Keystone sector methodology:network analysis comparative study

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Abstract**

In this paper, we present some new perspectives on rural regional development strategies.

Contradictory goals in macroeconomic policies, such as maximizing growth, efficiency and technological innovation with equity or efficient growth with regional disparities, tend to appear with higher costs to small open economies. A large number of studies are focused on this trade-off, using national and some regional aggregate indicators mostly based on economic flows (prices and quantities). However the urbanization process is still concentrated in a few traditionally big cities, which is particularly the case in Portugal.

The 'keystone sector' methodology we apply here shows that other important flows embedded in small town social networks can provide complementary understanding of such issues.

Conclusions about a case study in Portugal, its internal and external relations and the comparison with some US similar studies described in the literature, will highlight and enhance the understanding of this approach to the articulation of development strategies in sparsely populated regions in the E.U.

** - This paper is still in progress. The oral presentation will take into account ongoing improvements.

1. Research background

♣ I would like to express my appreciation to Geoffrey Hewings and Maureen Kilkenny, who provided useful support and comments during my empirical research.

In the last two decades, European Structural Funds allocated within a market-oriented policy, were supposed to provide investment in infrastructure to increase factor mobility and EU intra-trade. In its origin, European Regional Policy had three main components: FEDER – for regional infrastructures, FEOGA – for organization and agricultural survival and FSE –for social equity. This design appeared to be complete while it took in account the needed physical investment in transport infrastructures. It anticipated possible disruption in agricultural landscape and farm work conditions, and investing in human capital hopefully enabled people to get new labor skills guarantying higher labor mobility and labor market clearance.

Unfortunately the outcome of these combined policies was not satisfactory. It happens that, overall, reductions in transport costs worked against the economic development of low-density places (or rural areas). They favored urban polarization with increased congestion costs; secondly, incentives to avoid agricultural disruption did not provide sufficient and diversified amenities in rural areas and finally, firms and people did not spread out enough to equilibrate labor markets, increasing unemployment rates above unexpected levels (two digits). Up to now European Regional Policy has been a failure.

Theoretical approaches exclusively based upon neoclassical utility maximization framework are important and able to partially explain this outcome; but if decisions about location were freely chosen and optimal, concentration in cities is predicted and regional policies will be useless. However, funds have been allocated based upon population/income criteria, without considering any of the important policy agency problems. Competition for European funds is thus completely biased and success is dependant on everything but the real needs of people. Scale, complementarities and spillover effects are barely considered for projects and application for funds, which turn out in inefficiencies.

Because sub optimality exists[1], new approaches, which consider social interaction among players in a competitive arena, help to provide additional understanding of equity goals and policy design.

Small towns located in rural areas built specific social network patterns along time, which can be crucial to explain people attraction/repulsion. Therefore,

[1] For further discussion see Kilkenny (1998).

highlighting the social structure of those towns can shift the focus of investment criteria and spillover effects would be better understood.

2. Theoretical considerations

In a world characterized by increasing speed of information and high capital mobility it is important to understand at what extent the institutions created by man are able to provide economic efficiency and social equity. In fact, despite increased factor mobility and policy instruments regional disparities and labor market mismatches still persist across regions.

Social capital theory can then be useful to provide additional explanation to this phenomenon, once economic analysis has not showed satisfactory.

According to Sonis (2000) "*the collective behavior is the subjective mental evaluation of level utilities in the future, presenting sets of composite advantages"*, which have several socio-economic attributes and should be considered in different time and spaces. Further on he argues that "*…the meso-level variation principle of collective choice behavior determines the balance between the resulting cumulative social interactions among the population of adopters susceptible to the choice alternatives"*, which contribute to the equalization of the elite's power in supporting different alternative choices. This argument is presented within a framework of innovation diffusion and collective choice, where a collective utility function does not exist (at least is difficult to measure) when collective behavior does result from a simple summation of individual choices. Each individual is a permanent learner in his social environment and therefore does not decide according to rational choice theory. His choice will depend on the subjective perception he has about his active environment, which turns social interaction into a crucial issue.

Granovetter (1985) considers that "*under and over socialized accounts are paradoxically similar in their neglect of ongoing structures of social relations*", which means that "*economic action must consider its Embeddedness in such structures*". Individuals have their concrete personal relations (ego networks) and usually invest more in those links they perceive to be providers of higher benefits. Considering the actual speed of information flows, this choice has to rely upon trust they have on the existent institutions. On the other hand, monopolies and big international enterprises need these local connections in order to survive. To quote Granovetter (1985) again

"*small firms still persist because they have a dense local social networks*", they therefore survive because they use their social relations as an asset to survive within competitive markets.

Nan Lin (1999) argues that "*social capital is captured from embedded resources in social networks*" and this will be the definition that will allow us to measure and use the concept for additional explanations on competition. Being "a *relational asset distinct from other collective assets and goods such as norms, culture, trust*" (Lin, 1999) social capital is collectively produced; therefore it is unique and has no alternative forms[2].

The insight of Ronald Burt (1992) is interesting to this discussion because he argues, *"competitive behavior (and results) can be understood in terms of players access to holes in the social structure. It is important to know who owns the strategic positions"*. Social capital is then a production factor and each individual invests in social capital when he decides to spend energy in certain social relations as an instrument to access higher returns. Hence, players in economic activity have several capital assets. Besides the traditional physical and financial concepts of capital, each player can invest in human capital (increasing his personal skills, based on 'know what') but also in social capital (time/energy spent in social relations, based on 'know who').

