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Social Network Measures of Parent-Child Exchange:
The Applications in Taiwan and the Philippines

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This study draws on social network measures to describe complex flows of resources between older parents and their adult children. Using data from the 1989 Taiwan Survey of Health and Living Status of the Elderly and the 1996 Philippine Elderly Survey, we find that more than 80 percent of older Taiwanese and more than 97 percent of Filipino elderly are actively engaged in transfers with their children, yet few older persons are engaged in all of the possible transfer activity with children. Redistributive transfer patterns, where older parents receive resources from one or more children and then give resources to another child, characterize about 10 percent of older parent networks in Taiwan and 64 percent in the Philippines. In the majority of these cases, the older parents are involved in more than one redistributive flow with children. Most of these redistributive flows take place across household boundaries rather than exclusively within or outside of the household.

INTRODUCTION

The Intergenerational transfers in families play an important role in the social, economic, and physical well-being of older persons throughout the world. Both the resources families provide and the obligations they demand can affect such behavior as the timing and quality of retirement, migration patterns, and the use of formal health care services. Family transfers are especially important in many non-Western societies due to the lack of strong or pervasive public support systems such as social security or other old-age pensions (Kinsella and Gist, 1995) and where children and other family members are more geographically proximate (Glaser and Tomassini, 2000). Under such circumstances, broad social networks that encompass extended family, friends and neighbors may be more common. Moreover, in less-developed economies, transfers from family members provide resources for investment or to buffer against short-term economic problems in the absence of market-based alternatives such as formal credit or insurance markets.

In this paper we examine transfers of resources between parents and their adult children from the perspective of social network analysis, an approach that adds to the current body of knowledge on family exchange in two ways. First, data on intergenerational transfers are often difficult to present and interpret. Transfers involve multiple actors, multiple currencies and multiple directions. Tables that attempt to capture two or more of these dimensions are usually too cumbersome to portray clear or understandable patterns. Social network measures are able to capture multiple transfers among multiple actors (Uehara, 1990). Network measures also can be used to describe resource flows in terms of the types of goods and services transferred and to reflect the direction of resource flows, thus allowing for a more detailed, yet parsimonious, empirical description of the nature of activity within a social exchange network.

A second benefit of using a network approach is that it strengthens a currently weak empirical knowledge base of *how* the extended family functions in non-Western countries. A number of anthropological and in-depth community studies describe resource exchanges within the extended family (e.g., Cain, 1991; Peterson, 1993), but few nationally representative studies exist on exchange behavior among multiple family members.

The goal of this paper is to develop a set of parsimonious measures that summarize activity in familial exchange networks and that will be useful for comparative studies across populations with different family structures. We address the following research questions: 1) What is the level of transfer activity between older parents and their children?; 2) To what extent are older persons involved in concurrent exchanges with two or more of their children?; and 3) How many types of resources are being transferred between parents and children? We also examine how these network measures are related to each other (for example, are more active kin networks also more diverse in the resources transferred?). Lastly, we examine the relationship between the composition of the network and intergenerational transfer patterns.

DYADIC APPROACHES TO STUDYING INTERGENERATIONAL TRANSFERS

Most sociological and economic studies of intergenerational transfers focus on parent-child dyads rather than examining exchanges with children as part of a network of resource transfers. While questions about transfers between two people yield some insight, they provide a limited picture of the intergenerational transfer activity taking place across the family as a whole. A dyadic perspective simply does not provide the conceptual tools for formulating hypotheses about the strength or intensity of the family exchange network. Research on family transfers needs to account for the fact that the kin network is not solely the sum of its dyadic ties but instead embodies complex pathways of resource transfers among family members.

Interest is beginning to grow among researchers about how aspects of larger kin networks affect dyadic transfers. One comparative study of intergenerational coresidence and contact in Japan and the United States incorporates kin network information such as the count of the number of children, siblings, parents and parents-in-law (Rindfuss and Raley, 1998). Economic models of transfers in the United States have examined the effect of the total number and relative financial well-being among children on bequests and inter-vivos transfers (see Tomes, 1981 for an early review). Other studies in the United States have assessed the effects of shared family characteristics on transfers between parents and specific children, utilizing fixed effects models to control for unobserved family characteristics (Henretta et al., 1997; McGarry and Schoeni, 1997; Wong et al., 1995). This body of research extends our understanding of intergenerational exchange in important ways by examining the influence of characteristics of the members of the family network on transfers in a specific dyad. However, the research literature still tends to neglect an important aspect of intergenerational exchanges: that transactions between two individuals in a family network are not independent of the transactions (or lack thereof) among all other dyads in that network (Walker, Wasserman and Wellman, 1993).

Social Network Approaches

A social network approach differs from a dyadic approach, even one that considers network structure, because emphasis is placed both on *network structure* and on the *flow of resources* through this structure. Wellman (1996), among others, has shown the importance of going beyond establishing the ties that define the structure of the social network to an examination of the activity within that network. We would expect that many of the conclusions from prior research about intergenerational transfers would take on different meanings with this shift in focus.

