CRITIQUE OF THESIS

"Transaction Cost Theory and Just-in-Time Manufacturing: A New Look at Vertical Integration in the United States Automobile Market" by T.H. Klier, Michigan State University, 1993

A critique submitted in partial fulfilment of the requirements for the degree of Doctor of Business Administration

by

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CONTENTS

1. INTRODUCTION

The following is a critique of Thomas Helmut Klier's PhD thesis "Transaction Cost Theory and Just-in-Time Manufacturing: A New Look at Vertical Integration in the United States Automobile Market", Michigan State University (Klier 1993). I have chosen to critique this thesis for three reasons. First, my own research investigates the possible limits to size in corporations by applying transaction cost theory to explain size disadvantages. Klier's thesis builds on the same theoretical foundation and his review of the transaction cost literature is highly relevant to my own research effort. Second, Klier operationalises transaction costs in a similar way to what I expect to do in my research. I thus hope to build on his methodology when I design my test of the hypotheses in my research. Third, Klier discusses his statistical approach thoroughly and I expect to use a similar approach in my research. In particular, he uses both a binomial and an ordered probit model that I anticipate will be of use in my research.

2. EXECUTIVE SUMMARY

Klier has written a concise, well-structured, and thoughtful thesis that enhances our understanding of vertical integration and the role transaction costs play in make-or-buy decisions. It is an important contribution to knowledge since it is the first explicit analysis of how vertical integration is affected by just-in-time techniques in manufacturing. Klier shows that just-in-time techniques necessitate increased mutual commitment between OEMs and suppliers. This increase in commitment leads to quasi-integration[1] in the vertical chain, at the expense of market-based arms-length relationships characteristic of the Fordist era.

Furthermore, one of the key problems in the field of transaction cost theory is that there have only been a few attempts at operationalising the theory's concepts, and there are even fewer empirical studies. Klier's thesis adds to the knowledge in these areas and can usefully serve as a model for similar future studies.

The thesis is thoroughly researched and builds on an extensive survey of literature and a limited, but specific, empirical analysis based on a qualitative questionnaire sent to automotive manufacturers. The

[1] Quasi-integration is defined as long-term relationships between fairly autonomous but mutually dependent partners. This is distinct from vertical integration where the production process is fully internalised, and "no integration" where upstream and downstream firms have a purely contractual, market-based, relationship (cf. Klier 1993, 3-4).

hypothesis is tested creatively against earlier research and the new questionnaire data.

The statistical methods employed have been meticulously chosen and applied. However, the fairly low response rate to the questionnaire and the consequently small sample size, make it difficult to draw unambiguous conclusions. Seen as a whole, though, the thesis adds insights to the understanding of transaction costs and provides inspiration for further research.

3. REVIEW OF PROBLEM AND HYPOTHESIS DEFINITION

Klier identifies a crucial problem that has not been researched before, and articulates a testable hypothesis. The problem formulation is in line with earlier research and builds on the traditions of, for example, Monteverde and Teece (1982), and Masten, Meehan and Snyder (1989) who have studied related, but distinctly different, problems.

3.1 IMPORTANCE OF PROBLEM

The introduction of just-in-time techniques in the United States automotive industry has fundamentally changed manufacturing and sourcing arrangements. One survey (Helper 1991) shows that between 1984 and 1989, the industry was transformed, as exemplified by the increased information exchange between OEMs and suppliers, the shift in primary purchasing criterion from price to quality, and the lengthening of contract times. A key outcome of this is that vertical integration has decreased, while supplier relationships reputedly have become more co-operative in nature: "these results indicate progress toward a voice model[2] of supplier relations, in which suppliers play an important role in solving joint problems and in generating fresh ideas about products and

[2] As defined by Hirschman (1970).

processes." However, little research has been done on the linkage between the introduction of just-in-time techniques and the changing buyer–supplier relationships, and most information is anecdotal.