Actually, in concrete social life it is common to observe that some individuals with low skills can be social or economically successful just because they use important links and connections with strategically located people. Moreover, it is also possible that even with few connections they can reach the major benefits. The postman and the banker in a town are paradigmatic examples. The first has a huge number of social connections even though he does not use them to raise his personal welfare; likewise, the freshman banker in town can be connected to few people but suddenly improves his bank's profits.

"*Players establish relations with others. Each player connection can be based on trust, can be dependant, supportive or exchangeable; designing those links we will*

[2] There are different theoretical positions about social capital. It is a fuzzy concept while it has some characteristics of public goods and class/club goods. Public goods are characterized by non-rivalry in consumption and non-excludability. So far, social capital is not a pure public good while there is some rivalry in its consumption while social hierarchy and prominence will favor some consumers against others. Anyway we must consider that to be a public good it will depend on the good will of individual members and thus, norms, trust, sanctions, authority will become important to sustain social capital.

find the disconnections (holes)" (Burt, 1992). However, not all the relations are an efficient investment and the pattern of social links is not equally productive.

The structure holes argument is used "*for the separation between non-redundant contacts*" in a social network. The hole between two contacts will provide benefits that are in some degree additive rather than overlapping, in the whole competition arena.

This argument is particularly relevant in localities where low mobility is an obstacle to efficient reallocation of human capital, *i.e.* difficulties in changing workforce characteristics in the short run, and problems of replacing outmigrants with high skilled new comers. In these localities, rates of return will mostly rely on the social relations. In addition, this argument is especially relevant when one takes the view that the allocation of competitive opportunities is not made with respect to the single abilities needed for the modern valued tasks. Whatever specific locality endowments are, there are other people who could do the 'same' job within lower level of demand exigencies. In the new global knowledge economy "*…conditions are given to the proverb that says success is determined less by what you know than by whom you know*" (Burt, 1992: 10).

To know the competitive opportunities in a small town requires the condition (necessary though not sufficient) of knowing its social network structure. Although there are remaining problems of predicting attitudes or behavior within social network analysis, it can be used to predict patterns and similarities between attitudes and behaviors.

There is empirical evidence about the fact that people tend to develop relations with people like themselves[3], to the extent that one's resource and opinions are correlated with those with whom they have close contacts. The crucial point is, here, to describe how certain social structures enhance the benefits in the competitive arena. Acknowledging Burt (1992:13) there are two kinds of benefits: information and control. After finding the structural holes in the network it is possible to determine who knows about those opportunities and is able to generate the information benefits, which, in consequence, will provide control benefits to the whole network.

Where are the structural holes?

[3] See for example Fischer, 1982; Marsden, 1987 or Burt, 1990.

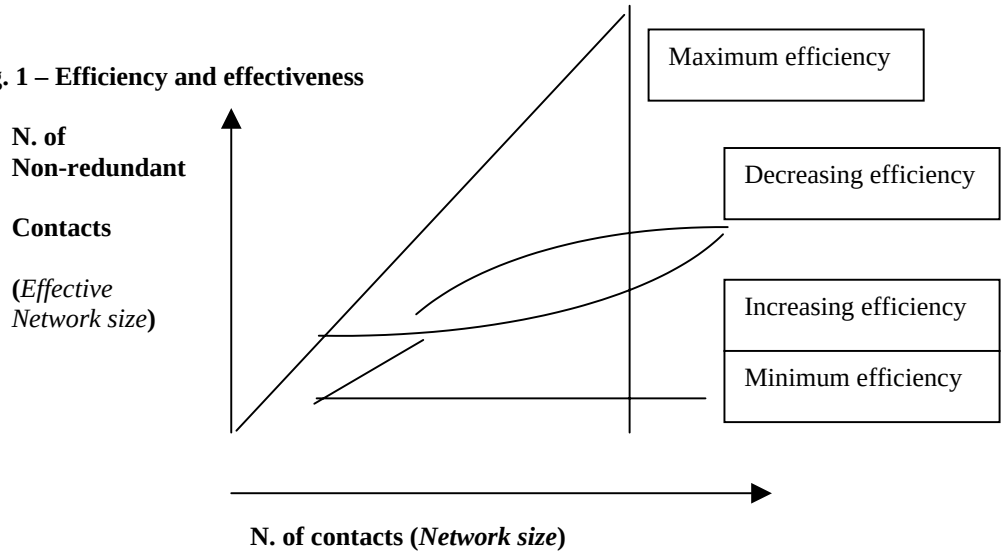
In a social network, bigger is not always better. Increasing the network size without considering its diversity can very often affect the quality of the social network. If added contacts lead each node to the same people they can become redundant, which means costly. A very dense network could be considered inefficient in the way that it returns less diverse information with a higher cost than a less dense but diversified network. Measuring the effort/time needed to add a new contact as an additional cost, one actor is inefficient if the new contact leads to a similar existent contact. It is considered as a redundancy while it only adds cost against no added gain.

