

Measuring more than just exchange: Are multiplex networks the key to understanding informal economic relationships?

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Abstract

This paper asks whether graph theory can help with measurement of informal economies, particularly for interactions between people that are not based on money, such as giving and sharing. This is followed by a discussion of factors that influence the possibility of measurement, such as property rights, types of goods, and collective forms of action. A specific epistemology is offered that can be used to inform longitudinal forms of economic measurement in preference to traditional exchange-based methods. The paper concludes with a call for network scientists to collaborate with economists and anthropologists to help create new interdisciplinary forms of measurement that recognise the messy and multiplex networks of our material social life.

1 Introduction

Measuring the activity in an economy is difficult. This is true for economists measuring the modern nation state but it is also true for anthropologists involved with smaller communities. The traditional form of measurement takes money as the empirical object and ignores interactions between people that are harder to record, such as gift giving and sharing, where receipts are typically absent. These activities are often referred to as part of the ‘informal’ side of the economy i.e. those activities that people value outside of financial transactions, but which are not regulated, monitored or evaluated by the state. The informal economy has received a wealth of academic attention over the past few decades largely due to the influence of anthropologists such as Geertz (1963) and Hart (1973).

Estimates vary on the significance of the informal economy, from those that trivialise it to others that suggest if it were to be measured financially it would exceed the value of the formal economy (Gibson-Graham, 1996). Regardless of estimates, large parts of informal economies remain unstudied because of the difficulty in recording non-monetary interactions between people. This is a) a significant issue for policy makers that base decisions on the size or growth of economies,

and b) a huge opportunity for researchers – particularly those that are capable of creating novel tools to capture and analyse new forms of data.

The following paper draws on previous research into how the informal economy is increasingly being mediated through digital communication (Harvey *et al.*, 2014a, 2014b). The widespread availability of social networks has meant that data on people, goods and transactions can be modelled explicitly, where previously it was impossible (See for instance the comprehensive EU commission review on organisations in the ‘sharing economy’ - Codagnone *et al.*, 2016). This suggests that data captured through social network analysis can provide novel opportunities, for economists and anthropologists alike, to influence policy. Despite often being concerned with different subject matter, economists and anthropologists (and economic anthropologists for that matter!) frequently study how people exchange resources in order that they can subsequently describe the aggregate or macro state of the economy. This emphasis on exchange, and more specifically the exchange of alienated property, has become the basis of modern economics. For example, gross domestic product (henceforth GDP) is used for comparing economies, and despite emphasising productivity it nonetheless is a measure of goods that are saleable. Thus such an account misses any form of productivity that is not described in terms of money. This is a huge methodological issue that is chronically under-researched. The following pages outline what such empirical measurement obscures, before outlining a preliminary sketch of an alternative approach. The paper ends by calling for specialists of social network analysis to help invigorate this debate by constructing alternative measures of economic activity that capture the depth and breadth that exchange-centred approaches miss.

2 Economic base and the possibility of exchange

Economic anthropology is a field of study that concerns itself with the production, consumption and circulation of objects between people. Implicitly then, the study involves thinking about how people think of themselves and how they think about the world around

them. This raises some tricky questions of ontology and epistemology for any comparative method. The seminal work completed by economic anthropologists, such as Mauss (1950/2002) and Malinowski (1922/1992), considered the various ways that items circulate through societies and their associated moral purpose. Later work by authors such as Polanyi (1944), Sahlins (1979) and Levi-Strauss (1949) included greater consideration about what economic relations could be described as fundamental, regardless of culture. These are referred to here as ‘archetypal’ relationships, but there is still disagreement about which relations are actually archetypal. Polanyi identified market exchange, reciprocity and redistribution as three different patterns for economic provisioning of material goods within societies. He also recognised the significance of the way people pool resources together through institutions or kinship groups and referred to this as ‘householding’. Each of these archetypes are relationships which in principle can be understood in graph theoretical terms as a directed graph, indeed Polanyi spoke of degrees of ‘centricity’ and ‘symmetry’ being implicit in each respective form (1944, p.51). In contrast, Levi-Strauss (1949/1969) and Sahlins (1979) both identified reciprocity as the basis of economic relations. Sahlins suggested that pooling should be considered as a special subset of reciprocal relations and described three forms of reciprocity: ‘general’, ‘balanced’ and ‘negative’. He suggested that each form of interaction is related to kinship i.e. how close or related people feel to each other, or as Sahlins (2012, p.28) puts it in later work as ‘*mutuality of being*’.

