

# Integrated Ownership Calculation

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## 1 Introduction

Ownership structures are often complex graphs with lots of cross- and circular ownership. Complex ownership structures makes it hard to identify how much an entity owns of another entity. T-rank has developed algorithms capable of calculating such ownership across a global ownership graph in an efficient and effective manner.

We will use the term *integrated ownership* for the total ownership an entity  $A$  has in another entity  $B$  (the sum of direct and indirect ownership  $A$  has in  $B$ ). Other authors may use terms like *total ownership*, *effective ownership*, *aggregated ownership* or simply *indirect ownership* for the same. *Integrated ownership* will also be the same as *cash rights*, given that all shares in a company has the same rights with regards to dividends.

One of the datasets T-rank calculates integrated ownership for, is the global ownership data in Orbis - Moody's global data resource on private companies. This white paper will discuss integrated ownership in general and some specifics of how Orbis data is handled.

## 2 Orbis' Ownership Links

In some cases, the exact ownership of an entity in another entity might not be known, but an indicator may state something like "Majority Owner". In order to be able to calculate integrated ownership where such links are involved, ownership according to Table 1 is assumed.

## 3 Structures containing direct links only

### 3.1 Structures without circles

The simplest possible shareholder structure is one single entity having a direct ownership in another entity by  $X\%$ . In this case, the integrated ownership will be the same as the direct ownership.

**Example 3.1.** *If an entity (A) owns a part of another company (C) through an intermediate company (B) (Figure 1), the integrated ownership is found by multiplying the percentages along the path. A owns 40% of B, which in turn owns 80% of C. Then A's indirect ownership in C is 40% times 80%:  $40\% \times 80\% = 32\%$ .*

**Example 3.2.** *In Figure 2, A has several ownership paths in the company D. The integrated ownership is found by summing the paths:  $50\% \times 5\% + 100\% \times 30\% + 65\% = 97.5\%$ .*

### 3.2 Structures with circular ownership

Circular ownership results in a company owning (directly or indirectly) a share of itself. The shares owned by the company itself are not available for any other shareholders to hold. However, since the other shareholders are the only owning stakeholders in the company, they also indirectly owns the shares owned by the company itself. When it comes to integrated ownership, these shares are divided pro rata amongst the other shareholders.

Table 1: Translation table

Value	Assumed numeric value
$>X$	$X + 0.01\%$
$<X$	$X - 0.01\%$
$+/- X$	$X\%$
Wholly Owned (WO)	98%
Majority Owner (MO)	50.01%
Jointly Owned (JO)	50.00%
CQP1	50.01%
Administrative authority (AA)	50.01%
Branch (BR)	100%
Foreign Company (FC)	100%
Sole trader (T)	100%
Vessel (VE)	100%
General Partner (GP)	0%
Negligible (NG)	0%
Not available (n.a.)	0%

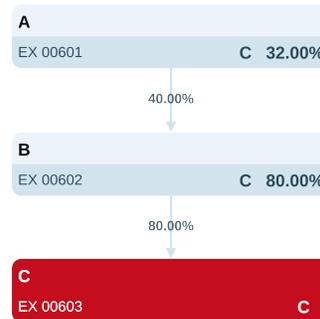


Figure 1: Simple ownership chain. The percentages on the arrows represent direct shareholdings, the percentages within the nodes are the calculated integrated ownership this node has in the subject (the red node).

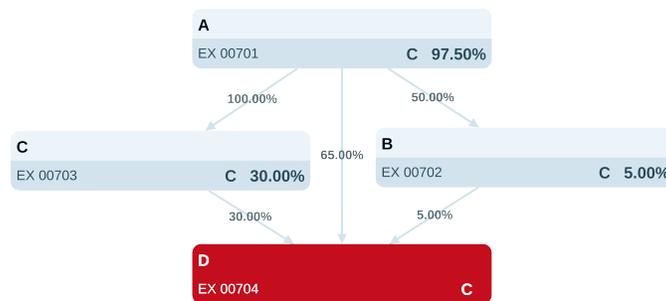


Figure 2: Multiple paths

**Example 3.3.** In Figure 3, B owns 80% of C, the last 20% is owned by C itself. Since B is the only direct owner in C, besides C itself, B also indirectly owns these shares – B’s integrated ownership in C is 100%.

A’s integrated ownership in C becomes  $40\% \times 100\% = 40\%$ .

**Example 3.4.** In Figure 4, E’s indirect ownership in itself is found by tracing the circular ownership loop  $E \rightarrow C \rightarrow D \rightarrow E$ :  $10\% \times 80\% \times 50\% = 4\%$ . E’s indirect ownership in itself must be taken into account when calculating A’s integrated ownership in E:  $50\% \times 80\% \times 80\% \times 50\% / (100\% - 4\%) = 16\% / 96\% = 16.67\%$ .

