

THE ILLICIT ARMS TRADE: A SOCIAL NETWORK ANALYSIS

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Abstract

In recent years, researchers have increasingly turned their attention to the proliferation of small arms and light weapons. Small arms are difficult to track and are not the stuff of military parades, but they are immensely destructive. In addition to what is already circulating, a substantial percentage of what is newly produced enters the black market and is destined for conflict zones across the globe. I argue that the illicit trade in small arms shares some important properties with networked forms of organization studied by sociologists. I then employ quantitative methods developed for the study of social networks in an effort to show the basic structure of illegal small arms transfers worldwide. The analysis draws from my Illicit Arms Transfers Database (IATD) still in development, so the results make use of the most rudimentary information being collected. They are suggestive, however, and the analytical approach promises to shed considerable light on a corner of the international arms trade that is of great interest to the research and activist communities, and of great consequence to those in war-torn regions of the world.

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Despite the downward trend in the total dollar value of the arms trade since the end of the cold war, there is no such trend in the international transfer of small arms and light weapons (SALW). Comprehensive and reliable longitudinal data on the volume of the SALW trade are only now becoming available, but developments over the past two decades point to an increase in the flow of this type of weaponry. The proliferation of low-intensity warfare, conflicts in which SALW figure prominently, is a source of increased demand, while stocks of military surplus created by the dissolution of the Warsaw Pact and the collapse of the Soviet Union vastly increased supply. Light weaponry continues to be produced—by an expanding number of manufacturers, many of them driven to export in order to achieve economies of scale—and some of this is added to the second-hand equipment circulating in today's war zones.

Of this trade in SALW, the value of which has been estimated at roughly \$4 billion per year, probably 10-20 percent occurs in the black and gray markets.¹ Information about the illicit arms trade abounds, particularly in the form of investigative journalism and reports on the field activities of nongovernmental organizations involved in small arms control and disarmament. Although much of this information has been gathered, collated, and examined by researchers in the academic and activist communities, systematic data collection and analysis has yet to proceed very far. Data collection itself is a formidable task. Aside from the obvious difficulty deriving from the efforts of black marketeers to keep their activities out of view, the variety of actors, locales, equipment, and forms of transaction involved in the illicit arms trade presents a major challenge for any attempt to catalog them in a systematic way. Nevertheless, some progress is

being made and it is not too early to begin mapping the structure of black market transfers of SALW.

This paper is a preliminary examination of the structure of illicit arms flows worldwide. It is preliminary in two ways. First, I am in the fairly early stages of collecting and coding data on illicit arms transfers, an effort that involves scrutinizing news accounts from multiple sources. Second, the method of analysis used in this paper, social network analysis (SNA), consists of a number of both descriptive and inferential techniques. The techniques most appropriate for mapping the small arms trade are the descriptive ones, but it is also the case that any mapping using descriptive methods is likely to be sensitive to missing and noisy data. Nevertheless, having entered these caveats, I want to give some sense of the main locales involved in the illegal small arms trade, as well as the usefulness of network analytical methods for illuminating the structural features of this particular black market. As our understanding of this proliferation problem improves, so too will the arms control efforts of policymakers and activists. But before moving on to the empirical analysis, I will expand on my rationale for treating the small arms trade as a social network.

THE ARMS NETWORK

Small arms transfers are entail economic transactions, but they are often transactions governed by more than market forces. State-sanctioned transfers may be elements in an ongoing military relationship between governments and illicit transfers, while driven on the supply side mainly by the profit motive, nevertheless require a degree of trust and shared commitment to an underground system of economic exchange. To highlight these features, which are common in

social networks, it is useful to contrast them with straightforward market transactions.

A market is a social entity that governs transactions between producers and consumers by way of a price mechanism, and economists typically locate pure markets at one end of a range of possible arrangements for the exchange of goods and services. This is the anarchic end. No authority is exercised in a pure market; economic production is governed by prices, which result from individual decisions affecting supply and demand. At the hierarchical end are organized social entities like firms. Within a firm, economic production is governed by an entrepreneur, whether an individual or a collective, who directs the allocation of resources within the organization. One of the questions that has occupied economists is: under what circumstances do markets give rise to hierarchical organizations as a means of coordinating economic exchange?

The classic treatment of this issue is by Coase, who maintained that “the operation of a market costs something and that, by forming an organization and allowing some authority (the ‘entrepreneur’) to direct the resources, certain marketing costs are saved.”² In contemporary scholarship, these sorts of costs are termed “transaction costs,” and they generally derive from the inefficiencies associated with incomplete information.³ Some economic transactions involve uncertainties—e.g., about continued access to specialized inputs into the production process—and although these might be handled by entering into contracts, the continual negotiation and renegotiation of contracts is costly. Such transaction costs, at least some of them, can be eliminated if the parties enter into an exchange relationship governed according to the bylaws of a hierarchical organization. Under these circumstances, firms will realize efficiencies not available in the open market and economic production and exchange will become more profitable.

Patterns of economic exchange governed by more than market forces but by less than hierarchical organizations have been of considerable interest to sociologists. Granovetter, for instance, has echoed the common criticism of the neoclassical economic approach to organization as offering a utilitarian and “undersocialized” conception of human action in which little allowance is made for the impact of social relations on economic exchange (except as a drag on the efficient allocation of resources). At the same time, early sociological correctives tended to propose “oversocialized” conceptions of behavior whereby individuals simply, and somewhat robotically, internalize societal norms, also leaving little room for the impact of ongoing social relations.⁴ For Granovetter and others, economic behavior is governed not only by institutional arrangements designed to discourage malfeasance and reduce transaction costs, or by a “generalized morality” instilled through the socialization process, but also by trust. Economic action is embedded in ongoing social interaction and more emphasis needs to be placed on “the role of concrete personal relations and structures (or ‘networks’) of such relations in generating trust and discouraging malfeasance.”⁵

A similar gap seems to exist in the political science literature on international organization. Liberals have criticized realists for failing to see international institutions as more than epiphenomena deriving from the distribution of state power. Instead, taking cues from new institutional economics, liberals see them as “information-providing and transaction cost-reducing entities.”⁶ Constructivists, in turn, taking cues from the institutionalist approach in sociology, fault liberals (and realists) for neglecting “the production and reproduction of identities and interests” and for assuming that “how states treat each other in interaction does not matter for how they define who they are.”⁷ But to date the focus of constructivist analysis has

been on the socialization of states—“states are people too,” Wendt says—and on the emergence and reinforcement of norms in international society, rather than on relations between states and outcomes that fall short of norm creation and institution building.⁸

In departing from transaction-cost explanations, sociologists who study economic organization are not abandoning the notion of rational action. They are suggesting that social constraints, or “embeddedness,” often makes seemingly nonrational behavior appear quite reasonable. Many economic transactions “aim not only at economic goals but also at sociability, approval, status, and power.”⁹ In the realm of world politics, those studying the arms production and transfer system have frequently observed that the arms acquisition policies of both developed and developing states don’t always make sense in terms of either military or economic efficiency. The “rationality” of those procurement patterns becomes apparent only when taking into account less material motives like status, prestige, and the symbols of modern statehood.¹⁰ And no less an authority than Hans Morgenthau, realism’s chief exponent, believed that “prestige, however exaggerated and absurd its uses may have been at times, is as intrinsic an element of the relations between nations as the desire for prestige is of the relations between individuals.”¹¹

Inquiry into the role of social relations in the emergence of various forms of economic organization is of fairly recent origin in sociology. But much of the research that has been done on interpersonal relations in economic life focuses on the creation and maintenance of social networks. Less anarchic than markets, networks of economic actors are at the same time not hierarchically organized. Where price serves as a control mechanism in markets and authority serves that function within a vertically integrated firm, personal relationships, typically

characterized by trust and a norm of reciprocity, are the glue that binds a social network together. It may well be that, under conditions conducive to social networks, hierarchically organized social entities are not required as a means of reducing uncertainty and managing transaction costs, but from a sociological point of view that begs some important questions. What are those conditions? To what extent can they be explained by the social, cultural, and political practices that embed economic interaction? Alternatively, to what extent can they be explained by the nature of particular forms of economic exchange?