The problem with the hypothesis that economic life is always premised upon reciprocity, albeit much of it ‘generalised’ reciprocity is that it is difficult to falsify without a longitudinal dataset which encompasses all of the relations between people that could be termed ‘economic’. Given that the economy is never simply localised, this means it is impossible to obtain the necessary dataset and thus the hypothesis remains impervious to analysis. Furthermore, any social scientific approach to human action which presupposes such an epistemic claim, reduces all social interaction to exchange, either through individual ‘transactions’ or as an all-encompassing feature of culture at large.

Each of the archetypal categories that Polanyi and Sahlins described can in principle be observed as empirical events by social scientists. Indeed, Sahlins describes a range of ethnographic studies in great depth, from across the globe, in order to justify distinct forms of reciprocity. The problem with these basic archetypes though, is that they do not reflect the real-world complexity that could be examined through longitudinal empirical studies. Furthermore, by describing all human relations in terms of ‘reciprocity’ this eliminates the possibility to examine behaviour which is not motivated by consequential ethics, in other words it ignores acts done for their own sake. The question thus

follows ‘to what extent can we define and compare categories of economic interaction?’ And, is it even possible to do so without reducing the discipline to relativism? In the second half of the 20th century these questions pulled anthropology apart. Some researchers, like Needham (1971), drew on Wittgensteinian notions of ‘family resemblance’ to question the universality of concepts like kinship, incest or marriage. Others (e.g. Leach, 1961) questioned whether English patterns of thought can be translated into universal axioms. They also cautioned against excessive empiricism with the aim of categorising social groups into types and subtypes.

Dominant schools of thought in the 20th century led to a focus on exchange as the main criterion of measurement. However, exchange relies on institutional support of private property. It is extremely difficult to find any anthropological or historical evidence of sustained exchange between people without institutions that first establish property rights (Graeber, 2011). Furthermore, the right of ownership is, as various anthropologists describe (e.g. Hart, 2005) only made possible because of a shared access to goods which support the possibility of individual appropriation. This undercarriage of goods is typically referred to as ‘base’ or infrastructure, because it quite literally supports the possibility of higher, more nuanced and individualised property rights (Gudeman, 2008).

To illustrate this point it is worth first considering the types of goods that can be said to exist and the property rights that are made possible by virtue of human relations to goods. Rather than analyse the simple dualism of public versus private goods, it is possible to acknowledge that some goods can be consumed a finite number of times and some goods can be appropriated by a person and then excluded from others. These attributes are recognised in the political-economy literature as subtractability and excludability (Hess & Ostrom, 2003). When the attributes are contrasted against one another four distinct types of goods can be distinguished. These are contrasted in the 2x2 matrix below:

		Subtractability	
		Low	High
Excludability	Difficult	Public Goods	Common Pool Resources
	Easy	Club Goods	Private Goods

Table 1: Types of Goods (Hess & Ostrom, 2003, p.120)

The possibility of excluding a good is a critical factor involved in whether or not a person can successfully appropriate and exchange it. Sometimes goods are public, like the air that humans breathe, and are shared by default because they cannot be appropriated by a single individual. Others, like fishing stocks are shared because there is a cultural resistance to ownership by a single person, these are referred to as common-pool resources. A further category is 'club' goods which have a low subtractability because many people can interact with them, but they are easy to exclude from people, for example a cinema or a lecture theatre.

The informal economy has received a large amount of attention wherever private goods have been concerned, but far less attention has been given to the way in which those same private transactions are made possible by more basic relationships between people and the objects they rely on. Categories of goods influence the potential property rights that can be assigned to them. Indeed, property rights should be identified as involving not merely private ownership, but a hierarchical range of qualitatively distinct possibilities depending on the category of good to which they are assigned. This has been discussed at length by Ostrom & Hess (2007), who note a list of seven different property rights, although this varies widely depending on culture and legal systems.

