Fisher Body revisited: Supply contracts and vertical integration

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Abstract The vertical integration of Fisher Body by General Motors has been a leading example in both the transaction-cost theory and the property-rights theory of the firm. The present paper makes the following contributions. First, we show how a simple extension of the property-rights theory of the firm (which allows for contractible trade) is able to rationalize the observed ownership arrangements, supply contracts, and investment behavior both before and after integration. Second, the model lends support to Klein's (2000) view that an increase in demand for closed automobile bodies was pivotal for vertical integration.

Keywords Vertical integration · Supply contracts · Hold-up · Property rights · Boundaries of the firm

JEL Classification L22 · L24 · L14 · K12

In his classic article on "The Nature of the Firm" Coase (1937) asked the fundamental question of what determines the boundaries of the firm. Why is it that, even though markets are in general thought to allocate resources efficiently, a large fraction of economic activity takes place insight firms? In particular, which forces determine whether a certain transaction is conducted via the market or insight the firm (e.g., through an employment relationship)? By now, Coase' thought-provoking questions have inspired a vast literature on the boundaries of the firm. Both the earlier transaction-cost theory (see e.g., Klein et al., 1978; Williamson, 1975, 1985) and the later property-rights theory of the firm (see e.g., Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995) have provided valuable insights in integration decisions of firms and have been applied widely.

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Given the relative scarcity of data, case studies have played an important role in studying questions of vertical integration.[1] In particular, the Fisher Body-General Motors case has achieved significant prominence in the literature. This case, first discussed by Klein et al. (1978), concerns the relationship between Fisher Body (hereafter, FB), a supplier of automobile bodies, and General Motors (hereafter, GM), a carmaker.[2] While from 1919 till 1926 the two firms had operated under an exclusive supply contract that obliged GM to buy all of its automobile bodies from FB, in 1926 the parties decided on full vertical integration of FB by GM. Both in the transaction-cost theory and the property-rights theory of the firm the Fisher Body case has been the leading example to highlight issues such as asset specificity, relationship-specific investments, exclusive contracts, and vertical integration. For example, the Fisher Body case has been discussed in the influential books by Williamson (1985) and Hart (1995), and in a variety of other economics and business textbooks, such as Tirole (1988), Milgrom and Roberts (1992), Carlton and Perloff (1994), Ricketts (1994), Salanie (1997), and Besanko et al. (1996). The continued prominence of the case is witnessed by a number of articles, such as Crocker and Masten (1996), Bolton and Scharfstein (1998), Holmstrom and Roberts (1998), Rajan and Zingales (1998), and Segal and Whinston (2000). More recently, there has been a renewed intense debate regarding the facts and interpretation of the Fisher Body case (see e.g., Casadesus-Masanell and Spulber, 2000; Coase, 2000; Freeland, 2000; Klein, 2000), to which we will return in more detail below.

Given the prominence of the Fisher Body case, it is the more surprising that there does not seem to exist a formal analysis that is explicitly tailored to this case. In particular, there does not seem to be a comprehensive explanation of why initially the parties deemed separate ownership in conjunction with an exclusive supply contract optimal, while later on the parties decided to integrate vertically, which was accompanied by the lack of any contractual supply provisions.[3] So far, the literature has mostly focussed on the choice of organizational form. For example, Klein et al. (1978) postulate that hold-up problems are mitigated within firms.[4] They argue that after a considerable change in demand conditions FB held up GM by refusing to make necessary investments in production capacity such that in the end vertical integration became necessary. Similarly, Hart (1995) argues that GM vertically integrated to insure a better bargaining position in the future. The literature is, however, relatively silent about what exactly rendered the initial supply contract regime inferior. "Why did GM and Fisher Body not [just] write a better contract" after demand conditions had changed, as Casadesus-Masanell and Spulber (2000, p. 75) reasonably ask? Clearly, one could take the position that (given the practical impossibility of complete-contingent contracts) any contractual arrangement was even more prone to hold-up problems and, through integration, the

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[1] For an overview over evidence on the transaction-cost and property-rights theories of the firm, see e.g., Whinston (2001).

[2] In a number of subsequent articles Klein has elaborated on his initial discussion of the Fisher Body case (see e.g., Klein, 1988, 1996, 1998, 2000).

[3] Note that such "inside contracting" is not uncommon in other instances (see e.g., Holmstrom and Roberts, 1998).

[4] Parties who make relationship-specific investments are likely to be subject to hold-up by their trading partner if contracts can only be incomplete; resulting in suboptimal investment incentives.

parties finally abandoned this inferior regime. However, such an explanation remains unsatisfactory: both GM and FB were established, sophisticated businesses, and it seems unlikely that a suboptimal governance structure could have prevailed for such a long time (or have been installed in the first place).