Powell addresses the last of these questions, maintaining that some forms of exchange are inherently more social than others. They depend not so much on formal authority, but on shared interests and ongoing relationships. In network forms of exchange, “the entangling of obligation and reputation reaches a point that the actions of the parties are interdependent.” The pattern of interaction “looks more like a marriage than a one-night stand, but there is no marriage license, no common household, no pooling of assets.”¹² Whereas market transactions are undertaken to maximize returns in the short and medium term, network exchanges are sequential and contribute to an overall pattern of enduring interaction. Much of what is exchanged in social networks is difficult to price—know-how and styles of production, for example—so the flow of information through networks is often “richer” than what is transmitted by the price mechanism in markets or by controlled channels of communication within a vertically integrated firm. Finally, because the mechanism of governance rests largely on trust and obligation, network forms of organization function well when composed of homogenous groups of actors. The opportunism and guile contributing to high transaction costs in the impersonal market setting is less common among those sharing professional, ethnic, or ideological backgrounds, and thus hierarchical governance

structures are less likely to emerge.

State-sanctioned Arms Transfers

The arms trade is characterized by some of the same features found in network forms of economic organization. Decisions to supply and purchase weaponry are often elements in ongoing arms-transfer relationships. In the case of state-sanctioned transfers, they are elements of more general military relationships. The supply of finished weapons systems can be accompanied by instruction in the operation and maintenance of equipment, construction of support facilities, and other forms of technical assistance. Arms transfers are, in many instances, embedded in relationships of mutual defense—e.g., weapons flows between members of formal military alliances like NATO—or in less formal commitments by suppliers to the security of recipient states. Those more general military relations, whether formal or implied, may also involve basing and overflight rights, military training and joint exercises, the coordination of strategy and tactics, the sharing of military intelligence, and other forms of collaboration intended to enhance the security of both parties to the transaction. While particular arms-transfer agreements may take the form of arms-length contracts, much of their meaning is lost if they are extracted from this social context. Instead of contracts, they may actually resemble long-term investments in mutually beneficial interstate relationships.

Consistent with Powell's description of exchanges within networks, it is difficult to attach a value to the political and military commitments that often accompany arms transfers between states. In addition to interstate commitments, weapons supplies embody the transfer of military technology, and many deals include arrangements for the licensed production of military

equipment by the recipient. This flow of technology and know-how between states, which is also hard to price, is an important feature of the contemporary arms trade and has had a measurable impact on the emergence of a “third tier” of arms producers in the international system.¹³ Thus, the information and meaning embodied in arms transfers can be substantially richer than what might be indicated by the market or military-use value of the weapons themselves.

Much more is involved in these transactions than a shipment of some increment of destructive capability from one to another state. Because arms transfers are indicative of the supplier’s commitment to the recipient’s security, as well as the recipient’s expectation (perhaps backed up with certain concessions) that it can count on this commitment into the future, the most significant and enduring arms-transfer relationships link states with congruent foreign policy orientations. During the cold war, for instance, the United States and its allies tended to supply arms to states whose policies were generally in accord with the global political-economic status quo, while the Soviet Union and its allies tended to supply dissatisfied or revisionist states.¹⁴ There was, then, in the arms-transfer network a certain homogeneity among states with the closest and most dependable ties. Such shared foreign policy orientations are not unlike the shared backgrounds (professional, ethnic, religious) that help sustain social networks comprised of individuals.

Black Market Transfers

Of course, not all arms transfers between states are imbued with social meaning; nor are transfers between nonstate actors. Indeed, illicit arms transfers by private dealers are typically undertaken solely for reasons of economic gain, so it might seem that the market conceptualization ought to

work well in this realm of the global arms trade. Yet illegal weaponry clearly does flow through transnational networks, as do narcotics and other contraband; on its face, “networkness” seems to be a more obvious feature of the black market arms trade than does its “marketness.”

When comparing market and network forms of organization—and one could imagine hybrid forms as well—it is probably useful to distinguish between the nature of the goods being exchanged and the mode of exchange.¹⁵ Above I suggested that states sometimes transfer arms, or sanction the transfer of arms, for reasons other than economic gain; arms transfers embody security commitments as well as raw military capability. Analogous commitments usually do not attach to black market transfers, at least those involving private dealers and their brokers. But other types of commitments are involved that lend these transactions to network forms of organization. Specifically, because these arms transfers are illegal and must be kept out of view, the transactions that enable them—deal-making, document forgery, financial transfers, illicit transport, and so on—also must be kept out of view, and parties to the transaction must trust each other in this regard. Furthermore, in many cases, the parties to such transactions anticipate the need for future exchanges, and therefore would like to be able to return to, or reactivate, these transfer channels as those needs arise. Their options are kept open by a set of mutual understandings and commitments to the maintenance of the social network.¹⁶

I am suggesting that, in the black market, transferred weaponry is not itself indicative of shared interests—say, common political or ideological goals that are furthered by the recipient’s enhanced military capability. Yet the parties’ separate interests—economic, military, or otherwise—surely are served by the maintenance of the black market’s infrastructure. Political, ideological, or other religious and ethnic attachments, may be relevant in a different way,

however. Because black market arms transfers occur in a lawless environment, one without formal mechanisms of contract enforcement, parties to these transactions must rely more heavily on trust (often reinforced by threat) than is the case for legal market transactions. This is why many criminal organizations recruit members close to home. The social cohesion created by ethnic, religious, or ideological bonds reduces the likelihood of defection and thus the risks of operating in an extralegal environment. Economic theories of rebellion posit similar social dynamics.¹⁷

More theoretical work needs to be done in order to fully conceptualize the global arms trade, and its multiple legal and illegal forms, as a social network. While it may be somewhat premature to proceed with empirical analysis, I believe that the network characteristics of the arms trade, and especially the black market trade, are sufficiently compelling that it is appropriate to simultaneously explore its structural features using some of the quantitative methods developed for social network analysis.

NETWORK DATA AND ANALYSIS

The Illicit Arms Transfers Database

The Illicit Arms Transfers Database (IATD) is an evolving dataset consisting of information gleaned from news and other reports of illegal arms shipments crossing interstate borders. The goal is to systematize the large amount of information that exists about the international black market in armaments so that some of these data might be subjected to social scientific analysis.

Virtually all illicit arms transfers are SALW, and in this category of armament researchers generally include pistols, rifles, assault rifles, carbines, machine guns, hand-held and

mounted grenade launchers, portable anti-tank and anti-aircraft guns, portable missile launchers, and small caliber mortars. Two groups are at the forefront of compiling and systematizing information on the small arms trade: the *Small Arms Survey* (SAS), based at the Graduate Institute of International Studies in Geneva, and the *Norwegian Initiative on Small Arms Transfers* (NISAT), affiliated with the International Peace Research Institute in Oslo. SAS maintains a publicly accessible database consisting of government publications and statements pertaining to the small arms trade; its data are distributed primarily through print sources, most notably the SAS yearbook. NISAT maintains an Internet database consisting of tallies of state-to-state transfers of small arms and light weapons. Thus, the primary focus of both groups' systematic data collection efforts is the legal trade in SALW.

NISAT, however, also maintains a "Black Market File Archive," a collection of news stories and investigative reports on the illicit arms trade. These accounts, which range widely in content and format, are collated into country folders based on the locale of the events described therein. Another source of information is the *WepsTrade newsgroup*, an electronic mail list maintained by David Isenberg, a senior analyst at the British American Security Council in Washington, DC. Newsgroup subscribers receive news stories on all aspects of the arms trade, including illicit transfers, collected from sources on the Internet. Both NISAT and Isenberg obtain their reports from multiple news organizations, as well as other organizations providing information on the black market arms trade.¹⁸ These two sources provide the raw information upon which the IATD is built.

