

Networks and Small Business Growth: An Explanatory Model

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ABSTRACT. To date, there has been limited empirical research related to network theory. With this article, we have tried to fill this gap by testing an explanatory model of the impact of networks on small business growth. To analyze this causal relationship, the log-linear technique was used. The results suggest that networks have an influence on the growth of a small business, especially through contacts with national and international entrepreneurs.

I. Introduction

The socio-economic scene is growing more and more complex by the day. Competition is stiffening, market demand is changing constantly, while government intervention does not make things easier, . . . Small businesses, too, are constantly faced with this incontrovertible reality. No doubt new opportunities are created here, but there are certainly risks involved too. Networking, with its emphasis on informality and opportunism, is seen as an ideal mechanism for thriving in these variable environmental conditions (Birley *et al.*, 1991). Networks, that imply organized systems of relationships with the external environment, are particularly valuable to the small business sector. The fragility which accompanies small size can namely be offset by the supportive environment provided by resilient networks (Szarka, 1990). So, the popular image of the entrepreneur as an isolated figure who overcomes obstacles and fends off dangers alone is at best incomplete (Dollinger, 1985).

In the literature, there are many contributions

representing different theoretical network perspectives. However, few have been presented so far trying to make network theory operational in a practical context, the result of which in turn could help organizations to position themselves in networks or to develop strategies in a network perspective (Paasche *et al.*, 1993). In addition, network theory demonstrates how the network position changes as the company develops, but there are few or no empirical studies available on the impact of network formation on the growth of a small business (Gibb, 1993). With this article, we have tried to fill this gap by analyzing the causal relationship between networks and small business growth. We will first present the conceptual model, which features the choice of the network variables, the importance of networks for the growth of the business and the role of entrepreneur- and enterprise-related characteristics on the network and growth scene. This is followed by a description of the hypotheses and the methodology. Then we analyze the impact of the network structure on small business growth. Finally, a roundup is given of the main research results and their policy implications.

II. Conceptual model

The literature describes and explains networks in various ways. However, it agrees upon the fact that networks are organized systems of relationships, hence a network is generally defined as a specific type of relation linking a defined set of persons, objects or events (Szarka, 1990). These relations constitute the network structure that may in turn take a lot of different forms. Consequently, different variables have to be used when analyzing a network (Paasche *et al.*, 1993). The literature mentions the determinants (social, communication, business and moral) of small business networks,

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the links between the relations (informal-formal and direct-indirect) and the objectives of networking. As Table I shows, we include variables that reflect network theory. The network elements to be analyzed are: consultation of external consultants, attendance of seminars, participation in trade fairs, geographical distribution of contacts with other entrepreneurs and discussion of important business decisions with relatives.

Let us make the comparison between the literature and the network variables to be analyzed. We start with the identification of the determinants that constitute the different network types.

Social ties are one of the factors that explain the network structure (see Mitchell, 1973; Aldrich and Whetten, 1981; Johannisson, 1986; Holt, 1987; Baker, 1990). Social network relations, Johannisson speaks of affective network relations, are maintained with family, friends and acquaintances. So, there is an emotional bond of friendship between the parties concerned. The social dimension may be present at contacts between the external consultant and the entrepreneur, among

entrepreneurs and among relatives. Communication is the second determinant (see Mitchell, 1973; Aldrich and Whetten, 1981). The communication network is the collection of those organizations and individuals with which the small firm has non-trading links that inform its business activities, such as external consultants, the family and other entrepreneurs. Relationships in this type of network are characterized by official and semi-official information flows. Although certain inputs will be paid for, no regular trade takes place.

Business considerations are the third component in the determination of a relation. Mitchell (1973) refers to exchange networks that contain the entities, like other entrepreneurs, with which the small businessman has commercial transactions. The core of the exchange network is the trading partners of the small business. Three main types of constitution (control, coordination and cooperation) can be discerned in exchange networks (Szarka, 1990). By control is understood quasi-hierarchical relationships allowing one company to dominate another. Coordination means

TABLE I
Comparison of network literature with network indicators to be analyzed

Indicators to be analyzed	External consultant	Seminars	Trade fairs	Contacts with entrepreneurs	Discussion with relatives
Network literature					
<i>Determinants</i>					
Social	*			*	*
Communication	*			*	*
Business				*	
- Exchange				*	
- Instrumental		*	*	*	*
- Strategic	*	*	*	*	*
Moral				*	*
<i>Links</i>					
Informal	*	*	*	*	*
Formal		*	*		
Direct	*			*	*
Indirect	*			*	*
<i>Objectives</i>					
Gathering of information	*	*	*	*	*
Response from external environment		*	*	*	
Canvassing and looking after customers and suppliers	*	*	*	*	
Enrichment of own knowledge	*	*	*	*	*
Psychological significance				*	*

* = Correspondence between literature and variables to be analyzed.

a situation in which a leading or a hub firm orchestrates the value-adding chain. In case of cooperation, there is a two-sided or multi-sided partnership where the partners are broadly equal and balanced, working together on a basis of trust stemming from mutual dependence. Johannisson (1986) recognizes the business element in the instrumental network relations, that are a tool for realizing business objectives. Seminars and trade fairs can contribute to this process. Finally, Jarillo (1988) is claiming that strategic behaviour is the main reason for building relations. According to him, the establishment of networks is a consequence of the needs of organizations to be effective. All the chosen network variables can fit in Jarillo's view. The moral aspect is the fourth and last determinant. The moral network relations arise from the fact that the entrepreneur feels morally obliged to do everything possible for his partners (relatives and fellow entrepreneurs) in the network (Johannisson, 1986).

Johannisson (1986) also points to informal against formal and to direct against indirect links between relations. An informal network consists of all possible information channels between individuals. They occur in all the selected network factors. A formal network, on the other hand, denotes a possible link between the entrepreneur and an organization rather than an individual. In the case of participation in seminars and trade fairs, there is certainly a dialogue between the entrepreneur and the organizing body. In direct relations there is a direct line between the entrepreneur and the network element. There are naturally direct contacts with external consultants, fellow entrepreneurs and relatives. Indirect relations imply that the network serves as an intermediate link. External consultants, other entrepreneurs and relatives may act as intermediaries.