To find such structural holes, empirical indicators - cohesion or structural equivalence – are used. Two contacts are redundant "*to the extent that they are connected by a strong relationship"* (husband and wife will constitute a redundancy to the set of a third person contacts). Two people are said to be structural equivalent "*to the extent that they have the same contacts*" (knowing one or two ministers in the same Government). Usually cohesion is the criterion to find direct contacts and structural equivalence is appropriate to find indirect contacts. Although they are important indicators, they are neither absolute nor independent. When jointly considered, redundancy is most likely to occur between structurally equivalent people connected by a strong relationship rather than between total strangers in distant groups.

Under this perspective, balancing network size is a question of optimizing structural holes. It is reasonable to predict that the number of structural holes will rise with the network size, so it is important to consider the two design principles behind the optimal network: efficiency and effectiveness.

These principles are represented in figure 1, extracted from Burt (*1992*: 24):

Fig. 1 – Efficiency and effectiveness



Efficiency is achieved when each player "*maximizes the number of non-redundant contacts in the network in order to maximize the yield in structural holes per contact*". As there is little gain from a new redundant contact, we say that, given N_i networks with the same sizes *NxN*, N_k will be the more efficient network if it has the high level of non-redundant contacts because the marginal cost to obtain the same amount of a benefit is higher.

Effectiveness is a different design principle that requires a distinction between primary and secondary contacts, in order to focus resources on preserving the primary contacts. In this design, contacts are not persons but ports of access to clusters of people beyond. These ports should be non-redundant to allow separate and more diversified sources of benefits. While the efficiency principle concerns the average number of people reached with a primary contact, the second principle, concerns the total amount of people reached through all the primary contacts.

The minimum efficiency line in fig. 1 describes the case in which each new contact is completely redundant to the network; the maximum efficiency line describes the case where each new contact is non-redundant. The other two lines in the middle describe the more probable patterns of network growth. The decreasing efficiency line refers to the case where initial contacts add a lot more than later contacts, once they start becoming redundant when friends of friends are included. The increasing efficiency line, where the contacts start to be redundant, and progressively shift to a cluster pattern when each player expands through the inclusion of contacts existent in other clusters. The more efficient players are those who can access to the structure holes (right side of the X – axis).

The two growth patterns can be desirable, depending on the strategy of the player and the strength of the primary contacts. If density can lower the probability that the contact will know about an opportunity, then it is worthy to increase the number of contacts in the cluster so that resultant redundancy offsets the imperfect information transmission within it.

The structural holes argument captures the causal agent directly and provides a different focus than other approaches (*i.e.* weak ties in Granovetter) mainly because it considers the player empowerment through the control benefits that the holes provide beyond the information benefits. Thus, players with an optimized network for structural

holes in addition to face more rewarded opportunities, are more likely to control benefits, giving certain players an advantage in negotiating their relationships.

Knowing the social structure of small towns (through different measures forward presented) will enable us to predict its cultural pattern and the value of its social capital. Furthermore it will tell us how likely each social network is able to internalize the benefits of structural funds invested in the locality and surrounding region.

In the next section we explain the specific methodology and discuss the results.

3. Methodological considerations

As a consequence of human system complexity – where everything is connected with everything else – and the improvement in new informational technologies – where "*tempo* of spread" crashes with human ability to deal with everything at the same time, the problem of innovation diffusion process in an active social environment[4] is more important than technology invention.

Several attempts to define the fuzzy boundaries among disciplines and to use methodological instruments depend on adequate measurement and accurate data gathering. Heterogeneity and dependence in space is not linear due to social interaction. Integration of social influences in player behaviors[5], social dynamics across time/space in innovation diffusion[6], demand and supply analysis or market equilibrium[7], is a challenging process in economic modeling.

In this paper we focus on social interaction among entities located in small towns, identifying its social structure and the prominence and hierarchy of the main institutions. With the obtained picture we understand how players located in this town can benefit (or not) from the existent social capital, which can be used as a guideline for investment decisions.

3.1. The keystone sector methodology

[4] Discussion on this issue is presented in Sonis, M. (2000).
[5] For a more complete survey see Becker and Murphy (2000).
[6] Sonis (2000).
[7] Several examples can be found in education, labor, housing, agriculture, public, regional and local economics and in crime, health, innovation, business, marketing issues. To more complete survey see Anselin (1999).

This new method to identify the keystone sectors in small communities is carefully documented in Kilkenny and Nalbart (2000) and the following explanations are mostly based on their text.

The **keystone sector** is considered the one that plays a unique and fundamental role within a community, which means that without it, the quality of economic life in the community will be inferior. As the nodes we chose are institutions, the keystone sector we look for will be the institution without which the social network will become disconnected. The 'keystone' concept was early used by the ecologist Robert Paine in the late 60's when identifying the predator as the critical species in an ecosystem[8].

This new method enables us to think about the importance of a large set of entities besides firms, which are not usually identified as important within an economic competitiveness context, such as churches, clubs, hospitals, social care institutions, schools, and so forth. We find attractive the application of this ecological idea to the social environment in a town, where a number of demographic changes in business occur across the years without a reasonable understanding of the predator activities. We found it appropriate since within a social capital framework it is probable that institutions other than firms, can play important roles in the growth and development processes, as above described, given that they provide important productive resources non-captured in other interactions[9]. The keystone sector methodology is also appropriate because our hypothesis is that regional disparities have been addressed in a biased format. Socioeconomic indicators that have been considered as criteria to apply for structural funds across countries disregard other important characteristics at the intermediate level of political agency. Our empirical experiment can thus turn into an important complementary approach (social) to existent economic analysis.