The unit of observation in the IATD is an illicit arms transfer "event," defined as coterminous with a particular arms shipment's journey from source to recipient, possibly

intercepted along the way. Each record in the database consists of data describing that event, including the actors and locations involved in the shipment's journey from originator to recipient (or interceptor), as well as the information source. Most variables in the database are event descriptors and can be grouped as they pertain to (a) the *source* of the arms shipment, (b) those involved in the arms *deal*, (c) the *characteristics* of the arms shipped, (d) the *journey* that the shipment took after leaving the source, and (e) the shipment's *destination*. Table 1 shows the categories of variables in the database and summarizes the type of information collected in each category. The table does not list every variable in each category—for example, actors like originators, recipients, dealers, etc., are also accompanied by information regarding their location and type—but it does indicate the range of information that the IATD must incorporate in order to capture the complexity of many illicit arms-transfer events. At present, there are over 60 variables in the database used to describe characteristics of different types of illicit transfers, although most records are missing data for many of these variables simply due to the paucity of information on black market transactions. Appendix A lists all of the event descriptors found in the IATD.¹⁹

[Table 1 about here]

The stories and reports collected by NISAT and Isenberg vary widely in the amount of useful information they contain. Some articles include detailed accounts of arms shipments from manufacturer to purchaser, including any number of participating intermediate dealers, brokers, and shipping agents.²⁰ Other reports include no codable event information at all. Some reports provide a wealth of background information, like previous events in ongoing arms-supply relationships. Others pick up a particular shipment's journey midstream, as when one military

organization supplies another organization, without any indication of where the first group acquired the weaponry. Even when reports contain complete information, the events themselves exhibit a wide range of forms. There is substantial variation in the number and type of intermediaries engaged in illicit transfers, the nature of the illegalities involved (forged end-user certificates, arsenal theft, etc.), and whether transfers were intercepted by state authorities or someone else other than the intended recipient. Appendix B provides an example of the way events described in an article from NISAT's Black Market File Archive are coded for purposes of inclusion in the IATD.

A major aim of the IATD Project to this point, one that has largely been achieved, has been to develop a data structure that can accommodate the variety of forms that an illicit arms transfer event may take. The set of coding rules has evolved over the course of the Project's lifespan (about four years) and has proven workable as a methodology for processing thousands of articles to date. So far, the Project has examined about 6,800 articles from NISAT's Black Market File Archive, retrieving about 3,300 events.

Network Structure

The IATD is being constructed to permit researchers to map the illicit arms trade, thus identifying key actors, transshipment locations, and destinations, as well as the dynamics of the arms flows. The set of tools known as "social network analysis" (SNA), used extensively by sociologists, is particularly promising for this purpose.²¹ The focus of SNA is less on the attributes or behavior of actors than on the structural dimensions of their social environment, which are distilled from the overall pattern of relationships or exchanges among the actors. The

social network itself is defined as the group of actors and the relationships or interactions that link them, and SNA methods are applied once it is assumed (or demonstrated) that a group of actors constitutes a network. Select data from the IATD have been analyzed using elementary SNA procedures in order to illuminate the main contours of the black market trade in Africa and Asia.²² Now, with a considerable amount of data assembled for all regions, it is becoming possible to map the illicit arms-transfer network on a global scale.

The informational requirements for the present analysis are minimal, however. Nodes in this network are operationalized as the *state locales* from which, to which, or through which illicit weapons shipments have moved. Once the IATD is cleaned and cross-checked, the database will allow researchers to operationalize network nodes as *actors*—suppliers, recipients, brokers, etc.—involved in these transactions, with locale simply being one of their attributes, but a more refined analysis along these lines is not advisable given the IATD’s present state of development. Here state locales are shown as nodes in the network if they were involved in at least one illegal arms transfer during the 1995–2005 period, the time span for which data have been coded, and if there is sufficient information to identify the state locale at both ends of the transfer. Although the database does contain a large number of additional descriptors, no other information is used for present purposes.

The network, depicted graphically in Figure 1, consists of 156 nodes (state locales) with 680 links among them, blocked according to geographical region. Each node bears a three-letter country code. The structure of the illicit arms trade resembles that of a scale-free network. In contrast to random networks, in which links or social ties are distributed randomly across the nodes, scale-free networks consist of some nodes with large numbers of connections (network

hubs), and many others with very few connections. One implication may be that the illicit arms trade can be disrupted more efficiently by targeting identifiable hubs, which are most important to the network's connectivity.

[Figure 1 about here]

Central Locales

An illicit arms transfer is a *directed* link in that it represents the flow of military resources from one state locale (or actor) to another. The network data are arranged as a square “sociomatrix” in which there is both a row and a column for each node in the network. A cell in the matrix contains a 1 if an actor located in the state represented by row i , designated n_i , transferred arms to an actor in the state represented by column j , designated n_j , in which case $x_{ij} = 1$; otherwise $x_{ij} = 0$. The main diagonal of the sociomatrix, where $i = j$, is ignored.²³ The *outdegree* of node i , $d(n_i)$, is the number of other state locales *to which* arms from n_i have been shipped; *indegree*, $d(n_j)$, is the total number of state locales *from which* arms to n_j have been shipped. That is,

$$d(n_i) = \sum_{\forall j \neq i} x_{ij} \quad \text{and} \quad d(n_j) = \sum_{\forall i \neq j} x_{ji}, \quad (1)$$

which are, respectively, the row i and column j totals of the sociomatrix. If there are s state locales in the network, the maximum number of directed ties between them is $s(s - 1)$.

In most social networks, certain actors are more prominent than others and the evidence of their prominence is often the number and type of social ties they maintain with other actors. The *centrality* of a network actor is sometimes indexed as its outdegree or indegree (or both), but since these measures are greatly affected by the number of actors in a network, it is useful to normalize the index. Thus, the normalized outdegree and indegree centrality indexes for state

locales in the illegal arms trade can be computed as

$$C'_D(n_i) = \frac{\sum_{\forall j \neq i} x_{ij}}{s-1} \quad \text{and} \quad C'_D(n_j) = \frac{\sum_{\forall i \neq j} x_{ji}}{s-1}. \quad (2)$$

Although this index will identify the most connected locales, it does so by counting only direct links between nodes.²⁴

Figures 2 and 3 arrange the state locales in the illicit arms trade so that the most central locales are positioned nearer the center of ten concentric rings, while less central locales are positioned nearer the periphery. Figure 2 is constructed using inwardly directed links. Several African countries (indicated in blue) figure as the most prominent locales for the inflow of illicit arms. This is not surprising given the frequency and endurance of violent conflict in the region. Angola (AGO), among the African countries, has the highest centrality, followed by Congo (COG), Sudan (SUD), Sierra Leone (SLE), Liberia (LBR), Uganda (UGA), Rwanda (RWA), Eritrea (ERI), and Democratic Republic of Congo (ZAR). Other non-African conflict areas also stand out: Colombia (COL), Pakistan (PAK), Israel (ISR), Palestine (PLO), Iraq (IRQ), Bosnia (HRV). These locales, of course, exhibit the highest demand for small arms and light weapons. Related to this, as both cause and effect, is the presumed existence of an underground infrastructure that makes getting weapons to these locales possible (even easy)—and of course profitable.

[Figure 2 about here]

The most prominent locales for the outflow of illicit arms are identified by examining outward directed links, as shown in Figure 3. It is noteworthy that, in comparison with inflow locales, there are relatively fewer states positioned near the middle of the chart; there are fewer

central arms sources than there are arms destinations. European countries (in purple), and especially former Soviet-bloc states, occupy positions of prominence: Czech Republic (CZR), Russia (RUS), Bulgaria (BGR), Ukraine (UKR), Belorussia (BLR), Poland (POL), Romania (ROM). One explanation might be found in the availability of cold war surplus and a black market infrastructure nurtured originally by their communist economic systems. Other European and non-European locales are also important in the illicit arms trade: Britain (GBR), Belgium (BEL), Germany (GER), United States (USA), Israel (ISR), South Africa (ZAF), China (CHN), Iran (IRN).