In the chosen network variables we also discern the five concrete objectives which entrepreneurs have in mind when forming networks. First of all, they construct networks for the purpose of gathering information. Entrepreneurs mainly sound out personal contacts for information. Those contacts are frequent in all the selected networks. They attach far less importance to written reports and formal meetings (Welsch and Young, 1982; Marchesnay, 1988). Secondly, the entrepreneur uses his network to obtain a response from his

external environment. People listen to him during seminars, trade fairs and contacts with other entrepreneurs. Canvassing and looking after customers and suppliers also serves as an important link in the networks of entrepreneurs. External consultants, seminars, trade fairs and other entrepreneurs are ideal channels for gathering news from and about customers and suppliers. Enrichment of the entrepreneur's own knowledge is a fourth objective. This includes hiring external consultants to provide skills which are lacking or insufficiently developed in the business (Marchesnay, 1988). This own knowledge can also be enhanced through seminars, trade fairs, contacts with other entrepreneurs and discussion with relatives. A final motive for network formation concerns its psychological significance. For the entrepreneur, a network constitutes an ideal means to integrate into social life (Johannisson, 1988). For instance, it may result in his acquiring a high social position (among fellow entrepreneurs and relatives).

The comparison with the literature clearly shows that network diversity is of vital importance. An entrepreneur needs to be represented in a sufficient number of networks in order to have some kind of voice in the outside world (Johannisson, 1990a).

The link between network formation and growth can be inferred from Figure 1. We see how information contributes to the growth of the company by strengthening understanding and intuition. These elements in turn make it possible to take the necessary actions and to streamline the organization of the company, which benefits growth. Since the gathering of information and its dissemination throughout the outside world is one of the objectives of network formation, we can say that network development leads to growth. The figure shows that growth is also influenced by communication. Since network formation involves communication with the external environment, networks will stimulate the growth of the company through communication as well. As Brown and Butler (1993) argue, the preparation of network beds in which communication can be grown has a beneficial effect on entrepreneurship. Tjosvold and Weicker (1993) state that through the development of a network, entrepreneurs are more likely to communicate and to receive information

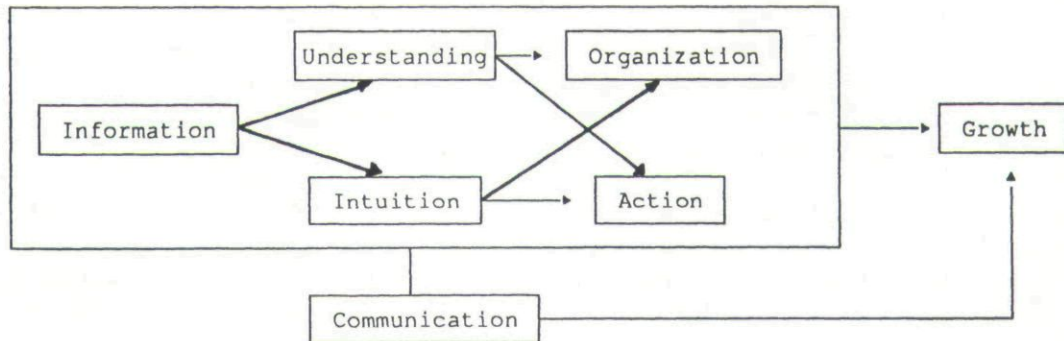


Fig. 1. From information over communication to growth.

accurately, resulting in an improvement of the business. Finally, Johannisson (1990b) stresses that an elaborative personal network will supply perspectives and experiences to the entrepreneur, that are needed for structural changes and continued growth of the business. We will analyze this causal relationship between network formation and growth. A growth enterprise is defined here as a company which has witnessed an increase in turnover over the last three years and expects a similar trend over the next three years too. By considering the situation over a period of six years, we want to attribute a continuous character to the notion of growth. In this way, accidental increases of turnover are overcome. Notice as well that growth is quantified on the basis of a fact (growth over the last three years) and a perception (expectation of growth over the next three years). We link the notion of growth to an increase in turnover, since we take the point of view of the entrepreneurs. Practically 90% of them, and there are no differences between the branches of industry, think spontaneously of an increase in turnover if they are asked to define growth (Donckels and Hoebeke, 1992).

Figure 2, where the entrepreneur is embedded in his business and in the external environment, makes it clear that he is the composer of the network elements. Birley *et al.* (1990, 1991) also stress the fact that every set of relationships is unique and is determined by the person creating the network. In addition, networking is primarily the domain of the small businessman, as he does not readily delegate this activity to subordinates. That is why we wish to examine whether an entrepreneur-related factor such as level of

training influences the relationship between network formation and growth. More particularly we will examine whether the impact of the network structure on growth is different for entrepreneurs with higher education than for entrepreneurs with lower education. It was a deliberate choice to do so for entrepreneurs with higher education and those with lower education. In earlier research we found that the level of training is the entrepreneur-related factor with the biggest impact on the nature of the networks (see Donckels and Lambrecht, 1994). Small businessmen with higher education have more different types of network. Figure 2 illustrates that there is also an interdependence between the SME and the external environment. We shall therefore also examine whether the causal relation between networks and growth is dependent on company-related factors. We will analyze whether the impact of network formation on growth is different

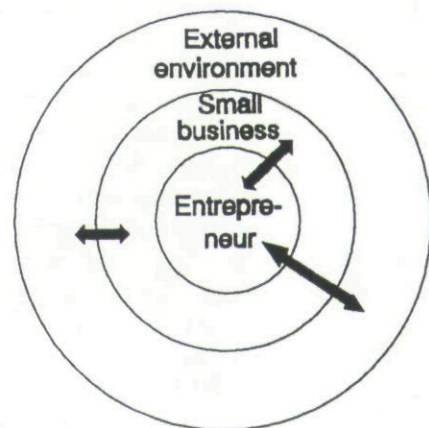


Fig. 2. The entrepreneur and his environment.

for the small (fewer than 10 staff) than for the medium-sized (10–99 staff) businesses. Here too we deliberately chose to make separate estimates for the small and for the medium-sized businesses. Our earlier survey, which we have already referred to, has revealed that company size is the company-related element with the biggest impact on network structure. Medium-sized businesses are present in more different networks.

