Shareholder Power and Control

T-rank AS

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1 Introduction

As a shareholder in a company, you will, in general, have two kinds of rights: 1) Cash rights and 2) Voting rights.

The term *cash rights* refer to the right to share in profitability, through dividends, liquidation or sale of the company. The values generated by a company should at some stage reach its owners – divided according to share distribution.

T-rank, in cooperation with Bureau van Dijk, has for a number of years offered the world's most comprehensive service when it comes to total ownership calculations. An entity's A total ownership in another entity B tells the percent of the cash rights A has in B.

Voting rights refers to the right to vote at the General Assembly, and through that, influence major decisions for the company.

Unlike cash rights, the level of *power* given by a certain share percent is not given by the ownership percentage alone, but is highly dependent on the distribution of the other shares.

If company A is owned by shareholder B with 30% and shareholder C with 70%, then shareholder B has no power at all.

If company A is owned by shareholder B with 30%, and 70 other shareholders with 1% each, then shareholder B has a very high degree of power.

T-rank, in cooperation with Bureau van Dijk, has launched a new service that provides estimations of voting power for all direct and/or indirect owners of a company. This unique service enables the user to investigate who controls or significantly influences the decisions of a company.

2 T-rank Power Index - an overall review

2.1 Background

The traditional definition of *control* is the following:

Definition 2.1. *A shareholder A is in control of company B, if A controls more than 50% of the voting rights in B.*

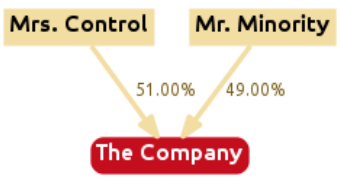

Figure 1: Mrs. Control has more than 50% of the votes and controls The Company

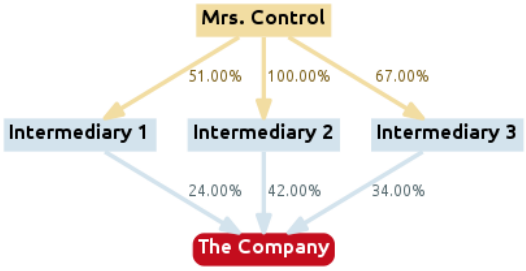

Figure 2: Control through several paths. Mrs. Control controls several intermediary companies, and through these, controls The Company.

Figure 3: Controlling chain, Mrs. Control controls The Company through a set of intermediary companies.

In all three examples, shareholder *Mrs. Control* controls more than 50% of the voting rights in *The Company*.

This traditional approach has some limitations.

1. The traditional approach is binary. A shareholder is either in control or not in control. There are cases where you are interested in shareholders with high degree of influence, but not necessarily "control".

2. The traditional approach does not address "De facto control". This concept will be explained in more detail later.

3. The traditional approach does not address circular ownership.

2.2 The difference between total ownership and control

It is important to emphasize that voting power and cash rights do not necessarily correlate. It is possible to have a high degree of total ownership and no control, and it is possible to have control with limited total ownership.

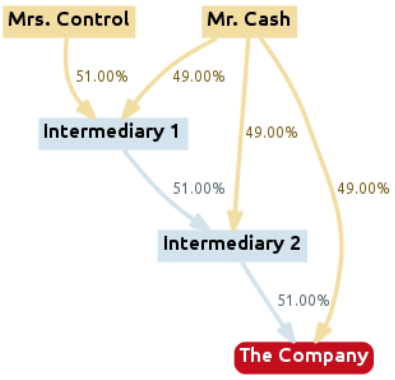

Figure 4: Control with low total ownership / high total ownership without control.