Social network approaches have been most extensively used to study social support for the elderly. These studies focus mainly on identifying the composition of the active social networks (those persons providing support *to* the older person) and the extent to which the type of support provided (e.g., affective or instrumental) varies by network composition (Litwin, 1996). Measures used include the size of the support network and the average, heterogeneity, and range of characteristics of the members of the support network (Marsden, 1990). A recent review of longitudinal studies of the support networks of older people in Europe showed tradeoffs over time between family members and friends in the composition of the support network, with the most consistent support coming from family members, especially adult children (Wenger, 1997).

Results from the Canadian East York studies, involving an intensive community network survey and qualitative interviews, highlight why certain types of ties are more supportive than others (Wellman and Wortley, 1990). The authors found that parent-child ties were positively associated with at least three dimensions of support, but that neither personal characteristics nor similarities among network members were associated with the provision of any particular kind of support (Wellman and Wortley, 1990: 581). Other network studies of social support have examined variation in the size of support networks, their density, composition, and the degree of reciprocity (Litwin, 1996; van Tilburg, van Groenou and Thomese, 1995; see Walker, Wasserman and Wellman, 1993 for a review). The multiplexity of these supportive relationships, defined as the number of supportive services provided, also has been found to be positively associated with the well-being and health of older persons (Mugford and Kendig, 1986; Uehara, 1990). A common analytical approach in these studies is to develop typologies of support networks and link them to health or social outcomes (Litwin, 1996; Mugford and Kendig, 1986; Sarason et al., 1983; van Tilburg, van Groenou and Thomese, 1995; Uehara, 1990).

Two observations can be made from this brief review of network studies of family transfers. First, much of this research has been conducted in Western societies; namely, North America, Western Europe and Australia. Second, many of these studies rely upon identifying the active links (those already engaged in transfer activity) to define the boundaries of the social network. This approach requires a respondent to "nominate" all of the persons with whom they have supportive contacts. However, just as a focus on dyadic transfers neglects the interdependency among pairs in the network, "treating the set of supportive ties as an entirely separate and enclosed system makes the assumption that they operate independently of all other relationships in the network" (Walker, Wasserman and Wellman, 1993). Who is not engaged in transfer activity is just as important as who is.

The present study attempts to fill in the gaps described above by applying social network measures of family exchanges in a non-Western setting and to examine intergenerational transfers in the context of the kin network . In the case of kin networks, the family structure itself defines the size and shape of the social network. By taking advantage of the relationship between the potential connections in the kin network and the actual resource flows observed among family members, we can calculate several indices that measure the degree of activate exchanges within the underlying kin structure.

The strength of a network approach to the study of intergenerational transfers is that it enables one to examine multiple resource flows and, from a more theoretical standpoint, connect exchange behaviors to the social structures in which they occur (Uehara 1990). Most studies of support and exchange have been conducted using ego-centric data which rely on respondents' perceptions of who is in the network

and restrict the network boundary to those actively involved in exchange behavior. Complete network analysis uses data collected from the entire social system in an attempt to understand how the various components of the system are interrelated. In this study we use data on the extended family--the kin network--to construct indices of exchange behavior from individual self-reports. Consequently, we can take advantage of the power of complete network analysis since we have a bounded social system and at the same time make inferences to populations based on sampling theory since the data are a nationally-representative probability sample. Thus, the network measures developed here are not simply capturing the sum of all dyads, but enable one to study facets of an interdependent system of connections and resource flows and use these measures as population-level indicators.

Conceptual Framework for Analysis of Kin Networks and Exchanges

Figure 1 depicts a sample ego-centric kin network with both potential and activated ties between adult children and the older parent (ego) shown. Ego is placed in the center in a banded circle, with spouse attached through a marriage sign (=). Children are represented by individual squares with triangles for spouses where present. Resource transfers are shown as solid arrows while inactive ties are shown as dotted arrows. Potential flows in each direction exist for each parent-child dyad. The measures described below provide summaries of the patterns of transfer activity taking place concurrently in a family such as the one depicted here. While the focus of the present analysis is on the complex transfers between parents and their children, other analyses may expand to include transfer patterns across multiple generations in the family, extending vertically to include grandparents and grandchildren, and horizontally to include siblings and cousins.

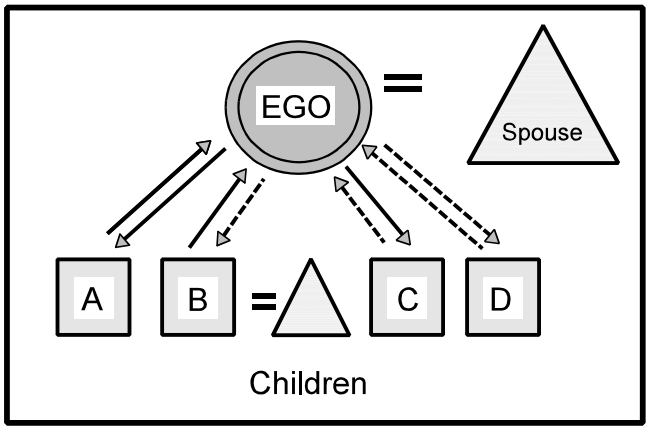

Figure 1. Schematic of Kin Structure, Active, and Potential Exchanges

In this study we are particularly interested in two-step pathways with ego (the older parent) at the center. These pathways can be seen as concurrent exchanges that potentially redistribute resources within the family. By receiving a resource from one child and giving in turn to another child, the older parent can contribute to and manipulate the family economy. If we think of these redistributive pathways as open unidirectional chains (see Gillmore, 1987) then the example in Figure 1 contains several open chains--child A and child B both give to the parent and the parent gives in turn to children A and C (child D is involved in no exchanges with the parent at this time). These flows generate three redistributive pathways: A ! Ego ! C; B ! Ego ! C; and B ! Ego ! A. It is important to note here that, although the parent is engaged in both giving and receiving with child A, this pathway is not distributing resources among family members, and consequently is not considered to be a redistributive pathway for the purposes of this analysis.

