounter higher-level dealers infrequently, drug law enforcement routinely pursues such individuals and gathers information about them and their business practices. The problem, from a research perspective, is that law enforcement generally focuses on information needed to prosecute, which can be different than information needed to understand market patterns. For example, if a drug trafficker said on a wiretap "I hear that the import price of drugs has gone up quite a bit since last year", that nugget could be useful for adjusting estimates of money laundering demand but not for convicting that individual; consequently such statements may not be recorded or analyzed systematically. Fuentes (1999) a police officer (later head of the New Jersey State Police) provided an exceptionally rich description of cocaine trafficking by interviewing convicted high level dealers for his PhD dissertation.

Likewise, while it is routine for prosecutors to offer reduced sentences in exchange for suspects offering information that can be used to prosecute others, it is rare for the criminal justice system to offer similar incentives in exchange for strategic information about market patterns or trends.

We would guess that if law enforcement could be convinced to employ "market analysts" to sift through their law enforcement confidential information to assemble market reports, quite a bit could be learned about money laundering. The trick is preserving a strategic focus when there can be pressure within a law enforcement agency to deliver tactical and operational intelligence.[17] It can also be difficult to convince law enforcement to share what they know.

The U.S. Drug Enforcement Administration has access to a wealth of information about higher-level traffickers and markets, and it does regularly publish "situation reports" and "threat assessments", but

[17] A vignette serves to illustrate. When one of us (Caulkins) was a graduate student working with police, the officers he was shadowing obtained access to an apartment overlooking one of the city's larger open air drug markets. The officers could use that apartment to watch all of the comings and goings in the market, unobserved. However, they were only able to sit and watch for 15 minutes before charging downstairs and making an arrest, and in the process alerting everyone below about their hide.

these reports have limitations that reflect the agency's culture as an operational not an intelligence agency. For example, price ranges may be defined by the min and max prices observed, without indicating a central tendency or insulating against the effect of outliers. Isolated cases may be discussed as if they were exemplars without consideration of sample selection effects. And so on.

In the early 1990s the U.S. tried to complement those efforts with an independent National Drug Intelligence Center (NDIC) whose mission was to focus on strategic analysis, but it was closed in 2012 and its functions transferred to the DEA.

There has also been only rather limited cooperation between the DEA and independent researchers. Good use has been made of DEA's STRIDE/STAR-LIMS data when those data have been shared, but sharing is limited.

Some researchers have made use of public court documents that are produced through the prosecution of high-level traffickers (e.g., Bright et al., 2012). Others have interviewed incarcerated traffickers (Marsh et al., 2012; Tzvetkova et al., 2016). But these efforts are limited, and absent some coordination or direction, would be unlikely to focus on BC or money laundering.

In short, law enforcement likely has relevant raw information – albeit not in easy to use form – but may or may not have the capability or the interest in weaving those snippets into cohesive descriptions of the higher-level markets as systems. And it is unclear at least to us, how best to bring together those data with the people with the skills, interest, and incentives to produce strategic market analysis.

4.0 Modification or Adaptation to Other Illegal Markets

Section 2 used a stylized market model to illustrate how one might estimate what proportion of the money drug users spend on illegal opioids needs to be laundered. Other illegal markets also generate demand for money laundering. Each merits its own study. We do not attempt that here, but instead offer a few comments about how such efforts might or might not differ from Section 2's opioids model.

The subsections are roughly arrayed in increasing order of difference from opioids and in decreasing order of our expertise. So particularly in the later sections, what we write should be understood to be a sincere effort to be helpful, but the statements are not made with the same confidence as those above. In particular, we presume there are others who are more knowledgeable about the financial flows in wildlife trafficking markets.

4.1 Cocaine and other traditional "expensive" drug markets

To a first approximation, the markets and distribution networks for cocaine (including crack) and methamphetamine operate similarly to traditional heroin markets. That may seem surprising because stimulants are very different drugs chemically and in terms of their effects on the user, but the business model and imperatives have a lot in common for all three of the "expensive" mass market drugs.

The structure and conduct of the distribution systems are shaped by several common factors, including very high values per unit weight ($160 CAD per gram is roughly twice as expensive per gram as gold) and

severe sanctions for distribution. That enforcement risk favors distribution through networks of more or less independent "cells" that have relatively small numbers of customers, and so require multiple layers to connect the small number of importers to the large number of users.

Cocaine, like heroin, is derived from a plant (coca bushes rather than opium poppies) that is grown overseas, meaning that money must flow out of Canada in some manner to pay those international suppliers.

