GROW - Accumulated ownership calculation

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1 Introduction

In some contexts it is necessary to find out how much a set/class/group of entities owns in a company. Examples of such contexts can be:

- Sanctions (1): Sometimes, a company owned more than $X\%$ by sanctioned companies is sanctioned by extension.

- Sanctions (2): Sometimes, a company owned more than $X\%$ by natural persons in specific countries is sanctioned.

- State owned companies: Sometimes, companies owned more than $X\%$ by public institutions need to be identified.

- Corporate groups: A company owned more than $X\%$ by companies in a corporate group G could be considered associated to G, e.g. when considering total loan exposure against the group.

Calculating the accumulated ownership a group of entities has in a company is not as straight forward as one might think. T-rank has developed two algorithms that are able to calculate such aggregated integrated ownership in an efficient way.
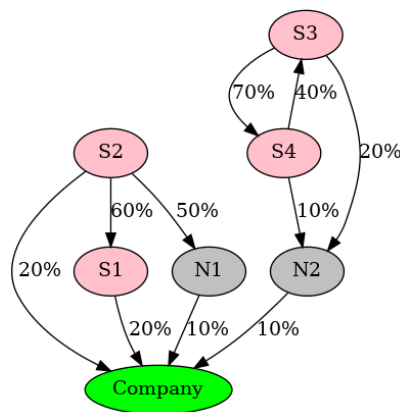
2 The problem

Figure 1: Ownership structure

Assume that we want to compute the accumulated integrated ownership the pink entities have in *Company*. The pink entities have the following integrated ownership percentages in *Company*:

s1: 20%
s2: $20\% + 60\% * 20\% + 50\% * 10\% = 37\%$
s3: $(20\% + 70\% * 10\%) * 10\% = 2.7\%$
s4: $(10\% + 40\% * 20\%) * 10\% = 1.8\%$

If we sum all these percentages together we get 61.5%. This is obviously not the correct answer because we are double-counting some ownership shares. For instance, the 60% of the 20% *S2* owns in *Company* through *S1* is counted both in *S1* and in *S2*. Using common sense, the accumulated ownership will be the 20% *S1* owns + the part *S2* owns directly (20%) + the part *S2* owns through *N1* ($50\% * 10\% = 5\%$) + the part the {*S3,S4*} SCC owns via *N2* (($20\% + 10\%) * 10\% = 3\%$) – for a total of 48%.

3   The solution

T-rank has two algorithms for calculating the accumulated integrated ownership a set of entities has in companies – one used for calculating the value for one specific company on-the-fly and one that calculates all integrated ownership values a group, or potentially several groups, has across a total data set.

3.1   Global GROW

Global GROW makes use of T-rank's standard algorithm for calculating all integrated ownership pairs for a data set – using a modified input. The algorithm can calculate accumulated ownership for an unlimited number of entity groups in one pass given that one of the following assumptions are true:

1. all groups are disjoint and there are no ownership paths crossing groups, or

2. there are no ownership paths within groups

3.2   Local GROW

Local GROW calculates the accumulated integrated ownership a group of entities has in one particular company.

Global GROW could also be used in a local setting. The downside of this approach is that the complete ownership structure from the requested company up to all entities in the group has to be loaded, something that often will involve 10s of thousands of entities and even more ownership links.

Local GROW only requires integrated ownership values between all entities in the group and the requested company along with all integrated ownership values internally between the entities in the group. It will then calculate the correct accumulated integrated ownership by resolving dependencies in the group.

Since T-rank has all integrated ownership values readily available (globally), this is a very efficient way of calculating the accumulated integrated ownership in a single company.