Vertical integration problems are also fertile ground for testing transaction cost theory. The theory predicts that vertical integration, rather than the use of market transactions, will be more common when the assets of the buyer and supplier are linked and interdependent. This so-called *asset specificity* can be in the form of site,[3] physical asset,[4] human asset[5] and dedicated asset specificity[6] (Williamson 1985, 95–96). With the increased use of just-in-time techniques, it is expected that the asset specificity increases and thus new co-operative forms of relationships between buyers and suppliers evolve, being closer to vertical integration than arms-length, market-based relationships.

> It is argued that the new manufacturing system is characterized by a high degree of mutual commitment between up- and downstream firms, leading to the formation of market-based vertical relationships. (Klier 1993, ii)

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[3] Site specificity arises when successive stages of production need to be located in close proximity to each other and the set-up or relocation costs are great.

[4] Physical asset specificity is high if assets are dedicated to a specific purpose and can not easily be used in other operations.

[5] Human asset specificity exists if human resources are trained specifically for a stage in the production process and the skill cannot be used elsewhere.

[6] Dedicated asset specificity exists when a supplier expands capacity based on demand from a particular buyer. Klier does not refer to dedicated asset specificity.

> The results support the hypothesis that that the arrival of just-in-time manufacturing influences the decision to vertically integrate. The degree of mutual commitment is consistently found to be a significant determinant of governance structure. The presence of high degrees of mutual commitment, typical for just-in-time manufacturing, strengthens the ability to enforce contractual agreements by making hold-up threats less credible. In doing so, it increases the self-enforcing range of contracts. (Klier 1993, iii)

Consequently, understanding the buyer–supplier relationships in the automotive industry from a transaction cost perspective can be an excellent test of the theory's predictive power. It can also contribute to making transaction cost theory more operational, a challenge the theory's proponents have struggled somewhat unsuccessfully with over the last twenty years.

Klier thus addresses an important issue and his research passes any test of importance and contribution to knowledge.

3.2 CLARITY OF PROBLEM AND HYPOTHESIS STATEMENTS

The problem stated by Klier—has the introduction of just-in-time techniques changed the nature of vertical relationships in the US

automotive industry?—is clearly expressed and succinct. He converts this problem into a hypothesis:[7]

> ...the introduction of JIT manufacturing can effectively reduce the propensity for opportunistic behavior by increasing the extent of mutual commitment present in vertical relationships. Therefore I expect an increase in mutual commitment to result in a decrease in the probability of vertical integration. (Klier 1993, 65)

Both the problem and the hypothesis are delimited and narrow since they address only one aspect of buyer–supplier relationships in a specific industry (automotive) and geography (United States). At the same time they are exhaustive and researchable. It is difficult to imagine other problems or hypotheses that should have been tested at the same time.

3.3 LINK TO THEORY

The problem and hypothesis are well linked to the theoretical foundation. Klier builds on Williamson's (1985) framework for understanding vertical relationships and complements this with four other theoretical sources to argue the expected outcome of the research.

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[7] Klier's hypothesis can be misunderstood since a decrease in vertical integration might lead the reader to believe that there will be a commensurate increase in market-based relationships (no integration). However, the proportion of such relationships will also decline according to Klier's hypothesis. The difference is made up of quasi-integration.

The key negative criticism is that Klier accepts Williamson's framework without testing its validity, or even recognising that the validity can be challenged. An example is Williamson's argument that increased uncertainty leads to increased vertical integration, which could be questioned since we have seen increased turbulence in the automotive market over the last 20 years, while vertical integration has decreased. Balakrishnan and Wernerfeldt (1986) demonstrated, without taking a transaction cost perspective, that technological uncertainty leads to less vertical integration. Walker and Weber (1984) made the same observation in empirical studies of make-or-buy decisions in the automotive industry. Mahoney (1989, 1992), in reviews of the transaction cost literature on vertical integration, argues that high uncertainty leads to less investment in specialised assets and consequently lower vertical integration. Clearly, Williamson's view can be challenged.[8]

3.4 RESEARCHABILITY

The problem is researchable since Klier breaks down his hypothesis into five sub-hypotheses, each of which can be tested quantitatively and without massive amounts of research. Furthermore, these sub-hypotheses

[8] A useful distinction may be to divide uncertainty into at least two components: volatility uncertainty and variety uncertainty. Volatility refers to temporal fluctuations, variety to degrees of freedom in technological and market choices.

are aligned with earlier research so that older data can be used to support or dismiss the findings.