This methodological approach is also driven from the theoretical considerations presented before. As a matter of fact, the analysis will focus on the 'interaction' rather than in the competitive actor's attributes and will look to the whole social structure as a production factor used to provide new competitive opportunities. As small towns are the main nodes located in the broad regional network, they are the appropriate scale to look at.

[8] "Key sector analysis is also familiar in economic structure studies as those whose backward and forward linkages creates above-average impacts on the rest of the economy" (Sonis, M., Hewings, G. and Guo, J. (2000).

[9] Interaction in input-output analysis is also approached within a q-analysis framework in Sonis, M. and Hewings, G. (2000)

3.2. **TT**[10] study

To achieve our goal we carried out a survey similar to the one described in Laumann (1985). We identified 140 entities located in town including private, public and non-profit institutions, and defined a direct interview with their main leaders. We tested the survey in order to identify possible questions that leaders would raise during the interview, to guarantee the privacy of each entity response. However, the surveyed leaders were informed that a University researcher wrote the questions, and that they were similar, for comparative purposes, to those within an international project.

We collected 83 usable responses (60%) and 3 were negative responses considering privacy reasons. Nevertheless some of the 83 entities revealed some reluctance to answer part of the survey, namely the questions related with money flows. Based on the answers we knew about the existence/absence of relational links in money, support and information each entity gives and receives to/from the other 82 on the list to solve community affairs[11].

The relational link between agents is used to study our test hypothesis. The answers in the survey allowed us to complete six binary matrices (1/0). By convention, each row in the matrix contained the sender of the flow, while each column housed the receipt of that same flow. Consequently we define an *83x83* matrix with diagonal zero, considering non-reflexive relationships (a_{ij} gives no information to a_{ij} himself).

Based on each pair of questions (give/receive) we defined three main relations we denominate as INFORMATION, MONEY and ORGANIZATION[12]. As we studied more than one link between agents at a time this is called a ***multiplex*** relation analysis[13].

The relational link between two actors is called a ***tie***, so that a ***tie*** is a property of the pair because it cannot pertain simply to one of the actors. As the relations are *directional* (links goes from a node to another), the matrices do not have to be symmetric.

In this analysis we look for ***dyads***, which consist of a pair of actors and the possible ***ties*** existing between them (Wasserman and Faust, 1994). As an example, we

[10] TT is the symbolic name we choose for the studied town.
[11] As defined in LAUMAN, E.O. (1985).
[12] Because these are the main resources for collective action.
[13] As defined in Wasserman and Faust (1994).

could say that the owner and the renter of a house are a dyad as the doctor and their patients are. Considering these definitions, we established as ***unity of observation*** the individual/entities from whom we have got information through the survey, about their ties with the other actors/entities presented in the list.

Data can be represented in a graph format, because relational ties have a direction (***arc,*** defined on the basis of who gives and who receives) and we can design directed graphs or digraphs, where the entities will be the nodes and the relations will be the arcs. Formally Robinson and Foulds (1980) define a digraph as:

A digraph is a finite, non-empty set N, whose elements $n_i = \{n_1, n_2, \ldots, n_g\}$ *are called nodes, together with a set* $A = \{a_{12}, a_{13}, \ldots a_{1g}, \ldots a_{g-1}, a_g\}$ *of ordered pairs of* a_{ij}*, called arcs, where* n_i *and* n_j *are distinct members of N.*

Nevertheless it is not convenient to represent in a digraph form when the number *N* is too large, which is the case.

Adjacency is the expression when we mean two actors are directly related, tied or connected with one another and formally we could assert that:

"Given actors n_i *and* n_j *in a set of N actors; and A=* a_{ij} *arcs denoting the existence of relations from actors i to agents j; actors i and j are adjacent if there exist either of the two arcs* a_{ij} *or* a_{ji}*. Given the digraph D = (N,A), its adjacency matrix A(D) is defined by A(D) =* a_{ij}*, where* a_{ij}*=1 if either* a_{ij} *or* a_{ji} *exists, and* a_{ij}*=0 if otherwise"* (Kilkenny & Nalbart, 2000:9).

In a first step, we studied the ***density*** of the entire surveyed network. This measure compares the existing relationships to all possible relations, which in this case, will be *6806* (83x82) since *N*=83. If the complete graph is the one where each actor has a relationship with all the others, the density will be 100%. In general, the proportion of the existing numbers of non-reflexive arcs in its possible maximum measures the density of a digraph. In our case, for each relation *R* an adjacency matrix (*AR*) *83 x 83* was constructed with entries $aR_{ij} = 1$ if the i_{th} actor has a relation *R* tie with the j_{th} actor and if not, $aR_{ij} = 0$. (Also, $aR_{ii} = 0$).

But actors may be direct or indirectly related through a third element of the network. To explain this difference in relationships among actors we use the ***path*** as a sequence of arcs from one node to another, which means that in a direct relation there is only a one-step arc between the nodes and in an indirect relation we can take multi-step paths into account. This is the way to consider each actor in a network in a richer form

more adequate to human reality. In fact an actor can be a ***transmitter*** (the arc is away from the node), a ***carrier*** (there are at least two arcs, one toward and one away) or a ***receiver*** (the arc is toward the node). Further on we can imagine an ***isolated*** actor that will be the case of a node with no arc that relate him with any other actors in the network.

With this identification process we will be able to interpret the results under the structural holes argument, finding the actors who can increase the whole network efficiency, because are more likely to use the non-redundant links.