III. Hypotheses

The geographical distribution of contacts with other entrepreneurs is influenced by the other network elements. Seminars, trade fairs and external consultants can help to spark off relations with national and international entrepreneurs. The impact of these contacts will however not be so significant if the entrepreneur's relatives have a greater say in business matters. Family businesses, where it is only natural that important business decisions are frequently discussed within the family, are closed systems which sooner hide their light under a bushel from third parties. This attitude explains why they are less inclined to broaden their horizons on the international scene than non-family businesses (Donckels and Fröhlich, 1991; Gallo and Sveen, 1991; Donckels and Aerts, 1993). We argue that network formation will stimulate growth through contacts with national and international entrepreneurs. This exchange of experiences can help entrepreneurs to solve shortcomings in their business and, moreover, contacts may result in contracts (Donckels and Hoebeke, 1990). They can turn to these interactions for new ways to examine an issue, for expanded knowledge, for additional support and for learning and discovering new ideas (Aldrich and Zimmer, 1986). Tjosvold and Weicker (1993)

underline that the contacts with national and international entrepreneurs, fuelled by other network elements, can motivate the small businessman to strengthen his business and implement changes to make the company grow. We can therefore formulate the following two hypotheses, which will be tested below for, respectively, the total sample, the entrepreneurs with higher education, the entrepreneurs with lower education, the small and the medium-sized companies.

Hypothesis 1: *The relations with national and international entrepreneurs are boosted by other network elements, but inhibited if the family influence is too strong.*

Hypothesis 2: *Network formation stimulates growth through contacts with national and international entrepreneurs.*

IV. Methodology

IV.1. Gathering of data¹

The research began in 1991 with an in-depth study of the literature. This clearly showed, as we have actually pointed out in the conceptual model, that the term "network" is given a variety of meanings. Since the entrepreneur plays a central role in network formation, we also examined in the literature the objectives of network development. In this regard, the survey was drawn up in such a way that the questions reflect the different network definitions and objectives. A specialized marketing agency interviewed 900 entrepreneurs by telephone. The respondents are located in three Flemish regions in Belgium and were selected at random from databases. They received an introductory letter before the telephone survey. Table II shows the composition of the sample according

TABLE II
Composition of sample (N = 900) (%)

Branch of industry	Number of staff					Total
	1–10	11–20	21–30	31–50	51–99	
Manufacturing	9.11	9.34	6.34	7.45	7.45	39.69
Services	9.67	4.44	1.11	1.78	1.22	18.22
Trade	22.22	9.98	4.44	3.56	1.89	42.09
Total	41.00	23.76	11.89	12.79	10.56	100.00

to branch of industry and company size. We define a small business as a company with less than 100 employees.

IV.2. Processing of data

The results of the telephone survey are presented analytically. The hypotheses were tested for the total sample, the entrepreneurs with higher education, with lower education, the small and the medium-sized companies through log-linear analysis (see Hagenaars, 1990). We used this method because it is ideally suited for identifying causal relations. Moreover, with this technique you do not have to be concerned with problems like multicollinearity, heteroscedasticity, etc. In log-linear models, both dichotomic and polytomic variables may be included. Figure 3, which gives a diagram of hypotheses 1 and 2, explains which categories make up the independent and dependent variables. The network variables which we include in the empirical analysis are the following: consultation of external consultants (fewer than two different consultants, at least two different consultants), attendance of seminars (yes, no), participation in trade fairs (yes, no), discussion with relatives (yes, no) and geographical distribution of contacts with other entrepreneurs (the most

important contacts are with entrepreneurs who are regionally, nationally or internationally situated). The dependent variable growth is dichotomous (growth, no growth). The figure also gives per category the percentages from the total sample ($N = 900$).

A possible drawback of the log-linear technique is that it only permits us to estimate the impact of the independent variables on one dependent variable. We cannot analyze the impact of the independent variables on the dependent variable and at the same time the impact of the dependent variable on the independent ones. This limitation of the log-linear technique is no drawback here, since our attention is focused on the impact of network formation on growth. As we said in the introduction, it is in that area where a gap has been found in the literature (see Gibb, 1993).

In order to understand the scope of the log-linear method, we explain the technical procedure for hypothesis 1 and the total sample.

First, the significant effects ($p < 0.05$) are selected. Next, several models are specified based on these significant effects. Then, the most suitable model has to be chosen. For the choice of the best model, that is explained in Appendices 1, 2 and 3, we based ourselves on the P-values ($p > 0.05$), AIC (Akaike's Information Criterion

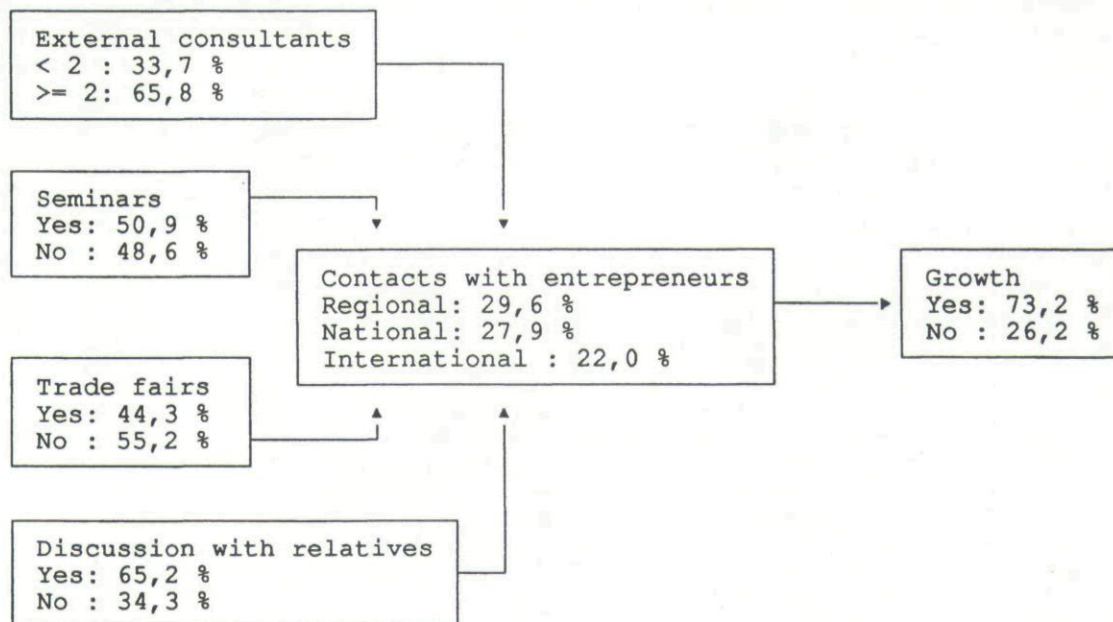


Fig. 3. Diagram of the hypotheses ($N = 900$).