Property Right	Definition
Access	The right to enter a defined physical area and enjoy non-subtractive benefits
Contribution	The right to contribute to content
Extraction	The right to obtain resource units or products of a resource system
Removal	The right to remove one's artifacts from the resource
Management / Participation	The right to regulate internal use patterns and transform the resource by making improvements
Exclusion	The right to determine who will have access, contribution, and removal rights and how those rights may be transferred
Alienation	The right to sell or lease management and exclusion rights

Table 2: Types of property rights (Ostrom & Hess, 2007, p.16)

If we consider the previous lecture theatre example, for instance, a university may own the alienable right of outright ownership, but the exclusion right of the theatre could simultaneously be appropriated by the SIMBIG conference management team, and conference attendees could also simultaneously enjoy rights to contribute to and access the theatre. The important aspect of this arrangement is that property rights simultaneously overlap between stakeholders. One change in the

rights of one stakeholder can affect the qualitatively distinct rights of others. The transformation of overlapping property rights is therefore an issue which involves multiplexity. Forms of measurement that involve multiple simultaneous relations may best be understood as multi-layered networks. In network science, multiplexity is the word used to describe how multiple overlapping relationships occur between a set of nodes. Bliemel et al. (2014, p.370) note that '*multiplexity occurs when multiple types of relationships overlap within the same set of actors, thus causing the relationships and actors to be interdependent*'.

3 Measuring informal economies through a network-centred approach: A preliminary sketch

The position adopted here presupposes neither reciprocity nor exchange across all areas of social interaction. This is a small detail, but the methodological significance is that individual acts may be observed as part of broader social structures without having to reduce explanation to either. What can be analysed instead are the property rights that overlap (through multiplexity) but are nonetheless separate in observable form. If property rights are understood as a transitive quality of people and the collective institutions they form, this opens up possibilities to measure and examine the transformation of property rights throughout networks over time. Network multiplexity adequately captures the nature of human economic relationships insofar as they are premised upon distinct, but nonetheless contingent and interdependent, property relations between people. This is similar to what Appadurai (1988) proposed by tracing the lifecycle of objects throughout an economy in order to reveal the way in which social structure is transformed:

'...we have to follow the things themselves, for their meanings are inscribed in their forms, their uses, their trajectories. It is only through the analysis of these trajectories that we can interpret the human transactions and calculations that enliven things. Thus, even though from a theoretical point of view human actors encode things with significance, from a methodological point of view it is the things-in-motion that illuminate their human and social context.' Appadurai (1988, p.5)

The informal economy has historically presented various methodological issues for quantitative analysis due to the lack of formal record or receipt during exchange, the absence of numerical balance in trade (i.e. currency), and the often deliberately subversive or illicit nature of informal exchange i.e. the activity is performed surreptitiously in relation to monetised or regulated market economies. Thankfully, the technical development of web technologies and the Internet have not only helped to facilitate new forms of informal economy but also provide the means to easily record,

and thus quantify at scale, the previously obscured economic relations between people. This is of interest for a variety of economic practices, particularly those that are mediated by the Internet, because longitudinal datasets can be associated with non-monetary interactions even in the absence of receipts. They can therefore be analysed retrospectively for patterns of activity that emerge over time. This is a novel and emerging form of inquiry but studies have already been completed for at least two popular websites including Couchsurfing (a service that allows people to share accommodation – see Lauterbach *et al.*, 2009) and for Streetbank (a service that encourages neighbours to give and share their belongings with each other – see Harvey, 2016).

Longitudinal datasets can provide insight into where and when reciprocity occurs between donors and recipients (direct reciprocity) and between networks of people motivated to ‘pass it on’ (i.e. indirect reciprocity). This type of approach can begin to ask questions that anthropologists have arguably failed to answer, such as what specifically is ‘base’, ‘gifts’ or non-monetary economics when compared to markets, and should the two be separated for the purpose of analysis? Only through such an approach is it possible to critique the claims that human life is always premised on reciprocal forms.