Methamphetamine is a synthetic drug that can be produced anywhere. Much is produced in Mexico, creating a distribution network very much like those for cocaine or heroin, but some is produced within Canada, in which case the producers' revenues net of raw materials costs would likely remain in Canada.

At least in the United States, crack does not have a separate distribution network. Rather, it is produced from powder cocaine mostly at relatively low market levels. Also, even though it is often sold in smaller unit sizes, making it appear cheaper, it has traditionally sold in the United States for about the same price gram as powder cocaine, after adjusting for differences in purity.

There may be some relevant differences in retail distribution. For example, the cocaine that is consumed as a "party drug" by weekend-only users may be purchased from retailers who are social connections, and so unlikely to accumulate sufficient revenues to require laundering. On the other hand, U.S. "crack houses" are retail selling operations with substantially greater sales volume than independent dealers (Caulkins et al., 1999), so the house boss might accumulate enough cash to require laundering.

Likewise, outlaw motorcycle gangs sometimes play an important role in retail meth distribution, and it is not clear whether they might amass revenues the way some crack houses do.

On the whole, however, the distribution networks for cocaine and methamphetamine have a considerable amount in common with classic heroin distribution networks.

4.2 (Illegal) cannabis market

Cannabis distribution networks differed from those of the expensive drugs even before legalization, by being flatter (larger branching factor, fewer layers), having more of the retail selling between friends rather than an arm's length supplier relationship (Caulkins and Pacula, 2006), and – perhaps especially in British Columba – having more domestic production. Indeed, up through at least 2000, when production in the United States was limited and Mexican imports were of lower quality ("commercial grade"), cannabis exported from British Columbia ("BC Bud") occupied an important niche in U.S. cannabis markets. So there would have been substantial value (whether in US or Canadian dollars) accruing to BC-based criminals from exports to US markets.[18]

Cannabis markets have become even more different with the quasi-legalization and then legalization of first medical and since October of 2018 also adult-use cannabis. In the first year of legalization, the black market continued to supply most of the cannabis, particularly in Ontario (where there were few retail stores) and British Columbia (where there is so much illegal production). Furthermore, legalization

[18] In the Western States Information Network price and purity reports, there are entries for "BC Bud" up through at least the 2012 report.

can increase use; the rise is larger for the intensity of use than for its prevalence. So even if the illegal market loses market share, if that smaller share is of a larger market, its total sales quantity may not decline as much. On the other hand, legalization has been triggering sharp declines in prices after the first year or two (Smart et al., 2017), which can suppress sales revenue for illegal distributors and, hence, potential demand for money laundering. And the expectation is that over time the legal market will drive out the illegal market. Within a few years of commercial stores opening, licensed sales accounted for perhaps two-thirds of cannabis sales to Washington State residents (Caulkins et al., 2019).

All of this is to say that cannabis is a special case, and it merits its own analysis, rather than presuming that a minor adjustment to the heroin market model with revised parameter values would be sufficient.

4.3 Drug markets in other provinces

Not all of the drug money laundered in British Columbia necessarily comes from purchases by users within the province. Money can move within a country, so it is possible that money made by drug dealers in British Columbia might be laundered in another province, and seems likely that money earned from sales elsewhere does get laundered within BC. For example, German (2018) states that many large-scale drug trafficking organizations, including Mexican DTOs, are believed to have transferred money through Vancouver, even if they are not Vancouver based operations. In particular, German (2019, pp.41-42) states that the Sinaloa cartel based its operations for all of Canada in Vancouver. He also says that more generally "illicit money flows into Vancouver from China, Iran, Mexico and other countries, coalescing with the proceeds of domestic drug traffickers and other crimes."

It would not be surprising if Vancouver provided money laundering services to other parts of Canada. It is one of Canada's four major financial hubs, and it has particular strengths in foreign trade settlement and foreign direct investment (The Conference Board of Canada, 2016). As German et al. (2018, 2019) point out, its casino and real estate sectors have distinctive features that facilitate laundering. Put differently, British Columbia may have – or have had – a competitive advantage relative to other provinces in providing money laundering services. If so, then it might be natural if it was able to "sell" those services to "customers" (criminals) who operate elsewhere.

It is unclear to us how economical it is to ship cash across Canada, but two arithmetic exercises illustrate ways one might think about it. Both recognize that Canadian bank notes weigh just a little less than 1 gram, and the prototypical dirty cash denomination is $20.