While a more thorough understanding of the Fisher Body case seems to be desirable in its own right, it is also interesting from a more general perspective. Arguably, a better understanding of how supply contracts and the choice of organizational form interact seems to be necessary to answer Coase' (1937) initial question why some transaction are conducted in markets, while others are conducted inside firms (see Holmstrom and Roberts, 1998, for an argument along these lines). A better understanding of this issue would also help to shed light on a controversy between Coase and Klein (see e.g., Coase, 1988, 2000; Klein, 1988, 2000), who have debated under which circumstances large specific investments and asset specificity indeed necessitate vertical integration: in contrast to Klein, Coase asserts that asset specificity problems can in general be handled contractually without the need for vertical integration.

The present paper makes the following contributions. First, we show that a simple extension of a property-rights model that allows for trade between the parties to be contractible is able to rationalize the observed ownership arrangements, supply contracts, investment behavior, as well as the regime switch in 1926. In particular, we discuss in detail how optimal initial arrangements were influenced by the parties' benefits from residual control and the benefits from investments. In our model the magnitude of these benefits initially implied the optimality of separate firms, while later on vertical integration became necessary. Second, the model provides support to Klein's (2000) view that the initial contractual solution was optimal, but that FB's refusal to invest in a new plant (subsequent to a substantial increase in demand for closed automobile bodies) made full vertical integration of FB by GM desirable. While Klein (2000) argues informally that the change in demand conditions pushed the initial supply contract regime outside its "self-enforcing range", he remained unsure what exactly it was "about the large, unexpected demand increase by GM that caused Fisher to take advantage of the imperfect body supply regime."[5] Our simple static model suggests that the change in demand conditions worsened FB's investment incentives and made a switch to a regime that maximized GM's investment incentives desirable.

In our formal analysis, we extend a standard property-rights model (see e.g., Hart, 1995). We assume that in addition to the ownership structure over an asset (e.g., FB's physical capital), the parties can sign supply contracts specifying trade quantities and transfer payments. The ownership structure determines who has residual rights of control over the asset. In line with the property-rights literature, we assume that, through renegotiations, the parties will always agree on an ex-post efficient outcome. Hence, the initial ownership arrangement and supply contract only serve as threatpoint in these renegotiations. That is, they determine the parties' bargaining positions. In order to capture the observation that some of the investments have been made by FB, while others have been made by GM, we assume that the parties make transferable investments in physical capital (e.g., a new plant), where only the total amount invested matters. This will imply that in equilibrium only one of the parties invests, where

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[5] Klein (2000, p. 129).

the identity of the investing party will, however, depend on the underlying market conditions. When trading with each other, both parties profit from a better asset. As the investor does not take this positive externality fully into account, investments under any contract will fall short of their efficient level. As a consequence, an optimal initial arrangement maximizes the investment incentives of one of the parties. We argue that, as initially residual rights of control were of moderate importance for GM and investments had mainly cost-reducing effects, in the early period of their relationship it was optimal for the parties to maximize FB's incentive to invest. This was achieved through separate firms and an exclusive supply contract because such an arrangement provided FB with a strong position in later bargaining. However, after the substantial increase in demand for closed automobile bodies GM would have benefited substantially more from FB's investments than before the increase. As a consequence, GM would have been able to appropriate a substantially higher share of the investment return through renegotiations; thereby deteriorating FB's incentive to invest. Due to these changes in the underlying market conditions, the model suggests that now it was desirable to provide GM with maximal investment incentives. That is, through vertical integration and the absence of any obligation to purchase from FB the parties maximized GM's bargaining position (in exchange for a side payment to FB).

Some caveats are in order. First, any formal analysis necessarily abstracts from some of the relevant issues. As Klein (2000), we emphasize residual control rights and investments in physical capital. However, other authors, such as Casadesus-Masanell and Spulber (2000), Coase (2000), and Freeland (2000), have put more emphasis on other issues such as the need to secure access to the Fisher brothers' specific human capital or coordination problems as driving forces behind the decision to integrate. While we do not deny that such considerations will also have played a role, we follow Klein (2000) in arguing that FB's refusal to invest in a new plant seems to have been pivotal (for a more detailed discussion, see Section 1 below). Second, the property-rights theory makes the simplifying assumption of taking the firm as a single, unified, rational decision maker.[6] Thereby, it obviously abstracts from what might be important issues, such as agency problems within firms, decision making by teams, bounded rationality, and behavioral issues.[7] However, we think it is interesting that our simple extension of a property-rights model is nevertheless able to replicate important stylized facts of the Fisher Body case.

The remainder of the paper is structured as follows. In Section 1 we present a brief account of the Fisher Body case and subsequently discuss how it has been interpreted in the literature. Section 2.1 introduces the model, and in Section 2.2 we show that this model is able to shed light on the Fisher Body case. Section 3 concludes.