= Likelihood chi-squared - ($2 \times$ degrees of freedom)) and BIC (Bayesian Information Criterion = Likelihood chi-squared - ($\log N \times$ degrees of freedom)). Of the best model, the multiplicative β -parameters are derived (see Appendix 4 for the way the β s are calculated) and the additive λ -parameters ($\lambda = \ln \beta$) are calculated and standardized. These standardized λ s are needed to examine whether there is a separate significant effect of the variables which are part of an interactive effect and whether there are significant differences between the categories of the variables. If the absolute value of the standardized λ s > 1.96 (z-value with $P = 0.025$ in the table of the standard normal distribution), we may conclude that there is a separate significant effect of the variable belonging to the interactive effect and that there are significant differences at the 5%-level (at the 1%-level if the λ s > 2.58 (z-value with $P = 0.005$ in the table of the standard normal distribution)) between the categories of the variables (see Appendix 1). Finally, on the basis of the β s we prepared adjusted frequency tables to facilitate the interpretation of the effects discerned. The β s are more difficult to use for interpretation

purposes (see Appendix 4 for the way these adjusted frequency tables are constructed; and Kaufman and Schervish (1986) for more technical details). We use the adjusted frequency tables to calculate percentages which are easy to interpret. The percentages do however need to be understood as probabilities or proportions. The entire log-linear analysis was carried out by means of the BMDP4F computer program.

In Table III we brought together the percentages of the logit models "Networks on contacts with entrepreneurs" and "Networks on growth" for the total sample. Let us analyze the impact on contacts with entrepreneurs. We observe that the contacts are influenced by the combined effect (interactive effect) of trade fairs and discussion with relatives (GI). On the other hand, there is also the separate impact of external consultants (E), seminars (F) and trade fairs (G).

V. Empirical results

We will test hypotheses 1 and 2 for, respectively, the total sample, the entrepreneurs with higher

TABLE III
Estimated row percentages of the logit models "Networks on contacts with entrepreneurs" and "Networks on growth" (total sample)

Independent	Dependent	Contacts with entrepreneurs			Growth	
		Regional	National	International	Yes	No
E (External consultants)	< 2	41.4	28.7*	29.9		
	≥ 2	35.3	37.9*	26.8		
F (Seminars)	Yes	33.1*	37.3	29.6		
	No	42.4*	32.0	25.6		
G (Trade fairs)	Yes	35.4	30.7*	33.9**	78.8**	21.2**
	No	39.0	38.7*	22.3**	68.9**	31.1**
I (Discussion with relatives)	Yes					
	No					
GI (Trade fairs and discussion with relatives)	Yes	Yes	36.8	36.1*	27.1**	
		No	34.4	25.3*	40.3**	
	No	Yes	37.5	35.6*	26.9**	
		No	41.0	41.3*	17.7**	
H (Contacts with entrepreneurs)	Regional				63.3**	36.7**
	National				79.6**	20.4**
	International				80.1**	19.9**

* Significant at 5%-level.

** Significant at 1%-level.

education and those with lower education, the small and the medium-sized companies.

V.1. *Total sample*

First we examine whether the geographical distribution of the contacts with entrepreneurs is influenced by the other network variables (external consultants, seminars, trade fairs and discussion with relatives). After examining hypothesis 1, we discuss the impact of the whole network structure (all the network indicators, including the contacts with entrepreneurs) on growth.

Impact on contacts with entrepreneurs

As was already pointed out during the processing of data, we observe in Table III an interactive effect of trade fair participation and discussion with relatives on contacts with entrepreneurs. There is significantly more chance that entrepreneurs who take part in trade fairs have contacts with international colleagues, when they do not discuss important business decisions with relatives. Entrepreneurs with those characteristics are roughly 40% likely to have international contacts. Entrepreneurs who take part in trade fairs, but discuss important business matters with relatives are 27.1% likely to have international connections. The probability is significantly higher that family businesses which take part in trade fairs have contacts with national entrepreneurs (36.1% probability, compared with 25.3% that the main contacts of non-family businesses which take part in trade fairs are with national colleagues). Notice that there are no significant differences concerning contacts with regional entrepreneurs.

When the variable "discussion with relatives" was taken out, we discovered that this effect did not have any significant impact on contacts with entrepreneurs. In hypothesis 1, however, we had predicted that family-bound entrepreneurs are less inclined to establish contacts with national and international entrepreneurs. This theory now appears to be somewhat contradicted here. It is only in conjunction with trade fair participation that the family aspect has an impact on the geographical distribution of contacts with entrepreneurs.

On the other hand, trade fair participation in itself does show a significant effect. There is a

significantly higher probability that participants in a trade fair have connections with international entrepreneurs (33.9% probability, compared with 22.3% for non-participants). There is a clear trend that seminars offer substantial opportunities for cross-fertilization with national and international entrepreneurs. Seminar attenders are significantly less likely to establish contacts with regional entrepreneurs (33.1% probability, compared with 42.4% for those who do not attend seminars). External consultants principally fertilize national contacts. Entrepreneurs with at least 2 different external consultants are roughly 38% likely to meet fellow national entrepreneurs on a very regular basis, compared with 28.7% for those with fewer than 2 different consultants.

We can say that hypothesis 1 is largely confirmed. The contacts with entrepreneurs are indeed influenced by external consultants, seminars and trade fairs. Discussion with relatives, however, has no negative impact on contacts with national and international entrepreneurs, which contradicts hypothesis 1.

Impact on growth

In Table III we observe that establishing contacts with other entrepreneurs is a network determinant for growth. Those with regional connections will be found significantly less frequently in the growth league than those with national and international contacts. For the entrepreneurs with national relations as well as for those with international connections, the probability to belong to the growth class is 80%, compared with 63.3% for those with regional contacts.

The importance of contacts with national and international entrepreneurs for growth is consistent with what we set forth in hypothesis 2. This needs to be completed, though, since participation in trade fairs also generates a direct growth effect. The probability that participants in trade fairs are in the growth league is significantly higher (0.79 compared with 0.69 for non-participants).