Example 2.1. *In Figure 4, shareholder* Mr. Cash *has a total ownership of* 86.73% *in* The Company*, but he is not in control. Shareholder* Mrs. Control *is in control of* The Company*, but has a total ownership of only* 13.27%*.*

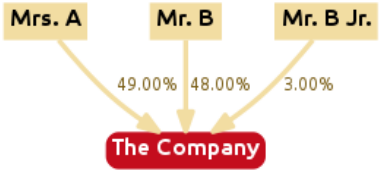

Figure 5: Shareholders with varying voting rights, but equal *voting power*

Example 2.2. *In Figure 5, The shareholders have varying degrees of ownership in* The Company*, but none of the shareholders are in control on his/her own. Two of the shareholders must cooperate to be in control, but it doesn't matter which two. Then it is fair to say that all the three shareholders have the same level of* voting power*.*

2.3 "Voting power"

T-rank calculates *voting power*. These scores are used as attributes to all pairs of connected entities, and the scores are visualized on shareholder maps.

Voting power is assigned to every pair of connected entities. A is in control of B, if A's voting power in B is (almost) 100%.

T-rank defines an (indirect) shareholder A's voting power in company B to be equal to the probability of A being in a position to flip a decision in B. In other words: *Voting power* = the probability of being a critical vote (a more formal definition is found in Chapter 3).

The T-rank Power Index will reveal new controlling shareholders, not identified via the traditional approach. The concept can be used to investigate controlling constellations, that is a group of shareholders who, voting together, constitute a controlling constellation.

The understanding of voting rights is important, with regards to risk, compliance etc.

2.4 A Power Index

When calculating the voting power, T-rank calculates a "Power Index".

Table 1: Voting table

Mrs. A	Mr. B	Mr. B Jr.	Result
No	No	No	No
No	No	Yes	No
No	Yes	No	No
Yes	No	No	No
No	Yes	Yes	Yes
Yes	No	Yes	Yes
Yes	Yes	No	Yes
Yes	Yes	Yes	Yes

Example 2.3. *In Table 1, the voting power for the shareholders in Figure 5 are calculated. There is one column for each shareholder. The rows represent the different ways the shareholders can vote, and the number of rows is equal to the number of possible voting combinations. A vote is coloured red if a change of that vote will change the result of the voting.*

The voting power *of a given shareholder is the number of red votes divided by the number of rows - here* $4/8 = 50\%$ *for all shareholders.*

The scores produced by the *Power Index* should be looked upon as estimates. In real life, there could be a lot of factors influencing who are the real powerful people in a company, both technical (different share classes, shareholder agreements) and human (a son always voting in accordance with his mother, a persuasive CEO). For more details about assumptions, see Chapter 3.1.2.

2.5 The value of the T-rank Power Index

The concept of *voting power* has at least four main values; 1) Investigate controlling constellations, 2) Reveal de facto controlling shareholders, 3) Understand the effects of circular ownership and 4) In general, understand who are the influential ultimate owners of a company ("Know Your Customer").

2.5.1 Investigate controlling constellations

A controlling constellation is a group of two or more shareholders voting together in an organized way, together controlling the subject company. The fact that a set of shareholders will coordinate their voting, for example due to family, marriage, or experience by history, must be revealed outside T-rank and BvD. The Power Index can be used to investigate whether a group of shareholders may possibly constitute a controlling constellation.

