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International cocaine and heroin trafficking: A network approach

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INTERNATIONAL COCAINE AND HEROIN TRAFFICKING:

A NETWORK APPROACH

A Thesis

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ABSTRACT

A missing piece from the international drug trafficking literature is research providing a comprehensive examination of the architecture of drug flow as well the identification of predicting variables of drug transit countries. Opportunistic variables appear from the literature review to be most common predictors. With transit countries being the reason for drugs reaching destination countries, the identification of predictors within drug transit countries could be very valuable in fragmenting the market. The current study focuses on cocaine and heroin, which are very problematic within the global scope. Although these two drugs are only produced within a small number of countries, they end up being used all over the world.

Using network analysis to illustrate the structure of both the cocaine and heroin networks gives insight into these markets that has not been produced in the literature to date. Key countries within the cocaine and heroin trafficking networks are known, but network analysis has never been used to investigate the global architecture of trade and the relative position of nations. Another unknown is how these two networks compare and contrast with each

other. A quadratic assignment procedure was used to determine how similar, and conversely, how different these two networks are. Measures of centrality were calculated for both networks to discover whether positionally important countries are known transit hubs. A binary logistic regression was estimated to determine which opportunistic variables significantly predict a country being involved in the transshipment of cocaine or heroin.

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CHAPTER ONE

INTRODUCTION

The Problem

International drug trafficking is a complex market that involves different stages of operations ranging from cultivation, manufacturing, large scale distribution, and local level drug dealing (UNODC, 2012). Heroin and cocaine are among the drugs that are most trafficked and abused throughout the world, and will be the focus of this research. Heroin and cocaine are both localized drugs, meaning they are not produced everywhere and they still end up being trafficked and used on every continent in the world. The drug trafficking market is very complex because drugs can be moved a lot of different ways, through a lot of different countries. With drugs being trafficked by land, air, and sea, it makes it very difficult to fracture this market.

Drug trafficking has a variety of effects on both countries as a whole and the individuals within. It has negative effects on the countries involved such as health, crime, and social costs (Cornell & Swanstrom, 2006;

Engvall, 2006; Interpol-General Secretariat, 1989; Layne, Khruppa, & Muzyka, 2001; Walker, 2005). Drug addiction results in crime, costs relating to treatment and criminal processing, environmental effects of production, and costs of enforcement (Cornell & Swanstrom, 2006). The problems associated with heroin and cocaine is the health problems resulting from usage, arrests related to usage, and organized criminal groups. Countries that act as transshipment points for drug trafficking are often faced with domestic substance abuse problems due to payment in product by trafficking groups which is often employed. Widespread drug use often results in a rise of property crime and prostitution, in an effort for addicts to obtain money for more drugs (Layne et al., 2001). Increased drug consumption has led to the spread of diseases such as HIV and hepatitis C, as well as widespread addiction (Engvall, 2006). Due to the increased involvement of African countries in the trafficking of heroin, substance abuse issues are very prevalent throughout the continent (Interpol-General Secretariat, 1989; Walker, 2005).

In understanding the problems that come about due to the international trafficking of cocaine and heroin, it would be useful for research to seek to dismantle the

cocaine and heroin trafficking networks that have emerged. Doing this would require the focus of the research to be on the transit countries involved in trafficking. Another useful objective would be to identify covariates of nations being involved in the transit of cocaine or heroin. Research seeking to achieve these two objectives would be extremely valuable in combatting the international drug trafficking industry.

Outline of Research

Chapter two will begin by presenting the theoretical framework of which this study is based on: network architecture theory and crime opportunity theory. Network architecture theory argues that the underlying interconnectivity and relative position of entities within the network shape the possible flow of materials and information among its nodes (Borgatti & Lopez-Kidwell, 2011). Crime opportunity theory, which posits that crimes occur due to situational opportunities and circumstances that facilitate them (Felson & Clarke, 1998), will present insight into how cocaine and heroin transit countries emerge. These two theories have not been used previously to examine international cocaine and heroin trafficking.

Despite the existence of the broad literature examining cocaine and heroin trafficking routes, not a single previous study was found to investigate the global trade architecture for both drugs. Instead, research to date has examined international cocaine and heroin trafficking in the regional context (e.g., Akyeampong, 2005; Cornell & Swanstrom, 2006; EMCDDA, Engvall, 2006; 2010; Farrell, 1998; Farrell, Mansur, & Tullis, 1996; Huang, Liu, Zhao, Zhao, & Friday, 2012; Hughes, Chalmers, Bright, Matthew-Simmons, & Sindich, 2012; Interpol-General Secretariat, 1989; Layne et al., 2001; Office of International Intelligence, 2002; Reid, Devaney, & Baldwin, 2006; Sabatelle, 2011; Singh & Van Zyl, 2007; Van Doorn, 1993). Fazey (2007) discusses international policy relating to international drug trafficking, but does not provide a complete examination of the international cocaine and heroin trafficking networks. Although a comprehensive illustration of these trafficking networks was not available, hypotheses about global trade networks can be generated by weaving the findings together. This current study will contribute to the field by testing hypotheses about the flow of international cocaine and heroin trafficking.

In order to understand how cocaine and heroin are trafficked globally, the modalities of transportation are of special interest. The various methods involving land, air, and sea will be presented. Each modality has several methods that are employed from within, making international drug trafficking very complex. In addition, globalization has made both global transport and communication easier, resulting in lower costs and ability to move mass quantities of cocaine and heroin (Cornell & Swanstrom, 2006; Fazey, 2007). Variables of opportunity relating to international cocaine and heroin trafficking will be introduced. These variables include corruption, exports, container port flow, geographical connectivity, and paved airports. Chapter two will conclude with the hypotheses generated from the literature review.

Chapter three presents the methodology used in this study, which is rooted in network analysis. Using publically available data from the Central Intelligence Agency (CIA), International Criminal Police Organization (INTERPOL), and the United Nations Office on Drugs and Crime (UNODC), two networks were created, one for cocaine and one for heroin, to capture the trade architecture supporting the international flow of each respective drug

from source to destination. Using each network created, structural and centrality statistics were calculated and analyzed in order to compare the structures of both the cocaine and heroin networks, as well as to identify which countries are important in the transit of each respective drug.

In addition to identifying critical transit nations, opportunity-based explanations for their importance are tested in a binary logistic regression model. This model was designed to predict whether a country occupies a cocaine or heroin transshipment point within the trade network. This study is very unique in two ways: a network methodology was used to uncover the global architecture cocaine and heroin trade activity; and, the research tests a multivariate model to predict which nations are at greatest risk for being transshipment hubs. Both have never been done in the scope of drug trafficking nor in this magnitude.

Chapter four contains the results of this study. The cocaine and heroin networks were found to be very similar in terms of structure. Also, despite consistencies observed among the literature and important transit countries identified through the centrality results, some of the top

scoring countries were not mentioned in the literature in the magnitude that the results showed. The reason for this is that previous studies were looking at seizure data, which measures the flow and this current study, examines the architecture of the entire cocaine and heroin trade. A visual illustration is also produced to aid in the understanding of both networks in the form of sociograms.

The results from the multivariate regression models showed that higher amounts of annual exports are significantly related to a country being involved in the transit of cocaine or heroin. This is a very interesting finding, and is observed in the network results, with world leaders such as Germany, France, Italy, Spain, Netherlands, and China being top scoring countries for centrality.

Chapter five provides both a summary of the results and a discussion of the similarities and differences observed from what was suggested in the literature. Theoretical and policy implications are also discussed within this chapter. The two underlying theoretical frameworks for this study are network architecture model, which gives insight into the trafficking routes for cocaine and heroin, and opportunity theory, which provides an explanation as to why certain countries are involved in the

transit of these drugs. This chapter concludes with the limitations of the study. The biggest limitation of this study is the usage of public data to construct the two networks; however, using three reputable sources to create them does strengthen validity and reliability concerns.

Chapter six is the final chapter within this study and it provides a cursory summary of important points from the findings, implications thereof, and guidance for future research. Network analysis has proved to be valuable in understanding international cocaine and heroin trafficking, and it could be also be instrumental in understanding other forms of illicit trafficking, in both the international or regional scope. This study is the first of its kind within the arena of international drug trafficking, and should be continued.

CHAPTER TWO

REVIEW OF LITERATURE

Theoretical Framework

This study adds to the international drug trafficking literature in two distinct ways. First, the study reveals the country-to-country architecture of two illicit drug markets. This is unique because previous studies examining drug trafficking have used the network architecture model to look at the structure of drug trafficking organizations rather than the trade structure of the global industry (Bright, Hughes, & Chalmers, 2012; Calderoni, 2012; Kenney, 2007; Malm & Bichler, 2011; Morselli, 2010; Morselli & Petit, 2007; Natarajan, 2006). Second, this study adds to the literature of international drug trafficking by applying opportunity theory on a macro scale. Using the opportunity theory within the context of this study contributes to our understanding of international drug trafficking by testing whether opportunity theories are scale independent. If so, significant predictors of countries being involved in the transshipment of cocaine and heroin should be identified.

Network Architecture Model

Borgatti and Lopez-Kidwell (2011) argue that the study of networks tend to fall within two categories: studies of the flow of goods or information through a network capture the relative importance of actors based on their position to control these resources; and, studies of network architecture that intend to reveal the underlying framework that gives rise to the flow observed. Architecture models seek to identify all possible connections in the framework rather than just the relations used to pass information or goods at any one time. In this sense, the aim of the architecture model is to capture all possible associations which enable the analysis of actors positioned to change the flow at any point in time.

Network architecture models are premised on the notion that all nodes within a given network play a specific role in order for group to succeed. In terms of this study, each node plays a role in the cocaine or heroin industries. There are three different roles within the international trafficking of drugs: source, transit, and destination. Source countries are those who produce cocaine or heroin. Transit countries are those that move it from the source to the destination. There are two types of transit countries:

distribution hubs and transshipment points. Destination countries are those which consume the drugs. Although each role serves a distinct purpose, it is not to say that they cannot overlap; in fact, there are some source countries who consume the drugs that are produced and some transit countries that consume the drugs they are moving to the destinations.

All of the nodes within the network coordinate on some level to be successful. Since cocaine and heroin are only produced in a handful of countries, the role of transit countries is especially important in the context of international drug trafficking. Social capital is also an important theoretical perspective in this study because it investigates the benefits of network position. In context of social capital, the network architecture model seeks to provide an explanation for the success of a particular node or group. This provides greater understanding of how cocaine and heroin move globally.

Several structural and positional characteristics were examined. The trade network links countries (nodes) to each other when pairs of nations are thought to pass these illicit drugs. An important aspect of trade architecture is path length, which gives an indication of the length of

commodity chains and the directness of trade relations. Nations may cluster in dense groups. Extreme clustering within a network has a dramatic effect on the flow by increasing path lengths. Clustering increases redundancy in the network by forming many alternative paths to route drugs, but this characteristic slows efficiency. In terms of international drug trafficking, one more unnecessary path length traveled could result in the detection and seizure of drugs.

Centrality is very important for drugs flowing throughout the network because countries that exhibit high measures of centrality will be most important (Freeman, 1978). Degree centrality captures how many others are directly tied to the nation of concern. On the other hand, Granovetter (1973) introduced the strength of weak ties theory that emphasizes the importance of betweeness centrality because those with a high betweeness will be in a better position to control the flow occurring among others. This produces greater 'brokerage' power of one nation among all others.

Crime Opportunity Theory

Felson and Clarke (1998) describe how opportunity facilitates the majority of crime that occurs. They present

the principles of crime opportunity theory and emphasize that they can be applied towards all types of crime. In this case, the focus is on international cocaine and heroin trafficking, as a result the principles will be molded to fit this current study. The first principle states that opportunities of crime are case specific, meaning that each crime is going to require a unique set of opportunity inducing conditions. In the context of international drug trafficking, such opportunities are going to be those which allow traffickers to move drugs freely from source to destination. The second principle states that opportunities of crime tend to cluster in a particular time and space. Time is going to be dependent on when the trafficker feels that they have the best opportunity to move the drugs without being apprehended. Space is the route in which the drugs are trafficked along, which is very important in getting drugs into local markets.

The third principle states that opportunities are dependent on routine activities that occur daily. For drug trafficking, it is possible that drugs are moved on the same path as licit items in order to avoid detection. Cohen and Felson (1979) developed the routine activities theory, which asserts that illegal activities are facilitated by

legal activities of everyday life. They also state that most crimes require motivated offenders, suitable targets and absence of a capable guardian. Although they used routine activities theory at the micro level, examining individuals through crime rates, it can also be applied to international drug trafficking in the macro view, within the broader framework of crime opportunity theory. The increases in licit international trade, in part facilitated by globalization and improved communication facilitates drug trafficking (Cornell & Swanstrom, 2006). The volume of international trade makes inspection of all traded goods impossible (Farrell, 1998).

The last three principles are concerned with opportunity reduction. Opportunity reduction is premised on the emphasis of crime opportunity theory being effective in crime reduction by removing opportunities that allow the crime to occur. In this case, this would mean disrupting the flow of cocaine and heroin by removing the most important transshipment point that has the least redundant ties. Selecting transit hubs with little redundancy serves to reduce the potential for displacement. In addition, nations tied to transit hubs that are unable to regulate trade are more apt to be vulnerable to displacement when

drug control policy removes an existing hub, which may suggest that countries that exhibit high amounts of corruption are more likely to be a transit country. This means that the existing trade architecture may reveal the effects of prior crime control initiatives.

Lastly, in order for opportunity reduction to be most successful, the scope must be as narrow as possible. This means that the important elements of international drug trafficking must be identified for each type of drug. The importance of predictor variables may differ for each substance. Using the opportunity theory within the context of this study will also add to the literature of international drug trafficking by examining opportunistic variables in order see if there are any significant predictors of countries being involved in the transit of cocaine and heroin.

International Drug Trafficking

Drug trafficking can be defined as the transport of both licit and illicit drugs for a profit (Huang et al., 2012). There are four international institutions that lead the fight against international drug trafficking, the UNODC, the World Customs Organization, INTERPOL, and the

International Narcotics Control Board. The main functions of these organizations pertaining to drug trafficking is to facilitate cooperation between nations, provide training on drug enforcement procedures, and obtain political commitment against drugs from various countries (Fazey, 2007). With a noted exception of Fazey (2007), studies examining international drug trafficking have typically focused on the regional or national level, such as: West Africa (Akyeampong, 2005), Africa (Interpol-General Secretariat, 1989), South Africa (Singh & Van Zyl, 2007), Europe (EMCDDA, 2010; Farrell et al., 1996; Van Doorn, 1993), Eastern Europe (Layne et al., 2001), Netherlands (Farrell, 1998), Central Asia (Cornell & Swanstrom, 2006; Engvall, 2006), Southeast Asia (Huang et al., 2012), Asia Pacific (Reid et al., 2006), Iran (Sabatelle, 2011), Australia (Hughes et al., 2012), and Colombia (Office of International Intelligence, 2002).