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[6] More detailed discussions of various criticisms that have been raised against the property-rights theory of the firm are, for example, to be found in Bolton and Scharfstein (1998) and Holmstrom and Roberts (1998). For a recent survey on behavioral organizational economics, see e.g., Camerer and Malmendier (2005). Based on Cohen et al. (1972), Gibbons (2003) discusses how organizational economics might profit from incorporating sociologists' insights on organizational behavior.

[7] For example, it is generally acknowledged that FB's behavior had to a certain degree also been influenced by the Fisher brothers' desire to be treated as a unit, their attachment to the family business, and their valuation of independence.

1 The Fisher Body-General Motors relationship

Considerable effort has been expended to unearth the facts underlying the Fisher Body case. Subsequent to the initial discussion in Klein et al. (1978), an intense debate regarding the facts and interpretation of the case has ensued, and exactly because this debate has been controversial, a rather detailed account of the relationship between Fisher Body and General Motors is available (see e.g., Klein et al., 1978; Coase, 1988, 2000; Klein, 1988, 2000; Casadesus-Masanell and Spulber, 2000; Freeland, 2000). Most of the evidence on the relationship between Fisher Body and General Motors stems from an antitrust case brought by the United States Department of Justice in 1949 against the 1917–19 acquisition by DuPont of 23% of the GM voting common stock.[8]

In the following, in Section 1.1 we first present an overview over the Fisher Body case, where we restrict attention to the main events.[9] Subsequently, in Section 1.2 we briefly discuss how the Fisher Body case has been interpreted in the literature.

1.1 The Fisher Body case: An overview

Prior to 1919, automobiles mostly exhibited individually constructed, open, largely wooden bodies. However, by 1919 production processes had begun to shift towards technologically more demanding composite (wood framed and metal skinned) closed bodies.[10] Having been founded by the Fisher brothers in 1908, and having produced closed bodies as early as 1910, by 1919 the Fisher Body Corporation was a very successful business.[11] It was the largest producer of automobile bodies in the industry building automobile bodies for all leading automobile manufactures. In the subsequent description of the relationship between Fisher Body and General Motors it turns out to be useful to distinguish an early period from 1919 through 1924 and a late period from 1925 through 1926.

Early period (1919–1924). The contract Fisher Body and General Motors signed in 1919 contained three main provisions[12]:

1. The first part was an exclusive supply provision. For a horizon of ten years it obliged GM to buy all its closed automobile bodies from FB. However, FB was free to additionally trade with other carmakers.
2. GM acquired a 60% interest in FB. The parties signed an agreement that put the shares acquired by GM in a voting trust. Unanimity was required for the trust to

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[8] References to the original sources can be found in the articles cited above.

[9] This overview is mainly based on Klein (2000), who also provides detailed discussions of the criticisms raised by the other articles cited above (see also Section 1.2 below).

[10] White (1991) provides an introduction into automobile production processes in the 1920's and discusses the history of the Fisher Body Corporation.

[11] As Coase (2000, p. 19) put it, "the tale of Fisher body is the tale of the Fisher brothers," who were running the company. Fisher Body was founded by Fred and Charles Fisher (along with an uncle), and four other brothers joined the company and assumed operating positions. Two outsiders, Louis and Aaron Mendelssohns, provided early financial backing (see Casadesus-Masanell and Spulber, 2000).
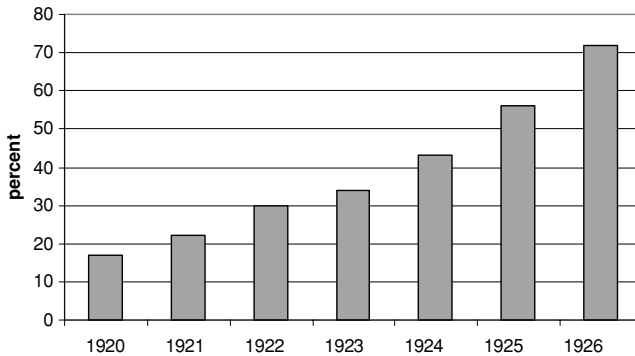
[12] See e.g., Coase (2000).

Fig. 1 Industry share of sales that were closed body

vote its shares on any action, and one of the Fisher brothers, Fred Fisher, was one of the four trustees.

3. The six Fisher brothers signed employment contracts with Fisher Body.[13]

As both Coase (2000) and Klein (2000) confirm, the unanimity provision in the voting trust agreement implied that, despite GM's 60% interest, FB was run as an independent firm.[14] Moreover, the employment contracts implied that the Fisher brothers were also in operational control of FB. In order to produce GM's closed bodies FB had to make large relationship-specific investments in plants and equipment,[15] and during this early period the initial contractual solution seems to have worked well. Until 1924 Fisher Body built or purchased 14 assembly plants, and 12 of those plants were located near GM production facilities. Notably, during these early years the market environment proved relatively stable and, presumably, did not evolve in a way dramatically different from what the parties had anticipated in 1919. In particular, GM's sales over the entire 1919–1924 period grew by only about 50%, and the share of industry sales that were closed body amounted to 17% in 1920 and 34% in 1923 (see Fig. 1 above).[16]

Late period (1925–1926). In contrast to the stable market conditions of the early period, the late period from 1925 till 1926 witnessed considerable change. GM's sales grew very rapidly, and Fig. 1 illustrates that there was an accelerating shift from open

[13] Shortly before expiration on October 1, 1924 these employment contracts were extended till 1929 (see e.g., Klein, 2000).