FedEx will ship a 1 kilogram package (so 1,000 1-gram notes worth $20,000) across the country for less than $100. That is less than $0.10 per $20 bill, or 0.5% of its value. Since money launderers often charge fees on the order of 5% of the value of what is laundered, a Vancouver-based service that charged 4% might steal business from a Montreal-based service that charged 5%, if the physical transport could be accomplished by FedEx'ing 1 kilogram parcels across the country.

But shipping cash is risky, and potentially illegal, and we have data on the cost of risky shipping of illegal drugs. Note that since a $20 bill weighs about 1 gram, it has a value to weight ratio of $20 per gram. That is within a factor of two of the value to weight ratio of illegal cannabis, for which the cost of illegal transport in the U.S. was about $400 USD per pound per 1,000 miles, before legalization (Caulkins and Bond, 2012). It is about 2,200 miles from Montreal to Vancouver, so by analogy one might guess that

the charge to transport $20 notes that distance could be about 2.2 * $400 * (4/3) / 453.6 grams per pound = $2.50 CAD per $20 note. That is almost one eighth of its value, an exorbitant cost if local launderers in Montreal would only charge 5%.[19]

So whether BC launders much criminal cash generated in eastern Canada might depend on whether the cost to move cash across the country looks more like the cost of shipping everyday items, or whether it looks more like the cost of transporting illegal cannabis around the U.S. during prohibition.

4.4 Prostitution and human trafficking

We are not experts on prostitution and human trafficking, but an initial analysis suggests that its structure of money flows is entirely different than that for heroin or other expensive drugs. Market data on human trafficking are extremely scarce. Here we draw our parameter estimates from Kara's (2011) description of street prostitution of trafficked individuals in the U.S. We would have greater confidence in the analysis below if newer, independent, and more representative data were available.

If, as Kara suggests, a sex worker averages 10 acts per day at $30 per act, then a pimp or brothel with 8 sex workers has monthly revenue of $48,000 (assuming 20 work days per month), against which Kara estimates operating expenses of $22,000 per month, leaving net revenues of $26,000 per month or $312,000 per year. That is, Kara assumes that the pimp is able to appropriate the majority of the sex workers' revenue. So a pimp who can steal or otherwise appropriate the net revenues of 8 sex workers has annual revenues that look more like those of a wholesale heroin dealer, not a retail seller.

Indeed, just for sake of illustration, suppose that pimp spent $170,000 per year on food, rent, and other living expenses, leaving $142,000 to be saved and so perhaps laundered. That $142,000 would be nearly one quarter of the 12 * $48,000 = $576,000 customers spent purchasing services from the sex workers.

The pimps' "suppliers" further up the human trafficking chain probably retain comparatively little of that revenue. Kara suggests that the cost per slave "recruited" is about $3,000, so if sex workers are exploited for an average of 30 months before being killed or released, then the pimp would be paying human traffickers only 8 * $3,000 * (12 / 30) = $9,600 per year in recruitment costs – or barely more than 1% of what customers pay purchasing commercial sex.

All of the numbers in this illustration could easily be off by a factor of 2 or 3, but the gist of the analysis would be robust with respect to such errors. Quite unlike the case of heroin trafficking, the highest levels of the distribution chain for trafficking victims might receive a quite small share of the revenue generated by the sale of the trafficking victimcs' labor. The key difference is that one $3,000 wholesale purchase of drugs might only produce $6,000 in revenues if retail prices are marked up by a factor of 2, but a $3,000 "purchase" of a sex worker who remains employed for 30 months could produce revenues of $180,000.

To push harder on this, one can distinguish trafficked sex workers who are residents from those who are trafficked across international borders from abroad. The latter are common in Europe, but in North America most sex trafficking victims are local. Many are run-aways or homeless, and "recruitment"

[19] Obviously shipping $100 bills reduces the cost as a share of value to 2.5%. However obtaining large numbers of $100 bills may be risky and/or expensive.

involves swindling and rape but not "purchase" from a higher-level international supplier. Primarily only victims moved across international borders are trafficked by high-level crime groups. Suppose there were 10,000 such internationally trafficked sex slaves in Canada at any time, each sold for $3,000 before working for 2.5 years. That would imply that annual revenues for all of those higher-level trafficking organizations would be "only" 10,000 * $3,000 / 2.5 = $12 million per year, compared to $1 billion in revenues generated by these victims.