Klier also recognises the limitations of his research. For example, he states that the changes in the manufacturing paradigm and in the determinants of governance structure may be driven by an underlying common source, but that he is not addressing this issue.

4. LITERATURE REVIEW

The literature survey is thorough and to the point. It covers the relevant literature of just-in-time manufacturing and transaction cost theory. However, it does not recognise alternative theoretical approaches such as agency theory and technology-driven explanations of vertical integration.

Klier chooses to divide the literature survey in two parts. First he discusses the general changes in the manufacturing paradigm in the United States, showing how the just-in-time philosophy overtook traditional Fordist manufacturing during the 1980s. He then discusses transaction cost theory and how the paradigm shift should affect vertical integration if transaction cost theory holds true.

4.1 THE PARADIGM SHIFT: FROM FORDISM TO JUST-IN-TIME

Chapter 1 of the thesis discusses the manufacturing paradigm shift. It focuses on the key aspects of relevance to the research and leaves out general discussions of the changes in the US automotive sector.[9] This makes the overview comprehensive, yet targeted. It achieves its purpose of positioning the issues at hand.

[9] Klier has a footnote on general discussions on page 12.

4.1.1 Fordism

Klier summarises the key aspects of the Fordist system on pages 13–17. He argues that Fordism is built on two principles: the separation of intellectual and manual work, and the specialisation of labour. The application of these principles resulted in the assembly line approach to manufacturing. The implication of the assembly line is that manufacturers favour stable production volumes and buffer inventory to avoid disruptions. As a consequence, General Motors, Ford, and Chrysler tended to 1) be vertically integrated, 2) have an arms-length relationship with suppliers, and 3) negotiate short-term (1 year) contracts with their suppliers.

A number of sources are used to illustrate these points. Most importantly, Cohen and Zysman (1987) are referenced on the buffer tendency, Scherrer (1991) is used to prove the vertical integration point, and Womack, Daniel and Roos (1990) and the MIT Commission (1989) are used as evidence for the supplier relations points. Together, these references suffice to support Klier's view on how the Fordist system works and this section of the literature review is appropriate in length and scope. The only issue may be that the definition of vertical integration used by Klier (value added/ revenue) is somewhat discredited (Caves and Bradford 1988), especially when comparisons are made between industries.

4.1.2 Just-in-Time Manufacturing

Klier uses pages 17–25 to characterise just-in-time manufacturing and contrast it with the Fordist system. His conclusion is that the new system represents a paradigm shift and that almost all attributes of the manufacturing approach have changed.

While Fordism built on separation and specialisation, just-in-time manufacturing is based on flexibility to changes in demand, according to Klier. From this stems a number of practices that differ sharply from the Fordist system. Teamwork is at the core of the system and the separation of intellectual and manual labour is less pronounced. Inventory is seen as a problem rather than a solution. Subcontractors are used for a large proportion of value added. To optimise the use of subcontractors, the just-in-time driven automotive manufacturer tends to have a closer relationship with its suppliers. Aspects of this are long-term contracts, more information sharing, and a reliance on the design capability of the first tier suppliers.

Klier draws on several studies to illustrate these points. Eckard (1984)[10] is used to show that the value added/sales ratio in Japan (just-in-time) is 15–20 per cent, while the North American (Fordist) ratio was 36–48 per cent

[10] See page 22 in Klier. Not referred to in Klier's reference list.

before the just-in-time era. The contractual arrangements are explained by drawing on Asanuma (1989) and Aoki (1988). Eckard (1984) and Dertouzos et al. (1989) provide the evidence on information efficiency. The only thing missing is a discussion of why the just-in-time system has evolved. Is it a good idea no one thought of before (except at Toyota), or are there underlying drivers such as modern information technology that explain why this paradigm is winning? Womack, Daniel and Roos (1990) discuss these issues.