[Figure 3 about here]

Pivotal Locales

Nodes in a network may also be important to the extent that they are positioned between two other nodes. In the case of the illicit arms trade, when one locale, n_i , has links to two other locales, n_j and n_k , which are not linked directly, n_i may provide an important conduit for arms shipments between actors in n_j and n_k . Some of the most important conduits are likely to be those lying on the geodesic paths connecting n_j and n_k . Thus, another measure of centrality, *betweenness* centrality, starts with the number of geodesics, g_{jk} , linking nodes j and k , and the number of these that contain node i , $g_{jk}(n_i)$. Betweenness can be measured as the sum of the probabilities that node i will be pivotal in transactions between j and k .²⁵

$$C_B = \sum_{\forall j < k, j \neq i \neq k} \frac{g_{jk}(n_i)}{g_{jk}}. \quad (3)$$

This measure is at its maximum when node i is located on all geodesics in the network. Not including node i , there are $(s - 1)(s - 2)$ possible directional links, and half that number of

possible nondirectional links. C_B can therefore be normalized as:

$$C'_B = C_B \left(\frac{(s-1)(s-2)}{2} \right)^{-1}. \quad (4)$$

Figure 4 identifies the state locales with the highest betweenness scores: Israel and the United States. They are followed by some of the former the Soviet-bloc states identified as important source locales (Czech Republic, Russia, Bulgaria, Poland), as well as some of the African states identified as central destinations (Angola, South Africa, Congo, Sudan). The literature on social and physical networks has long recognized the importance of such pivotal nodes in mediating the interactions between nonadjacent nodes.²⁶ Nodes characterized by high levels of betweenness are also the network's "high stress" points. Indeed, computing betweenness scores would seem to be the best way to identify the network's hubs and, for those wishing to disrupt the network, the best way to identify targets for concentrated political action.

[Figure 4 about here]

Closely related to this concept of betweenness is "brokerage." Brokers are nodes positioned between nonadjacent actors and through which a directional interaction takes place. Nodes that function as brokers for many node pairs therefore have high betweenness scores. Social network analysts have gone on to specify particular brokerage roles based on the actors' membership in groups.²⁷ For instance, a node occupies a "coordinator" role when it is interposed between nodes within its same group or organization. When the three nodes are members of different groups, the broker acts as a "liaison." Figure 5 depicts the brokerage roles operating when the broker and one actor are members of one group and the other actor is a member of a second group. Brokers (B) that mediate inflows into their group are "gatekeepers"; those that mediate outflows from their own group are "representatives."

[Figure 5 about here]

Identifying important brokers in a social network involves counting the number of triads in which that node is positioned as an intermediary. In the illicit arms trade, there are individuals and organizations that serve as brokers for particular arms transactions, and the IATD records these actors and their roles when the information is available. Because this analysis is limited to state locales, however, to say that locale B served as a broker for transfers between A and C simply means that arms were shipped from A to B and arms—not necessarily the same ones—were shipped from B to C; but arms were not shipped directly from A to C. That is, locale B is a broker to the extent that B could *possibly* function as a conduit for the shipment of illegal weapons from A to C, based on observed arms trade patterns from 1995 to 2005.

The groups used for this examination of brokerage are geographic regions, although potentially more interesting groupings would be possible for this sort of analysis (for example, based on political and economic characteristics, and not simply geographic ones). If node j is a broker for i and k , then let $b_j(ik) = 1$; otherwise $b_j(ik) = 0$. Node j 's brokerage score for the network is:

$$B_j = \sum_{\forall i \neq j} \sum_{\forall k \neq j} b_j(ik). \quad (5)$$

The score can be calculated conditional on the direction of the transaction flow and i 's, j 's, and k 's group membership, so that brokerage scores correspond to j 's role as a coordinator, representative, gatekeeper, etc.

Figure 5 shows the scores for the top “gatekeeper” and “representative” broker locales in the illicit arms trade. It is no surprise that the leading gatekeepers are African, Asian, and Middle Eastern countries; they are destinations for weapons shipped from outside the region and, we can

hypothesize, departure points for arms transiting to other locales within the region. Angola and Iran top the list, which conforms to their positions as central locales, measured in terms of in-degree or betweenness. It is also no surprise that most of the leading representatives are European states; along with Israel, China, and the United States, they are the most prominent source locales in the illicit arms trade, and possibly also transit points for arms leaving the region from other states. Britain is the most prominent broker locale in regard to the shipment of illicit arms out of Europe, followed by former Soviet-bloc countries. Again, I want to emphasize that the data used here only allow me to identify as brokers those nodes interposed between supplier and recipient locales. Determining the extent to which these nodes serve as conduits for weapons cargo transferred between nonadjacent nodes requires shipment-level data that I am still in the process of collecting but have not yet analyzed.

CONCLUSION

The illicit arms trade shares some important properties with networked forms of organization studied by sociologists. The complex and convoluted nature of black market arms transfers suits this realm of the arms trade especially well to investigation as a social network. Like any underground activity involving the exchange and transport of contraband (drugs, counterfeit currency, humans), the illicit arms trade operates within an informal organizational environment. The forces of supply and demand are mediated by the forces of trust, loyalty, and mutual commitment that govern the flow of information and material within a social network.²⁸

Since my dataset on the illicit arms trade are still at an early stage of development, the analysis in this paper employs only descriptive methods designed to explore the main structural

features of social networks. The results are not definitive, but they are suggestive. The black arms market appears to be structured as a scale-free network, even when the network nodes are operationalized fairly crudely as state locales. The locales occupying central position in the network readily stand out. African countries are prominent as destinations for illicit weapons flows. Angola, in particular is directly linked to many other locales and is positioned as a potentially pivotal node for arms transfers following indirect routes. Among the countries where illicit arms shipments originate, former members of the Soviet bloc appear central, whether as weapons sources or as conduits linking other locales in the network. One explanation for their prominence in Africa's illicit arms trade might be found in the availability of cold war surplus and a black market infrastructure nurtured originally by their communist economic systems. This, at least, is a reasonable working hypothesis for subsequent empirical research. Other important countries in the illicit arms trade include the United States, Britain, France, China, Israel, and Iran.

The utility of SNA methods (or any other quantitative methods) for illuminating the illicit arms trade obviously hinges on the quality of data that can be collected. Mapping the structure of the black market is hampered by the secrecy with which deals are concluded and the duplicity of the actors involved.²⁹ What we do know about it is due mainly to the perseverance of enterprising activists and investigative reporters and, as with any data source, this information is subject to measurement error and selection bias. The analysis of network dynamics often requires fairly complete information about nodes and links, particularly if the aim is to model network vulnerabilities. If the lack of information makes it necessary to restrict analysis to sampled data, important elements of the network structure may be missed. However, this danger should be less

pronounced when examining scale-free networks because even incomplete information is likely to identify the most prominent nodes.³⁰ That is, the same feature that makes these networks robust in the face of random failure also makes them more visible in the face of systematic efforts to reveal them. If I am right that the illicit arms trade is a scale-free network, then the fact that some of it remains hidden from view need not prevent us from mapping its basic structure.

More sophisticated SNA methods will become useful as our data collections improve. Rather than simply identifying actors and locales in the illicit arms trade, it will become possible to model the linkages among them as a function of factors on both the supply and demand side. The role of ongoing conflict, social and economic deprivation, weapons surpluses, criminal networks, and other conditions conducive to proliferation have been highlighted by small arms researchers and activists. The cause of arms control will be advanced to the extent that we can identify the most important forces driving proliferation, especially those that are most subject to policy intervention and manipulation, and the actors and locales that figure prominently as hubs in the arms supply network. When resources are scarce and attentions divided, efforts must be focused where they will do the most good.