If that is right, then the greater demand for money laundering services could come from pimps, whose business situation and need for money laundering are little different whether the sex workers are domestic or internationally trafficked. Whether such individuals need professional money laundering services may depend on the scale of their operations.

The numbers above work out to net revenues of about $75,000 per sex worker per year. A pimp who only supervised two or three sex workers may well be able to dispose of all of that revenue informally, but one who supervised 50 sex workers would have revenues matching the drug importers in the heroin distribution model above.

That suggests that if one wished to estimate the overall proportion of money spent on commercial sex that is laundered, one could do the following. First, randomly sample dollars spent buying commercial sex. What that means is essentially randomly sampling customers or purchases, but weighting the results by the amounts spent. Then work up the chain just one step, from the sex worker to the pimp, and "ask" two questions: (1) What proportion of the sex workers' revenues get turned over to the pimp and (2) how many sex workers does that pimp supervise? If most of the money is retained by the sex worker or goes to pimps who supervise relative few sex workers, then even if the commercial sex work industry is very large, only a small proportion of its revenues may need to be laundered. On the other hand, if a large share of the dollars spent purchasing commercial sex services are turned over to pimps who supervise, directly or indirectly, large crews of sex workers, then a larger share of the revenues from sex work may be laundered.

We have no prior expectation as to what such a study would find, but hope that this extremely rough arithmetic and structuring of the question offers a way to think about the problem, and a possible pathway forward for an empirical investigation.

4.5 Wildlife trafficking

Earlier this year, the Financial Action Task Force released a major report on money laundering and the international wildlife trade (FATF, 2020). We draw heavily on that report here, but present the facts in ways that may shed light on the Commission's questions.

Data on international wildlife trafficking (IWT) is even scarcer than that for illegal drugs, but a few salient observations seem reasonably likely to hold, at least in broad terms.

1. Globally, the size of the IWT market is large, but not as large as for illegal drugs. FATF (2020) places it at $7 - $23 billion USD; even the high end figures is less than one-tenth the estimated size of the illegal drug markets.

2. As with heroin and many other classic drug markets, the broad outlines of the trade include production/harvesting in less developed countries where prices are relatively low, and sale in wealthier final market countries at substantially higher prices. That price markup creates substantial illegal earnings, primarily in transshipment and final market, not source, countries.
3. Consumption in or near production areas can be significant. For example, for the poacher, the income derived from selling bushmeat may rival or exceed what they earn from supplying other body parts (bones, skin, horn, etc.) to the international wildlife trade.
4. Value per unit weight varies enormously across IWT products. Some – but not all – may be roughly as high as for illegal drugs. Notably, rhinoceros horn can sell for $65,000 per kilogram, which is roughly on a par with the wholesale (but not retail) price of heroin and cocaine in Canada. Most other IWT products have much lower prices per unit weight. Elephant ivory sells for $500 to $1,000 per kilogram, which is roughly on a par with cannabis. Pangolin scales are perhaps half as dear. Rosewood wholesales for about $50,000 per cubic meter[20], which is about $125 per kilogram assuming a typical wood density of 400 kilograms per cubic meter. Live tigers and lions may fetch $10,000 or $20,000; if that animal weighs 200 kilograms, that is $50 - $100 per kilogram. Prices in the $50 - $500 per kilogram range are roughly 1% as valuable per unit weight as is heroin at the Canadian import level, and 0.1% as valuable as heroin at retail.
5. International wildlife shipments may be similar in size but smaller in value to drug shipments, perhaps because there is a greater range of IWT products. Although there are many drugs of abuse, the big four (heroin, cocaine/crack, meth, and cannabis) dominate the market in terms of value. The largest elephant ivory seizure was 8.8 tonnes valued at $12.9 million USD ($1,500 per kilogram), presumably a retail value. At wholesale prices of $200 USD per kilogram, the value would be just under $2 million USD. The largest rhinoceros horn seizure was 124 kgs,[21] which would be worth $5 - $10 million at retail, but in Mozambique the value was far less. By contrast, last year when US authorities seized 16 tonnes of cocaine in Philadelphia. It was described as having a street value of over $1 billion USD, and we would estimate a wholesale value of about $160 million.
6. The demographic profile of IWT consumers is markedly different than for illegal drugs. IWT consumers in North America tend to be affluent, whereas most heroin, cocaine, and meth is consumed by people who live chaotic lives that often do not include ready access to modern banking services. Hence, almost all retail drug transactions involve cash; it is much less clear whether that is true for IWT.
7. It is our impression, and apparently that of the FATF (2020), that IWT retailers often operate front companies, such as a retail store selling legitimate products. So whereas a drug user almost always pays cash, an IWT customer might be able to pay using modern electronic methods (e.g., credit card, wire transfer), with the retailer simply obscuring the illegal nature of the product. That said, large seizures of illegal wildlife are often accompanied by seizures of substantial amounts of cash.
8. There are not, insofar as we know, data that permit demand-size market estimates for wildlife trafficking, particularly not by country or province. The conventional wisdom is that East Asia