4.1.3 Implication of Changes

Finally, Klier discusses the implications of the paradigm shift on pages 25–32 with a particular emphasis on the US market. He correctly observes that based on his earlier discussion, the level of vertical integration should increase when just-in-time systems are implemented. The reason for this is that the asset specificity (see Section 4.2, below, on transaction costs) should increase, and as a consequence it should be more advantageous to make components and sub-assemblies in-house. Klier then argues that this is not happening because OEMs and their suppliers are entering into new contractual forms that make vertical integration unnecessary.

A number of studies support which this argument are effectively referenced by Klier. Helper (1991), through two surveys comparing 1984

and 1989, shows that suppliers became increasingly likely to provide information to their customers. The average length of contracts also increased from 1.2 years in 1984 to 2.3 years in 1989. Furthermore, the most important purchasing criteria changed from price to quality over the same time period. Womack, Daniel and Roos (1990) demonstrate how the number of suppliers is declining and how the US automotive industry is converging towards a Japanese supplier pattern. Finally, Estall (1985) studied the locational patterns in the United States and found that logistical proximity between OEM and supplier is increasing.

This overview of the changes is compelling, but Klier does not explain why the changes are happening, only that they are happening. In fact, Mahoney (1989) illustrates that there does not have to be a contradiction between increased asset specificity and lower vertical integration. Klier would have made a better argument if he had referenced this work as well as some of the other research referred to in Mahoney's thesis.

In summary, though, the overview of the paradigm shift and its implications is to the point, solidly researched, and well written.

4.2 TRANSACTION COST THEORY

Klier discusses the relevant parts of transaction cost theory in Chapter 2 and the first part of Chapter 3, in total 27 pages covering the underlying theory and empirical studies.

4.2.1 Theory

This could have been a lengthy discussion because much has been written on the theory over the last 20 years, and vertical integration problems have been at the core of this effort. Fortunately, Klier summarises the key principles of transaction cost theory on pages 33–36 and 55–60 by only reviewing the cornerstone contributions of Coase (1937) and Williamson (1975, 1985). He correctly notes that according to their definition of the theory 1) it is the comparative differences in transaction costs that explain whether a firm chooses to procure in the market or produce internally (Coase); and 2) this comparative cost difference is driven by asset specificity, uncertainty and frequency of transactions (Williamson).

However, there are a number of theoretical objections to this definition and other definitions exist. Klier should have referred to this and then made the argument for choosing the particular definition above. An example of an alternative is Alston and Gillespie (1989), which offers an

extended framework that categorises transaction costs by factors of production along the production process. The key difference to Williamson's framework is that they define the nature of the costs at various stages in the production process rather than under which conditions market or internal costs exist. Another example is agency theory (Jensen and Meckling 1976), which identifies other drivers of vertical integration such as misalignment of incentives. In fact, Williamson (1984) makes a similar point within the transaction cost framework. In the end, Klier would probably have come to the same choice he did since most empirical work use the definition above, but his choice would have seemed more informed with an expanded discussion.

4.2.2 Empirical Studies

The emphasis of the literature review is on the ten relevant empirical studies that address the issue of vertical integration within contexts similar to what has happened in the automotive industry with the introduction of just-in-time techniques. Klier also refers to a number of studies which potentially could have been relevant to his research and explains why this is not the case. There is at least one important omission though.

Pages 36–54 review the ten studies. Among these ten studies are the widely quoted ones by Monteverde and Teece (1982), Masten (1984) and

Masten, Meehan and Snyder (1989, 1991). Each of these operationalises the drivers of transaction costs (asset specificity, uncertainty and frequency) and tests their explanatory power in a static setting. Two of the studies are from the automotive industry. Thus, they are highly appropriate to Klier and the only difference to his research is that he is testing for dynamic effects.