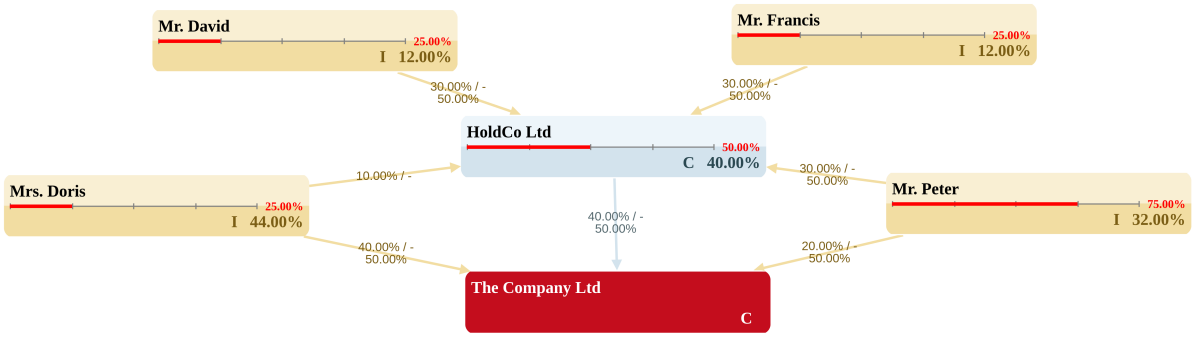

Figure 6: Shareholder map example

Figure 6 represents how T-rank will visualize voting power and total ownership in a single shareholder map. The arrows represent direct ownership. The labels on the arrows show the ownership on line one, and the direct voting power on line two (direct voting power is described in Chapter 3). Inside the vertices, there are two percentages. The big number represents the total ownership in the red company, while the length of the red bar with accompanying red percentage show the voting power this entity has on the analyzed, red company.

Doris has a total ownership of 44%, but voting power of 25%. Peter has total ownership of 32%, but voting power of 75%. If Peter and David (or Peter and Francis) always vote together, they control *HoldCo Ltd*, and if we add together the holding of HoldCo Ltd in *The Company Ltd* with Peter's direct holdings, we see that Peter and David (or Peter and Frances) together may control *The Company Ltd* – they will constitute a controlling constellation. That means that Peter and David together can have 100% voting power, while Doris and Francis under this assumption will have zero voting power.

T-rank plans to add functionality to the user interface that will let the user investigate what voting power a given constellation will have.

The fact that Peter and David always vote together must be revealed outside T-rank. T-rank merely calculates the voting power effect of a group of shareholders voting together.

Investigating controlling constellations is relevant for both risk and compliance investigations.

2.5.2 De facto control

De facto control is relevant in very distributed shareholder structures, where you have one large shareholder (under 50%) and a lot of small shareholders.

IFRS 10.B43 states:

> When the direction of relevant activities is determined by majority vote and an investor holds significantly more voting rights than any other vote holder or organized group of vote holders, and the other shareholdings are widely dispersed, it may be clear, after considering the factors listed in paragraph B42(a)-(c) alone, that the investor has power over the investee.

Figure 7: A owns 49%, the rest 3% each. 2^{18} voting combinations, A's voting power: $(2^{18} - 4)/2^{18} = 99.9985\%$, any of B-R have 0.0015%.

In Figure 7, the large shareholder has a voting power of 99.9985%. All the small shareholders must vote together to be able to beat the large shareholder. This is statistically highly unlikely, and the large shareholder should be regarded as de facto in control.

The *T-rank Power Index* can be used to reveal de facto controlling shareholders.

2.5.3 Circular ownership

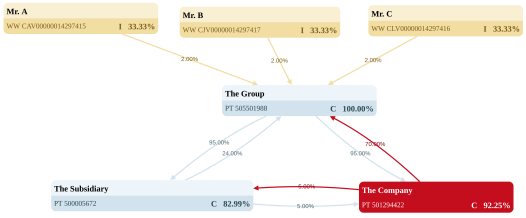

Figure 8: Anonymized real-life example of circular ownership.

In Figure 8, none of the ultimate owners seem to have any influence when you look at the ownership structure. The companies seem "self-controlling".

However, most compliance people don't believe in self-controlling ownership structures. Influence might be obtained in some other way, like shareholder agreements or share classes.

In such cases, T-rank will choose the assumption that the voting power is based on total ownership, and we will state that we "suspect" that the large total owners outside the circle, and owning into the circle, are the owners with a high level of power.

2.5.4 Who are the most influential owners?

Understanding who are the key stakeholders when it comes to voting power can be important in many situations.

Negotiations
Who are the important persons to persuade?

Risk
Are we willing to deal with a company where these people are the ones likely to be pivotal for the decisions?

Compliance
Should shareholder A be considered a *Beneficial Owner*?

Using T-rank shareholder maps, a quick glance on a map will tell you who is in a position to influence many decisions in a company.

2.6 Voting power and Beneficial Owners

Definitions of Beneficial Owners usually include both total ownership and control of voting rights. The total ownership part takes care of the cash rights, while the control of voting rights suggests some kind of voting power.

