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Research paper

Transnational cocaine and heroin flow networks in western Europe: A comparison

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ABSTRACT

Background: A comparison of the properties of drug flow networks for cocaine and heroin in a group of 17 western European countries is provided with the aim of understanding the implications of their similarities and differences for drug policy.
Methods: Drug flow data for the cocaine and heroin networks were analyzed using the UCINET software package. Country-level characteristics including hub and authority scores, core and periphery membership, and centrality, and network-level characteristics including network density, the results of a triad census, and the final fitness of the core-periphery structure of the network, were computed and compared between the two networks.
Results: The cocaine network contains fewer path redundancies and a smaller, more tightly knit core than the heroin network. Authorities, hubs and countries central to the cocaine network tend to have higher hub, authority, and centrality scores than those in the heroin network. The core-periphery and hub–authority structures of the cocaine and heroin networks reflect the west-to-east and east-to-west patterns of flow of cocaine and heroin respectively across Europe. The key nodes in the cocaine and heroin networks are generally distinct from one another.
Conclusion: The analysis of drug flow networks can reveal important structural features of trafficking networks that can be useful for the allocation of scarce drug control resources. The identification of authorities, hubs, network cores, and network-central nodes can suggest foci for the allocation of these resources. In the case of Europe, while some countries are important to both cocaine and heroin networks, different sets of countries occupy positions of prominence in the two networks. The distinct nature of the cocaine and heroin networks also suggests that a one-size-fits-all supply- and interdiction-focused policy may not work as well as an approach that takes into account the particular characteristics of each network.

Introduction

Cocaine and heroin users account for roughly 39 million to 55.5 million people worldwide (United Nations Office on Drugs and Crime (UNODC), 2012). Despite increased law enforcement activities, consumption of these two drugs continued unabated (Wiessing, Olszewski, Klempová, Vicente, & Griffiths, 2009). At a time when drug policy is increasingly taking an integrated turn and policy and enforcement organizations are increasingly adopting strategies that cut across drug types, the comparative study of drug-related phenomena such as trafficking is becoming increasingly important (European Union, 2012). The need for such analysis is compounded by the phenomenon of drug trafficking organizations diversifying their portfolios from a single drug into multiple drug categories, as in the case of Mexico's Sinaloa cartel, which now deals in cannabis, heroin, and methamphetamine (Keefe, 2012).

The magnitude of the illegal drug trade and its resulting problems have led governments and the drug policy research community to invest in producing large and comprehensive datasets on a variety of phenomena relating to this traffic (European Monitoring Centre for Drugs and Drug Addiction, 2008; UNODC, 2013; United States Department of Justice, 2014). These datasets contain information on prices, seizures, and flows of drugs, which lend themselves to a variety of interesting and potentially valuable analyses. Yet, with a few recent exceptions (Boivin, 2013, 2014a, 2014b), given the quantity and content of the available data, surprisingly little systematic research has been conducted at the country level that applies the methods of network analysis to the available data on these drugs. The main objective of this paper is, therefore, to use network analysis to compare the properties of drug flow networks

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for cocaine and heroin in a group of 17 western European countries, inferred using data on wholesale prices for these drugs, with a view to understanding their similarities and differences and to examining the implications of these findings for drug policy. Data permitting, the analytic methods presented in this paper can be applied to the analysis of other illegal drugs, including cannabis and amphetamine-type stimulants (ATS), in particular, and to other illegally trafficked goods and markets, including but not restricted to those for weapons, people, and wildlife.

The network approach to the analysis of drug flows is potentially rewarding on a number of levels. At the level of a single network, it can provide insights into how and why the network displays a particular set of structural properties, with implications for drug control policies including resource allocation and interdiction. Notions including but not restricted to centralization, core–periphery structure, path-redundancy, and membership can be brought to bear on these issues. At the level of an individual country, network analysis can identify the position and importance of each country in a network and the specific paths through which a drug enters, transits through, or exits a specific country. In doing so, such analysis can inform strategies for interventions by providing insights into locations in the network where the allocation of resources is most likely to be effective, both at the country level and at the level of the entire network. Comparisons of networks can likewise shed light on the degree to which an integrated approach to drug control is likely to work, and the degree to which customization for specific drugs and trafficking routes is warranted. Comparisons of the positions of specific countries in different trafficking networks can yield insights into whether the trade in one drug operates in a similar manner to the trade in another drug, which in turn can offer clues about the degree to which trafficking of one drug uses the same infrastructure as another drug.