[20] https://www.reuters.com/article/us-thailand-rosewood/thai-rosewood-gets-international-protection-to-curb-china-trade-idUSBRE92B0D620130312

[21] That seizure occurred in 2015; it was described as the largest at the time, although there may have been other larger ones since.

dominates the world market as by far the largest consumer of IWT. Europe and North America are distinctly secondary, with Asian communities within those regions often seen as accounting for a substantial share of that demand.

In sum, there are clear parallels between international trafficking of illegal wildlife and illegal drugs (Brown, 2017), but there are differences. Notably, the IWT trade is probably about an order of magnitude smaller, globally, and North American IWT markets may rely less on cash than do North American drug markets.

5.0 Some Implications of a "Cashless" Society for Drug Money Laundering

As already noted, drug markets so far have been almost exclusively cash businesses.[22] However, cash is becoming less important as a mode of exchange in the economy generally, being replaced by a wide variety of other modes, such as credit cards and direct electronic transfers from bank accounts, through systems such as PayPal and Venmo. This trend has gone furthest in Sweden, where many retail outlets refuse to take cash and even some bank branches do not handle cash (Arvidsson, 2019; Engbert, Fung and Hendry, 2018).

A cashless society is probably many years away for most countries. However it is clear that an increasing share of formerly cash transactions are now being carried out through other media of exchange as fintech firms introduce a wide array of cheap, convenient and safe innovations. What might be the consequences for the money laundering demands of illegal drug dealers? What follows are some brief speculations, intended to stir discussion rather than provide an authoritative account.

The demise of cash presents two separable problems for drug dealers:

(1) How can illegal transactions be conducted with privacy? A major attraction of cash is precisely its anonymity; every $100 bill is exactly like another and cannot be traced to a user except when in their hands.
(2) How can the revenues from dealing be converted into forms that permit accumulation and spending without exposure to law enforcement authorities?

There is already evidence on the first of these issues, since some drug transactions now occur through the internet. At least the darknet transactions, which have been more deeply researched, seem mostly to be international, with the seller and buyer in different countries. While in principle a buyer could make purchases from a distant seller by mailing cash through the postal service or a parcel delivery system such as UPS, this is slow and exposes both parties to possible loss. In fact, internet transactions are conducted almost exclusively through cryptocurrencies and mostly Bitcoins.[23]

It is somewhat puzzling that the share of drug transactions conducted on the internet remains very small, given the convenience and transparency that this offers compared to street purchases. The existing estimates suggest that less than 1% of retail revenues globally are generated through internet

[22] Surprisingly, that remains true of organized crime generally (Europol, 2015).
[23] For a helpful review of the variety of cryptocurrencies and their advantages and disadvantages see Lewis. McPartland and Ranjan, (2017). Weaver (2018) describes the risks faced by users of cryptocurrencies.

transactions (Kruithof et al., 2016), including both those on the open web (Demant et al, 2019) and those on the dark web (Aldridge and Decary-Hetu, 2016). Heroin is not one of the drugs frequently traded on the internet; e.g. a study of January 2016 transactions estimated that opioids accounted for about 6% of total internet drug revenues (Kruithof et al., 2016).

Moreover, cryptocurrencies are not truly anonymous (Weaver, 2018). Like all block chain currencies, Bitcoin's anonymity is threatened precisely because there is a ledger for all transactions. That has, predictably, led to the development of methods for concealment, which might be called "cryptocurrency laundering":

> "A typical way to conceal the illegal origin of bitcoins is the use of so-called mixing services (also known as mixers, blenders or tumblers). These are online services that exchange bitcoins for bitcoins, for a fee. After a user has submitted the bitcoins, the mixing service collects bitcoins from different sources (or even mines completely new bitcoins) and pays them back to the user on a different account. A typical fee is 3 percent." (Custers, Pool and Cornelisse, 2019; 740)

The resulting Bitcoins are essentially anonymous.