A problem with most definitions is that they use a fixed threshold for the percentage of voting rights that is considered to imply beneficial ownership. If you have 30% of the voting rights in a company, that could imply that you have anything from no voting power at all (another shareholder holds 70% of the voting rights and have full control of the company), to almost control (if the rest of the shares are dispersed among many shareholders). It could be argued that using some kind of voting power calculation, as outlined in this document, would give a more adequate definition of Beneficial ownership.

Regardless of the above, the T-rank Power Index can be used as an indication of control, which is relevant for most definitions of Beneficial Ownership.

3 T-rank Power Index - a theoretical review

3.1 Assumptions and Definitions

Power indices refers to a family of methods for measuring the influence/power a certain actor or coalition has in a voting situation. Among these, the most recognized is probably the method known as *Banzhaf Power Index*, originally invented by Lionel Penrose in 1946 and later reintroduced by John F. Banzhaf III. The method is sometimes referred to as *Penrose–Banzhaf index* and also as the *Banzhaf–Coleman index*.

Wikipedia explains the Banzhaf Power Index in this way[1]:

> To calculate the power of a voter using the Banzhaf index, list all the winning coalitions, then count the critical voters. A critical voter is a voter who, if he changed his vote from yes to no, would cause the measure to fail. A voter's power is measured as the fraction of all swing votes that he could cast.

T-rRank's definition of voting power is similar to the above:

Definition 3.1. *A shareholder S's voting power in a company C is equal to the a priori probability of S being pivotal for the outcome of a vote in C.*

By a priori, we mean that no voting history is taken into account and that all combinations of voting from all the shareholders are considered equally likely.

There are two differences between the original Banzhaf definition and T-rank's definition:

1. T-rank's definition has another normalization – turning the measure into a probability. This has the advantage of turning the calculated voting power into meaningful numbers, and also makes these numbers comparable across different situations. The disadvantage is that, while the scores for the different shareholders in the original definition sum up to 1, the sum of influences will vary from company to company for T-rank's definition.

2. The original definition only considers winning coalitions, while T-rank's definition looks both at winning and losing coalitions. Due to symmetry, this does not matter for the original definition. With T-rank's normalization, it is necessary to include the losing coalitions in order to give right scores in situations were ties are possible. If we consider a joint venture (two owners with 50% each) where more than 50% in favor is needed to get a vote through – T-rank's definition would yield voting power of 100% for each of the owners if only winning coalitions were considered – indicating full control.

The term *Voting power*, for the rest of this paper, will refer to T-rank's definition.

In Chapter 2.4, we outlined how the *voting power* could be calculated for a company with three shareholders holding 49%, 48% and 3% of the votes respectively.

Example 3.1. *4 shareholders, holding 6 (A), 4 (B), 2 (C) and 1 (D) shares respectively.*

The decision table is left as an exercise to the reader. The result will be 75% voting power to A while B, C and D will have 25% each. The result might seem counter-intuitive, but looking closer at the situation we see that: In order to beat A, all the others have to vote together. For A, it suffices to get any of the other shareholders on his side.

3.1.1 Voting power versus "the chance of getting your will"

We have defined *voting power* as the probability of being pivotal for the outcome of a vote. If you have no voting power at all and both you and the General Assembly have a 50/50 chance of voting yes or no, the assembly is expected to end up with a decision equal to your vote in 50% of the cases. On the other hand, if you are in full control of the company, the General Assembly decision will be equal to your vote in all cases.

We have the following relation between a shareholder's voting power z, and his chance of getting his will c (the correlation between the shareholder's voting and the outcomes):