[14] Obviously, this raises the question why GM indeed acquired the 60% interest. First, from a property-rights theory perspective, this transfer could be interpreted as an ex-ante "side-payment" from GM to FB, where, through ex-ante bargaining, the parties allocated some of the (expected) surplus of their relationship to FB (see also Footnote 27 below). Second, Freeland (2000) has argued that this acquisition (as well as the later full integration) might also have served defensive purposes, i.e., it might have been intended to preclude FB from any future integration with some other carmaker, such as Ford.

[15] The composite closed bodies of the time (wood framed and metal skinned) required substantially higher specific investments than the earlier largely wooden open bodies, and "large sums of capital were needed to make unique dies for each metal panel required, and huge facilities were needed to store bodies while paint and varnish dried" (White, 1991, p. 50f.).

[16] These data are taken from Sloan (1964, p. 152 and 214).

to closed automobiles. The number of vehicles produced by General Motors rose by 42% in 1925 and 48% in 1926, and the industry share of sales that were closed body jumped to 43% in 1924, 56% in 1925, and 72% in 1926.[17] As a consequence, in this late period FB's closed body sales to GM grew by about 200%.

At the same time (and in contrast to the early period), FB refused to build or acquire new plants near GM's facilities. In particular, FB refused to invest in an important new plant close to the GM Buick facilities in Flint, Michigan.[18] As GM's chief executive officer of the time, Alfred P. Sloan, put it: "the Fisher brothers, who were really operating the Fisher Body Company in those times, rather questioned the desirability of their putting up large amounts of capital to establish these assembly plants in conjunction with the GM assembly plants".[19] The failure to make these investments resulted in GM experiencing body shortages that ultimately forced it to reduce scheduled production. As a consequence of these problems, Sloan concluded that full vertical integration of Fisher Body in 1926 was "not a question of anything but a must." And indeed, following first boardroom discussions in February 1925, the vertical integration of Fisher Body by General Motors was finalized on June 30, 1926. On the very next day General Motors announced that it would create the Flint body-building facility itself.

1.2 The Fisher Body case in the literature

As discussed above, there has recently been an intense debate regarding the facts and interpretation of the Fisher Body case, and the original description of the case by Klein et al. (1978) has been challenged (see e.g., Coase, 2000; Casadesus-Masanell and Spulber, 2000; Freeland, 2000).[20] In reply, Klein (2000) sets out to refute these criticisms and maintains that vertical integration was meant to solve a hold-up problem that the parties faced. In the following, we briefly summarize both Klein's (2000) view and the alternative interpretations on offer. For more detailed accounts of this controversy, the interested reader is referred to the above cited articles.

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[17] Again, see Sloan (1964).

[18] On the one hand, GM preferred plants close to its production facilities because they implied lower transportation costs. On the other hand, by adding operations in Detroit (rather than investing in Flint) FB would have been able to better serve other customers, such as Chrysler. However, it is important to note that FB's refusal to invest close to GM facilities only arose after 1924, and Klein (2000) asserts that a Flint plant would clearly have maximized the joint profit of GM and FB. Hence, for simplicity, in the formal model we will treat the parties' investments as one-dimensional rather than two-dimensional (location and magnitude).

[19] Both this quotation and the one below are taken from Klein (2000, p. 114). During the early period (1919–1924) FB had mainly used proceeds from its sale of shares to GM to build or purchase various assembly plants. While Coase (2000) and Freeland (2000) argue that the Flint plant episode mainly represented a disagreement over financing, Klein (2000) argues that this is unlikely for two reasons. First, at the same time FB made investments in body capacity for other customers (e.g., Chrysler). Second, if FB's refusal to invest in the Flint plant would merely have been the result of a capital shortage, GM could have overcome this problem by providing a loan to FB for the capital costs, as it had done on at least three occasions in the past (see Klein, 2000, p. 110ff.).

[20] Both Coase (2000) and Freeland (2000) mainly agree with Klein's (2000) description of events, but differ in their interpretation.