4. Main results[14]

4.1. The results for Macro-structure

In **TT** town we expected to find a sparse network because traditional textile activity required mostly international INFORMATION connections to firms. However, uncertainty about the changes existed in consequence of the new roles of some public institutions in town such as the University and the Municipality. Traditionally, **TT** had important information clusters where worker's associations and textile unions played important roles. However, the last urban plan transformed old factories in University Departments; old neighborhood associations gave away to nightlife cafes and new commerce location allowed traditional retailer shops to be transformed into service and public institutions.

Could this shift be revealed in the network information flows patterns?

On the other hand, we predicted a very low density in MONEY flows, while we know that money is not abundant and a number of new institutions were fighting for funds in an external basis, at the national and international levels. Despite this, we were curious about the new role played by banks and insurance companies correlated with the housing boom in the last two decades.

Finally, it was expected to observe relative higher density in ORGANIZATIONAL flows, because difficulties emerged in consequence of job losses and labor-training demand, provided a better environment for a new institutional spring. As European funds have been predominantly given for infrastructure and

[14] The software we used to run the tests were: MicroSoft Excel 97, Unicet 5.0 for Windows.

training programs, competition is being held among different local institutions and we didn't know if a significant pattern in this relational links already emerged.

We present the results for density in the 3 matrices[15] in table 1.

Table 1 – Global Densities

N = 83

Social Network Concepts	Formulas	INF	MON	ORG
Density $\mathbf{V_2}$	$\sum V_{2ij} / N*(N-1)$	**0.156**	**0.007**	**0.057**
Density in USA study		**0.240**	**0.100**	**0.155**

It is worthy to note that global densities have low values compared with results from US comparative study.

In table 2 potential densities refer to the 2nd and 3rd steps, which means we also consider the mediation roles within the social network (direct and indirect links). We ran the results considering the same matrices and it is possible to verify that accumulated potential densities are significantly higher.

Table 2 – Accumulative densities

N = 83

Social Network Concepts	Formulas	Value	Value	Value
2 – STEP PATH - $\mathbf{V^2_3}$		*INF*	*MON*	*ORG*
Density V^2_3	$\sum V^2_{3ij} / N*N$	**0.51**	**0.098**	**0.506**
3 – STEP PATH - $\mathbf{V^3_3}$				
Potential Density V^3_3	$\sum V^3_3 / N*N$	**0.66**	**0.153**	**0.649**
Accumulative potential density	$\sum V^3_3 / N*N - \sum V_{3ij} / N*N$	0.54	0.09	0.592

Looking at the results, the main conclusion will be that considering this one-intermediary role, the network will potentially raise its density over the 51% and up to 66%, when the two-intermediary entities are considered (*INF*); 10 and 15% (*MON*) and 51 and 65% (*ORG*).

Following our theoretical argument it means that in **TT** there is plenty opportunities to some entities in the network, so they can benefit from the existence of structural holes and easily increase the network efficiency (*INF* and *ORG*). The extent to which each node is directly connected to all other nodes and the extent to which a node is directly connected only to those other nodes that are not connected to each

[15] The complete tables with results are in Appendix.

other, needs to be exploited further in a microstructure analysis (distance between two nodes).

Considering a **Component** as the largest subset of related actors within a network, means all actors relate to each other. When socio-matrices are dense we expect to find single components; when they are not, we expect to find components with different sizes. At least Money didn't appear to show a dense relation, but computing the UCINET test for **components** we found single components for all the 3 matrices. So far, we can say that **TT** has an overall dense network, where almost the entities can reach the others, mainly through two other agents in town. MON matrix remains sparse and two actors play the major role.

In the next section we are going to analyze the **Prominence** of the actors - more central and prestigious entities.

4.2. The results for the Micro-structure

From the preliminary tests we know that in **TT** town there are not isolated actors; somehow each actor is able to reach all the others in the network. However, we know that these links are not all mutual and that if some actors give/receive a lot to/from others, some other actors are not so prominent, which means they are not so extensively involved in relationships with the actors presented in the list.

4.2.1 Prominence

Prominence can be seen in different ways; actually an actor can be both a receiver and a transmitter or it can play only one of these roles. In order to rank the entities, we should consider all the direct ties both originated from (**outdegree**) and received by (**indegree**) the actor, plus all the indirect ties in consequence of the multiple **step paths**.

If we compute different matrix sizes or compare across different social networks, these measures of prominence should be standardized, normalizing each set of degree (in and out) with respect to the numbers of agents. In **TT** case, all the matrices have the same size (*83x83*), so that we did not need to do so.

In each table the results will include the sample statistics for **prestige** and **centrality,** allowing the ranking related with entities that showed values above the mean plus standard deviation distance. Actors with higher *outdegree* levels (they origin

a great number of flows within the network) have higher **local centrality**. Actors with higher *indegree* levels (the main sinks of flows coming from other actors in the network) have **local prestige**.