Trafficking routes are always changing, often in order to evade law enforcement (Reid et al., 2006). Drug traffickers use multiple trafficking routes to ensure that at least some, if not most, gets to the destination countries (Desroches, 2007). Drug trafficking is such a profitable industry that seizures are often looked at as

the cost of business and do not significantly affect profits (Williams, 1993). It is important to note that both heroin and cocaine are produced within a small number of countries.

Cocaine Trafficking Routes

Cocaine is only produced in South America, in particular Colombia, Bolivia, and Peru, with Colombia accounting for most of it (Akyeampong, 2005; Office of International Intelligence; EMCDDA, 2010; Farrell et al., 1996; Fazey, 2007; Hughes et al., 2007; Paoli & Reuter, 2008; Van Doorn, 1993; Williams, 1993). It is not uncommon for leaders in drug production to shift over the years. Peru was the largest producer of cocaine in 1991, with 275,000 tons generated annually, followed by Bolivia with 100,000 tons, and then Colombia with 80,000 tons (Van Doorn, 1993. Within South America, Argentina, Brazil, Bolivia, and Chile are very important in moving cocaine. The simplest path for cocaine is from Brazil to Spain and Portugal, through the Iberian Peninsula, which is the primary entry point for European bound cocaine. The Netherlands represents another entry point for cocaine (EMCDDA, 2010; Farrell, 1998, Office of International Intelligence, 2002; Paoli & Reuter, 2008). Another route

for cocaine is through Western Caribbean countries of the Bahamas, Dominican Republic, Jamaica, Haiti, and Puerto Rico to Spain, Portugal, and Netherlands. Cocaine also goes through the Eastern Caribbean to Europe (Office of International Intelligence, 2002). A recent study showed that about 40% of the cocaine reaching Europe went through the Caribbean (EMCDDA, 2010). Cocaine transiting the Caribbean is also destined for the United States (Office of International Intelligence, 2002).

West Africa has become increasingly important in cocaine trafficking (Akyeampong, 2005; EMCDDA, 2010; Farrell, 1998; Storti & De Grauwe, 2009). From South America, cocaine transits Benin, Ghana, Gambia, Guinea-Bissau, Nigeria, Sierra Leone, Mauritania, and Togo, and then is moved into Europe through Spain, Portugal, and Netherlands (EMCDDA, 2010). Research suggests that about 30% of cocaine in Europe moved through West Africa (Storti & De Grauwe, 2009). West Africa is also an important transit point for United States bound cocaine, with Togo, Ghana, and Nigeria being key transit countries (Akyeampong, 2005). Another route for United States bound cocaine is through Central America and Mexico (Office of International Intelligence, 2002). Australia is also a major destination

country for cocaine, with the United States, Argentina, South Africa, Mexico, Colombia, Panama, and the Netherlands being major transit points (Hughes et al., 2012). Ultimately, the main destination countries for cocaine, is Western Europe, Brazil, and the United States (Office of International Intelligence, 2002; EMCDDA, 2010; Fazey, 2007; Van Doorn, 1993). The major trafficking routes for cocaine and heroin identified from the literature are displayed in table 1.

Table 1. Known Trafficking Routes

Drug	Source	Transit	Destination
Cocaine	Colombia, Bolivia, Peru	South America, Caribbean, West Africa, Iberian Peninsula, Netherlands	North America, Western Europe, Australia
Heroin	Golden Triangle, Golden Crescent, Colombia	Balkan route, Silk route, Caribbean, Iberian Peninsula, Netherlands, Pakistan, India, Iran	North America, Western Europe, China, Russia, Australia

Heroin Trafficking Routes

Throughout the past century, the production of heroin has been dominated by Asian countries, notably the Golden Crescent in Southwest Asia and the Golden Triangle in Southeast Asia. The Golden Crescent includes Afghanistan, Iran, Turkey, India, and Pakistan and the Golden Triangle includes Thailand, Burma, and Laos (Akyeampong, 2005; Farrell et al., 1996; Huang et al., 2012; Van Doorn, 1993). In the 1980s, India, Pakistan, and Turkey were major producers of heroin; however they are not significant producers today, but these countries remain very important in the global heroin trade as transit countries (Interpol-General Secretariat, 1989; Paoli & Reuter, 2008; Williams, 1993).

In the early 1990s, the Golden Triangle, particularly Burma was the largest producer of heroin, followed by Laos and Thailand (Van Doorn, 1993; Williams, 1993). The Golden Triangle is still a major producer of heroin today, but their production has decreased substantially throughout the last decade. Heroin production in Burma dropped by 45% between 2003 and 2004 (Reid et al., 2006).

Another country that has been active in heroin production for much of the twentieth century and remains today is Afghanistan (Akyeampong, 2005; Engvall, 2006; Farrell et al., 1996; Fazey, 2007; Layne et al., 2001; Sabatelle, 2011; Van Doorn, 1993; Walker, 2005). Heroin production in Afghanistan has increased dramatically over the last ten years, and is the largest producer of heroin today (Sabatelle, 2011). Colombia is also a current producer of heroin, but not at the same level as the Golden Triangle and Afghanistan (Cornell & Swanstrom, 2006; Office of International Intelligence, 2002; Farrell et al., 1996; Van Doorn, 1993).

With heroin only being produced in a few locations globally, many countries are involved in transshipment to get it to major consumer markets. Akyeampong (2005) notes that Thailand, Ghana, Nigeria, Togo, India, South America, Netherlands, and nations in Central Europe are important transit points for heroin. Most of the heroin produced in Afghanistan is moved into Pakistan and Iran (Sabatelle, 2011; Van Doorn, 1993). About 37% of the heroin flowing from Afghanistan enters Iran. Iran accounted for 23% of heroin seized globally in 2008, despite Iran being known for their tough drug enforcement. Most of the heroin

passing through Iran goes to Turkey and onto Western Europe. Iran is the shortest path to Europe (Sabatelle, 2011). Apart from Western Europe, major destination countries for heroin from Afghanistan include Iran, Russia, Pakistan, and China (Cornell & Swanstrom, 2006).

The Balkan route is very important, particularly Turkey in moving heroin to destination countries in Western Europe. In 1991, 70-75% of heroin seized in Europe was moved throughout the Balkan route (Van Doorn, 1993). In addition to Turkey, the Balkan route includes Bulgaria, Romania, Hungary, Czech Republic, Greece, Albania, Kosovo, and Macedonia (Farrell et al., 1996; Paoli & Reuter, 2008; Van Doorn, 1993). The Balkan route can be divided into Northern and Southern routes; with the Northern route encompassing Turkey, the Black Sea, Ukraine, and Poland and the Southern route including Bulgaria, Albania, Serbia and Montenegro, Bosnia and Herzegovina, Croatia, and Slovakia (Layne, et al., 2001). The main destination countries for heroin moving along the Balkan route include Netherlands, Germany, Belgium, Scandinavia, France, Portugal, United Kingdom, and Spain (Cornell & Swanstrom, 2006; Engvall, 2006; Farrell, 1998, Farrell et al., 1996; Fazey, 2007; Layne et al., 2001; Paoli & Reuter, 2008; Van Doorn, 1993)

Central Asian states are very important in moving heroin from Afghanistan to Russia and Western Europe, which include Kyrgyzstan, Kazakhstan, Tajikistan, Turkmenistan, and Uzbekistan (Cornell & Swanstrom, 2006; Engvall, 2006;Fazey, 2007; Layne et al., 2001; Walker, 2005) This is known as the Silk route (Layne et al., 2001). Tajikistan and Uzbekistan are primary transit countries in Central Asia (Walker, 2005). Central Asia has been facilitated as a transit point for heroin due to the fall of the Soviet Union. The main destination of heroin moving along the Silk route is Russia; heroin is also moved from Russia through the Baltic States and into Western Europe (Layne et al., 2001).

Heroin from the Golden Triangle transits different countries than heroin from Afghanistan. Huang et al. (2012) examined the China route which begins in the heroin producing countries of Burma, Laos, and Thailand to China, where it is then moved to Hong Kong and Macau. Heroin from Burma transits India and Nepal, where it is shipped to China (Reid et al., 1996). Southeast Asian heroin that reaches the United States and Europe is shipped from Hong Kong, Thailand, and Singapore (Williams, 1993). Most of the heroin that is consumed in East Asian countries such as

Japan, Hong Kong, Philippines, Taiwan, and Singapore, as well as Australia is produced in Burma. Laos and Thailand, which are source countries for heroin, also act as transit countries for heroin from Burma (Reid et al., 2006). Heroin from the Golden Triangle also enters Europe through Netherlands, where it is moved into neighboring countries (Van Doorn, 1993).

An emerging transit point for heroin coming from Afghanistan and Colombia is Africa (Akyeampong, 2005; Fazey, 2007; Interpol-General Secretariat, 1989; Singh & Van Zyl, 2007). Heroin is moved from Colombia to West African countries of Nigeria, Cote d'Ivoire, Ghana, Togo, Benin, Niger, Monrovia, Liberia, Sierra Leone, and Senegal. Heroin transiting West Africa enters Europe through Spain, Italy, Netherlands, and Germany. East African countries of Kenya and Uganda are also involved in moving heroin to Europe, most often heroin from Afghanistan. Afghani heroin moving through East Africa and South Africa comes from Pakistan and India. South African countries such as Mozambique, Swaziland, and South Africa are also involved in moving heroin into Europe (Interpol-General Secretariat, 1989). Fazey (2007) notes that Kenya has been an emerging transit country within Africa.

Most of the heroin that reaches the United States is produced in Colombia. Heroin is moved from Colombia into other South American countries such as Chile, Argentina, Uruguay, and Venezuela. From these countries, heroin is moved through Central American countries of Costa Rica, Ecuador, and Panama into Mexico where it is moved into the United States. Another route heroin is moved on is through Aruba. The main entry points into the United States are New York, Florida, California, Arizona, and Texas (Office of International Intelligence, 2002). In addition to the United States being the main consumer of Colombian heroin, Western Europe also consumes a significant amount. Heroin is moved to Europe from Colombia through Jamaica (Cornell & Swanstrom, 2006), into Spain and Netherlands (Office of International Intelligence, 2002). Although both heroin and cocaine have far different routes, mainly due to the geography of production, the destination countries are the same.

Opportunistic Predictors

There is an estimated 134 countries worldwide that are involved in the heroin and cocaine industry, ranging from production, transit, and consumption (Layne et al., 2001).

In order for drugs to reach the main consumer nations of Western Europe and the United States, they must flow through a number of countries. Throughout the literature, the two most frequently cited factors that facilitate drug trafficking is corruption and routine activities. Drug trafficking relies on corruption to facilitate their business. Corruption involved in the drug trafficking trade is less likely to occur in developed countries, and more common in developing source countries (Desroches, 2007). Many of the major source and transit countries for both heroin and cocaine experience high amounts of corruption (Cornell & Swanstrom, 2006; Engvall, 2006; Layne et al., 2001; Paoli & Reuter, 2008; Sabatelle, 2011; Singh & Van Zyl, 2007; Walker, 2005; Williams, 1993). With transportation being a very important factor in moving drugs from source to destination countries, traffickers attempt to conceal drugs within licit traded goods and utilize natural geographical gateways (Office of International Intelligence, 2002; Engvall, 2006; Farrell, 1998; Farrell et al., 1996; Fazey, 2007; Hughes et al., 2012; Layne et al., 2001; Reid et al., 2006; Sabatelle, 2011; Singh & Van Zyl, 2007; Van Doorn, 1993; Walker, 2005).

Corruption

Throughout the review of literature on international drug trafficking, the region that was most cited with corruption problems was Central Asia. Corruption relating to drug trafficking in this region has occurred at all levels of government, including high level government officials, military personnel, ambassadors, and law enforcement (Cornell & Swanstrom, 2006; Engvall, 2006; Walker, 2005). Tajikistan has been described as the most corrupt of the countries in Central Asia. Engvall (2006) describes examples of corruption with the Ambassador of Tajikistan to Kazakhstan being caught twice for smuggling heroin, a former deputy defense minister being arrested for transporting heroin using a military helicopter, and military commander Yakub Salimov being arrested for being involved with heroin trafficking groups. Walker (2005) also provides an example with the head of the Tajikistan Drug Control Agency, General Miroev being arrested on corruption charges. Corruption has also occurred at law enforcement levels, including border patrol officers throughout Central Asia exhibiting high amounts of corruption at the borders. Walker goes on to state that low salaries of border patrol officers helps facilitate this corruption. Corruption in

Central Asian law enforcement agencies is estimated at 70% (Cornell & Swanstrom, 2006).

Central Asia may have the most widespread corruption relating to drug trafficking, however there are several other countries around the world that have similar problems. Layne et al. (2001) describes that throughout the 1990s, corruption became widespread throughout government officials in Ukraine. Also, the President of Lithuania was impeached in 2003 for his ties with Russian organized crime. Furthermore, the governments and law enforcement of Turkey and Albania, both being major transit countries for heroin, are very corrupt, allowing heroin to flow through those countries in high amounts. Furthermore, the Kosovo Liberation Army and Turkish military have been linked with drug trafficking (Paoli & Reuter, 2008).

Italy and Georgia have also experienced corruption of high level government officials relating to organized crime (Cornell & Swanstrom, 2006). West African countries have become a major transit point for both heroin and cocaine because of widespread corruption there, which allows trafficking groups to use commercial transportation (Paoli & Reuter, 2008). Corruption in the South African government and law enforcement facilitates South Africa as a major

transit point for both cocaine and heroin. Singh and Van Zyl (2007) note several instances of former South African police officers being arrested for drug trafficking. Also, during interviews with police officers, they noted widespread corruption throughout the country. Williams (1993) discusses corruption within the commercial transportation sector in Hong Kong with the Triads having members working in that industry, allowing them to conceal heroin within licit cargo. Drug trafficking relies on corruption to facilitate their business.

Routine Activities

Methods of transportation used in drug trafficking vary depending on the region the drugs are flowing through, which range from air, land, and area. A common method of the air modality is courier mules. The use of mules on commercial flights is common in the transit of heroin and cocaine from South America to Europe, Africa to Western Europe, and to Australia (Akyeampong, 2005; Office of International Intelligence, 2002; EMCDDA, 2010; Farrell et al., 1996; Fazey, 2007; Hughes et al., 2012; Interpol-General Secretariat, 1989; Layne et al., 2001; Singh & Van Zyl, 2007; Williams, 1993). The use of mules is extremely

common in moving heroin and cocaine from Africa into Europe (Fazey, 2007).