Klein (2000) agrees with Coase (2000) that asset specificity in itself is in general insufficient for vertical integration to be desirable. In particular, he argues that it is unlikely that the parties entered the initial supply contract regime by mistake. Rather it seems to be the case that initially the parties deemed an exclusive dealing contract sufficient to protect them against hold-up. Klein (2000) argues that the substantial increase in demand for closed bodies during 1925–26 gave FB leverage over GM and led FB to take advantage of GM's weak position. FB's refusal to invest in the Flint plant proved rather harmful for GM. To explain this behavior, Klein (2000) argues that, due to insufficient reputational capital, the rise in demand shifted the initial supply contract outside its "self-enforcing range", and vertical integration became necessary.

In contrast, Coase (2000) denies that hold-up played a role in the vertical integration of Fisher Body. In particular, he takes the fact that in the early period FB had invested in various new plants as evidence that investment problems were not pivotal in the decision to integrate. Rather he holds the view that GM was unsatisfied with the 1919 agreement because it had brought about a long-term relationship with FB that was unsatisfactory in the sense that the Fisher brothers paid insufficient attention to GM's needs. Hence, GM's aim was to bring the Fisher brothers (whose specific human capital was deemed important) in a closer relationship to improve coordination. And as the "trial marriage" of the initial regime proved a success for both parties, they finally agreed to fully integrate.[21]

Finally, in a similar spirit, Casadesus-Masanell and Spulber (2000) and Freeland (2000) also emphasize the need to secure access to the Fisher brothers and coordination issues as the driving forces behind vertical integration (see also Chandler and Salsbury, 1971).

2 Optimal contracts and the demand for closed autobodies

In this section, we present a simple extension of the property-rights theory of the firm, where the main stylized facts of the Fisher Body case emerge as equilibrium phenomena. Following the discussion above, these stylized facts may be summarized as follows:

1. From 1919 till 1926 FB and GM operated as two separate firms, where an exclusive supply contract was in place that obliged GM to buy all of its automobile bodies from FB. During this period, FB invested in several new plants to meet GM's needs.
2. After a substantial increase in demand for closed automobile bodies and FB's subsequent refusal to invest in an important new plant, the parties agreed on full vertical integration of FB by GM in 1926, after which GM built the plant itself. After vertical integration no explicit supply contract was in place.

Klein's (2000) analysis suggest that, while other factor (such as human capital specificity, market trends, etc.) will clearly also have played a role, the dramatic increase in demand for closed automobiles in the period 1925–26 seems to have been

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[21] Coase (2000) reports that, while visiting General Motors in 1932, he was told that the reason for vertical integration was to ensure that Fisher Body's plants were located close to General Motors' facilities. However, he deems this claim unlikely.

pivotal for the decision to integrate vertically. The simple model below supports Klein's (2000) view, but the mechanism at work does not rely on the reputational concerns emphasized by Klein (2000).

2.1 A simple property-rights model of supply contracts and vertical integration

Basic structure. Consider the following simple extension of a standard property-rights model (see e.g., Hart, 1995) that allows to simultaneously discuss the issues of the boundaries of the firm, supply contracts, and changes in the identity of the investing party. A downstream buyer B (e.g., General Motors) wants to procure a variable quantity of an input (e.g., automobile bodies) from an upstream seller S (e.g., Fisher Body), where B and S are assumed to be risk-neutral and symmetrically informed. Two organizational forms will be considered: B and S may either be separate firms or, alternatively, there may be an integrated firm in which B procures the input internally from S. Formally, we assume that there is an asset A (e.g., Fisher Body's physical assets) and two possible organizational forms O. Specifically, the asset A may either be owned by the seller (i.e., $O = S$) or by the buyer (i.e., $O = B$), where in line with the literature (see e.g., Whinston, 2001) the former case is interpreted as separate firms, while the latter case is interpreted as integration. The organizational form determines who has residual rights of control over A. That is, the organizational form determines which of the parties can decide about alternative uses of the asset not specified in an initial contract. The benefits from such residual control rights will be discussed in more detail below.

Before actually trading the parties may simultaneously make relationship-specific investments i^B and i^S in order to increase the value of the asset (e.g., by building a new plant), where i^B, $i^S \geq 0$. As discussed above, in order to be able to study changes in the identity of the investing party, we assume that B's and S's investments are transferable in the sense that the value a of the asset only depends on the total amount invested. Formally, the value of the asset is given by $a(i)$, where $i = i^B + i^S$.[22] Indeed, Hart (1995) has argued that for many investments in physical capital it will not matter which of the parties actually invests because such investments are frequently not specific to a particular party. Transferability of investments will imply that in general only one of the parties invests in equilibrium, but that depending on the circumstances it may either be B or S who invests. In line with the property-rights theory of the firm we assume that investments are observable to the parties, but that they are non-contractible.[23] As discussed above, the large increase in demand in 1925–26 was arguably unexpected, and hence it constitutes an unforeseen shift in underlying parameters rather than the realization of a foreseen state of the world. For this reason (and as it would not add any additional insights) we do not explicitly introduce uncertainty (e.g., regarding the effects of investments on the payoffs of the parties). However, the model could easily be generalized in this direction.