V.2. *Entrepreneurs with higher education versus those with lower education*

TABLE IV
Estimated row percentages of the logit models "Networks on contacts with entrepreneurs" and "Networks on growth"
(entrepreneurs with higher education versus those with lower education)

Independent		Dependent	Contacts with entrepreneurs			Growth	
			Regional	National	International	Yes	No
<i>Entrepreneurs with higher education</i>							
G (Trade fairs)		Yes				82.0*	18.0*
		No				71.3*	28.7*
H (Contacts with entrepreneurs)		Regional				65.1**	34.9**
		National				83.8**	16.2**
		International				81.8**	18.2**
<i>Entrepreneurs with lower education</i>							
G (Trade fairs)		Yes	41.9	26.1**	32.0**		
		No	38.8	43.6**	17.6**		
GI (Trade fairs and discussion with relatives)	Yes	Yes	36.4	41.5**	22.1**		
		No	48.5	12.2**	39.3**		
	No	Yes	39.5	35.4**	25.1**		
		No	43.2	45.0**	11.8**		
H (Contacts with entrepreneurs)		Regional				62.6**	37.4**
		National				74.9**	25.1**
		International				77.1**	22.9**

* Significant at 5%-level.

** Significant at 1%-level.

Impact on contacts with entrepreneurs

Among the highly qualified entrepreneurs we found no significant effects and therefore no suitable model. Among the entrepreneurs with lower education we observe, as in the total sample, an interactive effect of trade fair participation and discussion with relatives on contacts with entrepreneurs (see Table IV). Among the entrepreneurs with lower education, too, it is significantly more likely that entrepreneurs who take part in trade fairs have contacts with international colleagues, when they do not discuss important business decisions with relatives. They are 39.3% likely to have international contacts. The probability that entrepreneurs who take part in trade fairs, but discuss important business matters with relatives have international contacts equals 22.1%. Family businesses which take part in trade fairs have significantly more chance to be in contact with national entrepreneurs (41.5% probability, compared with 12.2% that non-family businesses which take part in trade fairs have contacts with

national colleagues). Among the entrepreneurs with lower education we find no significant effect either of discussion with relatives on contacts with entrepreneurs. So this conclusion does not tally with what we had predicted in hypothesis 1. There is however a separate significant effect of trade fair participation. There is a significantly higher probability that participants in a trade fair have connections with international entrepreneurs (32.0% probability, compared with 17.6% for non-participants).

Impact on growth

Among the entrepreneurs with higher education, too, we find that establishing contacts with other entrepreneurs is an important network determinant for growth. There is significantly less chance that those with regional contacts will be found in the growth league than those with national and international connections. For the entrepreneurs with national relations as well as for those with international connections, the probability to belong to

the growth class is more than 80%, compared with 65.1% for those with regional contacts. These findings confirm hypothesis 2. This however again needs to be completed, since participation in trade fairs also generates a direct growth effect. The probability that participants in trade fairs are in the growth league is significantly higher (0.82 compared with 0.71 for non-participants).

Among the entrepreneurs with lower education, the contacts with other entrepreneurs are the only network element that contributes to growth. Here, too, those with regional contacts are significantly less likely to be found in the growth league than those with national and international contacts. The probability that entrepreneurs whose main contacts are regional colleagues are to be found in the growth league is 0.63. For the entrepreneurs with national and international contacts, that score is 0.75 and 0.77 respectively. So the situation of entrepreneurs with lower education confirms hypothesis 2.

V.3. Medium-sized companies

Impact on contacts with entrepreneurs

As regards contacts with entrepreneurs, we found no suitable model for the small businesses. In the case of the medium-sized companies, though, there were significant effects, on which basis we were able to select a suitable model. Table V illustrates that there is first of all an interactive effect of trade fair participation and discussion with relatives on contacts with entrepreneurs. There is a significantly higher probability that entrepreneurs who take part in trade fairs and keep important business decisions firmly outside the family circle establish more contacts with international entrepreneurs. They are 48.7% likely to have international contacts, compared with 27.5% for those who take part in trade fairs, but discuss important business matters with relatives. The probability is significantly higher that family businesses which take part in trade fairs have contacts with national entrepreneurs (37.6% probability, compared with 19.1% for those which

TABLE V
Estimated row percentages of the logit models "Networks on contacts with entrepreneurs" and "Networks on growth" (medium-sized businesses)

Independent	Dependent	Contacts with entrepreneurs			Growth	
		Regional	National	International	Yes	No
G (Trade fairs)	Yes	33.9	28.6**	37.5**	81.8*	18.2*
	No	33.6	43.8**	22.6**	71.6*	28.4*
F (Seminars)	Yes	28.9*	38.8	32.8	80.5*	19.5*
	No	40.2*	33.1	26.7	71.9*	28.1*
E (External consultants)	< 2	36.5	29.4*	34.1		
	≥ 2	32.4	39.2*	28.4		
GE (Trade fairs and external consultants)	Yes	< 2	31.4	18.7	49.9**	
		≥ 2	35.4	36.0	28.6**	
	No	< 2	39.2	40.6	20.2**	
		≥ 2	30.4	42.2	27.4**	
GI (Trade fairs and discussion with relatives)	Yes	Yes	34.9	37.6**	27.5**	
		No	32.2	19.1**	48.7**	
	No	Yes	31.6	40.5**	27.9**	
		No	37.4	44.1**	18.8**	
H (Contacts with entrepreneurs)	Regional				66.4**	33.6**
	National				82.0**	18.0**
	International				82.2**	17.8**

* Significant at 5%-level.

** Significant at 1%-level.

part in trade fairs and do not discuss important business decisions with relatives). Trade fairs and external consultants is the second interactive effect on contacts with entrepreneurs. We notice that the consultation of at least 2 different external consultants only benefits the international contacts, in the event of non-participation in trade fairs. There is a 27.4% probability that entrepreneurs who do not take part in trade fairs and consult at least 2 different external consultants have contacts with international entrepreneurs. That probability is 20.2% for those who do not take part in trade fairs and have no more than 1 external consultant. Furthermore, in Table V we observe three separate significant effects. There is a separate influence of participation in trade fairs. There is a significantly higher probability that participants in a trade fair have connections with international entrepreneurs (37.5% probability, compared with 22.6% for non-participants). Non-participants are significantly more likely to establish contacts with national entrepreneurs (43.8% probability, compared with 28.6% for those who participate in a trade fair). There is also a separate impact of seminars. Seminar attenders are significantly less likely to establish contacts with regional entrepreneurs (28.9% probability, compared with 40.2% for those who do not attend seminars). Finally, there is a separate effect of external consultants. Entrepreneurs with at least 2 different external consultants are roughly 39% likely to meet fellow national entrepreneurs, compared with 29.4% for those with maximum 1 external consultant. We can say that hypothesis 1 is largely confirmed. The other network elements influence the geographical distribution of contacts with entrepreneurs. However, in contrast with hypothesis 1, there is no separate negative effect of discussion with relatives.