Literature review

In this section, we briefly describe two literatures on which this study is based. The first is the literature on drug markets, prices, price data, and the rich variety of information that is contained in these data – the network data on which this study is based are constructed using drug price data. The second literature is the relatively small body of work that quantitatively or qualitatively analyzes the organizational structure of drug networks, using concepts from fields including network analysis and its applications in other disciplines.

Data on prices of illegal drugs are widely regarded as containing useful information, but also as being inherently noisy. Because of their illegal status, drugs can be very expensive, embodying as they do the risks inherent in the trade and the often multiple transactions that they undergo as they move from producer to consumer (Miron, 2003). For example, while cocaine costs 325 Pounds per kilogram in Colombia, it may cost as much as 51,000 Pounds by the time it reaches the UK (Wilson & Stevens, 2008). Stringent law enforcement can contribute to high prices, though the size of this effect is debatable. According to Caulkins and Reuter (1998), heroin would cost a few US dollars per gram if sold in a legal environment. Because of its illegal nature, however, its cost was approximately US $2,000 per gram. Yet Farrell, Mansur, and Tullis (1996) show that the prices of heroin and cocaine actually fell during a time when seizures increased, suggesting that increases in supply may have overwhelmed any upward pressure on prices due to increased drug enforcement efforts. Indeed, because the demand for drugs such as cocaine and heroin is fairly stable, most fluctuations in price occur due to variations in supply (Clements, 2006), and in certain contexts law enforcement efforts have been shown to not be effective in reducing supply (Naylor, 2003; Paoli, Greenfield, & Reuter, 2009). There are, furthermore, a variety of additional factors that affect prices, including market scale, integration, labor market conditions, and resiliency of the drug supply chain (Boivin, 2013, 2014a; Bouchard, 2007; Caulkins & Reuter, 2010; Levitt & Venkatesh, 2000; Linnemann, 1966; Storti & De Grauwe, 2008), many of which are shaped by organizational factors including the structure of trafficking networks, both domestic and international.

A number of studies have examined the organizational aspects of the cocaine and heroin trafficking trades. Both drugs are produced primarily in developing countries, from which they must move to the developed world, their price increasing with every successive transaction (Reuter, 2009; UNODC, 2013). Cocaine moves through a network of small-scale organizations that often need to work in a coordinated manner (Kenney, 2007; Morselli, 2009). The heroin network is, likewise, a loosely-linked set of groups, rather than an oligopoly of a small number of large firms (Natarajan, 2006; Desroches, 2007). The pattern of flow is also shaped by geography and social, economic, and law enforcement related considerations (Chouvy, 2010; Decker & Chapman, 2008; Zaitch, 2002). For example, due to geographic and other factors, much of the cocaine trafficked in Europe enters through Spain (Sands, 2007), reflecting the transatlantic source of the drug.

When quantitative data are available on drug flow networks, concepts from the field of network analysis can be employed to analyze structural features of these networks and their implications for drug policy. Network analysis has developed in different directions in a number of disciplines, including computer science and engineering (for the analysis of information networks, circuits and logistics in operations research (Newman, 2010)) and sociology (for the analysis of social networks (Hanneman & Riddle, 2005; Wasserman & Faust, 1994)). It has also been used in a variety of ways in economics, engineering, and sociology. For example, Smith and White (1992) and De Benedictis and Tajoli (2011) used network analysis to study international trade. Mahutga (2006) used a core–periphery model to determine economic mobility. In sociology, Snyder and Kick (1979) used matrix block modeling to determine the existence of a "world system," and Kim and Shin (2002) utilized the concept of network centrality to determine the advancement of the globalization process in regards to world trade. Approaches similar to those used in the above studies can be used to analyze transnational cocaine and heroin flow networks in Europe.

More recently, in a series of papers, Boivin (2013, 2014a, 2014b) has made the case for employing quantitative methods of network analysis to study macro-social networks of drug flows. A key issue that emerges from this work is the imperfect nature of the data on drugs and drug flows. A consequence is the necessary trade-off between using existing anecdotal data, which are incomplete in their coverage (Boivin, 2014a, pp. 56–57), and making reasonable assumptions about the data to make inferences that expand the coverage of findings to cover a complete region (Chandra & Barkell, 2013; Chandra, Peters, & Zimmer, 2014; Paoli et al., 2009). Each approach has its strengths and weaknesses and, in the absence of definitive data on drug trafficking, can provide complementary and valuable perspectives on the drug trade. To demonstrate this, Boivin (2014b) uses network analysis to test propositions emerging from the "risks and prices" approach of Reuter and Kleiman (1986) and Caulkins and Reuter (2010) and the world systems approach of Wallerstein (1974).

Data and methods

Analytic approach

The data used in this paper represent two networks of transnational drug flows (i.e., cocaine and heroin) for 17 countries