Small to medium sizes aircrafts, ranging from single to twin engine planes are used to move cocaine from South America to Central America and Mexico (Office of International Intelligence, 2002), as well to Australia and Europe (EMCDDA, 2010; Farrell et al., 1996; Hughes et al., 2012; Williams, 1993). Cargo planes are also employed in moving drugs (Office of International Intelligence, 2002; EMCDDA, 2010; Hughes et al., Van Doorn, 1993; Williams, 1993). Farrell et al. (1996) found that between 1988 and 1991, 80.7% of cocaine that was seized in Europe was transported to Europe by air. For the same time period, Farrell et al. found that 51.4% of heroin was seized in Europe was transported to Europe by air. This suggests that the number of airports a country has may be indicative of a country being a transshipment point for cocaine and heroin, although the relationship may have a stronger correlation for cocaine. Hughes et al. (2012) found that between 2002 and 2006, the majority of cocaine seized in Australia was brought in by mules on commercial flights and the postal service. Although transportation by air is employed more often than by land or sea, it is limited in that the volume

of drugs moved by air is a lot less than by sea, especially with mules.

Land is another way that drugs are transported from source countries and along transit countries. Moving drugs by land is very common throughout Central Asia and the Balkan route (Farrell, 1998; Farrell et al., 1996; Fazey, 2007; Layne et al., 2001; Van Doorn, 1993), and also in transit of drugs through Pakistan and Iran from Afghanistan (Sabatelle, 2011). Commercial fleet trucks are commonly employed when moving drugs across Europe, due to the larger volume potential in commercial trucks compared to passenger vehicles (Farrell, 1998). Farrell et al. (1996) found that between 1988 and 1991, 16% of the cocaine seized in Europe was transported by land. In contrast, Farrell et al. found that 47.3% of the heroin seized in Europe during that same timeframe was moved by land. The higher amount of heroin moved to Europe by land compared to cocaine is explained by the geography of heroin production. Whereas heroin is produced in Afghanistan and Southeast Asia, which often transits the Balkan route by land, cocaine is produced in South America, where it has to be transported to Europe either by sea or air initially.

A lot of drug flow between countries occurs simply because it is geographically facilitated by borders. Colombia borders the major transit countries of Brazil, Ecuador, Panama, Peru, and Venezuela (Office of International Intelligence, 2002). Tajikistan shares a large border with Afghanistan, making it difficult with the limited law enforcement in Afghanistan and Tajikistan to effectively combat it (Engvall, 2006). Additionally, Afghanistan and Iran also share a very large border, with only three official border patrol outposts (Sabatelle, 2011). Lastly, China, Burma, and Laos share an extensive border, all of which is easily accessible with any type of vehicle. The length of the border makes it impossible for the Chinese border patrol to effectively control the flow into China from Laos and Burma (Huang et al., 2012). These studies suggest that a country's geographical betweeness to other countries may be a facilitating factor that allows them to be more susceptible to moving cocaine or heroin.

In addition to geographical facilitators of drug trafficking, vehicular transportation is also important. Heroin flowing from Afghanistan into Central Asia is transported within loads of agricultural or other consumer goods by commercial trucks. The route from Central Asia to

Turkey is traveled on by about 1.5 million trucks, 250,000 passenger trains, and 4 million personal vehicles annually. Heroin moving through Europe from the east westward typically is transported within licit commercial goods on trucks (Layne et al., 2001). A popular method of transporting heroin through Iran is in commercial trucks, concealed within licit cargo, such as fruit, vegetables, coal, paper, and inside appliances (Sabatelle, 2011). This may suggest that countries with high amounts of licit exports are more likely to be involved in the transit of cocaine or heroin.

The most important method for transporting drugs, especially for cocaine is by sea. Vessels utilized by sea can range from sea cargo vessels, private yachts, fishing boats, and go-fast boats (EMCDDA, 2010; Farrell, 1998; Farrell et al., 1996; Hughes et al., 2012; Van Doorn, 1993; Singh & Van Zyl, 2007). Maritime vessels including fishing vessels, bulk cargo freighters, and go-fast boats are the primary method for moving cocaine from South America to both Central America and Mexico (Office of International Intelligence, 2002). Hughes et al. (2012) noted that between 2006 and 2010, the predominant method of

transportation for cocaine seized in Australia was by sea cargo vessels.

Farrell et al. (1996) found that 3.3% of the cocaine seized in Europe was transported by sea and that 1.3% of the heroin seized was transported by sea. Despite the small percentages for both heroin and cocaine, when classifying seizures by weight, transportation by sea accounted for 45.5% of the cocaine seized in Europe. This means that larger shipments are used within the sea modality, representing a high profit to risk ratio. From 1988-1991, the distribution of methods for transporting cocaine (measured by seizures) into Europe are 16% by land, 80.7% by air, and 3.3% by sea. For the same four year period, the distribution of methods used to transport heroin into Europe are 47.3% by land, 51.4% by sea, and 1.3% by air. Cocaine entering Europe through Netherlands, Spain, and Portugal is most often brought in by sea (EMCDDA, 2010; Farrell, 1998; Farrell et al., 1996). Maritime transportation methods are the most the important because mass amounts can be shipped at one time and detection is minimal (EMCDDA, 2010).

Farrell (1998) applied routine activities theory in his case study of the Netherlands regarding their status as

a major drug transit country. Farrell explains that the high volume of trade into the Netherlands causes spillover from licit trade into the illicit trade. He also describes how the modus operandi for the international movement of illicit drugs and licit goods involves both maritime and land transportation, which Netherlands has a high concentration of. The Netherlands has two major ports in Rotterdam and Amsterdam, major port container traffic, large trucking industry, and geographical connectivity to other European countries. Another important factor Farrell describes is that larger licit trade flows lead to fast processing in ports, which often leaves illicit drugs to flow undetected.

Farrell's (1998) case study of the Netherlands was the only study found that directly examined the routine activities theory within the context of international drug trafficking, however, there were many studies that exhibited similar characteristics of opportunity. Consistent with Farrell's assessment of the Netherland's port traffic, many other countries share this feature. Ports in South Hampton of the United Kingdom, Antwerp of Belgium, Bremerhaven of Germany, Helsinki of Finland, Gdansk of Poland, and Prague of Czech Republic are very

important for incoming cocaine. Cocaine coming into these ports is often concealed within licit cargo, such as asphalt and coffee (Van Doorn, 1993). Ports in Ukraine are also used by traffickers to get heroin from Asia into Europe (Layne et al., 2001). Furthermore, Spain and Portugal have long coastlines that are accessible by any sea vessel (Farrell et al., 1996).

The port of Bandar Abbas in Iran is often used for both incoming and outgoing heroin. Iran also borders the Persian Gulf, Gulf of Oman, and Strait of Hormuz, which is also utilized frequently. The majority of heroin entering Iran by water comes from Pakistan (Sabatelle, 2011). South Africa also has a lot of port traffic, with seven ports throughout the country. Until recently, South Africa had trade sanctions against it, limiting the utility of their ports. Cargo is poorly monitored leaving South African ports; cargo is only inspected if authorities receive intelligence informing them of illegal activities (Singh & Van Zyl, 2007). Colombia has over 3,200 kilometers of coastline and also borders the Pacific Ocean and the Caribbean Sea, which facilitates drug flow by sea (Office of International Intelligence, 2002).

The volume of Chinese imports and exports make it likely that there is spillover from legal to illicit trade. China has many large ports in which heroin can be shipped from. The focus of customs on thoroughly checking cargo is those coming into China rather than those leaving. Interestingly, custom officers in Hong Kong and Macau do not thoroughly examine goods coming in from China, because they assume that Chinese customs officers thoroughly checked the cargo (Huang et al., 2012).

Since 2005-2006, sea cargo freighters have been the most common method of transporting cocaine that was seized in Australia. In addition, cocaine seizures in Melbourne, Brisbane, and Perth have increased substantially in comparison with Sydney, the traditional entry point into Australia, all of which are port cities (Hughes et al., 2012). Countries through Asia Pacific have extensive coastlines which allow for traffickers to enter countries undetected. It is estimated that about 5,000 sea cargo vessels travel through the Pacific Ocean on a daily basis (Reid et al., 2006). This suggests that countries with high amounts of port flow may be more susceptible to being involved in the transit of cocaine or heroin.

Current Study

This current study extends our understanding of international illicit drug trafficking of cocaine and heroin. As stated earlier, much of the research examining drug trafficking between countries has been done at the regional level. This research provides a global portrait of the architecture of cocaine and heroin trade and tests whether crime opportunity theory can account for the relative position of transshipment nations. Given the need to be crime specific, cocaine and heroin trafficking networks were examined separately. By looking at the structure and importance of nations within each it is possible to compare the two networks.

Prior research suggests that cocaine and heroin trade networks will not be the same. Not only will the cocaine network involve fewer countries than that of heroin and thus shorter average path lengths, but the nations with stronger central positions will differ somewhat. While there are some common participants within both the cocaine and heroin networks; however there is enough variability to suggest that the structures of both networks will not be equal.

Hypothesis 1: The cocaine and heroin networks will be structurally different in terms of reciprocity, transitivity, and the clustering coefficient.

The second objective of this study is to identify the major transit countries for the cocaine and heroin networks, respectively. For the cocaine network, research suggests that Spain, Portugal, and the Netherlands are important transit points (EMCDDA, 2010; Farrell, 1998, Office of International Intelligence, 2002; Paoli & Reuter, 2008), as well as West Africa (Akyeampong, 2005; EMCDDA, 2010; Farrell, 1998; Storti & De Grauwe, 2009) The major transit countries moving heroin originating in Afghanistan are predicted to be Pakistan, India, and Iran; Turkey was noted as an important transit country for moving heroin into Europe (Sabatelle, 2011; Van Doorn, 1993). The importance of these suggested transit hubs will be tested using measures of centrality.

Hypothesis 2: Spain, Portugal, and the Netherlands will be very important transit countries within the cocaine network in terms of in-degree, out-degree, and betweeness centrality.

Hypothesis 3: West African countries will be an important transit point, to a lesser extent than Spain, Portugal, and the Netherlands within cocaine network, in terms of in-degree, out-degree, and betweeness centrality.

Hypothesis 4: Pakistan, India, Iran, and Turkey will be very important transit countries in the heroin network, in terms of in-degree, out-degree, and betweeness centrality.

The second purpose of this research is to examine opportunistic variables that facilitate drug trafficking among transit countries. Each independent variable will be included in a multivariate regression model that will examine the predictive ability of each, while controlling for the other variables included. Throughout the literature, the facilitating factor that was discussed most frequently was corruption (Cornell & Swanstrom, 2006; Engvall, 2006; Walker, 2005). It was noted that corruption often facilitates a country being a major transit point. One of the limitations of the studies discussing corruption

as a facilitator was that much of the evidence was anecdotal; this study will improve on that by using a systematic measure of corruption for each country.

Hypothesis 5: Corruption will be a significant predictor of countries being major transit points in both the cocaine and heroin networks.

The second facilitating factor is high volumes of legal trade activity. A common assertion was that that licit and illicit trade coincided (Farrell, 1998). Four conditions are thought to identify nations with important legal trade positions: high volume of export activity, geographical betweeness, high port flow of licit goods, and number of paved airports. Since prior studies suggest that these factors are correlated with illicit trade rely primarily on anecdotal evidence, this study provides a global test of these opportunity measures associated with routine activities.

Hypothesis 6: Countries with high amounts of exports will be more likely to be a transit point in both the cocaine and heroin networks.

Hypothesis 7: Countries with high amounts of geographical betweeness will be more likely to be a transit point in the cocaine and heroin networks.

Hypothesis 8: Countries with high amounts of port flow will be more likely to be a transit point in the cocaine network

Hypothesis 9: Countries with high amounts of paved airports will be more likely to be a transit point in both the cocaine and heroin networks.

CHAPTER THREE

METHODOLOGY

Dual Approach

A network methodology was used to examine the socio-geographic structure of two trafficking systems, with emphasis on the patterns of interaction among and importance of specific nations, within the context of the complete network (Bright et al., 2012). Separate networks were created for each drug examined: cocaine and heroin. The two networks were analyzed to see how similar they are to each other. Using betweeness centrality, the transit countries within both networks was identified and a multivariate regression analysis was used to examine how various opportunistic variables account for the drug distribution role played.

Network Analysis

Separate networks were generated for each drug because cocaine and heroin are produced in different locations; prior research suggests that for this reason their respective networks will involve different countries. Before the analytical strategy is discussed, it is

important to mention the data sources, network generation protocol, and reliability and validity concerns.

Data Source

The data used to build the architecture of each drug trade network was gathered from the CIA World Factbook, INTERPOL, and the UNODC. The primary source of these two networks was the CIA World Factbook because information regarding cocaine and heroin trafficking is broken down by country, making it a natural starting point. The data from the CIA World Factbook provides a comprehensive examination of each countries role within the cocaine and heroin networks. The CIA World Factbook is updated every two weeks by the CIA; countries who fall of the grid regarding drug trafficking get removed, while countries who appear on the grid get added. The data is assembled by CIA analysts utilizing seizure data from individual countries as well as from intelligence information gathered from CIA sponsored investigations.

To assess the currency of this data, a test/retest method was conducted comparing the country-to-country trade relations from 2010 and 2012 for five nations, chosen at random. Archival trade relations were found using the way back machine on archive.org, to capture information from

the last update of the CIA World Factbook in 2010. This test yielded 90% consistency for cocaine trade connections and 93% reliability for heroin. This suggests that heroin trade relations for specific nations are slightly more stable than cocaine trade ties.

Apart from the CIA World Factbook, data from INTERPOL and UNODC was relied upon to supplement the data collected from the CIA World Factbook in order to capture a more comprehensive and reliable observation of the cocaine and heroin trafficking networks. The data from INTERPOL was assembled by intelligence analysts within, which was gathered for the project called White Flow. This project focuses on recent trafficking trends. The data was collected from individual country data and intelligence reports by INTERPOL analysts. The UNODC data came from the 2012 World Drug Report, which provides a current comprehensive examination of international drug trafficking. This data is collected by individual nations as well as the UNODC.

Network Generation

The architecture of illicit trade was modeled with a country-to-country network where trade ties indicated that one nation passes the drug to another. These networks are

directed and unvalued. Direction is needed to capture transshipment routes. Ties between countries are scored as 1 for known trade connection and 0 for no suspected, high-level shipping activity. Table 2 presents descriptive statistics for both networks. With the exception of the heroin network containing 18 more countries than the cocaine network, they are very similar in terms of number of components, ties, average path length, and density.

Table 2. Descriptive Network Statistics

Variable	Cocaine	Heroin
Number of Components	1	1
Number of Nodes	107	125
Number of Ties	509	527
Average Path Length	3.7	3.7
Density	4.5%	3.4%

Reliability and Validity

It is important to note that this data has its limitations, which may adversely affect the reliability and validity of the results. The three sources used had the most specific data on major countries involved in the heroin and cocaine network, such as those in Europe and South America. In many instances, data triangulation

suggested that ties between nations were somewhat reliable; meaning that the country-to-country trade connection was found in multiple sources. However, a more comprehensive picture of the trade network only emerges from compiling data from all three sources. For the cocaine network, 27% were in all three sources, 18% were in two sources, and 55% were in one source. For the heroin network, 26% were in all three sources, 12% were in two sources, and 62% were in one source.