Anthropologists have on occasion attempted to incorporate graph theory into practical ethnographic research (e.g. Hage & Harary, 1996). A wide range of social scientists have also sought to use graph theory - and in particular forms of directed graphs - in order to model trust, friendships, alliances and communication networks to better understand human relations. However, transference of property rights between people has received far less consideration and this may be due to influential ‘practice’ theory approaches that have taken precedence. For instance, the anthropologist Rodney Needham (1975) drew attention to the problem of categorising human activity through monothetic forms of classification and instead called for greater attention to be given to polythetic forms of classification, that are fuzzier. The point of polythetic classification is to help eliminate category errors. For example, when an anthropologist observes a one-way transfer of material wealth they should restrict themselves from thinking about the transfer as if it had a universal moral status e.g. as a gift or as a bribe as experienced in their own respective lives. This approach encourages researchers to understand other people on their own terms and relate the action to a broader set of social facts. The consequence of this is that research accounts are described in terms of incommensurable practices. This is a problem for any normative economic science because it removes the basis upon which to compare. In contrast to polythetic accounts of categorisation, the alternative described here is to recognise the ontological basis of interaction – that people and goods are both essential. There is a distinction between goods and the

property rights that people assign to them, so it is important to recognise both in any analysis of economic relations. The property rights that people assign to objects are *transitive* and can be passed between people in the case of exchange and giving, or rights can be granted to others without discrete transfers, such as in the case of sharing or access to common pool resources. Transferal of property rights occurs in both formal and informal economies and can be enacted by individuals or institutions i.e. groups of people acting in unison. Examining direct and indirect reciprocity of property rights, rather than the goods themselves, provides an insight into whether interactions are premised on some form of balance or whether they are done for their own sake.

One of the most promising approaches for examining property rights as graphs is the triad census. This is also the most immediate empirical measure for a digraph containing direct and indirect forms of reciprocity. For every possible triad of nodes in a directed network there is a potential for 16 different types of configuration. A triad census does not merely describe the nodes that interact through direct relationships, it also counts the nodes which are not active participants. It is this characteristic of the census which means that it can give an ‘overview’ of the structure of the network and the relationships that consistently emerge. According to Moody (1998, p.291) the triad census provides the most empirically direct way of measuring the way that *‘individuals negotiate local relations and how those local relations cumulate into structures. Researchers can test structural network hypotheses by comparing linear combinations of the triad census to that expected under a random or conditionally random.’*

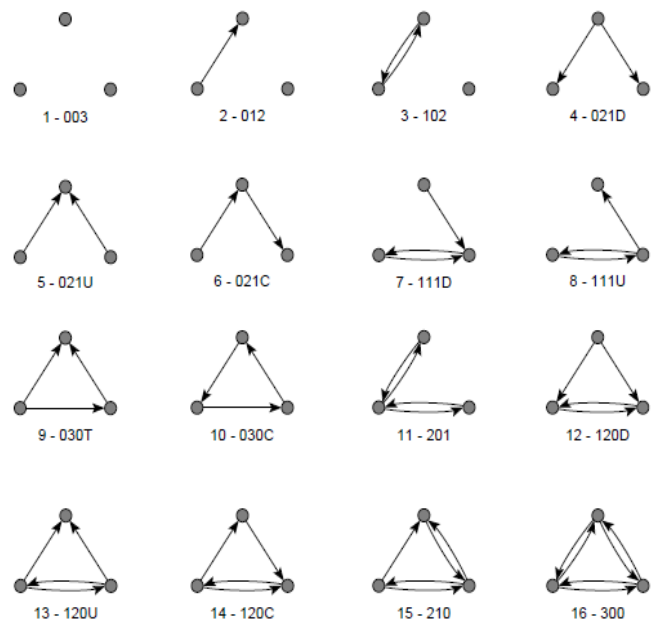


Figure 1: Types of Triads (Batagelj & Mrvar, 2001)

A variety of formulae have been put forward by authors over the past forty years to test network hypotheses (e.g. Holland and Leinhardt 1970, 1976; Fershtman, 1985; Snijders and Stokman, 1987), but this form of data collection exercise should not just result in straight-forward deductive testing of hypotheses. Instead it should help inform abductive reasoning about how particular economies come into existence, persist or perish. The prevalence of particular triads is illustrative of particular forms of economic relationship. For instance triad 10 is an instance of indirect reciprocity, which would demonstrate that people primarily use a system to give and take. In contrast, intransitive relationships (such as triads 4 and 5) demonstrate imbalance in the relationships between people. These questions of empirical balance are closely related to questions of morality that have concerned economic anthropologists since the beginning of the discipline. But it is only through cross-cultural comparison of datasets that reciprocity hypotheses can be tested. The collection and analysis of these relationships is impossible for the ethnographer, who may be able to interview and observe individual relationships at small scale. However, where organisations capture transactional data there is an opportunity for network scientists to analyse the *social structure* of economic relationships at scale, thus providing more insight than anthropologists alone.