Appendix A: Event Descriptors in the IATD

Arms Source

Originator
Originator Type
Originator Code
Originator Location
Originator Location Code
Originator Region Code

Arms Deal

Unspecified Intermediary
Intermediary Type
Intermediary Code
Intermediary Home
Intermediary Location Code
Intermediary Region Code
Arms Dealer
Dealer Type
Dealer Code
Dealer Home
Dealer Location Code
Dealer Region Code
Arms Broker
Broker Type
Broker Code
Broker Home
Broker Location Code
Broker Region Code
Shipping Agent
Agent Type
Agent Code
Agent Home
Agent Location Code
Agent Region Code

Arms Characteristics

Arms Type
Began Legal
License Violation
Battlefield Recovery
Arsenal Theft
Military Personnel
Sanctions Violation
Rogue Regime
Refurbished
Model
Manufacturer
Price
Quantity

Arms Journey

End User Certificate
Transporter
Transporter Home
Transship Location
Transship Location Code
Transship Region Code
Intercepted
Interceptor
Interceptor Code
Intended Recipient
Interception Date
Intercept Location
Intercept Location Code
Intercept Region Code
Shipment Date

Arms Destination

Recipient
Multiple Recipients
Recipient Type
Recipient Code
Recipient Location
Recipient Location Code
Recipient Region Code

Appendix B: Coding Example

Coding text-based accounts of illicit arms transfers is a labor intensive task. Researchers have made considerable progress in the development of automated coding algorithms for the creation of events data in other areas of international relations research, which has drastically reduced the time and labor required to generate reliable data suitable for analysis. However, descriptions of arms-transfer events are typically too complex to parse with the software available at this time. But as further progress is made on the machine coding of international events, new opportunities may become available for automated coding of these events as well.

What follows is an example of an article appearing in NISAT's Black Market File Archive, and descriptors for two arms-transfer events identified from this account and entered into the IATD. The article is from *Haarretz*, the Israeli daily, and was distributed by the U.S. government's Foreign Broadcast Information Service (FBIS).

Article

Israeli Businessmen Suspected of Selling Arms to Angolan Rebels

The United Nations is checking suspicions that Israeli firms and businessmen traded in arms and diamonds with UNITA rebels in Angola, in violation of the sanctions imposed by the UN Security Council. The impression of UN officials is that the Israeli Government is not very keen to cooperate in the investigation and is making no efforts to track down the suspects. A special monitoring committee set up by the Security Council in recent weeks approached the Foreign Ministry in Jerusalem via Israel's UN Ambassador Yehuda Lancry.

At the center of the investigation is Starco Investment and Trade of 13 Martin Buber St. in Haifa. The firm is suspected of having bought weapons for \$156,000 from Romtechnica, Romania's government arms company, in March 1996. According to the end-user certificates obtained by Ha'aretz, the final destination of the shipment was Togo's armed forces in the capital of Lome.

The shipment, flown aboard a cargo plane of the Bulgarian airline Avia-Service, consisted of 2,000 Kalashnikovs and pistols. However, the bill of goods stated that the shipment consisted of "technical equipment." A larger arms shipment from Romania to Togo three years later was again described as "technical equipment." This shipment included 40 RPG launchers and huge quantities of ammunition. The deal totaling \$0.5 million was mediated by East European Shipping Corporation, a firm based in the Bahamas and represented in Europe by Trade Investment International Limited, with an address in Britain. This shipment was transported aboard Coraca, a ship flying a Panamanian flag and headed for Lome. A check by the UN investigators, assisted by forensic experts, revealed that the end-user certificates of both shipments were forgeries.

Event 1

Originator: Romtechnica

locale: Romania

type: state manufacturer

Recipient: UNITA

locale: Angola

type: insurgent group

Dealer: Starco Investment & Trade

locale: Haifa, Israel

type: private company

Illegality

sanctions violation: UN

license violation: end-user certificate

Arms Shipped

type: Kalashnikovs, pistols

price: \$156,000

Date: March 1996

Event 2

Originator: Romtechnica

locale: Romania

type: state manufacturer

Recipient: UNITA

locale: Angola

type: insurgent group

Dealer: Starco Investment & Trade

locale: Haifa, Israel

type: private company

Shipping Agent

East European Shipping Corp.

locale: Bahamas

type: private company

Trade Investment International Ltd.

locale: Great Britain

type: private corporation

Transporter: Coraca

home: Panama

Illegality

sanctions violation: UN

Arms Shipped

type: RPG launchers

price: \$0.5 million

Date: 1999

NOTES

1. On the SALW, see Small Arms Survey, *Small Arms Survey 2006: Unfinished Business* (Oxford: Oxford University Press, 2006). The estimate of the illicit portion is reported in Nicholas Marsh, "Two Sides of the Same Coin? The Legal and Illegal Trade in Small Arms," *Brown Journal of World Affairs* 9 (2002), pp. 217-28.
2. R. H. Coase, "The Nature of the Firm," *Economica* 4 (1937), p. 392; see also Charles E. Lindblom, *Politics and Markets: The World's Political Economic Systems* (New York: Basic Books, 1977), esp. chap. 3.
3. For example, see Oliver E. Williamson, "The Economics of Organization: The Transaction Cost Approach," *American Journal of Sociology* 87 (1981), pp. 548-77.
4. Mark Granovetter, "Economic Action and Social Structure: The Problem of Embeddedness," *American Journal of Sociology* 91 (1985), pp. 481-510; see also Dennis Wrong, "The Oversocialized Conception of Man in Modern Sociology," *American Sociological Review* 26 (1961), pp. 183-93.
5. Granovetter, "Economic Action and Social Structure," p. 490.
6. Robert O. Keohane, *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton, N.J.: Princeton University Press, 1984), p. 101.
7. Alexander Wendt, *Social Theory of International Politics* (Cambridge: Cambridge University Press, 1999), p. 36; see also Martha Finnemore, "Norms, Culture, and World Politics: Insights from Sociology's Institutionalism," *International Organization* 50 (1996), pp. 325-47. This argument between realists, liberals, and constructivists fills many pages in the international relations literature. For a shortcut through the debate, see John J. Mearsheimer, "The False Promise of International Institutions," *International Security* 19

- (1994/95), pp. 5-49, and the follow-on symposium on institutions in the summer 1995 issue of *International Security*.
8. Wendt, *Social Theory of International Politics*, p. 215. The individualist orientation of the realist and liberal traditions in international relations theory probably guards against any tendency that constructivists might have to adopt an oversocialized conception of state action. Constructivists' preoccupation with norms, institutions, and identity formation, instead of interstate relationships, is perhaps temporary—due less to the ontology of constructivism than to its newness to the field.
 9. Granovetter, "Economic Action and Social Structure," p. 506.
 10. See, for example, Mary Kaldor, *The Baroque Arsenal* (New York: Hill and Wang, 1981); Mark C. Suchman and Dana P. Eyre, "Military Procurement as Rational Myth: Notes on the Social Construction of Weapons Proliferation," *Sociological Forum* 7(1992), pp. 137-161; Dana P. Eyre and Mark C. Suchman, "Status, Norms, and the Proliferation of Conventional Weapons: An Institutional Theory Approach," in Peter J. Katzenstein (ed.), *The Culture of National Security: Norms and Identity in World Politics* (New York: Columbia University Press, 1996); Alexander Wendt and Michael Barnett, "Dependent State Formation and Third World Militarization," *Review of International Studies* 19 (1993), pp. 321-47; David Kinsella and Jugdep S. Chima, "Symbols of Statehood: Military Industrialization and Public Discourse in India," *Review of International Studies* 27 (2001), pp. 353-73.
 11. Hans J. Morgenthau, *Politics Among Nations: The Struggle for Power and Peace*, sixth edition, revised by Kenneth W. Thompson (New York: Knopf, 1985), pp. 86-87.
 12. Walter W. Powell, "Neither Market nor Hierarchy: Network Forms of Organization," *Research in Organizational Behavior* 12 (1990), p. 301.