Even if the rest of society became mostly cashless, that might not lead to many more internet drug sales, at least for heroin. The barriers other than currency mode would remain. Many frequent heroin users need to consume the drug every day but have difficulty accumulating the funds to make multi-day purchases; hence they often make more than one purchase each day. On-line markets do not provide immediate delivery[24] and international mail may take a week.

However there is no reason why face-to-face drug purchases could not convert to electronic form. The buyer can transfer money to the seller with a smart phone, through one of many peer-to-peer services. Security of the transaction may be a problem that cannot be solved in the instant[25] but the bulk of drug purchases involve repeat customers, so rip-offs may be expensive to the customer in terms of future access to drugs.

In thinking about a cashless drug market, it is important to note that currency flows up, not down. Soudijn and Reuter (2016) studied high level cocaine traffickers in the Netherlands who were paid over a period of weeks for their drugs, having to convert small bills generated in the retail trade into 500 Euro notes for compact shipping to Colombia.

How easily would drug retailers move to credit transactions with the new payment systems? There are certainly incentives for doing so. It reduces the vulnerability of the dealer to being robbed. (Reducing robbery risk is one reason that Dutch buses no longer allow cash purchase of tickets.) However it does introduce new sources of vulnerability. The drug dealer would have to develop some business identity that would provide a plausible explanation for receiving many $20-$50 payments and the occasional

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[24] It is hard to imagine a drug market equivalent to Amazon, large enough to provide same-day delivery of illegal drugs, though local monopolies might develop with small "warehouses" scattered around the city. There are some indications of that in Russia (REF).

[25] Rosati, Vasquez, and Surane, 2020 describe the use of Velle, a transfer system operated by seven large US banks and popular in Venezuela. Establishing that the transaction is valid is not instantaneous, requiring the vendor to compare screen shots and confirming emails.

$200-500 expenditure. The cover of a street vendor license is plausible enough and easily obtained. Money laundering investigators have enough demands on their time that they are unlikely to pursue such small-time businesses. On the other hand, a street dealer once arrested would be at risk of having all business records seized, thus revealing the extent of operations and the identities of customers and suppliers.

For high level dealers the challenge is greater but then so are the resources for responding. Creating a business identity that allows for deposits of thousands of dollars and occasional expenditures of tens of thousands without creating suspicion in the peer-to-peer service requires the formation of a more complex business identity. This is not impossible. The money laundering literature describes many methods that have been used to conceal the regular flow of criminal earnings in the accounting records of legitimate businesses.

Suppose the various challenges are met, and the drug dealers' net revenues were in an electronic form. How would that affect the demand for money laundering services? In short, it might change the type but not the amount of money laundering. As noted in Section 1, most other forms of criminal proceeds (e.g. bribes to kleptocrats) are already not cash. Yet those proceeds also need to be laundered, i.e. to be separated from their criminal origin. In effect, going cashless would convert the money laundering problem of drug dealers into the money laundering problem that is already typical of most other beneficiaries of large and regular criminal revenues.

Others are more expert in how money laundering can be detected. Our purpose is to only suggest that a move from a cash-based drug trade is possible and will not obviate the need for evading money laundering controls. It may not require new methods of money laundering control so much as a refocusing of current approaches. Cash is the curse of the drug trade in part because it is the easiest target for money laundering investigators.

Appendix: Documentation of the Spreadsheet Model

This section describes the spreadsheet model and its operation in case members of the Commission wish to update it as better information arises concerning its parameters, such as prices at various market levels. This appendix is not intended for any purpose other than to help someone who wants to use or modify the spreadsheet. No substantive results are discussed here that are not in the body of the report.

The model is just an "accounting" model that counts up various quantities at different market levels. It is not a "statistical" model that finds the "best fit" to data or an "optimization" model. Its primary value is in enforcing consistency in beliefs/guesses about various parameters at various market levels.

The first sheet of the workbook contains the basic model. The other sheets were created to perform various sensitivity analyses.

The following color scheme is generally used for spreadsheet cells:

- Yellow indicates parameters (constants) that are entered at that point
- Green indicates values imported from other sheets
- No color indicates quantities that are calculated from other cells in that sheet
- Grey is used to emphasize calculated quantities that are central to a sensitivity analysis on that sheet

A.1 Organization of spreadsheet and types of people represented

The spreadsheet has a column for each of the various types of market participants at the different market level. The present version has four columns representing (reading from left to right) (heavy) users, retail sellers, wholesalers, and importers. Someone who believed there was an additional market level (e.g., 1st and 2nd level wholesale dealers) could insert a column and adjust accordingly.