Impact on growth

When we analyzed the impact on growth, we found no suitable model either for the small businesses. In the case of the medium-sized firms, there are three significant network effects on growth. First of all, there is the impact of contacts with other entrepreneurs. Here, too, those with regional contacts are significantly less likely to belong to the growth league. There is a 66.4% probability that they will be found in the growth

league, compared with 82% for those with national and international connections. This result confirms hypothesis 2. Secondly, there is a significant effect of trade fairs. Participants in trade fairs are significantly more likely to be found in the growth league than non-participants (0.82 versus 0.72). Finally, there is a significant impact of seminars. Seminar attenders are significantly more likely to be found in the growth league (0.81 versus 0.72 for those who do not attend seminars).

VI. Summary and conclusions

In this article, we have investigated the causal relation between networks and small business growth for a total sample, entrepreneurs with higher education, entrepreneurs with lower education, small and medium-sized companies. In the case of the total sample, the medium-sized companies (no suitable model for small businesses), the entrepreneurs with higher education and those with lower education, it was found that contacts with national and international entrepreneurs are the most important network determinant for growth. Entrepreneurs with regional connections will be found significantly less frequently in the growth league than those with national and international contacts. These connections with national and international entrepreneurs are most influenced by an interactive effect of trade fair participation and discussion with relatives and by a separate effect of trade fair participation. It was found that entrepreneurs who take part in trade fairs but keep important business decisions firmly outside the family circle tend to establish more contacts with international entrepreneurs than do family businesses. There is also a significantly higher probability that participants in trade fairs have contacts with international colleagues than non-participants. We wish to emphasize that discussion of important business decisions with relatives does not directly inhibit contacts with national and international entrepreneurs. It is only combined with the trade fair variable that consultation with relatives has an impact on these relations.

These empirical observations contain a clear message for entrepreneurs and for the supporting infrastructure (private and public). The entrepreneurs must realize that they do not live on a desert island. They must not neglect their external envi-

ronment, for a large number of business elements can be derived from that environment. Moreover, relevant information can be communicated to the outside world. If entrepreneurs want to get into the growth league, they must invest in network formation, with the emphasis on "invest". After all, we cannot get round the fact that setting up an efficient network requires considerable resources (effort, time and money). The institutions should launch initiatives which help to strengthen the entrepreneurs' network position. Such schemes include activities which focus on the exchange of experiences among national and with international entrepreneurs. By organizing network activities, the supporting infrastructure helps to create a climate of enterprise capable of stimulating small business growth.

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Appendix I: Selection of the most suitable models (total sample)

Impact on contacts with entrepreneurs (N = 705)

In a first phase, we examined which effects are significant. We found four, namely HIG, HG, HF and HE, where H = contacts with entrepreneurs (dependent variable), I = discussion with relatives (independent variable), G = trade fairs (independent variable), F = seminars (independent variable) and E = external consultants (independent variable). HIG means that there is a significant interactive effect of discussion with relatives and trade fairs on contacts with entrepreneurs.

In a second phase, models were specified on the basis of the significant effects found. We are able to specify 11 models, which have all been estimated:

Model	Degrees of freedom	Likelihood-ratio		Pearson	
		Chisq	Prob	Chisq	Prob
EFGI, HIG, HF, HE	20	21.12	0.3902	20.64	0.4186
EFGI, HIG, HF	22	26.87	0.2164	26.07	0.2488
EFGI, HIG, HE	22	27.34	0.1987	26.49	0.2311
EFGI, HIG	24	33.05	0.1030	31.99	0.1271
EFGI, HG, HF, HE	24	32.31	0.1195	30.89	0.1568
EFGI, HG, HF	26	38.15	0.0587	36.20	0.0880
EFGI, HG, HE	26	38.51	0.0542	36.33	0.0858
EFGI, HF, HE	26	38.00	0.0605	36.67	0.0800
EFGI, HG	28	44.31	0.0259	41.67	0.0465
EFGI, HF	28	43.70	0.0297	42.12	0.0423
EFGI, HE	28	45.11	0.0215	43.10	0.0340

The most suitable model is selected from among the models with PROBs > 0.05 (H_0 = model can be accepted). From the models with PROBs > 0.05 we opt for the model EFGI, HIG, HF, HE, since this has the lowest AIC and BIC. The selected model tells us that the contacts with entrepreneurs are influenced by the combined effect of trade fairs and discussion with relatives (HIG) and by the separate effects of seminars (HF) and external consultants (HE). The effect EFGI is included in the model specification in order to indicate that we are dealing with a logit model (model with dependent variable, in this case the variable H). Finally, it is examined whether there is a separate effect of the variables belonging to the interaction effect. So we need to verify whether there is a direct effect of discussion with relatives on contacts with entrepreneurs (HI) and of trade fairs on contacts with entrepreneurs (HG). This is tested on the basis of the standardized λ s (see Tables AI and AII).

When the absolute value of a number of standardized λ s > 1.96, we may conclude that there is a separate significant effect of the variable concerned at the 5%-level. The preceding tables show that there is a significant effect of trade fairs on contacts with entrepreneurs. The effect discussion with relatives, that also belongs to the interactive effect HIG, is not significant. From Table AII we can also infer that participants in trade fairs differ significantly from non-participants in terms of contacts with national and international entrepreneurs (significant difference at 5%-level if absolute value of standardized λ > 1.96 and at 1%-level if absolute value > 2.58).

TABLE AI
Standardized λ s of HI

Discussion with relatives (I)	Contacts with entrepreneurs (H)		
	Regional	National	International
Yes	-0.401	0.595	-0.191
No	0.401	-0.595	0.191

TABLE AII
Standardized λ s of HG

Trade fairs (G)	Contacts with entrepreneurs (H)		
	Regional	National	International
Yes	-1.104	-2.256	3.124
No	1.104	2.256	-3.124

Impact on growth (N = 705)

Significant effects: LH, LG and LF, where L = growth (dependent variable), H = contacts with entrepreneurs (independent variable), G = trade fairs (independent variable) and F = seminars (independent variable).