13. See Keith Krause, *Arms and the State: Patterns of Military Production and Trade* (Cambridge: Cambridge University Press, 1992); Richard A. Bitzinger, "The Globalization of the Arms Industry: The Next Proliferation Challenge," *International Security* 19 (1994), pp. 170-98; David Kinsella, "Arms Production in the Third Tier: An Analysis of Opportunity and Willingness," *International Interactions* 26 (2000), pp. 253-86.
14. David Kinsella, "Conflict in Context: Arms Transfers and Third World Rivalry During the Cold War," *American Journal of Political Science* 38 (1994), pp. 557-81.
15. On hybrid forms, see Jeffrey L. Bradach and Robert G. Eccles, "Price, Authority, and Trust: From Ideal Types to Plural Forms," *Annual Review of Sociology* 15 (1989), pp. 97-118.
16. Duffield examines the key features of transborder trade, including the illicit arms trade, in the context of civil war. See Mark Duffield, "Globalization, Transborder Trade, and War Economies," in Mats Berdal and David M. Malone (eds.), *Greed and Grievance: Economic Agendas in Civil Wars* (Boulder, Colo.: Lynne Rienner, 2000); also Mary Kaldor, *New and Old Wars: Organized Violence in a Global Era* (Stanford, Calif.: Stanford University Press, 2001), chap. 5; Neil Cooper, "Warlords and Logo Warriors: The Political Economy of Post-modern Conflict," in Jurgen Brauer and J. Paul Dunne (eds.), *Arming the South: The Economics of Military Expenditure, Arms Production, and Arms Trade in Developing Countries* (New York: Palgrave, 2002). Insightful discussions of black market arms transfers also include Michael Klare, "The Subterranean Arms Trade: Black-Market Sales, Covert Operations and Ethnic Warfare," in Andrew J. Pierre (ed.), *Cascade of Arms: Managing Conventional Weapons Proliferation* (Washington, D.C.: Brookings Institution Press, 1997); Marsh, "Two Sides of the Same Coin?"; Brian Wood and Johan Peleman, *The Arms Fixers: Controlling the Brokers and Shipping Agents* (Oslo: Peace Research Institute,

- 1991); and the essays in Lora Lumpe (ed.), *Running Guns: The Global Black Market in Small Arms* (London: Zed Books, 2000).
17. Paul Collier, "Rebellion as a Quasi-Criminal Activity," *Journal of Conflict Resolution* 44 (2000), pp. 839-53.
 18. For more information on NISAT's Black Market File Archive, see www.nisat.org/default.asp?page=/search.asp; on the WepsTrade newsgroup, see groups.yahoo.com/group/WepsTrade/. Isenberg manages a second newsgroup, Weapons Trade Observer, which duplicates reports distributed on WepsTrade; see lists.topica.com/lists/sento.
 19. For a full description of IATD coding procedures, including a complete list of variables and definitions, see David Kinsella, "Illicit Arms Transfers Database: Coding Manual." Working paper, 3 February 2007; available at web.pdx.edu/~kinsella/iatcode.pdf.
 20. Dealers are those middlemen who buy and sell the arms, in effect taking temporary ownership of the weapons along the way. Brokers are those who facilitate the arms deals. They bring parties together, perhaps helping with financing, and they usually profit from their brokerage, but they do not take possession or ownership of the arms shipment in route. Shipping agents are those who help arrange transportation of the arms, but who do not do the actual shipping. See Brian Wood and Johan Peleman, *The Arms Fixers: Controlling the Brokers and Shipping Agents* (Oslo: International Peace Research Institute, 1999).
 21. An authoritative and comprehensive guide to the methods of social network analysis is Stanley Wasserman and Katherine Faust, *Social Network Analysis: Methods and Applications* (Cambridge: Cambridge University Press, 1994). For a briefer treatment, see John Scott, *Social Network Analysis: A Handbook*, second edition (Thousand Oaks, Calif.:

- Sage, 2000). A comprehensive review of the network analytical literature in multiple disciplines is M. E. J. Newman, “The Structure and Function of Complex Networks.” *SIAM Review* 45 (2003), pp. 167-256.
22. David Kinsella, “The Black Market in Small Arms: Examining a Social Network.” *Contemporary Security Policy* 27 (2006), pp. 100-117; Kinsella, “The Illicit Arms Trade in Asia: A Social Network Analysis.” Paper presented at the annual meeting of the International Studies Association, 28 February – March 4, 2007.
 23. There are SNA procedures that work with valued data—in the present context, for example, the total dollar equivalent of arms transferred between actors—but my analysis is based only on binary data indicating the presence or absence of an arms transfer sometime during the 1990–2002 period. Some more elaborate techniques, including some statistical estimators, make use of information about the attributes of actors as well as their links. See Wasserman and Faust, *Social Network Analysis*, chaps. 10 and 15.
 24. An alternative measure of centrality, *closeness* centrality, uses geodesic distances between nodes, which may be indirect paths with two or more legs. In a network comprised of directional links, like this one, the geodesic distance from node i to node j , $d(n_i, n_j)$, is not necessarily the same as the distance from j to i , $d(n_j, n_i)$. Central locales, defined in terms of closeness, are those that are connected to many others through short distance paths.
 25. This measure requires two crucial assumptions. First, an actor in j who wants to reach an actor in k is assumed to prefer the shortest path (or paths) linking the two locales. Second, when there are multiple geodesics linking j and k , each has an equal probability of being chosen. Both assumptions are problematic if actors are expected to choose paths based not only on distance, but also on which locales (and actors) lie along the route. That, of course,

- is a reasonable expectation in the case of the black market arms trade. Nevertheless, I proceed in the hope that these assumptions might be relaxed in subsequent analyses.
26. See, for example, A. Shimbel, "Structural Parameters of Communication Networks," *Bulletin of Mathematical Biophysics* 15 (1953), pp. 501-07.
 27. Roger V. Gould and Roberto M. Fernandez, "Structures of Mediation: A Formal Approach to Brokerage in Transaction Networks," *Sociological Methodology* 19 (1989), pp. 89-126.
 28. For discussions of features of black markets in various realms, including the weapons trade, see R. T. Naylor, *Wages of Crime: Black Markets, Illegal Finance, and the Underworld Economy*, revised edition (Ithaca, N.Y.: Cornell University Press, 2004); Moisés Naím, *Illicit: How Smugglers, Traffickers, and Copycats are Hijacking the Global Economy* (New York: Anchor Books, 2005); and Willem van Schendel and Itty Abraham, eds., *Illicit Flows and Criminal Things: States, Borders, and the Other Side of Globalization* (Bloomington: Indiana University Press, 2005).
 29. See Anne-Kathrin Glatz and Lora Lumpe, "Probing the Grey Area: Irresponsible Small Arms Transfers," in *Small Arms Survey 2007: Guns in the City* (Cambridge: Cambridge University Press, 2007); Lumpe, *Running Guns: The Global Black Market in Small Arms* (London: Zed Books, 2000); Wood and Peleman, *The Arms Fixers*.
 30. On scale-free networks, see Albert-László Barabási and Eric Bonabeau, "Scale-Free Networks," *Scientific American* 288 (2003), pp. 60-69; Barabási and Reka Albert, "Emergence of Scaling in Random Networks," *Science* 286 (1999), pp. 509-512.

Table 1 Information Contained in the Illicit Arms Transfers Database

<i>source</i>	<i>deal</i>	<i>characteristics</i>	<i>journey</i>	<i>destination</i>
originator	dealer broker shipping agent	type model manufacturer price quantity illegality	transporter transshipment point interception	recipient