In reality, different people consume drugs at different rates. For example, in Everingham & Rydell's classic (1994) model of the U.S. cocaine market, they distinguished between "light" and "heavy" users, where heavy users consumed at about seven times the rate of light users. That is, it would take seven light users to contribute the same market demand as one heavy user in their model. In a model of money laundering, there is no particular benefit to breaking down different types of users, so we simply represent all users in terms of "heavy user equivalents".

For example, in the Bouchard et al. (2020) report, Table 17 considers the situation in which BC has 5,263 daily users, 4,644 near daily users, and 5,573 infrequent users who spend $23,747, $10,699, and $5,192 each per year, respectively, for a total of $203,601,633 spent per year on fentanyl. That situation would be represented in this type of model as having 8,574 daily (heavy) users each spending $23,747 per year, because that produces the same total spending of about $203.6 million per year.

A similar idea applies to retail sellers. Various sources have documented for multiple illegal markets that some retail dealers work essentially full-time (say, 30+ hours per week), but many work less intensively. The count of retail sellers given in Cell C2 of the spreadsheet should be understood as the number of "full-time equivalent" retail sellers. For example, if there were 1,000 people selling full-time and 1,000

selling half-time, that would be 1,500 full-time equivalent sellers. As is explained in the body of the report, even if all retail sellers were full-time, they probably do not generate much demand for money laundering services, and to the extent that many work part-time, that would serve to reduce their need to launder funds. (The less an individual makes, the eaiser it is to spend all of the proceeds.) So this simplification is conservative; a more detailed model that distinguished full-time and part-time retail sellers would conclude with even greater force that most of the net revenues retained at the retail market level does not need to be laundered.

Importers are the highest-level of dealer who works within Canada; their suppliers are exporters or smugglers who live abroad. The foreign exporters and smugglers are not counted or represented explicitly. Rather, the world market is seen as being able to supply an arbitrary amount to Canada at whatever is the going price. Wholesalers are intermediaries who connect retail sellers to importers.

A.2 Market levels and their purchase quantities and frequencies

Auto manufacturers convert a variety of raw materials (steel, glass, subassemblies, etc.) into cars, so the finished product (an automobile) is materially different than the inputs. Poppy farmers back in the source country (e.g., Afghanistan) are a little like that; they convert land, fertilizer, seed, and labor into opium. By contrast, opioid dealers within a final market country such as Canada by and large are just brokers. They buy a bag of drugs, subdivide it into smaller bags, and sell those in the next lowest market level.

The principal exception would be dilution or adulteration. We do not have data on heroin purity by market level and so did not include that. For now, simply understand transaction weights as being what that amount of heroin would weigh if it had the same purity that heroin does when sold to users at retail. E.g., if importers buy heroin that is 60% pure and somewhere along the distribution chain it is cut 1:1 so it is only 30% pure when sold to users, then if the spreadsheet describes importers as buying 12.5 kilogram lots, understand that as 6.25 kilograms of 60% pure heroin, since that is the same amount of heroin as 12.5 kilograms of 30% pure heroin. This simplification is not unreasonable because the value of diluents is very low compared to the value of the heroin itself.

Given that understanding of the fundamental operational activity of drug distribution within Canadian borders, the key attributes of any market participant are the quantity that they buy in a single transaction (row 3), the number of such purchases they make per year (row 4), and the price per gram they pay (row 6).

For simplicity, we neglect domestic seizures because seizures within a final market country's borders tend to be a modest proportion of total quantities, and also ignore changes in inventory levels, about which nothing is known. Hence, the weight of heroin (at a standardized purity) that passes through each market level is the same. That means that in each column, the product of the number of (full-time equivalent) people at that market level, times the quantity they buy in a single transaction, times the number of transactions per person per year has to be the same for each market level. I.e., the product

of the numbers in rows 2, 3, and 4 has to be the same in each column. In particular, they must multiply together to match the total market volume.[26]

Here we anchor estimates at the retail end of the market. Specifically, we assume daily users buy daily (365 times per year) the average daily amount they consume (4 "points" or 0.0004 kilograms, per Stockwell et al.), at an average price of $160 per gram (also per Stockwell), which produces annual spending of $23,360 per year.[27] That matches very closely Bouchard et al.'s (2020) figure of $23,747 for daily users.