Specified models on the basis of the significant effects:

Model	Degrees of freedom	Likelihood-ratio		Pearson	
		Chisq	Prob	Chisq	Prob
HEFGI, LH, LG, LF	43	49.50	0.2297	41.76	0.5252
HEFGI, LH, LG	44	51.37	0.2074	43.30	0.5013
HEFGI, LH, LF	44	56.78	0.0937	48.22	0.3062
HEFGI, LH	45	59.96	0.0670	51.36	0.2386
HEFGI, LG	46	73.68	0.0059	64.60	0.0365
HEFGI, LF	46	78.40	0.0020	69.37	0.0146
HEFGI, LG, LF	45	70.52	0.0089	62.89	0.0401

Chosen model with lowest AIC and BIC: HEFGI, LH, LG. So growth is influenced by contacts with entrepreneurs (LH) and trade fairs (LG).

Appendix II: Selection of the most suitable models (entrepreneurs with higher education versus entrepreneurs with lower education)

*Impact on contacts with entrepreneurs**Entrepreneurs with higher education*

No significant effects.

Entrepreneurs with lower education (N = 356)

Significant effects: HIG, where H = contacts with entrepreneurs (dependent variable), I = discussion with relatives (independent variable) and G = trade fairs (independent variable).

Specified models:

Model	Degrees of freedom	Likelihood-ratio		Pearson	
		Chisq	Prob	Chisq	Prob
EFGI, HIG	24	25.06	0.4025	23.57	0.4866

There is an interactive effect of trade fair participation and discussion with relatives on contacts with entrepreneurs. Based on the standardized λ s, we also found a separate significant effect of trade fair participation on contacts with entrepreneurs.

*Impact on growth**Entrepreneurs with higher education (N = 349)*

Significant effects: LFI, LH and LG, where L = growth (dependent variable), F = seminars (independent variable), I = discussion with relatives (independent variable), H = contacts with entrepreneurs (independent variable) and G = trade fairs (independent variable).

Specified models on the basis of the significant effects:

Model	Degrees of freedom	Likelihood-ratio		Pearson	
		Chisq	Prob	Chisq	Prob
HEFGI, LFI, LH, LG	41	32.02	0.8414	28.07	0.9380
HEFGI, LFI, LH	42	37.27	0.6784	31.97	0.8689
HEFGI, LFI, LG	43	45.10	0.3842	41.16	0.5515
HEFGI, LH, LG	44	38.11	0.7213	33.95	0.8628
HEFGI, LFI	44	51.36	0.2077	46.85	0.3565
HEFGI, LH	45	43.67	0.5283	39.36	0.7087
HEFGI, LG	46	52.13	0.2478	49.54	0.3340

Chosen model: HEFGI, LH, LG. Growth is influenced by contacts with entrepreneurs (LH) and trade fairs (LG). This model has the lowest BIC. Model HEFGI, LFI, LH, LG has the lowest AIC. However, there are no significant differences between the models HEFGI, LH, LG and HEFGI, LFI, LH, LG. Consequently, the most simple model is chosen. This is model HEFGI, LH, LG.

Entrepreneurs with lower education (N = 356)

Significant effect: LH, where L = growth (dependent variable) and H = contacts with entrepreneurs (independent variable).

Specified models:

Model	Degrees of freedom	Likelihood-ratio		Pearson	
		Chisq	Prob	Chisq	Prob
HEFGI, LH	45	45.69	0.4431	40.66	0.6563

Growth is influenced by contacts with entrepreneurs.

Appendix III: Selection of the most suitable models (small versus medium-sized businesses)*Impact on contacts with entrepreneurs**Small businesses*

No significant effects.

Medium-sized businesses (N = 474)

Significant effects: HIG, HGE, HF, where H = contacts with entrepreneurs (dependent variable), I = discussion with relatives (independent variable), G = trade fairs (independent variable), E = external consultants (independent variable) and F = seminars (independent variable).

Specified models on the basis of the significant effects:

Model	Degrees of freedom	Likelihood-ratio		Pearson	
		Chisq	Prob	Chisq	Prob
EFGI, HIG, HGE, HF	18	11.76	0.8583	11.35	0.8787
EFGI, HIG, HGE	20	18.15	0.5774	17.00	0.6532
EFGI, HIG, HF	22	25.74	0.2630	25.16	0.2895
EFGI, HIG	24	32.08	0.1249	31.49	0.1402
EFGI, HGE, HF	22	28.14	0.1712	27.25	0.2017
EFGI, HGE	24	34.21	0.0810	32.59	0.1129
EFGI, HF	28	46.49	0.0155	43.46	0.0314

Chosen model with lowest AIC and BIC: EFGI, HIG, HGE, HF. There is an interactive effect of trade fair participation and discussion with relatives on contacts with entrepreneurs (HIG). There is also an interactive effect of trade fair participation and external consultants (HGE). HF indicates that there is a separate effect of seminars on contacts with entrepreneurs. Based on the standardized λ s, we also found a separate effect of external consultants (HE) and of trade fairs (HG).

Impact on growth

Small businesses

No significant effects.

Medium-sized businesses ($N = 474$)

Significant effects: LH, LF and LG, where L = growth (dependent variable), H = contacts with entrepreneurs (independent variable), F = seminars (independent variable) and G = trade fairs (independent variable).

Specified models:

Model	Degrees of freedom	Likelihood-ratio		Pearson	
		Chisq	Prob	Chisq	Prob
HEFGI, LH, LF, LG	43	42.11	0.5097	39.71	0.6147
HEFGI, LH, LF	44	48.78	0.2868	45.52	0.4084
HEFGI, LH, LG	44	46.76	0.3596	44.28	0.4600
HEFGI, LF, LG	45	56.27	0.1210	53.66	0.1763
HEFGI, LH	45	54.59	0.1547	51.38	0.2381
HEFGI, LF	46	62.50	0.0529	59.65	0.0853
HEFGI, LG	46	62.70	0.0511	58.21	0.1068

Chosen model with lowest AIC and BIC: HEFGI, LH, LF, LG. Growth is influenced by contacts with entrepreneurs (LH), seminars (LF) and trade fairs (LG).