A second issue of concern relates to vague geographic references made by some sources, particularly in reference to the drug trade transiting through Africa and Asia. For example, Africa is mentioned in INTERPOL sources in a broad sense, such as cocaine is moved to West Africa and then to North Africa (INTERPOL, 2012). Broad classifications such as this occurred multiple times throughout almost every continent. In the dataset created, a variable was included labeled "Region of world" for each country which was collected from the CIA World Factbook (2012); whenever a broad term of direction occurred, the corresponding countries according the CIA World Factbook (2012) were included. This coding decision may over estimate the number of countries associated with the drug trade.

Like all research based on law enforcement data, this study faces the widely discussed challenge of being restricted by "known" crime activity. The countries identified in the cocaine and heroin trade from these sources are only the major, well known or established within their respective networks. It is likely that recent developments or global shifts in market activity may be omitted from the reports and thus, new or emerging trade routes will be missing from the present study. Since we do not know the extent to which other countries may be involved but are not listed, the results are limited to extrapolation to the known international drug trafficking networks. Despite this dilemma, the current research seeks to understand what has not been examined by the literature to date, therefore will be beneficial the drug trafficking literature.

An urge of caution is necessary as far as validity is concerned because of the nature of the data. The data were obtained from reputable sources (CIA, INTERPOL, and UNODC), however, only publically available data were used. It is likely that each organization keeps much of their information about emerging trends classified. With international drug trafficking being an important aspect of

transnational crime, a source of funding for terrorist groups, and a threat to national security for countries (Cornell & Swanstrom, 2006), there is likely to be a lot of data that is held back from the public. Another possible explanation for some data to be kept from the public is that if all the data these agencies had on the international drug trafficking industry was released, those involved in this trade would being using this data to their advantage.

Variables

Two sets of variables were used in this study. Network statistics identify critical structural characteristics and important players within the networks. The three structural statistics are reciprocity, transitivity, and the clustering coefficient. Two measures of centrality are used to determine the role countries play in the trafficking of both cocaine and heroin: degree and betweeness.

Five opportunity variables were generated for the multivariate regression analysis designed to predict transshipment nations. For this study, the five independent variables are: the World Governance Indicator (WGI) for control of corruption, annual exports, annual port flow,

geographical connectivity, and paved airports. The dependent variable is whether a country is a major transit point for each respective drug.

Network Variables

Reciprocity examines the relationship between two dyads, specifically whether or not the flow between two nodes goes in both directions. The degree to which a network is reciprocated provides an indication of cohesion (Hanneman & Riddle, 2011). The equation for reciprocity is displayed below (Snijders, Van de Bunt, & Steglich, 2010)

$$S_{2i}(X) = \sum_j x_{ij}\, x_{ji}$$

Transitivity is a relationship that occurs among three actors in a network. Of the various forms of transitivity, this study is concerned with transitive triples (Hanneman & Riddle, 2011). The equation for transitive triplets is displayed below (Snijders et al., 2010).

$$S_{3i}(X) = \sum_{j,h} x_{ij}\, x_{jh} x_{ih}$$

The clustering coefficient measures the extent to which nodes within a network tend to cluster with each other (Hanneman & Riddle, 2011). The equation for the clustering coefficient is produced below (Kemper, 2010).

These statistics were calculated for both networks and then compared among each other in order to determine which network is more structurally cohesive.

$$C_{gi} = \frac{1}{n}\sum C_i$$

Measures of centrality are used in order to determine which nodes, in this case countries, are in a favored position within the network. A favored position is taken to mean that the countries identified are more important than others in the transshipment of each respective drug. Degree centrality and betweeness will be calculated to see which countries emerge as favorable in these networks.

In general, degree centrality is the number of nodes a given node is connected to (Freeman, 1978). With directed networks, such as this case, there are two types of degree centrality: in and out-degree. In-degree measures the number of links that are delivered to a given node, whereas out-degree measures the number of links that are originating from a given node. Nodes that display a high out-degree are considered the most influential within that network and nodes with a high in-degree are considered to be the most prestigious (Hanneman & Riddle, 2011). The equation for in-degree is displayed below. The equation for

out-degree is second displayed below the in-degree equation (Wasserman & Faust, 1994).

$$C_D(N_1) = \frac{x_{+i}}{g-1}$$

$$C_D(N_1) = \frac{x_{i+}}{g-1}$$

Betweeness centrality measures a node's bridging function, that is, how often a node lies within the geodesic paths of other nodes within the networks (Freeman, 1977). Betweeness is often looked at as who has the power within a network, because a node with a high betweeness is in a favored position to broker exchanges (Hanneman & Riddle, 2011). The equation for betweeness centrality is displayed below (Knoke & Yang, 2008).

$$C_B(N_i) = \sum_{j>k} \frac{g_{jk}(N_i)}{g_{jk}}$$

Table 3 presents the descriptive statistics for the measures of centrality used. On average, the countries within the cocaine network have fewer direct ties, both in and out-degree, than the heroin network. Additionally, the standard deviations are smaller for nations in the cocaine network. In terms of betweeness, the cocaine network has more countries that lie along the shortest path of others,

but the heroin network has more countries with greater amounts of sending and receiving.

Table 3. Descriptive Centrality Statistics

Cocaine				
	Mean	Std. Dev.	Minimum	Maximum
In-Degree	2.2	2.6	.5	16.4
Out-Degree	2.2	1.8	0	11.7
Betweeness	1.1	1.7	0	7.6
Heroin				
	Mean	Std. Dev.	Minimum	Maximum
In-Degree	3.4	4.0	0	20.8
Out-Degree	3.4	3.3	0	16.8
Betweeness	.6	.8	0	4.0

These measures of centrality give important insight on the countries that are crucial in the trafficking of cocaine and heroin: centrality identifies those directly tied in both the sending and receiving cocaine and heroin, whereas betweeness identifies those which are intermediaries in the trafficking of cocaine and heroin. In other words, countries with high amounts of sending and receiving are distribution centers, and countries that lie between many countries are simply transshipment points. Betweeness centrality is used to determine the dependent variable in the logistic regression analysis. Countries

that are major transit countries within each respective network are coded 1 and countries that are not are coded 0.

The criteria for determining major transit countries is one beyond the standard deviation, which is adding the mean and standard deviation together for each network and using that as the cutoff point. Therefore, each country with a betweeness at or above 2.8 in the cocaine network and at or above 1.4 in the heroin network is coded 1. All countries with a betweeness below the cutoff point are coded 0. A second regression model was estimated using the CIA designation of countries being involved in the transit of cocaine and heroin, respectively in order to see how the independent variables interact with the CIA designation of a country being involved in the transit of cocaine or heroin. Table 4 presents descriptive statistics for the dependent variables in both networks.

Table 4. Descriptive Statistics for Dependent Variables

Cocaine (n=107)				
	Mean	Std. Dev.	Min	Max
CIA Designation	.81	.39	0	1
1 Beyond Std. Dev.	.15	.36	0	1
Heroin (n=125)				
	Mean	Std. Dev.	Min	Max
CIA Designation	.78	.42	0	1
1 Beyond Std. Dev.	.14	.34	0	1

Opportunity Variables

The first independent variable is corruption. This variable was obtained from the Worldwide Governance Indicators for 2011, which is produced by the World Bank (2011). This variable measures the amount of corruption that is present in each country, primarily the government. The data was generated from 30 sources including surveys of citizens and experts from various research institutes, think tanks, and non-governmental organizations (Kaufmann, Kraay, & Mastruzzi, 2010). Each country's corruption score is coded in terms of its percentile among all the countries, ranging from 0 to 100. This variable was initially coded with the higher score reflecting lower corruption; however, since it is believed that a higher corruption score will cause a country to be more active in

the drug trade, the coding is reversed, with a higher corruption score reflecting more corruption. Out of the 223 countries in the dataset, 10% of the cases are missing.

The second independent variable is exports. This variable was obtained from the CIA World Factbook. Exports are defined as the U.S. dollar (USD) amount of all merchandise exported out of a given country (CIA, 2012). The dollar amount for each country includes the worth of the merchandise itself, as well the insurance and freight costs. For this variable, there are 4% missing cases. An important limitation of this variable is that only licit exports are included, so depending on a country's illicit trade, it may be under estimated.

The third independent variable is port flow. The data for this variable was obtained from the World Bank (2012). This variable measures the amount of standard size containers that flow in and out of a given country yearly. Empty containers flowing in and out of ports are also included in the port flow. This is a limitation of the data because it is not known the extent to which the port flow of a given country is from empty containers or full containers. This variable has 8% missing cases. An explanation for this is that some countries have a reported

port flow of zero, because trade statistics are incorporated into the figures reported for their parent country. A prime example of this is Macau, which is a special administrative region of China. Despite these limitations, this variable will be valuable in determining whether countries with higher port flow are likely to be involved in drug trafficking.

The fourth independent variable is geographical betweeness. A network was created using data on bordering countries gathered from the CIA World Factbook and augmented with visual inspection of world maps. After the network was created, betweeness centrality for each country was calculated. The range for geographical betweeness is from zero to sixteen. Since it was noted that moving cocaine and heroin by land is a common mode of transportation, this variable will allow for the examination of this. Using betweeness centrality scores instead of the number of countries each country borders will be more useful because betweeness measures a given countries proximity to others' rather than those directly adjacent.

The final independent variable is paved airports, which measures the number of paved airports located in each

country. This variable was collected from the CIA World Factbook. It was observed in the literature review that air travel is a common modality for moving cocaine and heroin, either by mule on commercial planes, or in larger quantities on cargo or private planes (Akyeampong, 2005; Office of International Intelligence, 2002; EMCDDA, 2010; Farrell et al., 1996; Fazey, 2007; Hughes et al., 2012; Interpol-General Secretariat, 1989; Layne et al., 2001; Singh & Van Zyl, 2007; Williams, 1993). This variable indirectly estimates the amount of opportunity each country has to use air travel in order to move drugs. Countries with larger amount of airports exhibit more opportunity for drugs to be moved through it.

Descriptive statistics for each independent variable are listed in table 5 for each drug type. Since each drug network includes a different set of countries, though some nations may appear in both networks, there are slight differences in the reported means, standard deviations, and range. Due to the large range for exports, port flow, and paved airports, the values were converted into standardized z-scores. Doing this condenses the range which will make for a more robust statistical analysis. A resulting

consequence from this action made the minimum value for these variables a negative coefficient.

Table 5. Descriptive Statistics for Independent Variables

Cocaine (n=107)				
Variable	Mean	Std. Dev.	Min	Max
Corruption	45.78	27.56	2	96
Exports	0	1.0	-0.40	6.04
Port Flow	0	1.0	-0.38	8.16
Connectivity	1.26	3.14	0	16.15
Airports	0	1.0	-0.21	9.98
Heroin (n=125)				
Variable	Mean	Std. Dev.	Min	Max
Corruption	51.01	28.89	2	100
Exports	.01	1.02	-.44	6.15
Port Flow	.004	1.01	-.28	9.80
Connectivity	1.49	3.17	0	16.20
Airports	0	1.0	-.021	10.84

Analytic Strategy

The analytic strategy of this research is twofold: to use a quadratic assignment procedure (QAP) correlation to determine the similarity among the cocaine and heroin networks and to use a multivariate regression analysis for each network to examine how the five opportunistic variables mentioned affect the cocaine and heroin trafficking industry. A binary logistic regression is used

to examine how the five independent variables affect the dependent variable.

Network Analysis Strategy

The network analysis strategy involves a QAP correlation to determine the similarity between the respective cocaine and heroin networks. The requirement for a QAP correlation is that both networks being correlated must have the same actors (Hanneman & Riddle, 2011). In order to make the cocaine and heroin networks have the same actors; countries that are in one network, but absent from the other, are subsequently placed in that network, coded with a 10 representing structural absence. The Jaccard coefficient was examined from the QAP correlation to determine the extent to which both networks are similar.

Logistic Regression Analysis

In order to determine which covariates are associated with countries positioned to be transit nations within each drug network, a binary logistic regression model was estimated using SPSS. A binary logistic regression model examines the probability of the dependent variable occurring within the context of independent variables (Bachman & Paternoster, 2009). This type of regression model differentiates itself from other models of

multivariate regression in that the dependent variable is a binary variable. Unlike multivariate regression models with continuous dependent variables, a logistic regression does not assume a linear relationship because the dependent only has two attributes (Mendard, 2002). As mentioned earlier, there are five independent variables in this model: corruption, exports, port flow, geographical connectivity, and paved airports. A logistic regression model was estimated for each of the networks. Boot strapping was used for this model because of the dependent nature of the data and the data is highly skewed (Mooney & Duval, 1993).

Before a logistic regression model can be estimated, a check for multicollinearity is required. Multicollinearity is when the independent variables in the model are too highly correlated with each other, which poses a problem in regression analysis (Bachman & Paternoster, 2009). In order to check for multicollinearity, a five by five correlation matrix was calculated to ensure that none of the variables in this model are too highly correlated. Due to multicollinearity between exports and port flow within both the cocaine and heroin models, port flow was removed (see appendix A).

It is important when doing any multivariate regression models to make sure that the independent variables fit the model well (Bachman & Paternoster, 2009; Mendard, 2002). For this reason, two goodness of fit measures are examined: pseudo-R square and the likelihood ratio statistic. Pseudo R-square is similar to the R-square coefficient for ordinary least-squares regression models, but it has not achieved widespread acceptance among social scientists (Bachman & Paternoster, 2009), which is why other goodness of fit measures are being used as well. Specifically, there are two pseudo R-square measures that will be examined: Cox-Snell and Nagelkerke (Mendard, 2002); the most conservative score is reported in the results. Although they are not exactly the same as R-Square, they can be interpreted the same, as how much variation in the dependent variable is explained by the independent variables. The likelihood ratio statistic (-2LL) is interpreted as an indicator to examine how well the independent variables fit the model. In order for the model to be a good one, a small likelihood ratio statistic is desired (Bachman & Paternoster, 2009).

CHAPTER FOUR

RESULTS

Tests of Hypotheses

The results are divided into three sections: structural, centrality, and multivariate regression. The structural results present the three structural statistics for each network, allowing for a comparison among the cocaine and heroin network structures. In this section, the Jaccard coefficient is presented in order to see the similarity among the ties that exists within the two networks. The centrality results present the top fifteen countries for the three centrality statistics chosen for each network. The multivariate regression results present the findings regarding the independent variables' effect on the dependent variable. The exponentiated coefficient is included, which allows for a more precise look at the effect each independent variable has.

Structural Results

Table 6 presents the structural statistics for each network. The largest margin of difference among the structural statistics is reciprocity. The cocaine network has a reciprocity that is almost double to that of the

heroin network. Despite the large difference between networks, both have a small reciprocity relative to the entire network. Clustering coefficients for both network show that 20.5% of the cocaine network and 23.4% of the heroin networks are clustered. This statistic has the highest percentage among all structural statistics examined. The low transitivity for both networks shows that there are not many countries that group into clusters of three. Apart from reciprocity, the cocaine and heroin networks are very similar structurally.