Table 3.1 – *INF* Top Entities (Mean+1Std)

LOCAL CENTRALITY Mean = 15.7		LOCAL PRESTIGE Mean = 15.7	
Sector	**Value**	**Sector**	**Value**
Local Authority	37	Private Construction Firm	82
University	36	Middle School	82
Association Text. Ind.	30	Hospital	82
Employm. Pub. Office	29	Church	82
Pub. Inst. SME	29	Public Telecom	82
Local newspaper	29	Political Party	82
Association Retailers	24	Non profit Social Inst.	71
Middle School	24	Hotel	57
Pub.Inst.Foreign Com.	24	Union Teachers	56
Middle School	23	Local Radio	49
Middle School	23	University	41
High School	23	Union Teachers	39
High School	23	Employment Pub. Office	38

Table 3.1 shows the emergence of a new pattern, where traditional institutions gave place to new institutions in town. Except the private construction firm and the Portugal Telecom, all the others are mainly public service providers and non-profit organizations.

Table 3.2 – *MON* Top Entities (Mean+1Std)

LOCAL CENTRALITY Mean = 4.48		LOCAL PRESTIGE Mean = 4.48	
Sector	**Value**	**Sector**	**Value**
Local Authority	28	Private Construction firm	82
Employm Pub.Office	11	Private Insurance Comp.	82
Private Textile Firm	10	Private Build. Materials	23
University	10	Hotel	17
AssocTextile Ind	7	StudentUniv. Association	15
Bank	7	Cultural Association	14
Pub. Inst. SME	7	Local Radio	14
Pub.Inst.Foreign Com.	7	Union Retailer Workers	14
Pub. Inst. Leisure time	7		

The insurance company joined the private construction firm and the private building materials firm followed at a large distance. The presence of the Student University Association, the Cultural Association and the Local Radio, reveal the importance thses institutions have in the new shift of economic activity. In fact, they are the institutions that lead the initiative in community affairs, sponsored by subsidies and funds from the others.

Table 3.3. – *ORG* Top Entities (Mean+1Std)

LOCAL CENTRALITY Mean = 15.6		LOCAL PRESTIGE Mean = 15.6	
Sector	**Value**	**Sector**	**Value**
Local Authority	38	Student Univ. Assoc.	82
University	32	YMCA	82
Local Firemen	23	Private Transport firm	82
Association Text. Ind.	22	Employment Pub. Inst.	82
Pub. Inst. SME	21	Public Health Care C.	82
Student Univ. Assoc.	20	National Transit Police	82
Association Retailers	20	Hospital	82
Employment Pub. Inst.	19	Church	82
Public Health Care C.	19	Political party	82
Training Inst. Textile	19	Political party	81
High School	19	Local Radio	72
Pub. Inst. Foreign Com.	19	Private Insurance Comp.	55
Local Newspaper	19	High School	50

Overall, Public sector and non-profit institutions are much more represented than private firms all over the three matrices, enhancing the shift we predicted in our previous design.

4.2.2 Centrality

After looking at each player local centrality and prestige, we checked for **Global Centrality** in the network.

Global centrality is measured by the length and number of carrier and multiple step-path simultaneously; this indicator captures the position of strategic significance within the network or the best positioned entities to profit from the structural holes and increase the whole social network efficiency. Of course, this strategic significance depends on intermediaries, but global central actors can have important widespread effects.

To test for these location opportunities, we used three important concepts in social network analysis: closeness, betweeness and efficiency.

Closeness or distance that is a measure focusing on how close an actor is to all the other actors in the total network (Wasserman and Faust, 1997). The main idea is that actor a_i is considered central if it can easily interact with all the others, in the shortest path through other well connected actors. In the economic sense it is the one who can efficiently improve the flows in the net, benefiting the whole connection, reaching clusters of other actors already connected among them.

Betweeness is another measure that one can compute, counting the number of geodesics linking actors *j* and *k* (all the geodesics will have the same length) and then determine how many of these geodesics contain actor *i*, for all distinct indices *j, k and i*. So, the index for a_i will be the sum of the estimated probabilities over all the pairs of

actors not including the actor *i*. In other words, if actor *i* wants to contact actor *j*, actor *k* must be used as an intermediary, which gives him a certain responsibility to actors *i* and *j*. If we count all the minimum paths, which pass through *k*, we have the measure of his power in the network. To test these positions we applied both the Closeness and Betweeness UCINET calculations. The results are showed in Table 4:

Table 4 - Closeness and Betweenness

	Closeness	Betweenness
INF	Mean St Dev Min Max 61.72 12.57 52.23 100.0	Mean St Dev Min Max 63.89 151.9 0 842
	- Private Construction firm **- Middle School** **- Hospital** **- Main Church** - Public Telecommunication Firm **- Political Party** - Private Religious Solidarity Org.	**-Local Authority** **-University** -Institute of Foreign Commerce **- Public Employment Center** **-Middle School**
MON	Mean St Dev Min Max 53.4 7.55 50.62 100.0	Mean St Dev Min Max 39.8 125.8 0 821
	- Private Construction firm - Insurance Company	**-Private Construction Firm** -Textile (innovative) Firm -Textile Entrepreneur Association **-University**
ORG	Mean St Dev Min Max 62.7 14.85 53.59 100.0	Mean St Dev Min Max 53.5 130.56 0 669
	- Student University Association - YMCA - Private Transportation Firm **- Public Employment Center** **- Public Health Center** - Transit Police **- Hospital** **- Main Church** **- Political party** - Political Party	**- Public Health Center** **- Public Inst. Of Employment** **- Student University Association** **- Local Authority** -Retailer Entrepreneur Association.

- ***** Slightly less than the 1Std+mean value.
- **Bold** for 'at least 2 top places in all'.