We refer to these patterns as open chains, but it is possible that these chains could be closed by a transfer between two children. The latter situation represents "generalized exchange," a concept in the sociological literature that signifies indirect reciprocity among people (Ekeh, 1974). Measurement of generalized exchange in the family, however, requires data on flows among *all* family members.

Unfortunately, these data have no information about transfers that do not involve the older parent, and therefore whether these chains are in fact ultimately closed by a transfer among the two children is unknown. The open chain measure used in this study still captures complex redistributive flows among family members, though it does not completely identify flows between all family members. However, by empirically examining the degree to which older people are involved in redistributive pathways with their children, we gain a better understanding of the role played by an older parent in the management of resources within the family network and advance research on family transfers beyond what dyadic measures can portray.

DATA

Data are from the 1989 Taiwan Survey of Health and Living Status of the Elderly and the 1996 Philippine Elderly Survey, nationally representative surveys of persons aged 60 and older in Taiwan and 50 years and older in the Philippines. The final analytic samples are restricted to adults aged 60 years and older who have two or more living children (3,484 in Taiwan and 1,191 in the Philippines). Approximately 92 percent of older Filipinos and 91 percent older Taiwanese have two or more living children. The data are ego-centric, meaning that all transfer information is collected with respect to the older person (ego). However, these data bridge standard ego-centric and sociometric methods of gathering information about social network structure (Marsden, 1990). Ego-centric approaches ask respondents to name alters and then elicit information about those alters from the respondent. Sociometric approaches ask respondents to name alters within a community and then interview everyone in that community. These data bridge both approaches because there is a complete enumeration of family members and how they are related to each other while information about resource transfers was obtained only for transfers involving the older respondent.

The lack of information about transfers among the other actors in the network is an unfortunate drawback of ego-centric data. However, the availability of a large, nationally representative dataset from which even ego-centric network measures may be constructed constitutes an important step forward. Only one-fifth of studies of social networks of the elderly in the last decade have analyzed databases of 1,000 or more respondents (Litwin, 1996).

Survey questions were asked about transfers between parents and children made within the past year (Appendix A). Information on transfers was collected separately for each child and was elicited for three transfer currencies. Transfers between parents and children may consist of money, material goods, or services (physical care and help with daily activities). Both surveys are rich in detail about the currency of transfers and the people involved, both within and between households, but the surveys are limited in measurement of the volume or magnitude of flows. It is therefore not possible to quantify the amounts being transferred in each flow. For example, detailed information on assistance with personal care (help with bathing, dressing, and toileting) and help with instrumental activities (shopping, meal preparation, transportation, and managing finances) are collected for both intra- and inter-household care, but the frequency, number of tasks, and duration of these services is unknown.

RESULTS

The measure most often used in social network analyses of the flow of resources to or from older persons is the size of the active network. Figure 2 shows the relationship between the number of children actively involved in transfers and the total number of living children. The relationship of the activated to the potential exchange network varies between the two countries. In Taiwan, there is substantial variation in children's involvement in transfers across all family sizes. In the Philippines, in contrast, the greatest density is found along the diagonal indicating that, in most families regardless of family size, all the children are involved in exchanges with their older parents. This pattern is consistent with broad differences in culture: Chinese families select certain children, usually a married son, for parental support in old age, whereas obligations for parental support are more broadly distributed among children in the Philippines.