Table 6. Structural Statistics

Variable	Cocaine	Heroin
Density	4.5%	3.4%
Reciprocity	18.1%	11.1%
Transitivity	10.0%	11.7%
Clustering Coefficient	20.5%	23.4%

Another important aspect to examining the overall structure of these networks is to look at how similar they are based on the ties that exist. In order to do this, a QAP correlation was estimated. This resulted in a Jaccard coefficient of 0.163, which means that 16.3% of ties exist

in both networks. This shows that although there are a lot of countries that are in both networks, the same country to country paths are not observed with great frequency. Simply stated, the trade architecture for each drug is substantively different.

Centrality Results

Important transit nations are identified with three measures of centrality: in-degree, out-degree, and betweeness. Table 7 presents the centralization for each centrality statistic in both networks. Centralization reports the percent of the countries in the network that are directly connected to the nation with the highest score (Hanneman & Riddle, 2005). Within the heroin network, a greater percent of nations are tied directly to the highest scoring country. On the other hand, betweeness exhibits most centralization within the cocaine network.

Table 7. Centralization Statistics

Centralization	Cocaine	Heroin
In-Degree	14.3%	17.6%
Out-Degree	9.5%	13.5%
Betweeness	6.6%	3.5%

The top fifteen scoring countries for in-degree centrality in each network are presented in table 8. Spain, Portugal, and the Netherlands are the top three scorers for the cocaine network and among the top five scorers for the heroin network. Furthermore, at the bottom of the list, Mali, a West African country, is a high scoring country within the cocaine network. An interesting observation among the top fifteen countries for in-degree for both networks is the prevalence of European countries, primarily Western Europe, and also that many of the same European countries are observed for both networks.

Table 8. Top Fifteen In-Degree Centrality Scores for Cocaine and Heroin Networks

Cocaine		Heroin	
Country	In-Degree	Country	In-Degree
Spain	16.4	**United Kingdom**	20.8
Portugal	13.1	**Netherlands**	20.8
Netherlands	13.1	**France**	20.0
United Kingdom	11.7	**Spain**	19.2
United States	9.8	**Portugal**	16.8
Dominican Republic	6.1	**United States**	12.0
Haiti	6.1	Ireland	12.0
France	5.6	**Italy**	11.2
Jamaica	5.1	Australia	7.2
Italy	4.7	Germany	6.4
Egypt	3.3	Russia	6.4
Greece	3.3	Taiwan	6.4
Hungary	3.3	**Austria**	5.6
Mali	3.3	**Greece**	5.6
Austria	3.3	Hong Kong	5.6

Bold denotes country is on top 15 for both networks

Table 9 presents the top fifteen scoring countries for out-degree. For the cocaine network, the prevalence of South American and Caribbean countries is observed. Also, Jamaica, Dominican Republic, and Haiti are top scoring countries in the cocaine network for both in and out-degree. United Kingdom, France, Egypt, and Greece are also high scoring countries for both in and out-degree, designating all nine of these countries major transit hubs for cocaine. For the heroin network, West Africa is well represented in the top five for out-degree. This is

surprising because West Africa was hypothesized to be important in the transit of cocaine, not heroin.

Table 9. Top Fifteen Out-Degree Centrality Scores for Cocaine and Heroin Networks

Cocaine		Heroin	
Country	Out-Degree	Country	Out-Degree
Brazil	11.7	Ghana	16.8
Trinidad and Tobago	7.9	Cote D'Ivoire	16.8
Venezuela	6.5	Liberia	15.2
Bolivia	6.1	Senegal	14.4
Jamaica*	5.1	Colombia	12.0
Dominican Republic*	4.7	**Venezuela**	11.2
Haiti*	4.7	Pakistan	8.8
Argentina	4.7	**Egypt**	8.8
Ecuador	4.7	Vietnam	8.0
Peru	4.7	China	7.2
United Kingdom*	3.7	India	7.2
France*	3.7	**France***	6.4
Egypt*	3.7	Germany*	6.4
Greece*	3.7	Turkey	6.4
Cyprus	3.7	Macau	6.4

Bold denotes country is on top 15 for both networks
* denotes country is on top 15 within network for both in and out-degree centrality within given network

France and Germany are the only countries within the heroin network that are in the top fifteen for both in and out-degree, meaning they are major transit hubs. Venezuela, Egypt, and France are the only countries on the top fifteen for out-degree in both networks. The distribution of

countries for heroin is spread more geographically than in-degree, with countries from West Arica, South America, Middle East, East Asia, and Western Europe observed.

Lastly, the top fifteen scoring countries for betweeness are presented in table 10. The most surprising observation in this table is that Greece is the top scoring country for betweeness in the cocaine network and Germany is top scoring country in the heroin network. European countries are well represented for betweeness in both networks. Interestingly, France and Egypt are the only countries within the cocaine network to be in the top fifteen for each centrality statistic presented. On the other hand, Germany is the only country within the heroin network to be in the top fifteen for each centrality statistic presented as well.

Table 10. Top Fifteen Betweeness Centrality Scores for Cocaine and Heroin Networks

Cocaine		Heroin	
Country	Betweeness	Country	Betweeness
Greece	7.6	**Germany****	4.0
Germany	7.0	**Italy**	3.7
Hungary	6.4	**France**	3.6
France**	6.2	**Poland**	3.6
Macedonia	6.2	Turkey	2.8
United Kingdom**	5.9	Russia	2.5
Egypt**	5.1	**Austria**	2.2
Poland	4.5	Ethiopia	2.1
Brazil	4.4	**Ukraine**	2.1
Croatia	3.5	India	2.0
Netherlands	3.5	Bangladesh	1.8
Ukraine	3.1	Albania	1.6
Italy	3.1	China	1.6
Austria	3.0	**Hungary**	1.6
Mali	2.9	Spain	1.6

Bold text denotes country is ranked in top 15 for both networks

** denotes country is on top 15 within network for all three measures of centrality within given network

Regarding the hypotheses, most of the countries thought to be important in the transit of cocaine and heroin are observed in the top fifteen scores for at least one centrality statistic. For the cocaine network, the Netherlands and Mali are represented on the top fifteen for two of the three centrality statistics (In-Degree and Betweeness), whereas Spain and Portugal are only listed on one (In-Degree). It is interesting that Mali is the only

West African country represented in three tables depicting centrality within the cocaine network.

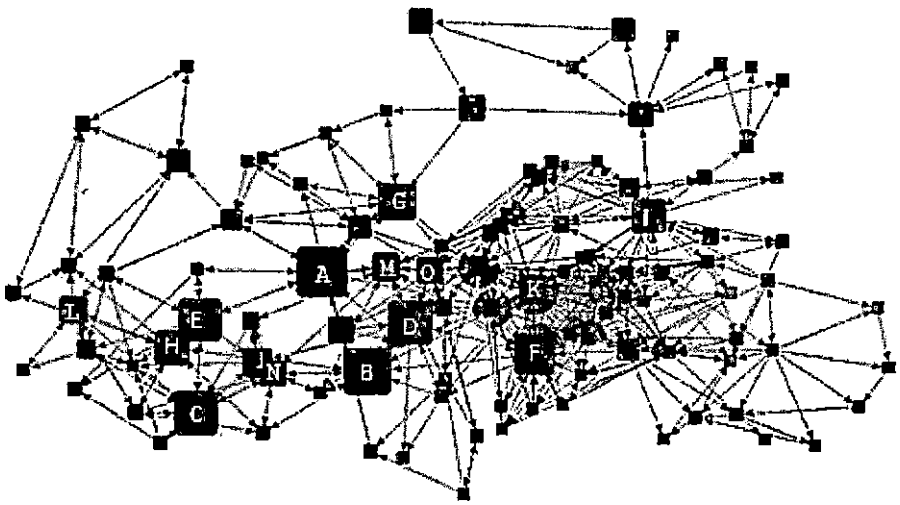
For the heroin network, Iran is the only country from the hypotheses that is not represented here. India and Turkey are the only countries from the hypotheses that are represented in the top fifteen scores for two of the centrality measures (Out-Degree and Betweeness). Turkey has the fifth highest betweeness and India has the tenth highest, making them very important in the transit of heroin. Pakistan is only represented in the top fifteen scores for out-degree. Although the countries listed in the hypotheses were not found to be most important in the transit of cocaine or heroin, all except Iran were found to be very important in terms of centrality statistics.

A series of sociograms were produced for each network to give a visual representation. For all the sociograms displayed, the larger nodes represent larger betweeness scores within the countries displayed.

Cocaine Trade Architecture

Figure 1 below is a sociogram of the entire cocaine network. Although at this point it is difficult to make sense of anything, the clustering in the right center of the network is visible. This region with the clustering is

Western Europe. With the exception of the clustering within Western Europe, the network is loosely connected.



Symbology

Size denotes betweeness score

Country Codes

A Greece	F United Kingdom	K Netherlands
B Germany	G Egypt	L Ukraine
C Hungary	H Poland	M Italy
D France	I Brazil	N Austria
E Macedonia	J Croatia	O Mali

Figure 1. Sociogram of the Cocaine Network

Figure 2 below is smaller slice of the cocaine network, displaying the countries that are one path length away from Spain, Portugal, and the Netherlands. These three countries have the highest in-degree scores for the cocaine network. At this stage, the network is easier to dissect. This sociogram shows that the four major routes for cocaine

from the source countries of Colombia, Bolivia, and Peru to Western Europe are through the Caribbean, North Africa, West Africa, and directly from South America.

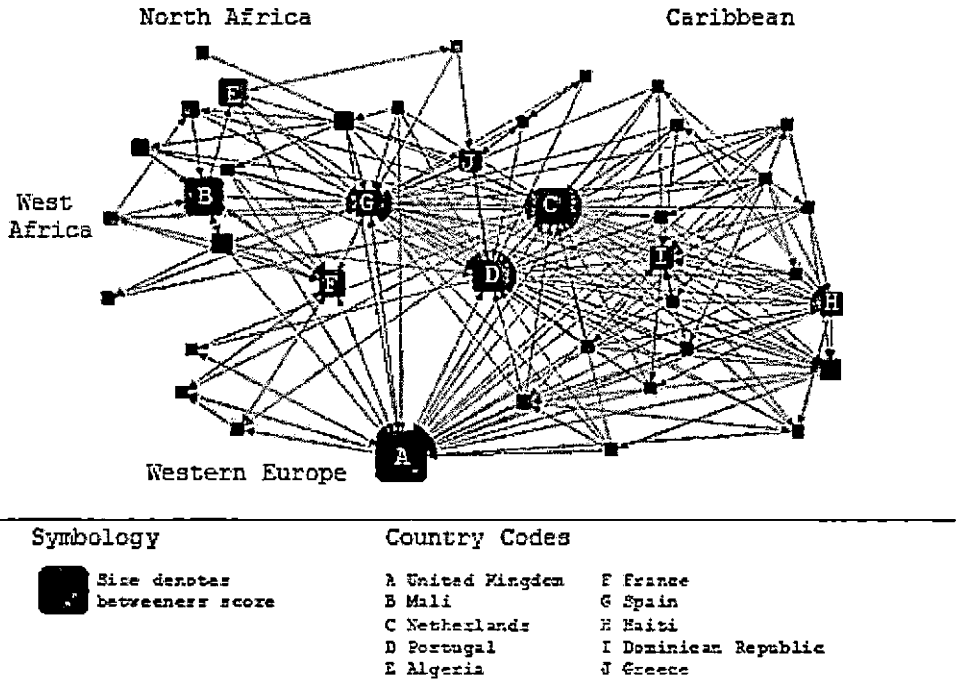


Figure 2. Sociogram of Spain, Portugal, and the Netherlands within the Cocaine Network

Figure 3 below displays the countries that are one path length away from the West Africa countries of Benin, Cape Verde, Cote d'Ivoire, Ghana, Guinea-Bissau, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Although Mali was the only West African country in

the top fifteen scores for the measures of centrality, as a region, West Africa is a transit hub for cocaine for both Western Europe and the United States. Within West Africa, Ghana and Mali are the main transit countries for cocaine to West Africa, although the other countries do transit cocaine to a lesser extent.

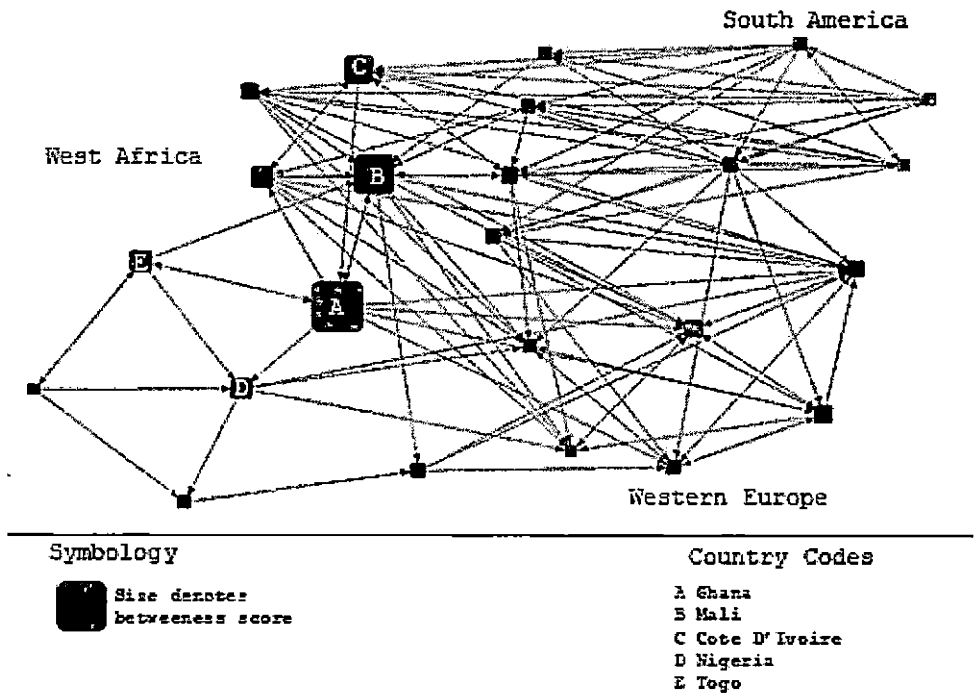
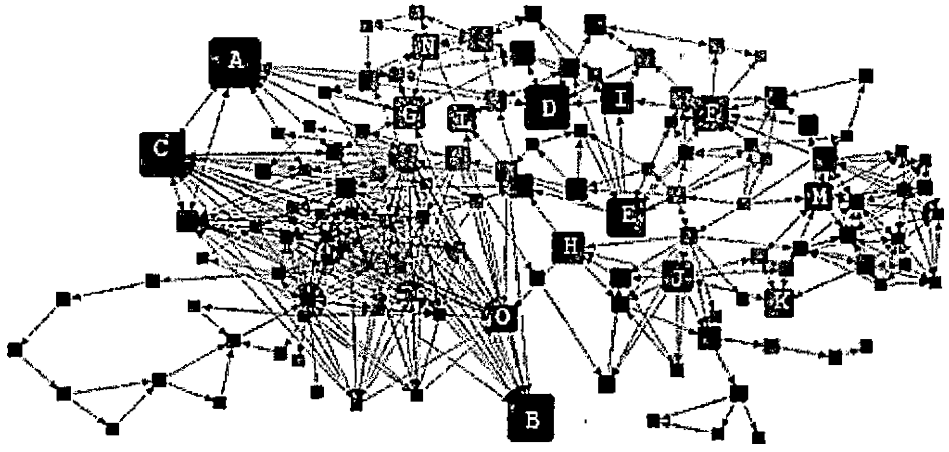


Figure 3. Sociogram of West Africa within the Cocaine Network.