Appendix IV: Calculation of the β -parameters and creation of the adjusted frequency tables

We will now explain how the β -parameters from equation (A1), which represents the results of the impact on contacts with entrepreneurs of the total sample, are derived:

$$F_{nklm}^{HEFGI} = \eta \beta_n^H \beta_j^E \beta_k^F \beta_l^G \beta_m^I \beta_{nj}^{HE} \beta_{nk}^{HF} \beta_{nl}^{HG} \beta_{nlm}^{HGI} \quad (A1)$$

where H = contacts with entrepreneurs (dependent variable); E = external consultants (independent variable); F = seminars (independent variable); G = trade fairs (independent variable); I = discussion with relatives (independent variable); η = overall averages; β = multiplicative parameters; n, j, k, l, m = categories of H, E, F, G and I respectively (n = 1, 2, 3; j = 1, 2; k = 1, 2; l = 1, 2; m = 1, 2) and F_{nklm}^{HEFGI} = frequencies in a five-dimensional frequency table.

Equation (A1) indicates that the contacts with entrepreneurs are influenced by the interactive effect of trade fair participation and discussion with relatives (HGI) and by the separate effects external consultants (HE), seminars (HF) and trade fairs (HG). The main effects (β_n^H , β_j^E , β_k^F , β_l^G , β_m^I) are part of equation (A1), because they are included in the other effects. However, these main effects and the overall averages have not been recorded in the article, since they do not provide any relevant information when the observed effects on the dependent variables are analyzed.

To derive the β s, we must find the maximum likelihood estimator $\hat{F}$ for F , since the expected frequencies F are not known. This is equal to the observed frequencies f :

$$\hat{F}_{njklm}^{HEFGI} = f_{njklm}^{HEFGI} \quad (A2)$$

Equation (A2) makes it possible for (A1) to be written as follows:

$$\begin{aligned} f_{11111}^{HEFGI} &= \eta \beta_1^H \beta_1^E \beta_1^F \beta_1^G \beta_1^I \beta_{11}^{HE} \beta_{11}^{HF} \beta_{11}^{HG} \beta_{111}^{HGI} \\ f_{21111}^{HEFGI} &= \eta \beta_2^H \beta_1^E \beta_1^F \beta_1^G \beta_1^I \beta_{21}^{HE} \beta_{21}^{HF} \beta_{21}^{HG} \beta_{211}^{HGI} \end{aligned} \quad (A3)$$

In total, (A3) is composed of 48 equations ($3 \times 2 \times 2 \times 2 \times 2$ categories).

In order to solve the identification problem, the restriction ("effect coding") is imposed that the product of the β -parameters over each of the subscripts occurring in the parameter is one:

$$\begin{aligned} \pi_n \beta_n^H &= \pi_j \beta_j^E = \pi_k \beta_k^F = \pi_l \beta_l^G = \pi_m \beta_m^I = 1 \\ \pi_n \beta_{nj}^{HE} &= \pi_j \beta_{nj}^{HE} = 1 \\ \pi_n \beta_{nk}^{HF} &= \pi_k \beta_{nk}^{HF} = 1 \\ \pi_n \beta_{nl}^{HG} &= \pi_l \beta_{nl}^{HG} = 1 \\ \pi_n \beta_{nlm}^{HGI} &= \pi_m \beta_{nlm}^{HGI} = \pi_l \beta_{nlm}^{HGI} = 1 \end{aligned} \quad (A4)$$

For the equations (A3) the following equivalences apply:

$$\begin{aligned} \beta_1^H &= \frac{1}{\beta_2^H} & \beta_1^E &= \frac{1}{\beta_2^E} & \beta_1^F &= \frac{1}{\beta_2^F} & \beta_1^G &= \frac{1}{\beta_2^G} & \beta_1^I &= \frac{1}{\beta_2^I} \\ \beta_{21}^{HE} &= \beta_{12}^{HE} = \frac{1}{\beta_{22}^{HE}} = \frac{1}{\beta_{11}^{HE}} \\ \beta_{21}^{HF} &= \beta_{12}^{HF} = \frac{1}{\beta_{22}^{HF}} = \frac{1}{\beta_{11}^{HF}} \\ \beta_{21}^{HG} &= \beta_{12}^{HG} = \frac{1}{\beta_{22}^{HG}} = \frac{1}{\beta_{11}^{HG}} \\ \beta_{211}^{HGI} &= \beta_{112}^{HGI} = \beta_{121}^{HGI} = \beta_{222}^{HGI} = \frac{1}{\beta_{122}^{HGI}} = \frac{1}{\beta_{221}^{HGI}} = \frac{1}{\beta_{212}^{HGI}} = \frac{1}{\beta_{111}^{HGI}} \end{aligned} \quad (A5)$$

Using (A5), the equations (A3) can be rewritten as follows:

$$\begin{aligned} f_{11111}^{HEFGI} &= \eta \beta_1^H \beta_1^E \beta_1^F \beta_1^G \beta_1^I \beta_{11}^{HE} \beta_{11}^{HF} \beta_{11}^{HG} \beta_{111}^{HGI} \\ f_{21111}^{HEFGI} &= \eta \frac{1}{\beta_1^H} \beta_1^E \beta_1^F \beta_1^G \beta_1^I \frac{1}{\beta_{11}^{HE}} \frac{1}{\beta_{11}^{HF}} \frac{1}{\beta_{11}^{HG}} \frac{1}{\beta_{111}^{HGI}} \end{aligned} \quad (A6)$$

The effects can now be calculated from the equations (A6).

The β s are used for the creation of the adjusted frequency tables. They are put in the DATA table as starting or initial values and the table of expected or predicted counts is requested in order to derive percentages from the OUTPUT table. A final aspect of the procedure in case of the creation of a two-dimensional adjusted frequency table (one independent and one dependent variable) is the specification of a model of independence. The general procedure for the creation of a three-dimensional adjusted frequency table (in case of an interactive effect, for example the HGI relationship) is similar to that utilized to create the two-dimensional table, but some of the details are different. The entries for the DATA table are then calculated as follows:

$$\text{START entry } n, l, m = \beta_{nm}^{HI} \times \beta_{nl}^{HG} \times \beta_{nlm}^{HGI}$$

Furthermore, the model specified for the adjustment procedure is a two-way relationship between I and G and a one-way effect of the dependent variable: IG, H. By specifying this model, it is assumed that I and G are not independent on the bivariate level.

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