$$z = 2c - 1 \tag{1}$$

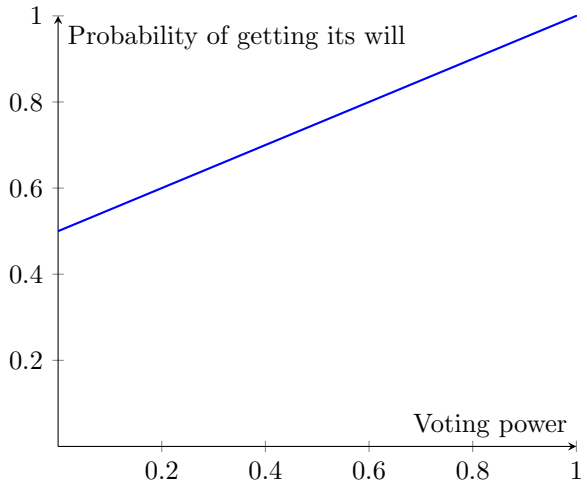

Figure 9: "Chance of getting your will" as a function of Voting power. Here we see that when you get your will 50% of the time, your voting power is zero; while if you get your will all of the time, your voting power must be (and is) 100%.

3.1.2 Assumptions

The T-rank Power Index should be looked upon as an estimate of how much voting power the various direct and indirect shareholders in a company have. All kinds of influence scoring have to rely on some kind of theoretical model, making certain assumptions about the real world.

Through BvD, T-rank has access to the world's most comprehensive data set with respect to company ownership. There are, however, certain limitations with regards to the data, which imposes certain assumptions when it comes to voting power calculation:

1. In general, we don't know if shares in a company belong to one or several share classes. Because of this lack of knowledge, we have to make some assumption. We choose the simplest assumption: "one share one vote".

2. We do not know if there exist stock options or other relevant instruments. If they exist, they are not taken into account.

3. We do not know if a company has special voting rules. The T-rank voting power algorithms can handle any quota, per company, for passing a motion. Due to lack of information, we have to assume that the simple majority rule is used in all companies.

4. Shareholder data for a company is often incomplete. In such cases, assumptions has to be made about how the remaining shares are distributed, and these assumptions will affect the voting power for the known shareholders. T-rank assumes a1) that no unknown shareholder has more shares than any known shareholder, a2) that no unknown shareholder has more than 5% of the shares and a3) that the shares for which we do not know the owner are equally split among a minimum number of shareholders given a1 and a2. If 50% or more of the shares are owned by unknown shareholders, no voting power will be calculated for the company at all.

In addition to the assumptions above, the model itself imposes certain assumptions:

1. All shareholders are always present and voting

2. Blank votes are not permitted

3. Any motion involves only two alternatives

4. All combinations of shareholder votes are equally probable. This assumptions implies, among others, that no set of shareholders (tends to) act as a coalition.

Self owned shares (directly owned) are assumed to have no voting rights and are distributed pro rata to all the other shareholders when calculating influence.

BvD have two types of ownership links in their database: direct ownership links and total ownership links. Total ownership links are hard to handle in a meaningful way when it comes to voting power. It is possible to construct examples where someone indirectly owns arbitrarily close to 100% of a company without any voting power at all. At the same time, it is possible to construct examples were someone owns arbitrarily close to nothing in a company but still has full control in the company. Based on this, T-rank does not take total ownership links into account when calculating voting power. We will, however, whenever someone has a total ownership of more than 50% in another company, mark the owning company as a likely candidate for having control in the target company.

3.2 Voting power in ownership hierarchies

In the examples so far, we have only looked at direct shareholders. We will now extend to ownership hierarchies, starting with the simplest cases where there is at most one ownership path from any entity to any other entity (polytrees).

Example 3.2. *In Figure 10, we have 4 sources (nodes without owners, often natural persons): A, B, C and E. All the other nodes (the legal persons) will be told what to do by their owners.*

The subgraph {A,B,C,D} is familiar from Chapter 2.4 – we know that A, B and C all have 50% voting power in D.

If we remove A, B and C from the graph and look at the subgraph {D,E,F}, we get a simple joint venture case that will also lead to 50% voting power for each of the owners.

Now, since C has a 50% probability of being pivotal for a decision made in D, and D's imposed point of view has a 50% probability of being pivotal for a decision in F, it follows that C's voting power in F is $50\% * 50\% = 25\%$. *Since F controls both G and H, it further follows that C's voting power in G and H is also 25%. E's voting power in all of F, G and H can similarly be found to be 50%.*

Note that the kind of reasoning used here only holds for the special case where the ownership graph is a polytree.