Heroin Trade Architecture

A sociogram of the entire heroin network is presented below in figure 4. Similar to the sociogram of the entire cocaine network, it is difficult to make out the individual countries' paths. Extreme clustering is also visible within the left side of the sociogram, which is Western Europe. There is also subtle clustering on the right side of the sociogram, which is Eastern Asia. This is because China is a major transit country for heroin, moving it into most East Asian countries as well as Australia. Other than the two clusters within the sociogram, this network is loosely connected.



Symbology

Size denotes betweeness score

Country Codes

A Germany	F Russia	K Bangladesh
B Italy	G Austria	L Armenia
C France	H Ethiopia	M China
D Poland	I Ukraine	N Hungary
E Turkey	J India	O Spain

Figure 4. Sociogram of the Heroin Network

Figure 5 below is a sociogram of Spain, Portugal, and the Netherlands within the heroin network. These three countries were in the top fifteen scores for in-degree, making them very important for cocaine coming into Western Europe. Similar to the cocaine network, the Caribbean, North Africa, West Africa, and South America are very important transit hubs for Western Europe. The heroin that transits the Caribbean and West Africa is primarily from Colombia. The importance of West Africa within the heroin trade is very interesting because the literature suggested

that West Africa was most important in the trafficking of cocaine.

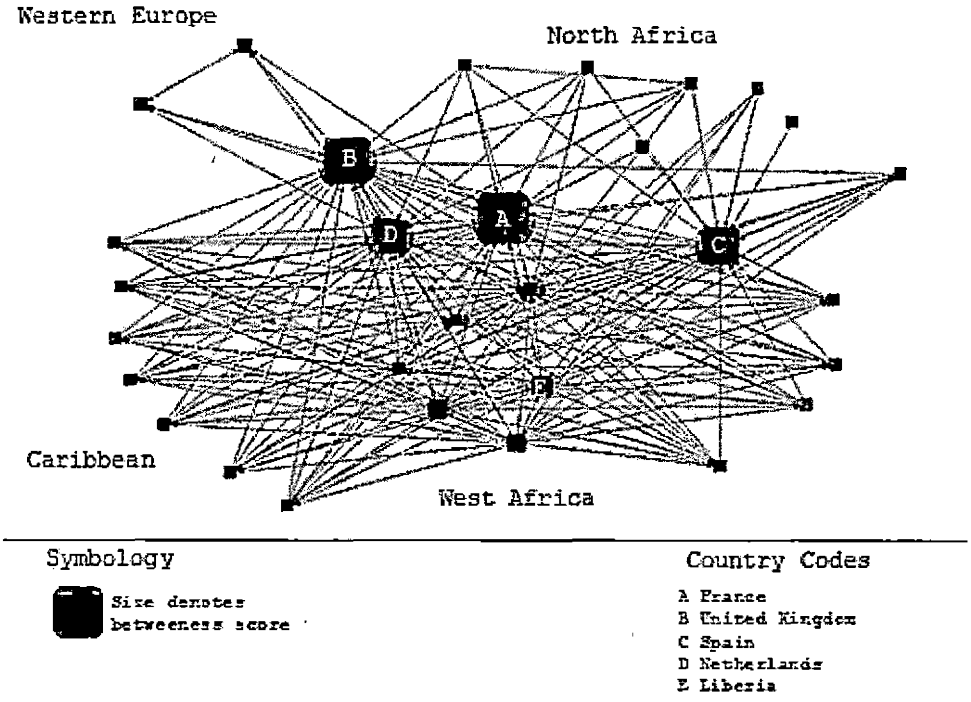


Figure 5. Sociogram of Spain, Portugal, and the Netherlands within the Heroin Network

One of the misleading things from figure 5 is that it suggests that most of the heroin coming into Western Europe is from Colombia, when in fact, Afghanistan supplies 90% of the world's heroin supply (Sabatelle, 2011). The literature suggested that the four transit countries for moving Afghani heroin into Western Europe were Iran, Pakistan,

India, and Turkey. Iran and Pakistan are bordering countries to Afghanistan, India is a bordering country of Pakistan, and Turkey is a bordering country of Iran, making these countries very interconnected within the heroin trade. Although Iran was not a top scoring country for any of the measures of centrality, this country does play a role within the heroin network.

Figure 6 below is a sociogram of Iran, Pakistan, India, and Turkey. This sociogram shows the many paths that heroin takes from Afghanistan. The most well-known route is the Balkan route, which begins at Turkey and goes up through Southeastern Europe into Western Europe. The beginning of this route is illustrated in the top left of the sociogram below. Another notorious route is the Silk route, which goes up through Central Asia and into Russia, which is illustrated on the top right of the sociogram below. Russia, although known as a consumer of heroin, also moves it into Western Europe through Ukraine and other Eastern European countries. The Silk route through Central Asia also transits heroin into Azerbaijan which feeds into the Balkan route at Turkey. Iran and Pakistan are also involved here, as they move heroin into both the Balkan and Silk route. Lastly, Pakistan and India are very important

because they move heroin into Eastern Africa, which is a transit hub for Western Europe.

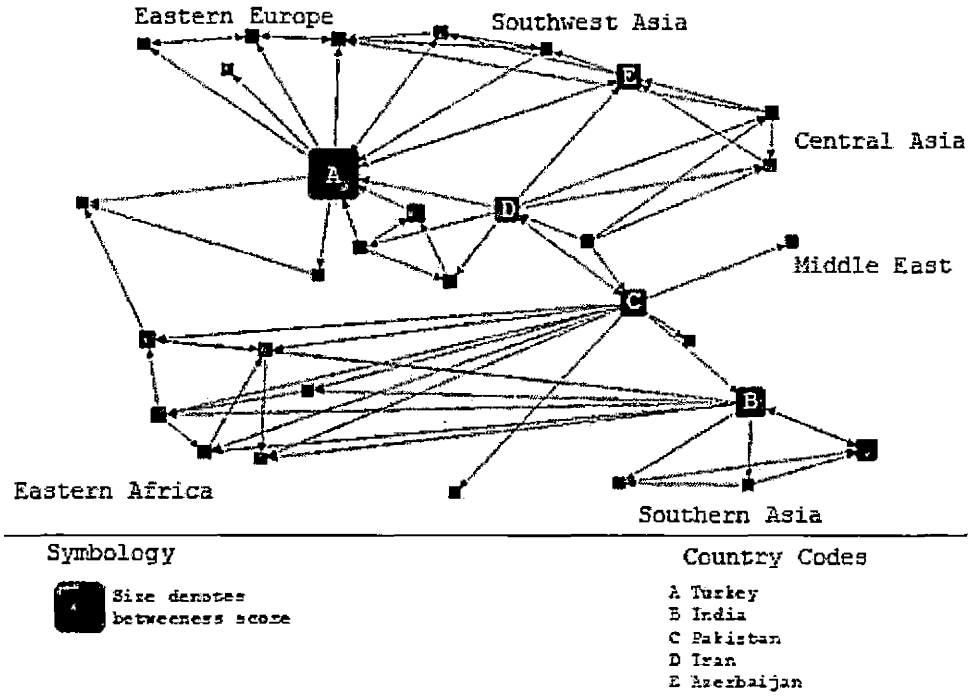


Figure 6. Sociogram of Iran, Pakistan, India, and Turkey within the Heroin Network

The heroin network is more complex than the cocaine network due to multiple sources for heroin production. Where cocaine is only produced in South America, heroin is produced in South America, Afghanistan, and the Golden Triangle (Laos, Burma, and Thailand). Laos, Burma, and Thailand are not of particular interest in this study

because for the most part, they supply the regional area of East Asian countries rather than the international market. Western Europe is the epicenter for both cocaine and heroin.

Multivariate Regression Results

Two binary logistic regression models were estimated for each network, using the same independent variables: corruption, exports, geographical connectivity, and paved airports. The first dependent variable was whether a country was involved in the transit of the respective drug, with the criteria being described in depth earlier. There are sixteen countries within the cocaine network and seventeen countries within the heroin network that are designated as major transit countries (See Appendix B). The second dependent variable was the CIA designation for a country being involved in the transit of that particular drug.

Table 11 presents the logistic regression results for the cocaine network. With one beyond the standard deviation as the dependent variable, exports were found to be the only significant finding, with higher amounts of exports being related to a country being a major transit point for cocaine. An interesting finding within this is that the

odds of country being a major transit country increases 409% for countries with higher amounts of annual exports.

Table 11. Logistic Regression Results for Cocaine Network

Variables	1+Standard Deviation			CIA Designation		
	B	SE	Exp.	B	SE	Exp.
Corruption	.000	.013	1.000	.008	.012	1.008
Exports	1.629*	.821	5.098	.969	1.101	2.634
Connectivity	.105	.157	1.111	-.200*	.148	.819
Airports	-.002	.005	0.998	-.003	.005	.997
N	104			104		
Pseudo R^2	.160			.116		
-2LL	71.211			88.971		

* denotes p<.05

With the CIA designation as the dependent variable, geographic connectivity is the only significant finding, however with the coefficient being negative; it suggests countries with higher geographical connectivity are less likely to be a transit country for cocaine. Also, although not significant, countries with higher amounts of annual exports 163% increase in the likelihood of being a transit country. This odds increase for annual exports is smaller in magnitude, but similar to the model using one beyond the standard deviation as the dependent variable.

Comparing the goodness of fit measures from both models, using one beyond the standard deviation as the dependent variable is more appropriate. This model has a pseudo r-square of .16, where the pseudo r-square for the CIA designation model is .12. Furthermore, the one beyond the standard deviation model has a lower least likelihood ratio, suggesting the independent variables fit better than the CIA designation model. The first model does a better job of explaining the model, but both models have relatively low pseudo r-squares, meaning that there are other explanations for countries being involved in the transit of cocaine.

Table 12 presents the logistic regression results for the heroin network. With one beyond the standard deviation as the dependent variable, exports and geographical connectivity were found to be significant. Annual exports have a much higher coefficient as well as a much higher exponentiated coefficient. The odds of a country being a major transit country increase 230% for countries with higher annual exports. Geographical connectivity, although having a much lower coefficient is important to note.

Table 12. Logistic Regression Results for Heroin Network

Variables	1+Standard Deviation			CIA Designation		
	B	SE	Exp.	B	SE	Exp.
Corruption	.004	.013	1.004	-.007	.009	.993
Exports	1.193*	.560	3.295	.094	.765	1.098
Connectivity	.133*	.094	1.142	-.039	.102	.962
Airports	-.001	.005	.999	-.001	.006	.999
N	123			123		
Pseudo R^2	.130			.037		
-2LL	81.765			127.270		

* Denotes p<.05

With the CIA designation as the dependent variable, there are no significant findings. Also, each independent variable has coefficients that are close to zero, suggesting no effect from the independent variables on the dependent variable. In addition, there is no independent variable that highly increases the odds of a country being a major transit country.

Similar to the cocaine results, for heroin, one beyond the standard deviation is the better model of the two. The CIA designation model has a far lower pseudo r-square of .037, compared to a .13 for the one beyond the standard deviation model. The least likelihood ratio is also a lot higher for the CIA designation model.

Out of the four hypotheses constructed to determine opportunistic variables that predict a country being a major transit country, only annual exports and geographical connectivity were found to be significant. For the cocaine network, annual exports were significant for the model with one beyond the standard deviation model and geographical connectivity was significant for the CIA designation model. Interestingly, both annual exports and geographical connectivity were found significant for the one beyond the standard deviation model within the heroin network, although annual exports had the largest effect. Another surprising observation was no significant findings for the CIA designation model within the heroin network.

CHAPTER FIVE

DISCUSSION

Summary of Results

Since there is no prior study to examine the country to country structure of international trafficking of cocaine and heroin in its entirety, there are no results to compare with. Despite the lack of prior research examining this aspect of the drug trade, since separate networks were created for each drug, this allows for a thorough comparison between cocaine and heroin. Contradicting the first hypothesis, the structure of both networks is very similar. Both networks had reciprocity, transitivity, and clustering coefficient that were very close to one another. There was a small margin of difference between both networks for reciprocity, but there was still only a 7% difference.

The low density observed in both networks is explained by the geographical area that is covered throughout them. Many countries within each network do not send or receive drugs directly to one another, which results in a loose and sparsely connected network. Another reason for the low levels of cohesion is the many paths that both cocaine and

heroin take from source to destination countries. For example, the major routes for cocaine are through the Caribbean, West Africa, directly from South America, and Central America. For heroin, the major routes are through the Caribbean, West Africa, East Africa, Eastern Europe, the Middle East, East Asia, the Balkan route, the Silk route. It was expected that the heroin network would have a much lower density due to the larger geographical span of the market, but it is only slightly lower.

The clustering coefficient for both networks had the largest percentage among the structural statistics, with about one fifth of each network being clustered. As observed in the sociograms in chapter four, the main reason for this in both networks is Western Europe. Western Europe is the heart for both cocaine and heroin, with various entry points from many different countries. The geographical configuration of Western Europe is an explanation for this. Drugs come into Western Europe through several entry points and flow between each country.

The hypotheses regarding the measures of centrality were for the most part supported by the literature. The countries identified from the literature to be major transit countries for both cocaine and heroin were top

scoring countries for each centrality statistic, with the exception of Iran in the heroin network. One surprising finding was the importance of West African nations within the heroin trade, where it was thought they would be vital within the cocaine trade. Another surprising observation was the prevalence of Western European countries within both networks, proving the point that this region is the center of the drug market.

There is a lot of consistency with the literature and the centrality results. These studies from the literature were not using a network methodology, making this study a unique analysis to this topic. Prior studies have shown that the South American countries of Argentina, Bolivia, Brazil, and Chile are important in moving cocaine into the Iberian Peninsula and the Netherlands (EMCDDA, 2010; Farrell, 1998, Office of International Intelligence, 2002; Paoli & Reuter, 2008). The out-degree results show that Argentina, Bolivia, Brazil, Peru, and Venezuela are important in sending out cocaine. In addition, Spain, Portugal, and the Netherlands have the three highest in-degree scores for the cocaine network, thus validating prior research stating their importance.