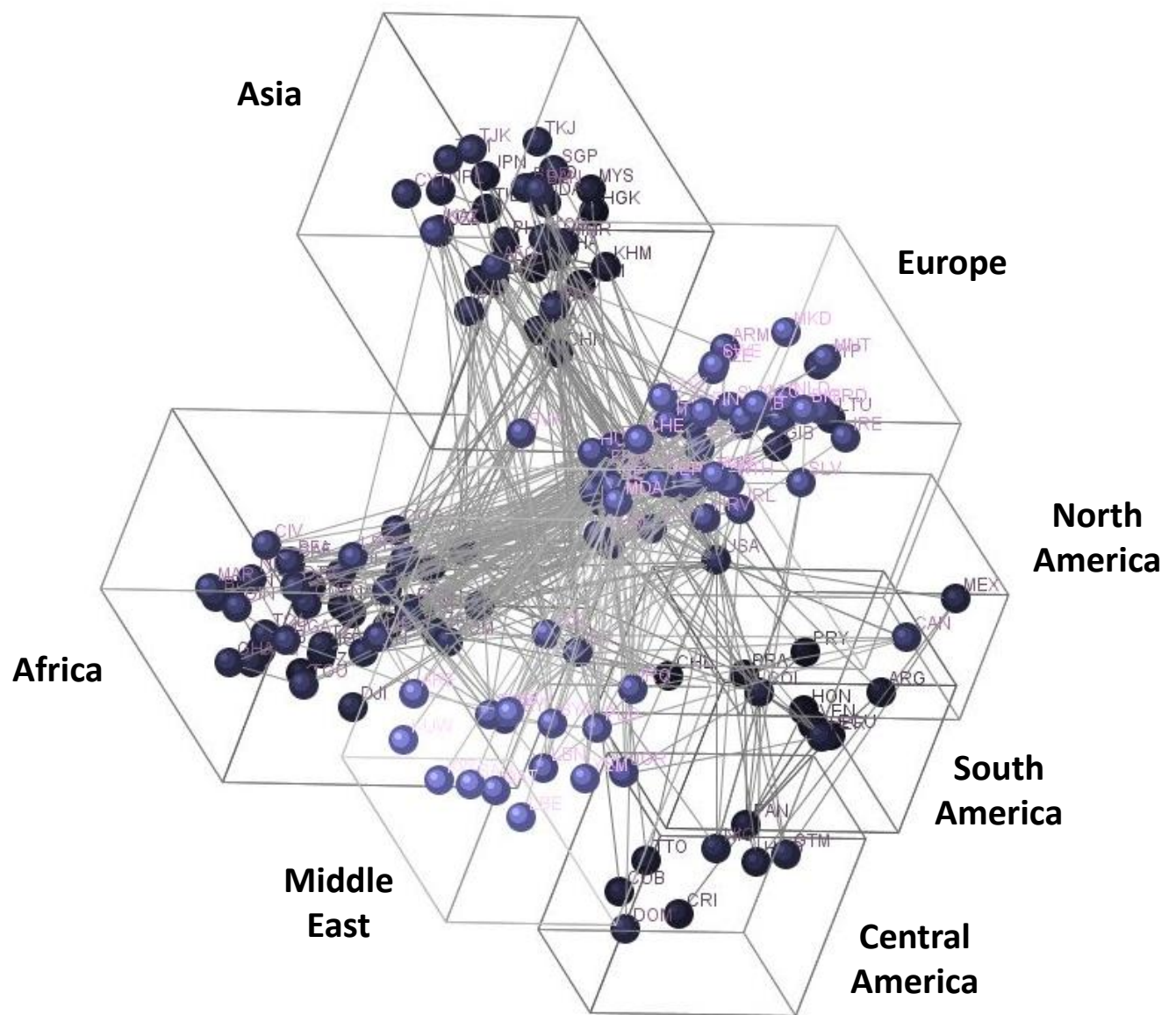


Figure 1 Locales in the Illicit Arms Trade

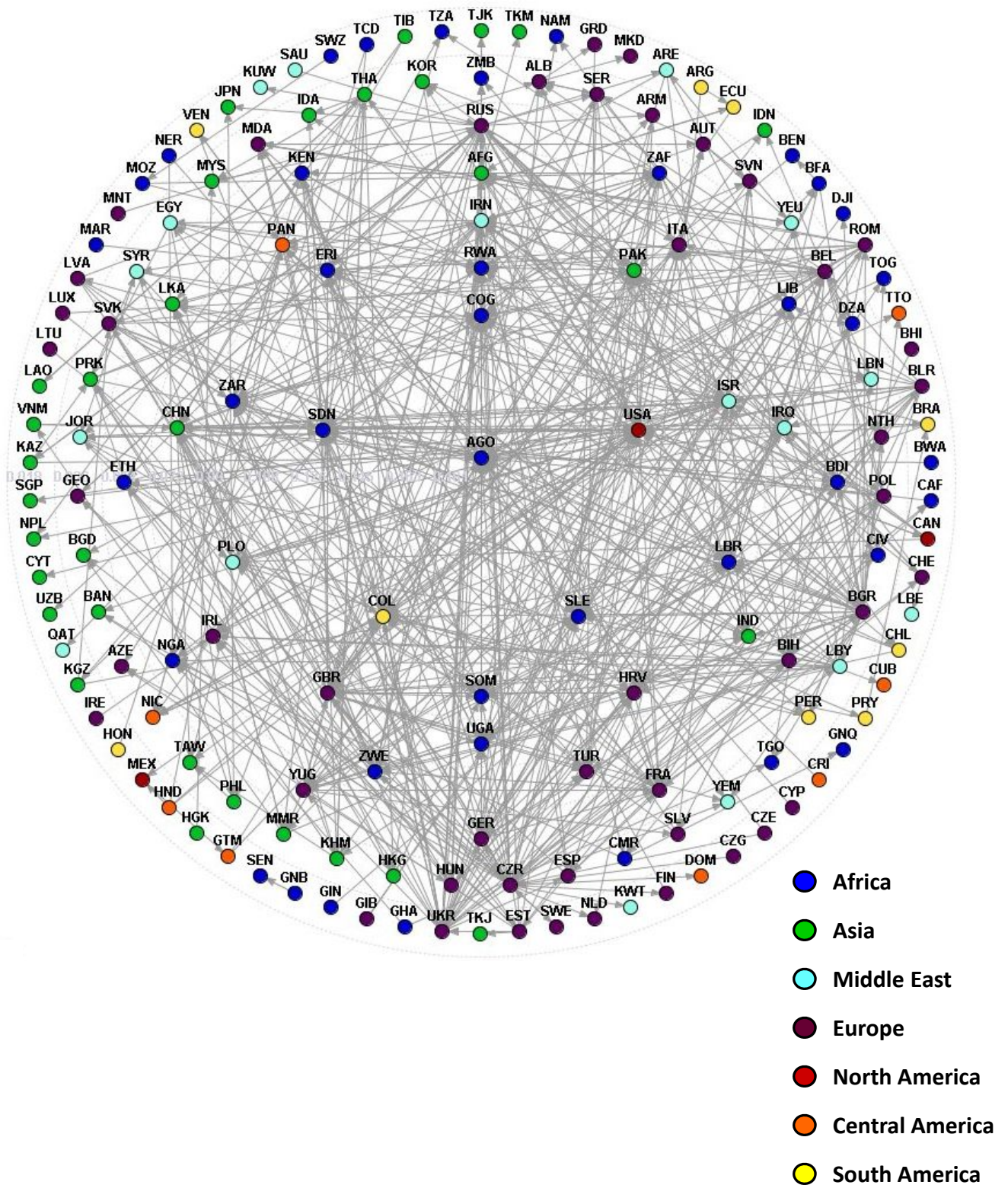


Figure 2 Inflow Centrality in the Illicit Arms Trade

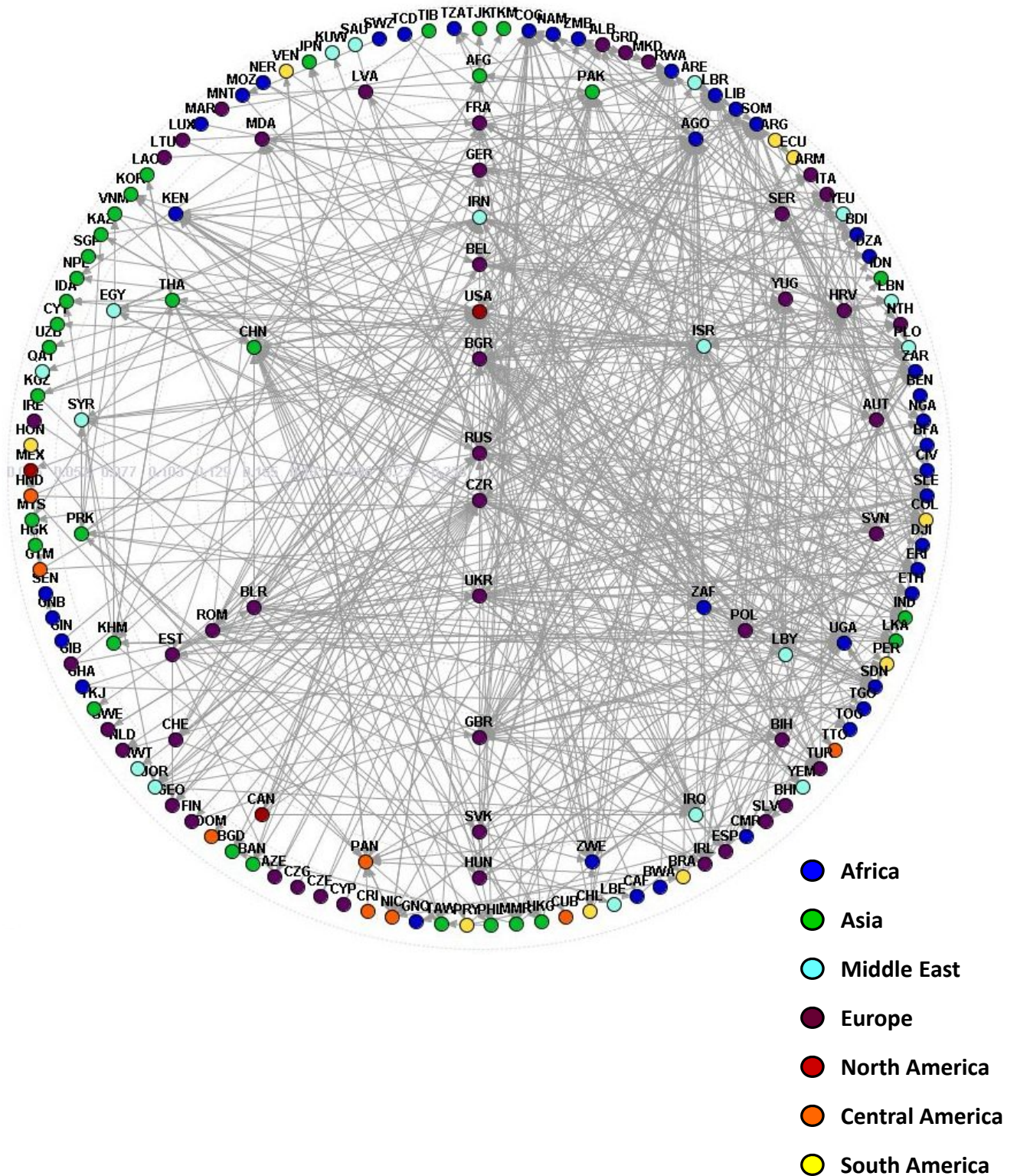


Figure 3 Outflow Centrality in the Illicit Arms Trade

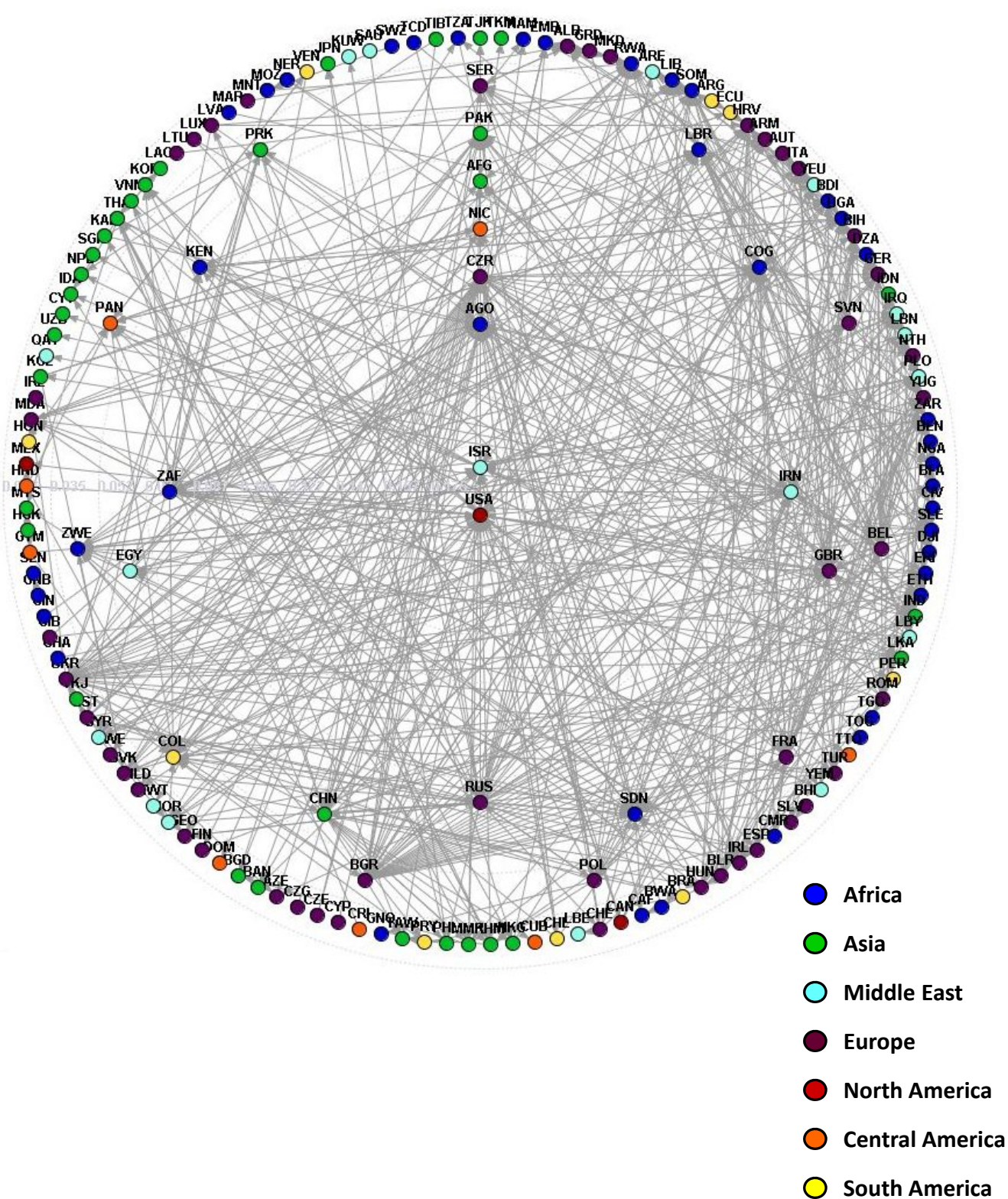
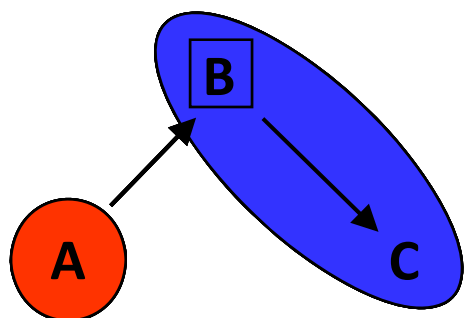


Figure 4 Betweenness Centrality in the Illicit Arms Trade

Gatekeepers



Africa

Angola	76
South Africa	32
Uganda	27

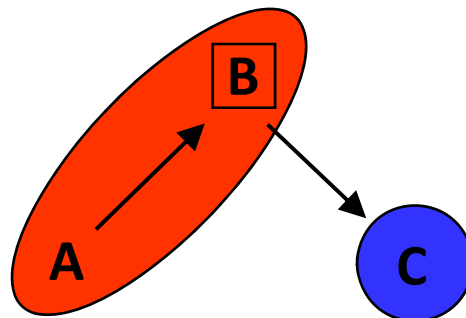
Asia

Pakistan	36
China	32
Afghanistan	22

Middle East

Iran	71
Iraq	18
Libya	12

Representatives



Europe

Britain	131
Russia	114
Czech Rep.	94
Bulgaria	89
France	73

Others

Israel	108
China	43
United States	22

Figure 5 Brokerage Locales in the Illicit Arms Trade