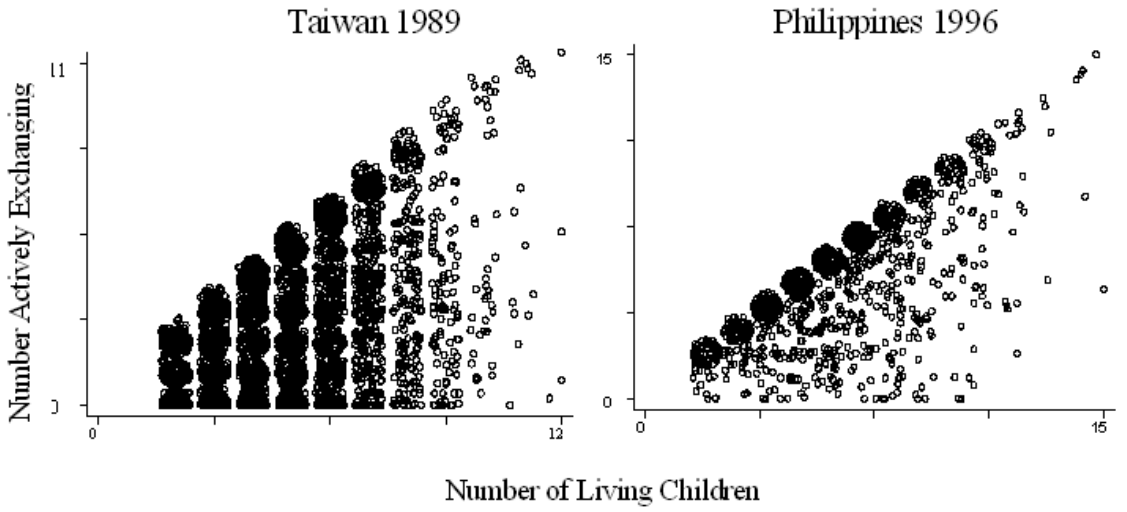

Figure 2. Number of children actively exchanging by the total number of living children available

In order to describe more fully the exchange activity in the family network we move from an examination of network membership to an analysis of transfer activity in terms of ties and pathways of resource flows. These units may be best described in terms of the schematic in Figure 1. *Ties* represent a one way flow between the older person and one of their children (a single arrow in the diagram), and a *pathway* describes a two-step flow of resources beginning, in this example, with one child giving to the parent who gives to another child. Each of these units is used to develop summary measures of transfer activity presented below. Table 1 shows the univariate distributions of all of the network measures.

The extent to which a given kin network is actively engaged in transfers among its members may be quantified using counts and ratios of the number of active ties and paths relative to the total possible. First, the number of *active ties* is calculated by taking the sum of all inflows and outflows of resources currently being given and received between the older person (i) and all members ($1 \ldots F$) in their family:

$$\sum_{k=1}^{F} \left[T_{ik} + T_{ki} \right] \tag{1}$$

where T_{ik} represents an outflow of resources from the older person (i) to family member (k); and T_{ki} represents an inflow to (i) from (k).

The number of active ties shows a positively skewed distribution in both countries (Table 1), but most older respondents are actively involved in exchanges with children. The average number of active ties is 2.8 in Taiwan and 6.9 in the Philippines, and over 80 percent of Taiwanese and 98 percent of Philippine parents have 1 or more ties with children activated. Though the mean is lower in Taiwan, over half of the Taiwanese sample is involved in 3 or more transfers, and 87 percent of older Filipinos were involved in 3 or more transfers. In Taiwan, the largest family had 12 children or 24 possible ties, while the maximum observed was 18. In the Philippines, the largest family had 15 children, or 30 possible ties, with the highest observed value of 25. Thus it appears that the largest families were not fully activated, indicating a potential threshold in the number of children that may be involved in resource transfers with parents, but it is difficult to interpret these observations further without standardizing this measure by family size.

Table 1. Univariate Statistics for social network measures of exchange activity among adults aged 60 and older with 2 or more living children: Taiwan (1989) and the Philippines (1996)

	Mean	*Standard Deviation*	*Median*	*Min*	*Max*	*Skew~*	*Kurtosis~*
Active ties*	*(nties)*						
Taiwan	***2.83***	***2.29***	*3.00*	*0*	*18*	*0.84*	*0.80*
Philippines	***6.89***	***4.17***	***6.00***	***0***	***25***	***0.990***	***1.99***
Exchange activation*	*(exact)*						
Taiwan	***0.28***	***0.20***	***0.25***	***0***	***1***	***0.23***	***-0.51***
Philippines	***0.56***	***0.26***	***0.50***	***0***	***1***	***0.08***	***-0.12***
Open Chains*	*(ochains)*						
Taiwan	***0.45***	***2.35***	***0.00***	***0***	***72***	***13.02***	***284.91***
Philippines	***10.55***	***17.46***	***4.00***	***0***	***144***	***3.38***	***18.68***
Generalized Exchange Activation*	*(geact)*						
Taiwan	***0.02***	***0.10***	***0.00***	***0***	***1***	***6.52***	***50.89***
Philippines	***0.29***	***0.34***	***0.15***	***0***	***1***	***1.10***	***0.16***
Multiplexity*	*(mplex)*						
Taiwan	***0.74***	***0.61***	***0.67***	***0***	***3***	***0.91***	***0.66***
Philippines	***1.55***	***0.64***	***1.71***	***0***	***3***	***-0.66***	***-0.14***
Multiplexity of Active Ties**	*(mplex2)*						
Taiwan	***1.36***	***0.51***	***1.00***	***1***	***3***	***1.36***	***1.26***
Philippines	***1.84***	***0.41***	***2.00***	***1***	***3***	***-0.37***	***0.46***

** N=3,484 (Taiwan) N=1,191 (Philippines)*

*** N=2,877 (Taiwan) N=1,161 (Philippines)*

The *exchange activation* measure indicates how fully engaged the respondent's family exchange network is relative to its size. This score is a measure of network density, though it is different from traditional density measures that (as a rule) exclude all ego-alter ties because these are usually the ties that define the network (Wasserman and Faust, 1994). In the present case we are not under such restrictions because the boundaries of the network are defined not by ego-alter transfers, but instead by family relationships. Therefore, we can estimate a density measure that is akin to a sociometric density measure by calculating the proportion of all *possible* ties involving the respondent that are currently activated. The exchange activation score is obtained by dividing the number of active ties by the total possible inflows and outflows in ego's kin network:

$$\frac{\sum_{k=1}^{F}\left[T_{ik}+T_{ki}\right]}{2F} \tag{2}$$

where the numerator is the count of active ties described above and the denominator is 2*F*, or twice the number of members in the kin network (equivalent to the total number of possible in- and out-flows in the network).