The higher the value of **Closeness**, the shortest is the path from the entity to connect other entities in the community. In the present case we can say that the Private Construction Firm reaches the most other agents with the fewest steps in the Money matrix (more than 1Std higher than the mean). This result is consistent with the hypothesis of the huge increase in construction activity and the housing boom over the last decade.

The higher the value of **Betweeness**, the more potential an actor has to control third-party relationships. Again, the Private Construction Firm in Money matrix, but also the Local Authority in Information and the Public Health Center for Organization matrices.

In a global view, pointing out the actors that appeared more than once in the whole network, we have **University Student Association**, **Municipality, Public Employment Center, Public Health Center**, **Private Construction Firm, Middle School, Hospital, Church, Political Party** and **University** as the strategic entities, which is mostly consistent with our hypothesis. Through eight public institutions and one private firm in the construction sector, the entire social network is connected. Attending that this is the pattern registered during the dictatorship, centralization is a constant across time that could be pointed as a probable explanation for the development delay. We will turn to this point, in the comparative conclusions. The third test is for **Efficiency**, computed on the basis of these two others, and shows a pattern of increasing efficiency (see Fig. 1).

4.2.3 Peripheral entities or isolates

These should be the entities least likely to be strategic in the network, once they are the isolated actors. They are the actors with very low values for local and global centrality (more than 1Std below the means). There are no peripheral entities in the ORGANIZATION matrix, though we can consider as peripheral the traditional Club of old textile aristocracy, together with center political parties and one of the Teacher's Union in what Money matrix concerns. Information matrix showed a sufficiently dense network but 6 entities have values below the 1Std+Mean level: four firms from agriculture, development, textile mechanics and automobile retailer as the above-mentioned club along with one of the churches.

The branches are consistent with the declining sectors in economic activity and its social effects. The political parties that are not in the local power have also low centrality.

4.2.4. Keystone entities

In a preliminary analysis, **TT** city showed a very interconnected sample of entities with no clubs or cliques, which doesn't give any expectancy for a particular set of actors displaying unique patterns of relations. Nevertheless, **closeness** and **Betweeness** tests revealed important differences among certain entities that required promoting the '**keystoness'** test in order to check for significant changes in the network structure due to the excision of those entities (called the Cut points).

We tested for the hypothesis that any single actor played such a role. The procedure consists in removing one at a time, each central entity found in precedent tests from all the three socio-matrices after which we conduct another component analysis with the resultant matrix. There is a cut point when the removal of that entity from the system will be able to increase the number of components, *i. e.*, dividing the graph in two or more separate components, leaving them without connections.

We ran this test for several entities one at a time within each of the matrices and none of them was positive, i.e., the whole matrix always maintained just one component. In the case of INFORMATION and ORGANIZATION we tried yet to remove the top 6 entities but the result did not changed. Though, when we excise both Private Construction Firm and the Private Insurance Company in MONEY relations, the matrix will spread in 5 components. In our opinion this is due to the extremely weak density of the MONEY matrix rather than to the vital importance of those actors and, at the same time, reveals the general low propensity to risk while instead of make other applications, entities prefer to guarantee the future in insurance and real estate assets.

When any entity appears to be critical we say that the single component structure in all the matrices is robust, i.e., there is no single actor that does not have a substitute as a vector in each network considered. As we found that excising 2 of the actors from the MONEY matrix could be critical, we followed tests through the Block Modeling procedure for the structural equivalence test.

4.2.5 Block Modeling – Redundancy test

The UCINET software provides a procedure called CONCOR (from CONvergence of iterated CORrelations) that delineates **structurally equivalent** entities. The test identifies sets of entities among the all sample with different behavior patterns. Formally we say that actors' *n* and *n+1* are structurally equivalent if *n* relates only with *k* and *k+1* ($n \neq k$), then actor *n+1* relates only with *k* and *k+1* and the sociomatrix will turn in rank *N-1*. Simplifying in other words this is the same than considering that the information of two rows (or columns) is equal; one of them could be removed without altering the network connectivity (redundant nodes).

This test proceeds in two steps: first by a square case-by-case correlation matrix; the second step is a clustering procedure to group the cases into stochastically

structural equivalent sets. The display of the test splits the whole set of cases into subsets that have all positive correlation within each subgroup, and negative correlation between the subgroups. The procedures switch the initial order and put members of the subsets next to each other, blocking them together[16].

Some of the blocks are clearly similar and substitutable entities, namely those two we found for MONEY (private construction and insurance companies) and Banks in Information (all the banks together in a subgroup). As we have tried to excise the top six entities in INFORMATION and ORGANIZATION matrices we did not carry out more excision tests by sets of entities. Trying to make some comparative statements with the research presented in Kilkenny and Nalbart (2000) we tried to run the test with the excision of the banking sector but it did not split the network structure. In sum, there is no evidence for a keystone sector in **TT** social network, although it could be a consequence of some noise revealed in the survey.

5. Summary Evaluation

After carrying out the empirical analysis based on the multiplex survey about information, money and organizational support links within the town, our main findings can be summarized as follows:

1. There are no Keystone sectors in **TT,** as found in various US studies. None of the entities surveyed is decisive in the global network context; however, the private construction and insurance firms together, act like a keystone due to the minimal density in Money matrix.
2. Densities are substantially lower than in previous studies. This network is, then, less likely to maintain the existent social capital, particularly in *Money* relations. The textile industry is captured in *Organization* at the Associative level, which means that their monetary receipts have no significant effect in the internal structure, as predicted. This 'cluster' requires further study in their external links.

