



Indirect control and power in mutual control structures [☆]



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ABSTRACT

In a mutual control structure (mcs) agents exercise control over each other. Typical examples occur in the area of corporate governance: firms and investment companies exercise mutual control, in particular by owning each others' stocks. We represent such situations in two equivalent ways: by a function assigning to each coalition the set of controlled players, and by a simple game structure in which for each player a simple game describes who controls that player. These concepts are similar to authority distributions and command games in Hu and Shapley (2003a, 2003b). An mcs is invariant if it incorporates all indirect control relations. We axiomatically develop a class of power indices for invariant mcs. We impose four axioms with a plausible interpretation in this framework, which together characterize a broad class of power indices based on dividends resulting both from exercising and from undergoing control. Extra conditions can further refine this broad class.

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1. Introduction

A mutual control structure describes a situation in which agents exercise control over each other. Typically, such situations occur in the area of corporate governance, when a conglomerate of firms and investment companies control each other, specifically by possessing shares or stocks. The purpose of this paper is to study a general abstract model for this kind of situations and to develop power indices, meant to represent the real power of the involved players. We first describe an example which will be revisited throughout the paper.

1.1. The Porsche–Volkswagen case

From 2008 onwards, the Porsche group started buying common stocks of Volkswagen AG on a grand scale. On January 5, 2009, Porsche announced to own more than 50% of the common stocks. However, the original plan to take over Volkswagen failed and the founding of an integrated corporation was announced. Fig. 1 is a simplified organization chart of this corporation. *Porsche Families* is an aggregation of several companies and holdings which are held by members of the families Porsche and Piëch; it holds 90% of *Porsche SE*. *Qatar* is an aggregation of several holdings which are held by the Qatar Investment Authority, Doha. *Lower Saxony* includes Hannoversche Beteiligungsgesellschaft mbH which is held by Lower Saxony. *Volkswagen AG* holds 100% of Porsche Holding Stuttgart GmbH which in turn holds 100% of *Porsche AG* – therefore

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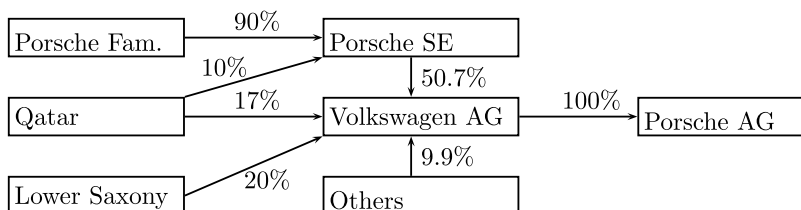


Fig. 1. Porsche and VW voting rights by the end of 2012, based on the annual reports 2012 of Volkswagen AG and Porsche Automobil Holding SE GmbH.

Porsche Holding Stuttgart GmbH has been left out. *Others* means investors which hold less than 3% of the shares and are therefore not mentioned in any reports.

Although Porsche SE has the majority of voting rights of Volkswagen AG, Lower Saxony has a veto power according to two laws.¹ These laws specify in particular that important decisions can be made only with 80% of the voting rights (of which Lower Saxony owns slightly more than 20%). Fig. 1 describes the situation as it was before mid June, 2013. Meanwhile, Qatar has sold its shares in Porsche SE back to Porsche Families. For the sake of the example, however, we stick to the situation before mid June, 2013.

1.2. Mutual control structures

Interesting as the historical development of the Porsche–Volkswagen case may be, even until very recently, in this paper we will be mainly interested in the resulting organization chart as represented in Fig. 1. This will serve as a recurring example (Example 2.3 in the next section, and its continuation further on). Here, and in similar situations, the question arises: Who is, ultimately, in control, and how much power do the involved parties have? The purpose of the present paper is to answer these questions and contribute to the literature by developing a general game-theoretic model.

Formally, a mutual control structure C will be a map assigning to each nonempty coalition – i.e., a subset of a given finite set of players N – another coalition. The interpretation of $C(T) = S$ is, that each player of S is controlled by the coalition T . For instance, $i \in S$ is a firm, and the coalition T of firms or investment companies has a majority of the shares of firm i . We impose the natural condition of monotonicity: if T controls S , then any coalition containing T also controls S . While the mutual control structure C thus captures direct control, it does not necessarily capture indirect control. The latter means that whenever T controls S , and S and T jointly control R , then T indirectly controls R . Thus, if j is a firm in R and S and T jointly have a majority of the shares of j , then T controls j if it is the case that T controls all firms in S . A mutual control structure will be called invariant if it satisfies this condition. In the paper we describe a procedure, similar to the one in Hu and Shapley (2003a), which assigns to each mutual control structure its unique minimal invariant extension.

Alternatively, a mutual control structure can be described by a vector of simple games, to be called a simple game structure in the paper. For each player, there is a (monotonic) simple game whose winning coalitions are exactly those that control that player. There is a one-to-one correspondence between mutual control structures and simple game structures.

1.3. Related literature

Our approach is closely related to the work of Hu and Shapley (2003a, 2003b), in particular our Section 2. If player i is controlled by coalition S , i.e., $i \in C(S)$, then S is called a ‘boss set’ for player i in Hu and Shapley (2003b), but next to boss sets they also consider ‘approval sets’. Our procedure to update mutual control structures in order to incorporate indirect control is quite similar to the one in Hu and Shapley (2003a), but, as mentioned, their assumptions on such a structure are different. In this respect, our approach is simpler and focuses on control (‘boss sets’ in their terminology). Hu and Shapley (2003a, 2003b) also study command games, which are equivalent to our simple game structures. They propose a power index (Hu and Shapley, 2003b), which, however, is quite different from the power indices that we arrive at, see below.

Similar to the articles of Hu and Shapley (2003a, 2003b) is the work of Grabisch and Rusinowska (2011). The authors introduce influence and follower functions and relate them to normal command games of Hu and Shapley (2003a, 2003b), i.e., command games in which a player cannot be controlled by two disjoint coalitions.

A relatively early approach to the problem of indirect control in the literature is Gambarelli and Owen (1994). This approach explicitly distinguishes between firms and investors. In what is called a ‘reduction’, all power is reduced to power of the investors, i.e., the firms leave the scene. The proposed reduction operation bears some resemblance to our procedure of making a mutual control structure invariant. Gambarelli and Owen (1994) end up with so-called consistent reductions which, however, are not necessarily unique, in contrast to our minimal invariant extensions. Denti and Prati (2004) focus on the determination of winning coalitions among direct and indirect stockholders of corporations. Also Driessen and Sun (2006) distinguish between firms and investors. They consider such a situation as an application of a so-called ‘set game’.

¹ Namely, §111 AktG (Aktengesetz) and §4 VWGmbHÜG (Gesetz über die Überführung der Anteilsrechte der Volkswagen Gesellschaft mit beschränkter Haftung in private Hand).

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