Caribbean countries such as Dominican Republic, Haiti, Jamaica, and Trinidad and Tobago were found to have the highest in and out-degree scores, designating them as transit hubs for Western Europe and the United States. This finding is consistent with a report published by the Office of International Intelligence (2002). Wasserman and Faust (1994) state that nodes with a high in and out-degree score are hubs because they receive from a variety of sources and send out to a variety of sources.

Akyeampong (2005) stressed the growing importance of West Africa within the cocaine trade, which is a notion that was not observed in the magnitude expected. Mali was the only country to score in the top fifteen for any measures of centrality. West Africa may not have been well represented within the measures of centrality, but after examining the sociogram for West Africa, it is clear that the region is a transit point for cocaine. Network redundancy may be an explanation for the lack of importance for individual West Africa countries. There are a large amount of country to country paths to destination countries in both West Africa and other regions that it may have masked the importance of West Africa.

Using measures of centrality to determine important nodes within a network can be very useful. But, it is important to choose the right measure to examine, because each centrality statistic tells a different story. For this reason, in and out-degree, as well as betweeness centrality were examined. Using in and out-degree together identifies major transit hubs and betweeness identifies transshipment points. Table 13 presents the top fifteen countries identified from the literature, in and out-degree, and betweeness for cocaine. This allows for a comparison between the top centrality scoring countries and what the literature stated.

Table 13. Major Cocaine Transit Countries by Designation

Literature	In/Out-Degree	Betweeness
Argentina	**Austria**	**Austria**
Bolivia	Cyprus	**Brazil**
Brazil	**Dominican Republic**	Croatia
Chile	**Egypt**	**Egypt**
Colombia	**France**	**France**
Dominican Republic	**Germany**	**Germany**
Ghana	**Greece**	**Greece**
Guinea-Biassau	Guinea	**Hungary**
Haiti	**Haiti**	**Italy**
Jamaica	**Hungary**	Macedonia
Mexico	**Italy**	Mali
Netherlands	**Jamaica**	**Netherlands**
Nigeria	**Mali**	Poland
Portugal	**Portugal**	Ukraine
Spain	**United Kingdom**	**United Kingdom**

Bold denotes country appears in more than one column

There are six countries that were identified in the literature that were observed in the top fifteen scores for either in and out-degree or betweeness. It is interesting that West African countries were expected to be important in terms of centrality and are not well represented. Guinea is a transshipment hub, having a high in and out-degree, and Mali has a high betweeness, but countries such as Ghana and Guinea-Bissau were also expected to be important. The Dominican Republic, Haiti, and Jamaica are very important transit hubs for both Western Europe and the United States.

Similar to the cocaine network, there is a lot of consistency among the literature and centrality results within the heroin network. Previous studies have discussed the importance of Pakistan and Iran in the transit of heroin from Afghanistan (Cornell & Swanstrom, 2006; Sabatelle, 2011; Van Doorn, 1993). This was observed in the current analysis, as Pakistan and Iran are instrumental in feeding both the Balkan route and Silk route. Although these two countries are far away from the destination countries within Western Europe, they serve as major conduits in flow of heroin into that region.

Pakistan, along with India was also found to important in the transit of heroin to East Africa, where it is then moved into Western Europe. This finding supports a report by the Interpol-General Secretariat (1989), which discussed the growing importance of East Africa due to heroin transiting the region from India and Pakistan. The importance of East Africa was not observed in the centrality results, with the exception of Ethiopia, which was in top fifteen for betweeness.

The Balkan route, which was emphasized in the literature as being instrumental in heroin reaching Western Europe (Farrell et al., 1996; Paoli & Reuter, 2008; Van

Doorn, 1993), was observed in this study. The Balkan route countries of Turkey, Albania, Hungary, Poland, and Ukraine were all found be in the top fifteen for measures of centrality. Ukraine and Poland, in addition to being part of the northern Balkan route, are also involved in moving heroin from Russia into Western Europe, which was emphasized by Layne et al. (2001).

The literature stated that heroin from the Golden Triangle was moved by China, Macau, Hong Kong, and Taiwan into other East Asia countries, Australia, and the United States (Reid et al., 1996; Van Doorn, 1993; Williams, 1993). This was partially observed through the network analysis, with the exception of the United States receiving heroin from these countries. China, Macau, Hong Kong, Vietnam and Taiwan were all found to be the in the top fifteen centrality scores for at least one statistic. China was the only country of these to be in the top fifteen for betweeness centrality. Huang (2012) posited about the China route, which was suggested to be important in the international trafficking of heroin. These countries are important in moving heroin throughout East Asia; however the results failed to show them playing a major role in the international trafficking of heroin.

Table 14 shows the top fifteen countries for key transit countries identified from the literature, countries with high in and out-degree centrality, and countries with the high betweeness centrality. Turkey was only country from the literature to have a high in and out-degree. Turkey, India, Hungary, and Ukraine, also mentioned in the literature, were found in the top fifteen for betweeness centrality. An interesting observation from this is the presence of Caribbean countries in the top fifteen for high in and out-degree. This was also observed in the cocaine network. An urge of caution is necessary for this however; because the Caribbean countries of Anguilla, Antigua and Barbuda, Barbados, Cayman Islands, and Dominican Republic are heavily involved in the transit of Colombian heroin, not Afghani heroin, which supplies 90% of the world's heroin (Sabatelle, 2011).

Table 14. Major Heroin Transit Countries by Designation

Lit Review	In/Out-Degree	Betweeness
Cote d'Ivoire	Anguilla	Albania
Ghana	Antigua and Barbuda	**Austria**
Hungary	**Austria**	Bangladesh
India	Barbados	China
Iran	Cayman Islands	Ethiopia
Jamaica	Dominican Republic	**France**
Kenya	**France**	**Germany**
Mexico	**Germany**	Hungary
Pakistan	**Hong Kong**	**India**
Tajikistan	**Italy**	**Italy**
Turkey	Russia	Poland
Uganda	Spain	**Russia**
Ukraine	Taiwan	**Spain**
Uzbekistan	**Turkey**	**Turkey**
Venezuela	United Kingdom	**Ukraine**

Bold denotes country appears in more than one column

Network redundancy is an important concept to keep in mind for this study. With the large number of countries involved in the trafficking of cocaine and heroin, this results in a large variety of routes. This is one of the reasons for such a low density throughout both networks. For example, the network results showed that cocaine comes into Spain, Portugal, Netherlands, France, Italy, and the United Kingdom from several West African, Caribbean, and South American countries. Removing one of these transit countries from the network would have little or no effect on cocaine reaching the destination. This same trend is

observed within the heroin network. There are so many paths that cocaine and heroin take from source to destination that it diffuses the effect of one particular country being involved in the transit of drugs.

The multivariate regression models used to determine opportunistic variables that make a country susceptible to being involved in the transit of cocaine and heroin yielded unfavorable results to the hypotheses developed from the literature. Annual exports were found to be the only major significant predictor of countries being a major transit country for both cocaine and heroin. This provides support for previous studies that showed that countries with high amounts of licit trade allow for the transit of illicit drugs (Office of International Intelligence, 2002; Engvall, 2006; Farrell, 1998; Farrell et al., 1996; Fazey, 2007; Hughes et al., 2012; Layne et al., 2001; Reid et al., 2006; Sabatelle, 2011; Singh & Van Zyl, 2007; Van Doorn, 1993; Walker, 2005). Unfortunately, there were no major significant findings for corruption, geographical betweeness, and paved airports being a predictor of a country being involved in the transit of cocaine or heroin.

Theoretical Implications

One of the objectives of this study was to identify the trade structure depicting the country to country movement of cocaine and heroin from the source to the destination. The network architecture model was the underlying theoretical perspective for this. This model states that in order for a network to be successful, all the nodes, or countries in this case must work together in order to succeed (Borgatti and Lopez-Kidwell, 2011). The architecture of both networks was revealed in this study and shed important insight into how cocaine and heroin are moved globally. Moreover, individual countries were identified through calculating measures of centrality, which capture those that play an important role.

This portion of the study is purely descriptive, however it is essential to the research of international cocaine and heroin trafficking. Prior studies examining this have not utilized network analysis to examine the structure; instead they have utilized seizure data and anecdotal information to explain this phenomenon. Integrating the network architecture model into international drug trafficking has made it possible to examine structural characteristics as well as individual

characteristics of those involved. This model has proved to be useful in illustrating the international trafficking of cocaine and heroin, and should be called upon to examine other forms of international crime, such as money laundering, human trafficking, arts and antiquities trafficking, and any other crime that is transnational.

Trafficking routes presented in the literature were compared with networks generated for this study to assess whether this study provides unique trade network information not available from published literature. Since much of the published literature relies on seizure information, this comparison also provides a preliminary assessment of the difference between trade system architecture and trade flow. Using the literature on trafficking routes reported in the extant literature, two separate comparison networks (cocaine and heroin) were produced. A QAP correlation was used to compare the trade architecture to the trade flow (as reported in the extant literature) for each drug type.

The Jaccard coefficient for the cocaine network is 0.070 and 0.134 for the heroin network. This means that the two corresponding networks are 7% and 13.4% similar, respectively. This shows that the trafficking routes

presented in the literature, based on seizure information, most often from prior decades, are different than what is observed in the current study. One reason for this may be that the literature simply focuses on the more important countries within the networks, whereas this study is more comprehensive. Nonetheless, the two Jaccard coefficients show the need for new research examining this, as the literature may be out dated and under estimating the networks.

Network analysis allows for a precise examination of structure and position that is not warranted in other methodologies. This study was global in scope, however the network architecture model could be used to examine drug trafficking within a particular region of a country. Cocaine and heroin that are sold on the streets at the local level had to have been brought in from other areas. This model could help determine the path these drugs are brought in on.

The second objective of this study was to determine if there were any significant predicting variables of countries being involved in the transit of cocaine or heroin. From the literature, it was revealed that opportunity was the dominant characteristic that

facilitated a country's involvement in the trafficking of drugs. Annual exports were the only major significant finding within the regression models that were estimated. The results showed that a country with higher amounts of annual exports dramatically increases the chances of them being involved in the transit of cocaine and heroin.

Although more significant findings were desired, this is still important to the study of international cocaine and heroin trafficking. With annual exports being such a major significant finding, this does lend support for opportunity theory as an explanation for countries being involved in the international trafficking of drugs. Felson and Clarke (1998) theorize that in order for most crimes to be committed, there must be opportunity that helps facilitate this. Countries with high amounts of annual exports do provide opportunity for the trafficking of illicit goods through the trade of licit goods. Farrell (1998) notes the difficulties of 100% inspection of international trade, which allows illicit goods such as drugs to be moved undetected.

Opportunity theory, which is generally used when studying crimes of an individual (Felson & Clarke, 1998), is applicable to transnational crime as well. This study

validates that point; opportunity does make certain countries vulnerable to crime. This study was done at the global level, but opportunity theory could be examined at the regional level or within individual nations. Cities or areas within a city that experience high amounts of drug trafficking may be caused by opportunity. This theory could be instrumental in examining and combatting drug trafficking at all levels.

Policy Implications

The findings of this study bring new insight on policy implications for international cocaine and heroin trafficking. From the network analysis, major countries and routes were identified that are responsible for moving cocaine and heroin globally. Policies could be developed targeting individual nations that could aim to dismantle their participation within the trafficking of cocaine and heroin. This would be an ambitious endeavor due to that fact that there are many routes that cocaine and heroin are trafficked along.

In addition to countries that are important in terms of centrality within the two networks, the multivariate regression showed that countries with higher amounts of

annual exports are significantly more likely to be involved in the transit of cocaine and heroin. This could also prove to be beneficial to combatting international drug trafficking. Policies could be developed that better monitor trade involving countries with high amounts of annual exports. As with the previous notion, this could also pose difficulty, however it may be worthwhile in exploring.

Farrell and Roman (2006) developed the idea of crime as pollution, which sees crime as a form of pollution caused by facilitating factors. They argue that crime pollution is a product of opportunity and the lack of a capable guardian. They use the example of cell phones that became popular and common in the 1990s to illustrate their point; stating that the common usage and abundance of cells phones at that time led to increased cell phone theft. The abundance of cell phones led to the increased opportunity for the theft of them. The polluter in this case would be cell phone manufacturers that produce these because they failed to anticipate and attempt to prevent the crime that could result from their product. A further example is alcohol manufacturers that distribute it to local bars, where it is consumed and often times results in disorderly

conduct and other crimes. The alcohol manufacturers would be the polluter in this case because they produce this product that causes problems, but are not held liable.

This notion of crime as pollution can be applied to international drug trafficking. Although drug trafficking is illegal and not produced in a legal setting, there are certain elements that enter the legal realm. Enormous profits are made from drug trafficking, which are often laundered through financial institutions. The polluter in this case would be the financial institutions that allow this to occur. They are not the ones producing these drugs, nor trafficking it, however they are facilitating its prosperity. Farrell and Roman suggest tactics such as asset freezing and regulating transactions within financial institutions to combat this.

Another form of crime as pollution within international drug trafficking are the countries that the drugs are trafficked through. Again, as with the financial institutions, they are not the ones directly involved in the trafficking, but they help facilitate it to happen. Policies could be developed that enforce accountability among countries where drug trafficking is prevalent. There is not one single cause of countries being involved in the

transit of drugs. The causes include lack of patrol around borders, lack of inspection for incoming and outgoing cargo, and corruption among law enforcement.

Eck and Eck (2012) expanded on Farrell and Roman's (2006) notion of crime as pollution and constructed a typology for intervention policies: means based and ends based. Means based policies establish pollution control regulations that are to be adopted that will aid in the reduction of a particular crime problem. This is done in one of two ways: command and control, which sets forth a mandate that is required to be implemented, and subsidies, whereby monetary inducements are used to generate participation among a particular policy. Ends based policies focus on the outcome rather than the means. In this case, instead of setting a specific mandate to be followed, an end result is established and each party comes up with their own method to solve the problem. Those who fail to achieve the desired end result are faced with monetary penalties or sanctions.

Either type of intervention policies could be successful if implemented correctly. For means based interventions, international policies could be developed to minimize the facilitation of drug trafficking through

individual countries. The main focus of these policies should be aimed at border control, focusing on both incoming and outgoing traffic. The United States Department of Homeland Security (2013) uses a multi-layered approach for incoming and outgoing cargo which includes screening requirements, detection canines, surprise inspections, and undercover investigative work to combat illicit goods from coming into the country. This method is far from perfect, because the United States is very active in the drug market; however it is a step in the right direction. If every country had policies such as this, there may be a decrease in the illicit drugs coming into various countries. Similar policies such as this could be adapted towards border patrol for incoming and outgoing vehicles between countries.

As a result of the high volume of drugs transported into ports throughout the world, there have been programs created to reduce it. The Container Control Program is a program that was developed in collaboration between the UNODC and World Customs Organization to help the governments of Ecuador, Senegal, Ghana, and Pakistan in reducing the high volume of trafficking that is occurring within the legal trade of goods transported in containers.