As shown in Table 1, the exchange activation score is by definition bounded by 0 and 1 and has a slightly positive skew. The negative kurtosis scores indicate a bimodal distribution, with peaks at 0 and at .5. About 18 percent of Taiwanese respondents show no exchange activation and 25 percent are at a 50 percent activation level. In very few cases is more than half of the possible activity in the older parent's network taking place. In the Philippines, although less than 3 percent of families have a score of 0, fully one-quarter of families show exactly 50 percent of all possible exchange activity[1].

While exchange activation is a useful summary of the ties between older persons and their children, it is basically an aggregation of dyadic activity. We now move to a more distinctively network-based approach by looking at the pathways of resources that involve multiple family members.

As described above, concurrent transfers can be summarized as a set of redistributive pathways, represented by an open unidirectional chain via which resources flow from child (A) to child (B) through the older parent. Like the dyadic measures, the intensity of redistributive exchange can be estimated as a count or standardized according to the size of the kin network. The count is the number of paths along which resources flow from one member of the network to another through ego. The number of *open chains* is calculated by taking the sum of all paths through ego from one member of the kin network (k) to other members of the kin network (j),

$$\sum_{k=1}^{F}\sum_{j=1}^{F}\left[T_{ki}T_{ij}\right] \tag{3}$$

where T_{ki} are flows to the older person (i) from network member (k) and T_{ij} are flows out from the older person to other members of the kin network (j), where $k \neq j$.

Two-step pathways that are reciprocal (i.e., where resources flow from a child to the older parent and return to the same child) are not counted in this measure, as these flows would be reciprocal rather than redistributive flows. They do, however, contribute to other open chains. For example, in the family represented in Figure 1 there are 3 open chains, one of which begins, and one of which ends with child A, who is both giving to and receiving from the parent.

Table 1 shows that involvement in redistributive exchange as measured by the number of open chains is much more limited in Taiwan than in the Philippines. The extremely high kurtosis for Taiwan indicates that the distribution is highly concentrated around one value, which in this case is zero — about 90 percent of the sample has no open chains involving children. Those who are a part of open chains are involved in not only 1 but up to 72 such pathways (the latter case is a family with 9 children, all of whom are both giving and receiving with the older parent). However, high numbers of open chains are relatively uncommon in Taiwan, even among those with redistributive activity. Almost 25 percent of those involved in any open chains are involved in only two.

In the Philippines, while the distribution of the open chain measure is still positively skewed, the distribution is much flatter than in Taiwan. Indeed, the majority of older parents have at least one open chain (64 percent) and more than half are involved in three or more of these pathways up to a maximum of 144.

To standardize the measure by the size of the kin network, we divide by the maximum number of possible pathways through which ego can connect alters in the kin network (in this case, all of the adult children) to each other. *Redistributive exchange activation* is computed by dividing the number of open

[1]This measure is not equivalent to the proportion of the members of the network involved in transfers because it takes into account both transfers to and from the older person. For example, if all the children in the network were giving but none receiving resources from the parent, exchange activation would be 50%, though involvement would be 100 percent.

chains by *F* (the number of children) multiplied by *F*-1. This denominator accounts for all possible non-reciprocal two step pathways, excluding those that originate with a particular child and return to that same child, just as described above under the number of open chains:

$$\frac{\sum_{k=1}^{F}\sum_{j=1}^{F}\left[T_{ki}T_{ij}\right]}{(F*(F-1))} \tag{4}$$

The redistributive exchange activation score is by definition bounded by 0 and 1. As a result of the low level of redistributive activation in the Taiwanese sample, the mean for this measure is only 0.02, and the skew and kurtosis of the distribution are quite high (shown in Table 1). Among those involved in redistributive pathways, activity is concentrated mainly in the area below 0.5, showing that most Taiwanese families exhibit less than half of the possible redistributive exchange activity between older parents and their children. At the same time 5 percent of those with any redistributive exchange activity have a score of 1.0, indicating that some families have all possible open chains activated.

Among Philippine families, redistributive exchange activity is much higher. The mean is 0.29, indicating less concentration around zero. Only about one-third are not involved in any redistributive pathways, and the distribution of scores is much closer to a normal distribution, with only a slightly positive skew and negative kurtosis.

Describing these pathways as redistributive does not in and of itself explain the motivations for these transfers or presume that they are related in the minds of the giver and receiver. For example, although a parent might state that he or she is giving assistance to a daughter because the daughter needs help with cooking, the ability of the parent to give this support to the child who needs it may depend upon material or financial contributions from another child. In this sense the two transfers can be perceived as being independent in the mind of the parent, while they are in fact interdependent within the family system.

The measures described thus far treat ties as binary indicators of the presence and direction of transfer flows between the respondent and his or her children. We now move to exchange measures that incorporate the volume and type (or currency) of resources transferred within the respondent's kin network.