The model assumes there are 10,000 such heavy-user equivalents in part because that places the total (classical heroin) market value ($233.6 million) within the range Bouchard et al. (2020) find for fentanyl ($200 - $300M). Someone who thought the market was larger or smaller can just scale the numbers at each market level proportionately.

That implies a market volume of 1460 kilograms (at retail purity). For the sake of round numbers and because it is about right in many markets, we assume a "branching factor" of 10 – meaning there are ten at one market level for every entity at the higher market level. Thus, 10,000 heavy users, 1,000 full-time equivalent retailers, 100 wholesalers, and 10 importers. We choose round, typical transaction sizes for what is bought by retailers (an ounce, 0.5 kilograms, and 12.5 kilograms) which work out to also imply round frequencies of purchase. E.g., 1460 kilograms spread over 10 importers who buy 12.5 kilograms per transaction implies 11.7 purchases per year – which is basically once a month.

Anyone who had better information about typical transaction sizes or frequencies could rejigger those numbers accordingly, just holding their product (in line 5) constant across columns (market levels).

A.3 Price markups

The prices that dealers at each market level pay to obtain drugs determine what proportion of the money users spend on drugs stays with each dealer. This is just a mechanical consequence of the arithmetic. If retailers had to pay $150 per gram for drugs they sold at $160 per gram, then they would only keep $10 out of every $160 that users spend. And so on up the line.

We do not have empirical estimates of prices at each market level, so in the base case we just assume prices double from one market level to the next. In particular, users pay retailers $160 per gram, retailers pay wholesalers $80 per gram, wholesalers pay importers $40 per gram, and importers pay foreign suppliers $20 per gram.

There is a lore that drug dealers try to "double their money" and sometimes they do. Still, the price doubling assumption is also something of a placeholder, in the absence of empirical estimates; it makes

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[26] If it were desired to factor in purity by market level, then what would be the same at each market level is the product of those three factors and also purity. If seizures by market level were added, then it would the product of these factors at one level equals the product of those factors at the lower level, plus the amount seized between those two market levels.

[27] It does not matter here that heavy users buy exactly once a day every day. That the parameter value is 365 says only that such users average 365 purchases per year. In reality, even "daily" heroin users sometimes have periods of non-use (Kaplan, 1983). On the other hand, users sometimes buy more than once in a single day.

the calculations work out to round numbers and so the logic of the calculations easy to follow. We replicate the analysis with prices increasing by a factor of 1.6 at each market level. E.g., retailers buy from wholesalers at $100 per gram and sell to users at $160 per gram. Based on our general experience with other drug markets, we would guess that perhaps the true price inflation in BC is between those two ratios and likely closer to 1.6, although of course there is no reason the price multiplier need be the same across all pairs of adjacent market levels.

A.4 Revenue retained at each market level

Given prices at each market level, simple arithmetic yields net revenue retained at each market level (also referred to as revenue net of the cost of goods sold or revenue net of COGS). The sales price for dealers at each market level (Cells C8:E8) is just the purchase price at the next lower market level. Multiplying the difference between the sales price (row 8) and the purchase price (row 6) by the quantity sold (row 5) yields the earnings for that level. Alternately, this can be computed as the difference between sales price and purchase price divided by sales price, times the total revenue at that level.

The gross and net revenues of that market level in aggregate (in Rows 9 and 10) are converted into gross and net revenues per organization (in Rows 11 and 12) by dividing by the number of organizations (from Row 2).

Row 13 contains the (fairly arbitrary) assumptions about amount of money that an individual or organization at each market level can spend in cash each year on normal expenses. Subtracting that from the per organization revenue net of COGS (Row 12) gives the amount of excess cash each organization at that market level might potentially need to launder (Row 14). Multiplying that by the number of organizations (from Row 2) and dividing by one million gives (in Row 15) the total potential demand for money laundering services at that market level (in millions of dollars), which is converted into a percentage of money users spend by dividing by total spending on drugs (from Cell B7).

There are three of those percentages for retailers (Cell C16), wholesalers (Cell D16), and importers (E16), and in addition Cell E17 describes the percentage of users spending that ends up going abroad to pay foreign suppliers. That probably in general also constitutes demand for money laundering, unless the importers ship dirty cash abroad to pay for the drugs they buy, although the particulars may differ. That is money that becomes an asset of people who live outside of Canada, whereas the first three categories represent assets of people who work within Canadian borders.

Rows 20-31 are simply an abbreviated restatement of quantities in Rows 1-16. Rows 1-16 "Derive" the results; Rows 20-31 present them in a way that is perhaps easier to interpret.

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