This program involves training courses for port and customs officials, with aims of increasing seizures in ports within these countries. This program could be expanded to countries that are known to be major transit countries for cocaine and heroin. An argument against this would be that drug trafficking through these countries would simply be displaced. Prior research has shown the displacement effect to be minimal and sometimes even nonexistent (Eck & Eck, 2012; Felson & Clarke, 1998).

For ends based interventions, an end objective could be constructed by an international agency, such as the United Nations. An example objective could be the decrease of illicit drugs coming through individual countries. This would be a hard difficult objective to measure, but this would leave each country to come up with an interpretation on how to combat the problem. Each country is different, so a one size fits all approach may not be useful in this case. It may be better to construct a final objective and leave it to countries on how to deal with it. Countries who achieve the objective could be rewarded with some type of monetary subsidy and those who fail to achieve it will face international sanctions. These international sanctions

should be focused on trade, since that is an important component to most countries economy.

Raising the bar on incoming and outgoing cargo as well as incoming and outgoing vehicles will certainly reduce illicit drugs transiting countries, but may also reduce other types of illicit goods. Strengthening international borders would make trafficking between countries a lot harder. Engvall (2006) argues that globalization and open borders between most countries significantly increased drug trafficking. Layne et al. (2001) states that Ukraine has about 1,500 roads going into Moldova, Russia, and Belarus, only 98 of which have border patrol posts. Huang et al. (2012) discusses the difficulty that Chinese border patrol agents are faced due to geographical span and lack of man power. Fences, security cameras, and motion detectors are a few tools that may aid in this. These would act as a deterrent and may reduce cross border trafficking in countries with currently no barriers in place to prevent unmonitored border crossings.

A further step that could be adopted would be mandatory inter-agency cooperation. The major international institutions involved in the combatting international drug trafficking are the UNODC, the World Customs Organization,

Interpol, and the International Narcotics Control Board (Fazey, 2007). These institutions could try to facilitate inter-agency cooperation between countries. With this particular dilemma, an ends based policy could be implemented with the objective of countries collaborating and sharing vital information on drug trafficking. Those who fail to do so could be liable for international trade sanctions. This would be motivation for most countries to actively participate. In addition, countries with very sophisticated drug enforcement agencies such as Iran (Sabatelle, 2011) and the United States (Office of International Intelligence, 2002) could collaborate with countries with much weaker drug enforcement agencies such as Ukraine (Layne et al., 2001), Central Asia (Engvall, 2006), and other countries internationally to help improve drug enforcement locally. This may prove to have a positive effect on the international drug trafficking industry.

Future Directions

With this being the first attempt at using network analysis to examine international drug trafficking, there was no framework to follow for it. This study drew inspiration from previous research examining the network

architecture among drug trafficking groups (Bright et al., 2012; Calderoni, 2012; Kenney, 2007; Malm & Bichler, 2011; Morselli, 2010; Morselli & Petit, 2007; Natarajan, 2006) and expanded it to examine the network architecture of countries involved in the international trafficking of cocaine and heroin. Future research should continue this exploration into the drug trafficking trade utilizing network analysis. This study used publically available data from CIA World Factbook, UNODC, and INTERPOL; researchers should seek to find other sources of data.

Bright et al. (2012) states that the five traditional categories of data that is commonly employed in network analysis: data from offender databases, transcripts from court proceedings, transcripts from surveillance, summaries from police interrogations, and media reports. Using data from different sources may yield a more accurate view of international drug trafficking. Gaining access to more classified data from agencies such as the CIA, UNODC, and INTERPOL is desired for future research examining the international drug trade. This may result in a more refined and accurate view of the industry. With this study examining the global scheme of cocaine and heroin trafficking, it may be more feasible to lower the scope of

the study and examine the regional level of drug trafficking. Obtaining data for the international trafficking of cocaine and heroin proved to be difficult; obtaining data for a smaller geographical region may be successful in illustrating the international trafficking of cocaine and heroin. Studies could be conducted that examine trafficking in each region of world, separately; this may be helpful for a closer understanding of it.

Future research should also seek incorporate the network flow theory, which examines a network in terms of what is flowing within (Borgatti & Lopez-Kidwell, 2011). This would require estimating the amount of cocaine and heroin flowing between the countries on a global scale. Obtaining seizure or shipment data at this scale would require developing an international collaboration mandate, such as those supported by the UNODC, World Customs Organization, INTERPOL, where all nations contribute valid, reliable and current information. Clearly, this is a significant challenge; however, research at the regional level using this may be possible. This study provided valuable insight into the countries that were involved in the trafficking of cocaine and heroin, but the network flow model could provide a more precise examination of which

countries have the greatest amount of cocaine or heroin flowing through it.

This study showed the utility of network analysis in examining the architecture of transnational crime, and it should be used for other forms of transnational crime, such as the trafficking of automobiles, antiquities, humans, small arms, and anything else that is trafficked at the international level. Doing this could bring new insight into which countries are vulnerable to transnational crime. Network analysis is a unique methodology that allows for an examination of structure and position within a given network (Hanneman & Riddle, 2005), which is not possible within other methodologies.

The multivariate analysis showed that opportunity, in the form of high annual exports within a country significantly predict a country being involved in the transit of cocaine and heroin. The low pseudo r-squares for both cocaine and heroin show that there are other variables that should be taken into account. The variables included in this study should continue to be examined in the context of international drug trafficking using different measurements and sources. The literature suggested each of these variables to be important in facilitating the

international trafficking of cocaine and heroin, although the evidence was mostly anecdotal, is worth the extra look.

There also other variables that could be examined within future research. International heroin and cocaine trafficking is typically conducted by drug trafficking groups (Fazey, 2007; Hughes et al., 2012; Interpol-General Secretariat, 1989; Singh & Van Zyl, 2007; Van Doorn, 1993; Williams, 1993). Huang et al. (2012) found that 76% of the defendants in their study of heroin trafficking in China were involved in drug trafficking groups. Chinese Triads are very active in moving heroin from the Golden Triangle to markets in Europe and the United States (Williams, 1993). The trafficking of heroin and cocaine from Africa to Europe has been dominated by Nigerian trafficking groups (Akyeampong, 2005; Interpol-General Secretariat, 1989; Singh & Van Zyl, 2007).

Heroin being trafficked through Europe, most often the Balkan route, is carried out by Turkish and Albanian trafficking groups (Fazey, 2007). Cocaine is often trafficked by Colombian, Antillean, Surinamese, and Dutch trafficking groups (Van Doorn, 1993). Hughes et al. (2012) notes that despite Mexican cartels typically involved in cocaine and heroin flowing into the United States, they are

expanding into new markets, such as Australia. Cocaine and heroin flowing through Africa is often done by Nigerian trafficking groups (Akyeampong, 2005; Interpol-General Secretariat, 1989; Singh & Van Zyl, 2007). Ethnic ties among drug traffickers are very important because it helps facilitate a reliable source for moving drugs from one country to the next (Desroches, 2007).

Williams (1993) describes the international drug trafficking industry as one with tight ethnic affiliation. A further example is the ethnic and familial ties that exist are among those in Northern Afghanistan, Tajikistan, and Uzbekistan (Engvall, 2006; Layne et al., 2001; Walker, 2005). The Tajik population, which is present in the Central Asian population, makes up about 25% of Northern Afghanistan population (Engvall, 2006). Another example is the cultural, linguistic, and ethnic ties of the Spanish and Portuguese population to those in cocaine producing countries of South America (Farrell et al., 1996). In addition, the amount of Colombians living in Europe is about half a million, with about half that amount living in Spain, facilitating cocaine flow from South America (Paoli & Reuter, 2008).

Huang et al (2012) notes that Chinese within the Southwestern region share ethic ties with those in Laos and Burma. In their study using court data from China, Macau, Hong Kong, Burma, and Laos, 83% of the sample was of Han ethnicity. There is also a large amount of Iranians that live in Western Europe. With Iran being an important initial transit point for heroin, this provides a linkage between Europe and heroin producers (Paoli & Reuter, 2008). A large percentage of Nigerians, most often students live in India, which often results in them acting as gatekeepers to the Indo-Pakistani heroin suppliers (Interpol-General Secretariat, 1989). Conversely, there is also a large amount of Pakistanis living in South Africa, which also fosters a link to the major heroin transit country of Pakistan (Singh & Van Zyl, 2007). Akyeampong (2005) also notes the large amount of Ghanaians living in Brazil and other South America countries, which facilitates cocaine trafficking into West Africa. Beyond the large number of West Africans living in South America, there is also a large number of West Africans living in Europe (Paoli & Reuter, 2008).

The heroin trade in the United Kingdom is controlled predominately by Turkish trafficking groups. Throughout

Europe, Albanian trafficking groups compete for market dominance in heroin with Turkish groups. Most of the heroin trafficking in the European Union is done by Turkish groups. About five million Turkish citizens reside in Europe. With their family ties in the major heroin transit point of Turkey, Turkish employment in heroin trafficking is easily facilitated. Turkish groups are heavily involved in the trafficking of heroin from Afghanistan because Turkey has been a major transit point for Afghan heroin since the 1970s, which helps facilitate Turkish groups continued involvement in trafficking heroin (Paoli & Reuter, 2008).

Albanian trafficking groups' dominance in heroin trafficking is in the Nordic countries, although they are present in Western Europe. Albanian trafficking groups account for about 80% of the heroin being trafficking in Nordic countries and about 40% in Western Europe. Albanians constitute about 1.4 million people living in Europe (Paoli & Reuter, 2008), with Albania being a major transit point along the Balkan route, this provides a link to Albanians within West Europe. The link between prevalence of drug trafficking groups and ethnic ties should be further examined.

Another variable that deserved attention is the length of borders between countries. As noted earlier, many countries have long extensive borders that make it impossible to fully patrol. Tajikistan shares a 1,206 kilometer border with Afghanistan, with most of the border being very mountainous, making it difficult with the limited law enforcement in Afghanistan and Tajikistan to effectively combat it (Engvall, 2006). Additionally, the border between Afghanistan and Iran is 936 kilometers and consisting of desert and mountainous terrain. Throughout the 936 kilometer border, there are only three official border patrol outposts (Sabatelle, 2011). China, Burma, and Laos also share a border of 4,060 kilometers, all of which is easily accessible with any type of vehicle. The length of the border makes it impossible for the Chinese border patrol to effectively control the flow into China from Laos and Burma (Huang et al., 2012). Farrell et al. (1996) note that Spain and Portugal have long coastlines that are easily accessible by any sea vessel.

In order to combat the international drug trafficking industry in a useful and constructive manner, further insight must be gathered by researchers. It is important that research seeks to find out the vulnerabilities that

cause a country to be a transit point for illicit goods. This study has attempted to seek out the opportunistic predictors that make a country susceptible to being a transit country by taking anecdotal information presented in the literature and creating systematic variables that measure a given countries vulnerability for each variable. Data collection for the variables for each country proved to be difficult, but not impossible, and should be further examined.

Limitations

This study is not without its limitations. The scope of this study made it very difficult to find a useful data source. The first limitation is the data that was used to construct the two networks. Using publically available data from the CIA World Factbook, UNODC, and INTERPOL does raise some validity concerns; however, using the three sources to supplement one another strengthens the validity. It was shown earlier that a little more half of the countries within the cocaine and heroin networks were observed in one source. This means that if only one source was utilized for this study, almost half the network would not be included.

A further limitation is the dependent variable for the regression models. The dependent variable was dichotomous. The dependent variable was coded using a cutoff point within the between centrality results. Measures of centrality are highly dependent on the network and highly skewed (Hanneman & Riddle, 2005); for this reason, the variable was coded dichotomously. With the limitations being stated, this study is a beneficial contribution to the study of cocaine and heroin trafficking. It embarked on a new frontier within the field by using network analysis to illustrate and analyze the entire trafficking networks. Both the network analysis and the multivariate regression models have proved to be extremely useful in gaining a deeper understanding of cocaine and heroin trafficking.

CHAPTER SIX

CONCLUSION

Summary

This study sought to identify major transit countries for cocaine and heroin, compare the structure between the cocaine and heroin networks, and identify opportunistic variables that significantly predict a country being involved in the transit of each respective drug. The centrality results showed consistency with the literature regarding major transit countries; however, the highest scoring countries for out-degree and betweeness centrality among both networks were not discussed in the magnitude that was found in this study. An explanation for this is that the majority of the literature was dated and prior research focused on the seizure which measured the flow of cocaine and heroin, where this study used an architecture framework that sought to examine the various paths each drug takes to its destination.

Contradictory to the hypotheses regarding the structure, both networks were very similar in that they were loose and sparsely connected. The fact that both networks are similar is interesting because both drugs have

different source countries, different trafficking routes, and major destinations differ slightly. Furthermore, opportunity theory proved to be valuable in explaining what makes a country susceptible to being a transit country for cocaine and heroin. Despite annual exports being the only major significant finding throughout both networks, this is an important stride for research examining illicit trafficking.

The implications of these results are very important for the understanding of these two trafficking networks. First, this study showed that Western Europe is the epicenter for both networks. Second, it showed that there are many trafficking routes for both drugs, which means fragmenting these networks would be difficult by attempting to remove one country. Third, it showed that examining networks in terms of flow and architecture can result in different findings, albeit not completely different. Fourth, it showed that opportunity does play a major role within this market.

This study illustrates the utility of network analysis in examining international drug trafficking. With no prior research examining the global architecture of cocaine and heroin trafficking, this study makes an important

contribution to this area of research that has not been attempted previously. This study demonstrated that using publically available data from multiple sources can be very useful in examining illicit networks. Network analysis should be called upon in future research to examine all types of transnational crime.

APPENDIX A

TESTS FOR MULTICOLLINEARITY

Five by Five Correlation Matrix

Cocaine					
	Cor.	Geo.	Ex.	P.F.	P.A
Cor.	-	.153	-.331**	-.277**	-.137
Geo.	.153	-	.106	.083	.006
Ex.	-.331**	.106	-	.843**	.671**
P.F.	-.277**	.083	.843**	-	.854**
P.A.	-.137	.006	.671**	.854**	-
Heroin					
	Cor.	Geo.	Ex.	P.F.	P.A
Cor.	-	.172	-.290**	-.098	-.128
Geo.	.172	-	.149	.161	.022
Ex.	-.290**	.149	-	.801**	.550**
P.F.	-.098	.161	.801*	-	.357**
P.A.	-.128	.022	.550**	.357**	-

denotes p<.05
** denotes p<.01

Legend:

Cor.: Corruption

Geo.: Geographical Betweeness

Ex.: Annual Exports

P.F.: Annual Port Flow

P.A.: Paved Airports

APPENDIX B

TRANSIT COUNTRIES INCLUDED

IN THE LOGISTIC REGRESSION

Cocaine:

Greece, Germany, Hungary, France, Macedonia, United Kingdom, Egypt, Poland, Brazil, Croatia, Netherlands, Ukraine, Italy, Austria, Mali, Algeria

Heroin:

Germany, Italy, France, Poland, Turkey, Russia, Austria, Ethiopia, Ukraine, India, Bangladesh, Albania, China, Hungary, Spain, Slovakia, Greece

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