Multiplexity measures the average number of currencies being transferred between older parents and their children, calculated by dividing the total number of *valued flows* by the total number of children in the family. The number of valued flows is the total number of currencies being given and received in parent-child pairs. In these data, each transfer may consist of up to three currencies (money, material goods, or services), meaning that the maximum number of valued flows is equal to three times the number of children in the family. Multiplexity is calculated as:

$$\frac{\sum_{k=1}^{F}\sum_{c=1}^{3}\left[\max\left(T_{kic}, T_{ikc}\right)\right]}{F} \tag{5}$$

where $\max(T_{kic}, T_{ikc})$ represents the total number of currencies (c) being transferred in either direction between the older parent (i) and each family member (k) and F is the total number of children in the family. Multiplexity has a minimum of 0 and a maximum of 3 (derived from the three currencies of money, material goods, and services). In a family with a multiplexity score of 0, there are no transfers of any currency, whereas a multiplexity score of 3 indicates that the older parent is engaged in transfers of all three currencies with all children.

For Taiwan, multiplexity is only slightly positively skewed and relatively flat. However, there is integer heaping, with 18 percent of the sample at zero and smaller peaks at 0.5, 1.0, and 2.0 as well. Both the mean and the median number of currencies being transferred is less than 1. This is influenced by both the proportion of families with no exchange activity in the sample (18 percent) and the limited number of currencies being exchanged. In the Philippines, the diversity of resource flows is higher, with a mean of 1.55 and a median of 1.7. The modal value for this sample is 2.0 with 23 percent of the families exchanging an average of 2 currencies in each parent-child dyad.

To examine the multiplexity of ties apart from the influence of the proportion of families who are not involved in any exchanges, which is much greater in Taiwan than in the Philippines (18 percent versus 2.3 percent), we calculate a measure of the *multiplexity of active ties*,

$$\frac{\sum_{k=1}^{F}\sum_{c=1}^{3}\left[\max\left(T_{kic}\ ,\ T_{ikc}\right)\right]}{2T} \tag{6}$$

where the number of valued flows in the numerator is divided by two times the number of active ties ($2T$) rather than the number of family members in the network. This changes the minimum value of the variable to 1, as families with no transfers ($2T$=0) are excluded.

Table 2. Correlation matrix of social network measures of exchange activity among adults aged 60 and older with 2 or more living children and 1 or more active ties: Taiwan (1989) and Philippines (1996)

	Active ties	Open chains	Exchange activation	Redistrib. exchange activation	Multi-plexity	Multi-plexity of active ties
Active ties*	***1.00***					
(nties)	***1.00***					
Open chains*	0.43	***1.00***				
(ochains)	0.87	***1.00***				
Exchange activation*	0.71	0.37	***1.00***			
(exact)	0.68	0.58	*1.00*			
Redistributive exch. activation*	0.31	0.70	0.51	*1.00*		
(geact)	0.60	0.66	0.89	*1.00*		
Multiplexity*	0.53	0.20	0.78	0.30	*1.00*	
(mplex)	0.45	0.25	0.74	0.45	*1.00*	
Multiplexity of active ties**	0.46	0.14	0.57	0.19	0.76	*1.00*
(mplex2)	0.06	0.07	0.27	0.20	0.66	*1.00*

* N=3,484 (Taiwan) N=1,191 (Philippines)

** N=2,877 (Taiwan) N=1,161 (Philippines)

The univariate statistics for the multiplexity of active ties (Table 1) indicate that differences between the two countries are much smaller. In Taiwan, the average number of currencies being transferred in a parent-child pair is 1.36, with a median of 1. In the Philippines, the comparable numbers are 1.84 and 2.0. This confirms that most of the transfer activity in Taiwan is in single flows of individual currencies, and implies that most Taiwanese families target the activation of their exchange network

to meet specific needs while families in the Philippines appear to have a more broadly active family network, giving and receiving in multiple currencies.

This measure is a useful amplification of the multiplexity measure and more precisely reflects the resources that are being transferred in the active exchange network, but the exclusion of cases with no transfer activity from the measure is a drawback in developing network variables that can be used in multivariate analyses, as important information about the level of activity in the sample is lost.

The measures presented here are examples. They are intended to provide the basis for developing generalized network algorithms that incorporate other characteristics of kin structure and transfers that can be tested in substantive hypotheses.

The development of network measures of intergenerational transfers extends existing ways of looking at resource flows in families and captures specific dimensions of family resource distribution parsimoniously. It is therefore necessary to determine the extent to which these network measures capture unique aspects of familial transfer patterns. In this section, we present bivariate correlations of the six measures described above.

Table 2 shows a correlation matrix of the measures described above, calculated only for older persons engaged in 1 or more transfers with their children in order to avoid the influence of perfect correlations among families with no exchange activity. The count variables are listed first (i.e., active ties and open chains) followed by activation scores.

As expected, there is a high correlation between the count variables and their standardized versions, r=0.71 for the number of active ties and exchange activation in Taiwan, and r=0.64 for the number of open chains and redistributive exchange activation in the Philippines. There is a very strong correlation between overall exchange activity and redistributive activity in the Philippines, though not in Taiwan. The high correlation between multiplexity and exchange activation (0.78 in Taiwan and 0.70 in the Philippines) implies that more active exchange networks have greater breadth in the currencies that they distribute, while less active exchange networks are more specialized.