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[22] To simplify the analysis we assume that investment costs are equal to i^B and i^S, respectively, a is strictly increasing and concave, $0 < a < 1$, and (in order to ensure interior solutions) $\lim_{i \to 0} \frac{\partial a(i)}{\partial i} = \infty$ and $\lim_{i \to \infty} \frac{\partial a(i)}{\partial i} = 0$.

[23] This assumption is supported by the observation that in the late period of 1925–26 the Flint plant became such an issue, which would presumably not have been the case had investments been contractible.

The considered timing is as follows. At a date 0 the parties sign an initial contract (O, q, t) specifying the organizational form O, a trade quantity $q \in [0, 1]$ that B procures from S, and a transfer payment t from B to S.[24] Hence, the standard property-rights model is only augmented in that trade between B and S is assumed to be contractible. Subsequently, at date 1 the parties invest. The initial contract is possibly renegotiated at date 2, and finally trade takes place and payments are settled at date 3. Renegotiations are discussed in more detail below.[25]

Payoffs of the parties. If renegotiations at date 2 were to fail, the parties would obtain the following payoffs from executing the initial contract. First, B and S would derive payoffs from trading the contractually specified quantity q internally. For simplicity, we assume that, conditional on investments, the seller's marginal cost of production and the buyer's marginal valuation of trade are constant. In particular, we assume that the seller's cost of production are given by $q \cdot \sigma \cdot [1 - a(i)]$, and that the buyer derives a benefit $q \cdot \beta \cdot a(i)$ from procuring quantity q from the seller. As both parties profit from a more valuable asset when trading internally, investments have two direct effects: at the same time, they reduce the seller's cost of production and increase the buyer's valuation of trade. The variables σ and β are parameters that are meant to capture potential differences in the responsiveness of the parties' payoffs to investments, where $\sigma, \beta > 0$. Second, the parties may derive benefits from residual rights of control over the asset. These benefits from residual control depend on the organizational form specified in the initial contract. That is, the organizational form determines which of the parties has the right to decide on alternative uses of the asset. For example, while GM clearly was its most important customer, prior to integration FB had the freedom to supply other carmakers as well (and did so). However, such external trade did not take place subsequent to integration. Consequently, we assume that the owner of the asset derives the following benefits from having residual rights of control: in the case of separate firms, S derives a control benefit $s \cdot a(i)$, while in the case of an integrated firm, B obtains a control benefit $b \cdot a(i)$, where $s, b > 0$. As above, the benefits from control are the larger, the more has been invested. To summarize, for given contract terms, the threatpoint payoff of the seller is given by $\pi^S = t - q \cdot \sigma \cdot [1 - a(i)] + s \cdot a(i)$ if

[24] When signing their contract in 1919, FB and GM also agreed to set the price of automobile bodies equal to FB's variable cost plus 17.6 percent, which was meant to ensure reasonable pricing. In the late period of their relationship GM also became dissatisfied with this formula, but FB's refusal to invest in the Flint facility seems to have been the more pressing problem (see e.g., Klein, 2000; Freeland, 2000). If the payoffs of both FB and GM would have been fully verifiable by a court, it would in principle have been possible to make FB residual claimant on any returns from its investment. However, from a practical point of view, such full verifiablility seems to be highly unlikely, and this contention is supported by the fact that in the 1919 contract it was specified that there would be compulsory arbitration in the event of any *disputes* regarding price. As a consequence, we make the simplifying assumption that only fixed transfer payments are possible.

[25] Given additional technical assumptions it can be shown that the parties cannot gain from considering more complicated contracts (e.g., option contracts), where the contract terms (i.e., the organizational form, the trade quantity, and transfer payments) are functions of later messages of the parties (see Roider, 2004). This paper more generally discusses the issues of asset ownership and quantity contracts. It is, however, not tailored to the Fisher Body case, and consequently, in contrast to the present paper, it does not discuss the precise conditions that led to the optimality of separate firms respectively vertical integration in the Fisher Body case.

$O = S$, and $\pi^S = t - q \cdot \sigma \cdot [1 - a(i)]$ otherwise. The threatpoint payoff π^B of the buyer is defined in an analogous way.[26]

However, as the parties are symmetrically informed, the Coase Theorem implies that, independent of the initial arrangement, B and S will always agree on an ex-post efficient trade quantity and an ex-post efficient organizational form through renegotiations at date 2.[27] That is, whenever the initial contract terms turn out to be inefficient, the initial contract will only serve as threatpoint in renegotiations. Hence, it remains to characterize the ex-post efficient trade quantities and organizational forms. First, as during the period under consideration Fisher Body was the foremost producer of automobile bodies, we assume that, independent of investments, it is ex-post efficient to trade the maximum amount $q = 1$ internally.[28] Moreover, we assume that ex-post the parties always agree to use the asset jointly, resulting in a (joint) benefit $j \cdot a(i)$, where $j > \max\{s, b\}$. That is, in line with the property-rights theory of the firm we assume that residual control rights become contractible only ex-post. To summarize, the ex-post surplus is given by $\phi = a(i) \cdot (\sigma + \beta + j) - \sigma$.