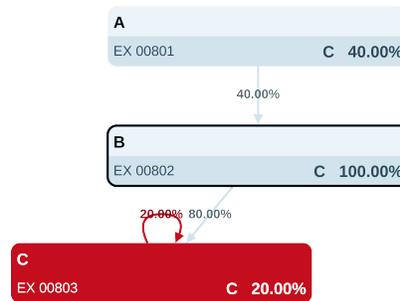


Figure 3: Self owned shares

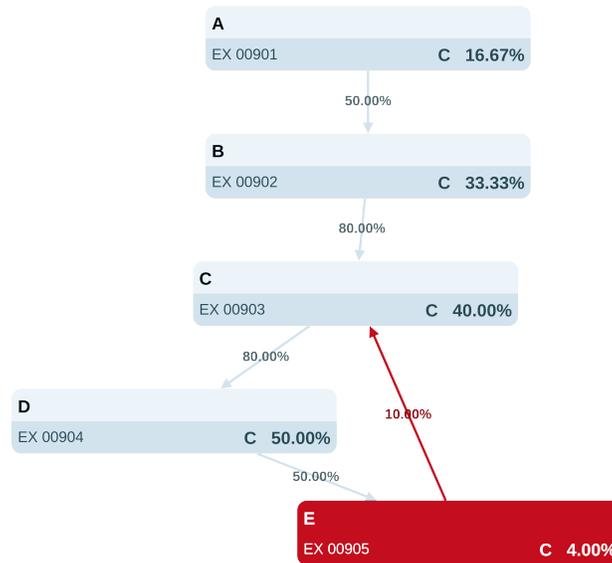


Figure 4: Self ownership through ownership circle

Another way to look at this is to say that A owns  $50\% \times 80\% \times 80\% \times 50\% = 16\%$  in E through B, C and D. A further owns 16% of the shares owned by E itself through this link - 16% of 4% = 0.64% for a total of 16.64%. But the last 0.64% also implies a bigger stake of the shares owned by E in itself:  $0.64\% \times 4\% = 0.0256\%$  - and so on. This yields an infinite geometric series, with the sum being the same as the formula we started out with.

**Example 3.5.** In Figure 5, there are two ownership paths from C to itself. C's self ownership is  $100\% \times (10\% + 100\% * 10\%) = 20\%$ . A's indirect ownership in C now becomes  $50\% \times 80\% / (1 - 20\%) = 50\%$ . Here we see that the answer using the geometric series makes sense - because it says that B owns in fact 100% of C, that is,  $80\% / (100\% - 20\%)$  of C. Further, we see that C indirectly owns 100% of E, and thus A's integrated ownership in E becomes 50%.

Real life examples are often much more complicated, with several circles merged together and with many more companies involved - making the integrated ownership almost impossible to calculate manually.

## 4 Structures involving total ownership links

Some of Moody's information providers provide total ownership links between entities (*total ownership* being a synonym for integrated ownership). When we talk about *total ownership*, we refer to data coming from information providers, while we reserve *integrated ownership* to mean ownership calculated by T-rank). For total ownership links we do not know what the underlying ownership structure looks like. It could be a direct

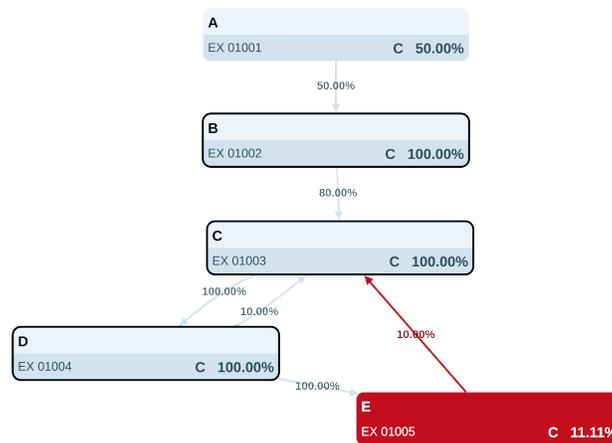


Figure 5: Self ownership through several paths

ownership, an indirect ownership through one or more intermediate companies, or even ownership through several ownership paths. These total ownership links are displayed as dashed arrows with the percentage attached.

When some or all of the links in a shareholder structure are provided as total ownership links, this brings ambiguity into the calculations, since the information provided in general is incomplete.

T-rank will in cases of ambiguity take a conservative approach – given that the presented ownership links are correct, we will present the minimum possible ownership of one entity in another entity.

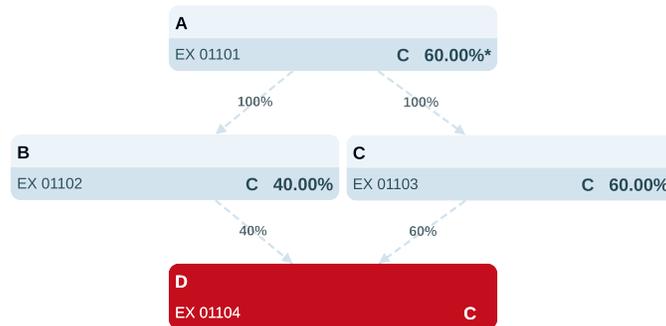


Figure 6: Total ownership links

**Example 4.1.** In Figure 6, all displayed links are total ownership links. We know that some information is lacking, since A must have some definite total ownership in D. If the links in the example were direct links, we would add the paths together and conclude that A has an integrated ownership of 100% in D.

However, the underlying structure of direct links shown in Figure 7 is an example of a structure making all total ownership links in the previous figure correct. Here, A’s integrated ownership in D is only 60%.

The *strongest path* (the single path yielding most ownership) from A to D is 60%, which is minimum correct value for the indirect ownership of A in D. Thus, this is the integrated ownership that will be presented in the T-rank solution.

All integrated ownership figures which suffer from the weakness of involving total ownership links – and therefore some ambiguity – are marked with a \* in the maps.

In the special case where a total ownership link (or a combined direct- and total ownership link) is the only ownership link leading to an entity (the owned entity), we can safely regard the link as a direct link during our calculations since no ambiguity may occur in these cases.

For mixed structures, involving both direct and indirect ownership links, T-rank first calculates integrated ownerships based on the direct links only, then applies the strongest path approach to the graph built



Figure 7: One of the possible underlying ownership structures

by combining integrated ownership links calculated in previous step and total ownership links from the information providers.