[16] Tables for results are presented in Appendix.

3. **TT** social structure shows a strong dependence on Public Institutions and Non-Profit Associations. Private enterprises do not play an important role in the social network (with few exceptions). Namely the recently privatized bank system has no significant role. This contradicts similar studies in U.S. towns, where banks play an important role in information, money and support relations. The Municipality, the University, the Student University Association and the Public Employment Center seem to play the important role in the present, contrasting with the traditional structure where the textile firms were central.
4. Even erasing the six more central institutions as a set, did not split the network into more than one component, revealing no dominance or centralized social structure. According to critical mass theory, this lack of actor centralization can explain part of the internal competitive disadvantages in town.
5. The block-modeling test revealed that there are over 15 groups of structural equivalent entities in 'information' and 'money' interactions and 12 in 'organizational support', which enhances the possibility that some entities can be used as ports of access to other clusters increasing the efficiency of the network.
6. The values of the accumulated densities in 2nd and 3rd paths (for *INF* and *ORG*) (54 and 59% respectively) reveal a high level of non-redundant contacts diminishing the marginal cost to obtain the same amount of benefits in the first two flows. Nevertheless, the best-located actors pertain to non-profit organizations, which constrain the competitive advantage provided by those holes.
7. Structural hole measures confirm that the kinds of benefits that can be used are small, as long as public and non-profit sectors are not related to profit. This social structure should be locally dense to preserve and maintain resources and maybe that a sparse network would be an advantage for external links. In itself, the existence of structural holes does not mean a great deal. The use entities can make of them would essentially be non-productive despite culturally valuable.
8. Social structure reveals the same pattern than in the old regime where public sector, church and school were the basic of anti-democratic centrality.

Wrap – up

Economic performance around the world shows some important changes with different geographic puzzles and urban/rural paths. Tradition and culture seem to play a

decisive role in locality restructuring, differentiating community ability to adopt competitive strategies. This suggests the need for alternative approaches, which complement economic impact analyze.

As social network analysis is a methodology focused on interaction among actors who, embedded in their specific social contacts, can play a leading role to accomplish the development goals in a community. The whole town is then the observation unity in this analysis and the outcome is different from looking at the sum of individual behaviors.

In this paper we tested the hypothesis of the keystone sector and the change in the social structure of a small traditional industrial town located in a European rural underdeveloped region. Due to its export base tradition, it was expected to find few internal contacts density. Nevertheless, it was unpredictable which were the more prominent actors while from the last two decades we knew that industry lost its share in the city employment structure.

No keystone sector was found, which contradicts the US evidence. Although structural holes are present, the prominence indicators reveal that it is improbable that best-located actors can really benefit for information and control to ameliorate competition. It was expected to find an institutional network structure based on the dictatorship public sector more than in private organizations and no dominating private sectors. In fact, the prominent players mostly belong to the public and non-profit sectors and the only relevant private firms belong to construction and insurance sectors revealing the real estate dynamics connected with developer benefits provided by the main public institutions. The margin over 25% of redundant contacts ask for more further research focused on the content of the analyzed flows.

Conclusions

The benefits of regional policies have many public goods aspects and so far private oriented incentives are not successful in dealing with them. The urbanization process in small towns located in rural areas is contradictory; these need more people but there are not too many people to attract. In addition, to sustain their role as providers of upgraded services to the region, these towns need more well educated people that, in general, are more likely to appreciate a new package of goods, composed by amenities, unspoiled natural environment and social capital, avoiding the

congestion costs in bigger cities. With new information technologies, highly-qualified workers can make wider decisions about where they want to live and competition in labor market will be also established in the basis of non-market factors like social characteristics of the places. Towns with high levels of social capital will be more likely to provide higher returns to business and workers. It is then important to look at social aspects of regional development as a complement of other economic based analysis.

Although social capital measurement still present some methodological problems, we think that this methodology provides us an interesting contribute to fulfill this gap.

Non-market oriented institutions are accessing the structure holes of low dense networks, weakening the ability to obtain higher returns. Instead, US studies revealed different structures where banks played the keystone role. The difference in returns is obvious in consequence of the different goals; in fact, looking for profits is a characteristic that fits firms and not non-market institutions. Still centralized and public dependant hierarchies need different kind of policies.

However, external structural holes in the global competition arena need further research, while we think that, a dense local structure is more likely to internalize the opportunities of global structural holes.

Improving the methodology and empirical designs will certainly frame further research and complement other economic approaches, which ignores the role played by local actors in rural regions.

Surveys in the two neighbor towns, **CC** and **GG**, are being carried out in order to enable a better understanding of the competitive opportunities in regional polarization towns. In these surveys we will include inter-town questions, we will specify the content of the links to understand internal and external interactions, and doing so we intend to ameliorate the equity effects in the design of development strategies for sparsely populated regions in the EU.

Finally it is important to state that inefficiency in Portuguese regional policy can result from ignoring the knowledge about existent social structures. In fact, the allocation of available European funds for rural regional development is done through nationally imposed institutions rather than considering these locally based competitive opportunities. If the lack of money revealed in small towns were offset by efficient

information and support networks, the whole town and rural region would certainly better off. Doing so, we intend to enhance the importance of social capital for equity effects in the design of strategic development in sparsely populated regions within the EU.

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