For simplicity, suppose that the parties share any surplus resulting from renegotiations in Nash-bargaining in equal parts. Hence, when taking renegotiations into account, the total payoff of the seller is given by

$$\Pi^S = \pi^S + t + \frac{1}{2}(\phi - \pi^S - \pi^B) = \frac{1}{2}(\phi + \pi^S - \pi^B) + t, \qquad (1)$$

and the total payoff of the buyer is given by $\Pi^B = \phi - \Pi^S$. Hence, despite the fact that the initial contract is renegotiated later on, it influences how the surplus ϕ is distributed between the parties because it affects their threatpoints. As the parties anticipate this at the investment stage, it is through this cannel that the initial contract influences investment incentives.

2.2 Fisher Body revisited

In the following, we solve the above model by deriving the optimal organizational form and the optimal supply regime. In particular, we will discuss (i) why initially it was optimal for Fisher Body and General Motors to be organized as two separate firms that were linked through an (exclusive dealing) supply contract, and (ii) why the large, unexpected increase in demand for closed automobile bodies in 1925–26 necessitated vertical integration, which was accompanied by the lack of a supply contract.

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[26] Note that, while after 1924 the Fisher brothers participated in GM's stock incentive plan, their interest in the Fisher Body Corporation was more than ten times larger than their interest in the GM Corporation (see e.g., Klein, 2000). Hence, even after 1924, FB's and GM's incentives were clearly not aligned.

[27] An outcome is called ex-post efficient if it maximizes the joint payoff of B and S. Independent of its (later) distribution between them, the parties want to maximize the size of the cake because there will always exist transfer payments such that both parties are better off. Note that any ex-ante transfer payments (i.e., before investments have been made) would not have any effect on investment incentives, and hence such payments are not considered explicitly.

[28] Formally, this amounts to assuming that even absent any investment the value of the asset is sufficiently large (i.e., $a(0) > 1/(1 + \beta)$).

Assumptions. Throughout our analysis of the Fisher Body case we will maintain two assumptions. First, we assume that residual control was more important for GM than for FB (i.e., $s < b$). While GM was its most important customer, as an independent firm FB also supplied other automobile makers, such as Ford, Hudson, Chrysler, and Studebaker, and from these "external" trades it derived its residual benefits of control. However, as became more and more apparent over time, residual control was of utmost strategic importance to GM. After integration, GM's competitors (all of which immediately stopped buying from FB) were deprived of an important supplier. Additionally, before integration, GM much feared that the Fisher brothers might sell their FB shares to an unfriendly interest, which, given its dependence on FB's bodies, would have disrupted GM's business considerably (see e.g., Freeland, 2000). Second, we argue that, with respect to trade between FB and GM, investments had stronger direct effects on FB than on GM: arguably, while new plants will certainly have improved the quality of supplied bodies, the main effect of new plants (and in particular their right location) seems to have been to reduce FB's cost (i.e., $\beta < \sigma$).

As a preliminary step, the following two observation prove useful to gain an intuition which form optimal initial contracts should take.

Observation 1. Under any initial contract there exists an equilibrium where only one of the parties invests, and no other equilibrium leads to a larger total amount invested.

This observation immediately follows from the fact that the payoffs of the parties only depend on the total amount invested. That is, the buyer's and the seller's investments are perfect substitutes in the payoff functions of the parties. This implies that there always exists a corner solution where only the party with the higher incentives invests at all, while the other party abstains from making any investment. Only in (uninteresting) knife-edge cases there might exist additional investment equilibria (leading to the same total amount invested) where both parties make positive contributions.

Observation 2. Under any initial contract the total amount invested falls short of its first-best level.

That is, the parties face an underinvestment problem arising from potential holdup. To see this, note that under any contract the investment return that a party obtains falls short of the social return ϕ_i of its investment (where, throughout, subscripts denote partial derivatives). To illustrate this for the case of the seller, reconsider the right-hand side of the seller's total payoff function (1). First, due to his limited bargaining power, the seller only captures half of his contribution to the joint surplus ϕ. Second, while the seller's investment raises his threatpoint payoff π^S the buyer benefits as well because he profits from a more valuable asset (recall that π^B is increasing in a). As a consequence, the effect of any investment on π^S falls short of its effect on ϕ. Third, the seller's investment raises the buyer's threatpoint payoff π^B, which reduces the available renegotiation surplus, and the seller internalizes half of this reduction through renegotiations. These three effects lead to inefficiently low investment incentives for the seller under any initial contract. In particular, note that even when the initial contract stipulates the ex-post efficient trade quantity $q = 1$, the second effect (and

the non-contractibility of residual control rights) implies this result. A completely analogous argument holds for the case of the buyer. In combination with Observation 1 this shows that Observation 2 must hold true. Combined, Observations 1 and 2 immediately lead to the following result.