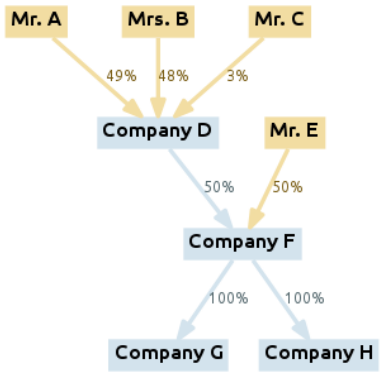

Figure 10: Polytree

Until now, we have only assigned influence from source nodes to non-source nodes. In one sense, this makes sense. At the end of the day, A, B and C can instruct the management of D how to exercise the ownership power in D and so on. However, we also want to consider F to be in control of G, and one of the things we are going to use the T-rank Power Index for, is to determine when one company is in control of another (has 100% or close to 100% voting power).

If we look back at Definition 3.1, the definition could seem applicable also for finding the voting power for i.e. D in G: D's vote may or may not be pivotal for a decision in F which then, may or may not be pivotal for a decision in G, no matter whether D makes up its own mind or if its vote is imposed by its owners. There is a problem though – what do we mean by "the probability" in this situation? If our room of opportunity is defined by all possible combinations of votes in source nodes, a node like F will have 75% probability of voting *No*, which would affect F's voting power in its subsidiaries in more complicated examples than the one above.

In order to make the definition absolutely clear and at the same time keeping Equation (1) true, we use the following definition for voting power by non-source nodes:

Definition 3.2. *A non-source entity S's voting power in another entity T is found by first removing all of S's shareholders, thus making S a source node, and then applying Definition 3.1.*

Another way to look at this is to say that the voting power a company S has in another company T is equal to the voting power you will get in T if you buy yourself control of S.

In some situations, it might be useful to understand how much power each delegate to a General Assembly represents, regardless of the ownership structure above the direct owners. For this purpose, analogous to direct ownership, we define *direct voting power*:

Definition 3.3. *Direct voting power into a company T is the voting power found by analyzing the subgraph defined by T, the direct owners of T and all direct ownership links going into T.*

3.3 Diamond structures

When we have a pair of nodes with at least 2 disjoint paths going from one of them to the other, we call the subgraph containing the pair along with all paths between them, a *diamond*.

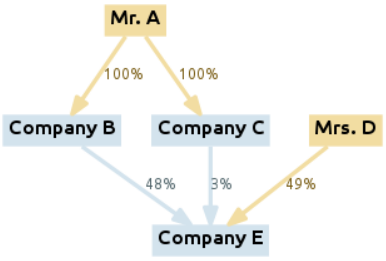

Figure 11: Simple Diamond

Example 3.3. *The subgraph {A,B,C,E} in Figure 11 is a very simple diamond.*

We can observe that A has full control in E by controlling B and C, which together control E. Thus, D has no voting power in E at all, from which we can conclude that a diamond not only affects voting power within the diamond itself, but also the voting power of entities owning into entities within a diamond.

Using Definition 3.3, we see that B, C and D each have 50% direct voting power in E.

Using Definition 3.2, we see that B and C has 50% total voting power in E each, while D has 0%. This is in line with the fact that all control flows through B and C jointly, while D has no voting power at all, as long as A determines how B and C vote.

3.4 Circular ownership

Circular ownership occurs when a company has ownership in itself, via at least one other company. A SCC (Strongly Connected Component) is a subgraph where every company has ownership, directly or indirectly, in all other companies within the subgraph.

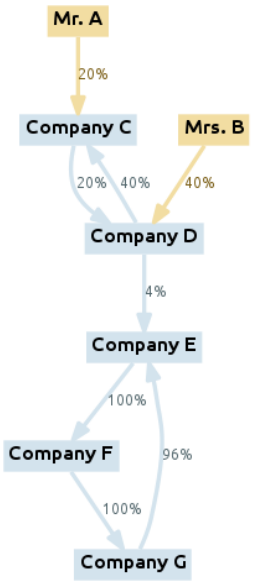

Figure 12: SCC

Example 3.4.