Another important aspect of the development of network measures of intergenerational transfers is to determine the extent to which they convey information independent of the underlying family structure and living arrangements of families. We present below a multivariate analysis of the number of open chains to examine how family structure and living arrangements are related to transfer patterns. Table 3 shows the means and standard deviations for three sets of independent variables included in the multivariate models. First, a set of variables representing basic demographic characteristics of respondents is included: these are age (in single years), sex, and self-reported health status (response categories are poor or fair health versus good or excellent health). These variables are retained in the models to control for basic variation in demographic effects. The Philippines sample is slightly older on average, contains a higher proportion of women, and has a much higher proportion of elderly reporting that they are in poor or fair health compared to the elderly in Taiwan.

The second set of variables represents family structure characteristics: marital status (married or not married), the number of living children, and the age of the youngest child. Overall, 69 percent of the Taiwanese elderly are married compared to 57 percent of the Philippine elderly. While older persons in the Philippines have more living children on average than in Taiwan (6 versus 5), the average age of the youngest child is about the same (31-32 years).

The third set of variables represents living arrangements of older adults. Living arrangements are indicated by two dummy variables comparing living with unmarried children only or living with one or more married children with older adults who live with no children. More than half of older Taiwanese live with one or more married children compared to 22 percent who live with only unmarried children and 22 percent who do not live with any of their children. In the Philippines, approximately

equal proportions fall into the three groups, with 37 percent coresiding with married children, 36 percent with unmarried children only, and 30 percent living with no children.

Table 3. Definitions and means of the independent variables adults aged 60 and older with 2 or more living children: Taiwan (1989) and the Philippines (1996)

	Taiwan (n=3,484)		**Phillippines** (n=1,191)	
Variables	Mean	S.D.	Mean	S.D.
Demographic				
Age (60-90+)	68.12	6.40	69.12	7.19
Female	.45	.50	.56	.50
Poor or fair health	.23	.42	.51	.50
Family structure				
Married	.69	.46	.57	.50
Number of living children	5.12	1.95	6.36	2.50
Age of youngest child	30.96	8.11	31.72	59.52
Living Arrangement				
Unmarried Coresident Children Only	.22	.41	.37	.48
Married Coresident Children (may include others)	.56	.50	.36	.48

Table 4 shows the coefficients from a regression model of the number of Open Chains. We use a Poisson regression model because the outcome variable is a count variable and also a rare event, with a distribution dominated by zeros (McCullagh and Nelder, 1989). The model is not intended to be explanatory, but rather to explore the association of involvement in redistributive exchange with family characteristics.

Family structure is strongly associated with the number of open chains in which the older person is involved. Because the outcome variable is a count measure rather than the standardized activation score, the number of living children acts as a control for family size in the model, and it is significantly and positively related to the number of flows. The presence of a spouse in the household appears to have a buffering effect, reducing the number of pathways among children involving the older parent, though this is not significant in the Philippines. There is an inverse relationship with the age of the youngest child, possibly representing the greater role of the parent in controlling resources that go to younger children, though the effect is quite weak in the Philippines.

Living arrangements also are associated with the number of open chains, though much more strongly for Taiwan. Among Taiwanese parents, those who live with a child, especially an unmarried child, are involved in more redistribution of resources than those whose children all live outside the household. In the Philippines, the effects are modest and significant only for those living with one or more married children. It is important to remember that living arrangements and other intergenerational transfers may be jointly determined, so this relationship cannot be considered causal. The results from the Poisson model further confirm that there is a consistent and positive association between the level of redistributive flows and children's coresidence, though this varies between the two countries.

Table 4. Coefficients from a Poisson regression model of the number of Open Chains among adults aged 60 and older with 2 or more living children: Taiwan (1989) and the Philippines (1996)

	Taiwan	Philippines
Variables		
Demographic		
Age	-0.037 *	-0.029 *
Female	0.441	0.180 *
Poor or fair health	-0.376 *	-0.046 *
Family structure		
Married	-0.399 *	-0.030
Number of living children	0.252 *	0.251 *
Age of youngest child	-0.033 *	-0.002 *
Living Arrangement		
Co-resident unmarried kid	0.639 *	0.015
1+ co-resident married kid	0.357 *	0.072 *
N	3,484	1,191
Model Chi-square	903.0*	6196.3 *

* $p < .001$

DISCUSSION AND CONCLUSION

We have argued in this paper that a dyadic approach to family transfers provides only a partial explanation of family exchange behaviour. The network approach advocated here enables researchers to examine transfer activity involving multiple actors, multiple directions, and multiple currencies. Our aim has been to adopt a network approach to family transfers by constructing several network measures of intergenerational transfers and applying these measures to nationally-representative samples of older Taiwanese and Philippine adults.

Six illustrative social network measures were constructed to describe complex patterns of transfers among older parents and their children. These measures showed that most Taiwanese elderly are involved in transfers with their children, yet in few cases is more than 50 percent of the parent-child network activated. Involvement in redistributive exchange is relatively uncommon among the Taiwanese elderly: about 90 percent of older adults have no open chains (i.e., receive resources from one child and give resources to another child). Of those who do engage in redistribution, the intensity of activity is rather low. Most transfer activity is in flows of single currencies and tends to be concentrated among a subset of adult children within the family, indicating specialization in transfers with children. The coresidence of adult children appears to play an important role with regard to transfer activity, though it is not the sole location of parent-child transfers.