Conclusion 1. An optimal contract maximizes the investment incentives of one of the parties.

If this were not the case, it would follow from Observations 1 and 2 that there exists an alternative contract leading to a higher total amount invested (and hence to a higher joint surplus) contradicting the optimality of the contract under consideration.

Conclusion 1 limits the search for optimal arrangements to two candidates: one arrangement where the seller's investment incentives are maximized, and one where this holds true for the buyer. Now, which initial contracts maximize a party's investment incentives? First, note that a party has larger incentives to invest if it holds residual rights of control because control over the asset leads to a better position in renegotiations. That is, the seller has a larger incentive to invest when there are separate firms. Likewise, the buyer has greater investment incentives under integration, where he has residual control. Second, the seller's investment incentives are the larger, the larger the quantity that the buyer is obliged to procure from him. Intuitively, this follows from our above observation that investments seem to have had a larger cost-reducing than quality-enhancing effect. If this holds true, a larger contracted quantity improves the seller's threatpoint position, and hence leads to larger investment returns. Formally, this implies that $\pi_i^S - \pi_i^B$ is increasing in q (see Eq. (1) above). By analogy, this implies that the buyer's investment returns are larger when there is no up-front obligation to buy from the seller. To summarize:

Conclusion 2. For any given parameter constellation, one of the following two initial arrangements is optimal:

(1) There are separate firms and the parties sign an exclusive dealing supply contract that obliges the buyer to procure all of his inputs from the seller. In this case, only the seller invests in equilibrium.

(2) There is an integrated firm and the parties refrain from signing an initial supply contract. In this case, only the buyer invests in equilibrium.

Hence, there only remain two questions. First, why is it that in the early period of the relationship between FB and GM the first arrangement was optimal? Second, why did the dramatic increase in demand for closed automobile bodies in the late period of their relationship necessitate a shift to the latter arrangement?

Early period (1919–1924). Recall that in the early period of 1919–1924 demand for closed automobile bodies was still modest, and the entire early period exhibited relative stability. Arguably, as closed automobile bodies had not yet achieved the importance they had in the late period, during the early period General Motors' benefit from residual control would only have been moderate. Given a sufficiently strong cost-reducing effect of investments, it was, hence, possible to provide FB with stronger

incentives than GM. This implied the desirability of separate firms combined with an exclusive dealing contract in the early period. Formally, $s + \sigma > b + \beta$ held, which, in combination with Eq. (1) above, implies the claim.

Late period (1925–1926). However, as demand for closed automobile bodies had grown rapidly in the late period, this made trade (and in particular a new plant) much more valuable for General Motors, and it became crucial for GM to have control over production facilities. Formally, there seems to have been an upward shift in both b and β causing the above inequality to reverse. Hence, any additional investment suddenly had a much stronger effect on GM than on FB, and consequently it became optimal to provide GM with maximal investment incentives. As Conclusion 2 reveals this was achieved through vertical integration and the absence of a supply contract.

3 Conclusion

The present paper revisits the classic Fisher Body-General Motors case that has received considerable attention in the transaction-cost and property-rights literatures on the boundaries of the firm, where it is the leading example to discuss the issue of vertical integration. Despite its prominence, there does not exist a formal model tailored to the case explaining both the initial supply contract regime and the subsequent vertical integration, as well as the switch between the two. We present a simple extension of a property-rights model that allows to study the interplay between asset ownership and supply contracts. While any formal analysis necessarily abstracts from some of the relevant issues, we show that this simple model can reproduce important stylized facts of the Fisher Body case. The model lends support to Klein's (2000) view that the large, unexpected increase in demand for closed automobile bodies in 1925–26 was an important driving force behind integration, and it sheds light on his question what exactly it was that caused Fisher Body to take advantage of the imperfect body supply regime. While Klein (2000) argues that the demand shock pushed the initial supply contract regime outside its "self-enforcing range", the present model suggests that, while initially separate firms combined with an exclusive supply contract were the optimal way to ensure maximal investments, the higher demand rendered the contractual externality of FB's investment more severe. As a consequence of the increase in demand trade became more valuable for General Motors, and hence GM would have been able to appropriate a larger share of the investment returns through renegotiations. This worsened FB's incentive to invest. The increase in demand seems to have made it optimal to provide GM with investment incentives instead. This was best achieved through vertical integration and the absence of any obligation to buy from FB (both of which improved GM's position in later bargaining). And indeed, right after vertical integration GM invested in the Flint plant itself.

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