Considered by itself, the triad census shown above does not provide much insight. The census is used merely as a means of identifying the presence (or indeed absence) of particular triadic relations within the network and this subsequently can provide an empirical measure of transitivity. According to Kadushin (2012, p.25) statistical tests *'are very supportive of the proposition that interpersonal choices tend to be transitive. Intransitive triads are very rare ... Nonetheless, balance is only one theory about choice in a network and does have its limitations by postulating rigorous rules for relations that in messy social life do not always hold.'*

Transitivity is an interesting concept for examining informal economies because it gives an insight into the relative proportion of the network that can be said to be balanced. However, for economic relations where a transfer of property takes place, these are unlikely to be of a similar nature to other human relations such as friendship or trust because excludability and subtractability are both constraining factors. Indeed in work completed recently (Harvey 2016) this has been found to be the case for an informal website that encourages gift giving and sharing. But very little attention has been paid to the effect this type of action has on the multiplexity of property rights, indeed it would require a complex and dynamic account of transformation. This is a huge opportunity for social network specialists and anthropologists to collaborate for a novel research agenda, which can help to inform economic pol-

icy. As more of the economy becomes digitally-mediated there is an increasing amount of data that can be used to analyse informal economies in ways previously impossible. This wealth of data being created by emerging online services as part of the 'sharing economy' is predominately online and held by organisations. This creates a challenge of access for researchers, but it also represents an opportunity, because those same organisations are often non-profit and depend upon support from policymakers. If the social effects of new models are to be properly understood and communicated to policymakers there must be far greater scrutiny given to multiplex relationships and how they change through time.

4 Why does this matter and what next?

There are arguably three areas where a non-exchange centred form of measurement could help with normative social science for economics and/or anthropology:

A) Many political decisions are made on the basis of aggregate accounts of exchange between people. Although simplistic, growth in exchange figures are generally viewed as positive e.g. GDP. However, this lacks depth and fails to account for the way in which people actually provision for themselves. Various authors have drawn attention to the limitations of economic growth (e.g. Schumacher, 1973; Jackson 2009) previously, but few have called for a fuller account of economics that includes non-exchange type relations between people.

B) Resource dilemmas are a popular topic in economics in which researchers examine how people act (or fail to act) in cooperation when given shared access to a resource. There has been a great deal of attention given to this area (e.g. Ostrom, 2011) but models rarely mention network multiplexity and the way it constrains or enables emergent property rights. This absence represents an opportunity to bolster existing theory through experimental economics and ethnographic studies.

C) Anthropologists often describe cultures in which legal systems and property are fundamentally different from capitalist arrangements. Some groups of people refuse to engage with private property or money due to metaphysical / ethical beliefs about the nature of the world and the status of humanity (e.g. Hutterites of North America – see Hostetler, 1967). For anthropologists studying these types of culture an account of property rights that recognises network multiplexity would help to describe how people actually enact communal property rights in order to maintain social cohesion.

Anthropologists seldom know the latest methodological innovations in network science, but are well placed to understand the variations of property rights that people all over the world experience in their day-to-day lives. The scope for collaboration when measuring economies is enormous, particularly if a realist theory of property rights is combined with network measures of reciprocity, centrality, transitivity and is understood as a multiplex phenomenon. The subject matter of this paper covers an abstract, and at times obscure, problem from economic anthropology, but the practical consequences of economic measurement has an impact on us all. Economic growth is measured solely in terms of exchange and this is used to justify political choices across the globe. An approach that recognises the multiplexity of property rights can provide a fuller and more appropriate understanding of the way economies form, but this will require much greater collaboration between disciplines.

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