In the Philippines, nearly all older parents with two or more living children are involved in transfers with their children, and the majority are involved in 3 or more transfers. Older Filipinos also are much more likely than their Taiwanese counterparts to be involved in redistributive transfers, to do so more intensively, and to exchange a greater number of different types of resources on average. Coresidence appears to play a less important role in facilitating the redistribution of resources by older adults.

The comparisons of our measures of exchange behaviour across two countries provides a good example of the usefulness of standardized measures in examining family support across different cultures. The relatively low prevalence of redistributive exchange observed in Taiwan is not entirely surprising because strong normative rules about giving behaviour in Taiwanese families lead us to expect that children will more often be giving resources to their aged parents rather than receiving them. In the Philippines, rules are less focussed on married sons and consequently, exchanges are more likely to vary according to economic needs of the children rather than coresidence or other characteristics. These relationships merit further attention.

A limitation of the analysis is that family transfer activity is measured only at one point in time. Exchanges between parents and children take place across the life course, but the measures shown here focus on transfers in a single year. The possible relationship of early life investments by parents in their children (such as in education) to later life support by children is not considered here. Thus, transfer patterns among multiple family members that might be characterized as redistributive if examined over time are neglected.

This study also focuses on a subset of familial transfer activity — between older parents and their children. While older persons are most often on the receiving end of resources from children, they also may be passing resources along to siblings, parents or other relatives. The same measures that are used here to examine parent-child exchanges can be used to describe patterns of resource transfers among a broader set of family members and across generations.

Two additional areas of future research deserve consideration. First, many more empirical studies of family exchange are needed in order to examine critically the assumption that the extended family functions as a network of mutual obligation and support (see Cain's (1982) criticism of this assumption for South Asian families). In other words, to what extent does the family network truly operate as a "safety net" for its members? The research literature still lacks a strong empirical base documenting the variability within ideal-type family system models (such as strong norms of filial obligation within Asian families).

Another goal for future research is to use these standardized measures of family network activity as explanatory variables for such important outcomes as the physical or mental health status of older persons. The literature on the effects of social support on health is vast, especially for Western countries, and social support has consistently been found to be a buffer against morbidity and mortality (Berkman and Syme, 1979; Haines and Hurlbert, 1992; House et al., 1988; Seeman et. al., 1987; Silverstein and Bengtson, 1991). Network measures of resource flows would further clarify the relationship between social support and individual well-being. In addition, characteristics of an older person's intra-familial exchange network and their position in that network could serve as independent predictors of other important life course events such as retirement timing or migration (see Wenger, 1997) or the adoption of formal care services (long-term and acute) and assistive technologies. For example, a small study of elderly in Taipei, Taiwan found that those older parents who provided instrumental assistance to family members were less likely than others to be admitted into a nursing home during the study period (Wu et al., 1997).

Measures such as the ones we suggest in this paper can be used to examine transfer patterns among other family members at various stages of the family and individual life course. With the increasing number of nationally-representative data sets that include information on family exchange activity, the research community is afforded many new opportunities to understand how family exchange systems, and the resources they make available, are connected to individual outcomes.

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Appendix A – Survey Questions about Transfers

For each type of transfer (money, material goods or services), a series of questions was asked that identified the people involved. Parallel information was collected for both giving and receiving transfers with specific members of the family. In addition, characteristics of members of the family and household are documented in great detail. Children were individually identified and a number of characteristics were gathered about them (e.g., such as their place of residence, marital status, and so on). Somewhat more limited information was collected on other types of kin (parents, siblings, and grandchildren). While the direction of flows and the characteristics of the participants were documented, little information was collected about the quantity of support flows (e.g., hours of time or specific amounts of money). The exact survey questions on transfers in the 1989 Taiwan Survey of Health and Living Status of the Elderly are described below.

When the respondent gives support to any individual, for each main type of support (activities of daily living, instrumental activities of daily living, financial transfers and provision of material support) the respondent was asked:

> "Do you currently (provide assistance to anyone in the form of _____/give money to someone to help him or her/ provide material support on a regular basis or through special gifts of food or clothing) to anyone?"

If the answer is yes, they were then asked the following two questions:

> "To whom do you (provide this assistance/give this money)? Anyone else?" and
>
> "In the past year, who was helped most in this way?"

When any individual gives support to the respondent, for each main type of support (activities of daily living, instrumental activities of daily living and other services, financial, or material), the respondent was asked:

> "Is there anyone who (helps you with bathing, etc./ gives you money to help you now/ gives you food or clothing or other goods to help you now)?" or "Do you currently receive any assistance from any of these sources with daily activities such as household chores, etc.?"

If the answer is yes, they were then asked the following two questions:

> "Who provides this (assistance/support) to you? Anyone else?"

and

> "In the past year, which person (or service) was most important in terms of (providing physical care assistance to you/ assisting you with your daily activities/ providing financial support to you/ providing material support to you)?"