In Figure 12, there are two SCCs – {C,D} and {E,F,G}.

SCCs give rise to special problems when it comes to voting power. If we look at {E,F,G} above, it looks like we have a "self-controlling" group of companies. Every company seem to control itself, through another company. What happens if the different companies have different views on a topic? Depending on the sequence of voting, the group as a whole may reach (or not reach) different conclusions. Let us say that, to start with, E is in favor of something while F and G are against. If F holds a General Assembly, it will be told to be in favor. If G is next to hold the General Assembly, he also will be told to be in favor and we reach a stable state where every company in the group is in favor. On the other hand, if E was the first one to hold the General Assembly, he would be told to be against and we reach another stable state. It is also possible to find voting sequences where the group never reaches a stable state: F,E,G,F,E,G,.....

In the other SCC, {C,D}, there are no controlling shareholders. However, when C holds a General Assembly, the initial opinion of D will have a strong bearing on the result. From a technical point of view, the companies in an SCC may have influence on the other companies. This is different from ownership structures without SCCs, where every company at the end is instructed by its beneficial owners.

Whether the initial views of the companies in an SCC have impact is an open question, and the answer is probably different from case to case. It is known that circular structures have been created in order to make companies more closely tied together, and also to allow them to have some degree of autonomy with respect to the owners holding the cash rights. On the other hand, circles may also be created in order to hide control. Control by the parties outside the circle could be achieved by shareholder agreements, share classes etc.

Marc Levy and Ariane Szafarz [2] have developed an approach called *Generalized Banzhaf* for calculating voting power when SCC's are involved. They give all entities in an ownership structure a starting vote, and then investigate what happens for all possible voting sequences. The voting power is measured by taking the average of what happens for all possible combinations of starting votes and voting sequences (the infinite sequences where you don't reach a stable state have probability 0 and may therefore be ignored). This approach assigns voting power, not only to the source nodes (natural persons), but also to companies within an SCC.

T-rank has adopted the Generalized Banzhaf index when analyzing companies within SCCs. However, the voting power given to companies within the SCCs are not displayed in our user interface. For these companies, we apply Definition 3.2 here as well.

In addition, in order to help our users investigate suspicious ownership structures, we add a special kind of alert links from entities pointing into an SCC as follows: Consider the subgraph containing an SCC, and all entities with direct ownership into the SCC, along with the ownership links from these entities into the SCC. We then apply our total ownership algorithm to calculate the cash rights these external entities get for each company in the SCC, based on these direct links. Under the assumption that voting power often follows cash rights, we then apply the standard Banzhaf index on the cash rights – for each company in the SCC.

In Example 3.4, Generalized Banzhaf will give D no influence over any of the companies in {E,F,G}, since they are in total control of each other. However, sine D has all of the cash rights to all these companies according to the algorithm above, we will add a "suspicion of 100% voting power" link from D to all of the companies.

3.5 Monte Carlo simulations

In most situations, voting power is calculated by use of exact algorithms according to the definitions given in this document. For some very complicated parts of the ownership graph, we have to use Monte Carlo simulations in order to reach a result. The simulations give a good estimate of the exact score, and the error will rarely exceed a tenth of a percent.

3.6 Can voting power be added together?

Unfortunately, the voting power of individual shareholders may not be added together to check how much voting power a set of shareholders will have if they act as a coalition. However, as a rule of thumb, if two shareholders that are independent of each other (meaning none of them have a (in)direct ownership in the other), have at least 100% voting power if you add them together, they often would be in control of the company if they cooperate. If two (or more) independent shareholders have less than 100% together, they will usually not be able to form a controlling coalition.

References

[1] Wikipedia, "Banzhaf power index. — Wikipedia, the free encyclopedia," 2017. [Online; accessed 25-September-2017; available at `https://en.wikipedia.org/w/index.php?title=Banzhaf_power_index&oldid=774190208`].

[2] M. Levy and A. Szafarz, "Cross-ownership: A device for management entrenchment?," *Review of Finance*, vol. 21, pp. 1675–1699, July 2017.