A few observations are warranted without discussing each of Klier's ten reviews. He makes a thorough assessment of Monteverde and Teece (1982) and notes that while their methodology was sound their sample was small. Thus, the significance of their test was not strong. Unfortunately, this comment is not carried forward into the statistical part of the thesis that relies heavily on Monteverde and Teece's article.

Klier also reviews Masten, Meehan and Snyder (1991) extensively and notes that their study not only tested under what conditions a firm chooses internal or market transactions, but also quantified the monetary impact of these choices. It could have been worthwhile to discuss why this approach was not appropriate in Klier's study, especially since this study has been cited as the most interesting empirical study of transaction costs (Joskow 1991).

Finally, a notable omission from the review are the two studies in the automotive industry by Walker and Weber (1984, 1987) who focus on the uncertainty aspect of transaction costs. They use a methodology similar to Monteverde and Teece in their first study and make the important distinction between demand uncertainty and technological uncertainty. They find that high demand uncertainty leads to vertical integration while technological uncertainty has little effect. In their second study they determine that demand uncertainty only is important when markets are thin. Thus, uncertainty does not, on balance, appear to be an important factor. Perhaps this finding should have influenced Klier's statistical approach.

In conclusion, as with the review of just-in-time research, Klier has successfully identified a narrow set of relevant research and extracted the main findings in a succinct manner. The suggestions for improvement are not material.

5. ANALYTICAL APPROACH

The analysis section is the weakest part of the thesis. It is sufficient to support the hypothesis, but it is neither creative nor comprehensive. The statistical discussion, however, is excellent.

5.1 ANALYTICAL METHOD

Klier needs to demonstrate two things to verify or reject his hypothesis. First, he needs to show that the preferred governance model has changed over time towards quasi-integration. Second, he has to demonstrate that these changes are caused by the introduction of just-in-time techniques.

5.2 DATA COLLECTION

The underlying data appears to be of dubious quality and there is neither validation of the quality of the data nor a discussion of what would have constituted a data sample with higher integrity. In fairness, data in the other related surveys is not always of sufficient quality, so Klier's sample is good in relative terms but poor in absolute terms.

5.2.1 Current Data

Klier chose to test his hypothesis by collecting data from the three domestic US car manufacturers. He collected 89 observations from various organisational units (there is no mention of response rates) who were asked to fill out a questionnaire (Klier 1993, 123–132). The questionnaire only asks for qualitative assessments, usually on a scale from 1 to 5. For example, the definition of 5 in the assessment of engineering effort is "a lot of engineering effort".

The definitions are thus fairly loose and open to a wide range of interpretation by the people responding to the questionnaire. Perhaps this was the only way to get information from the car manufacturers, but the combination of the small sample and the open-ended questionnaire certainly has reduced the data integrity.

5.2.2 Earlier Studies

Klier also had to draw on data from earlier research to complement his current industry survey. However, earlier studies have not tested Klier's hypothesis explicitly, and thus he had to go back to the source material to find ways to extract information that helped him test his hypothesis. Both Monteverde and Teece (1982) and Masten, Meehan and Snyder (1991)

provided such data. Unfortunately, data from the most closely related study in the automotive industry (Masten, Meehan and Snyder 1989) was not made available.

Despite the fact that this earlier data was quite different from what he actually needed, Klier identified the opportunity and collected the information. However, the dissimilarities make meaningful statistical comparisons difficult.

5.3 STATISTICAL ANALYSES

While there are limitations in the choice of research methodology, and the underlying data used is somewhat weak, the statistical analysis is solid. Klier clearly explains why he chose the methods used, discusses the merits and problems of each choice made, and applies the statistical methods rigorously.

Klier's dependent variables are discrete. He is investigating the changes in the propensity to vertically integrate, quasi-integrate, or not integrate, given the introduction of just-in-time techniques. Thus, he correctly uses qualitative response models which allow for discrete dependent variables, rather than linear regression models which are intended for continuous dependent variables (Greene 1993, 635).

5.3.1 Comparison to Previous Studies

Klier needs to compare his results to previous studies (Monteverde and Teece 1982; Masten, Meehan and Snyder 1989) since he does not have longitudinal data in his own survey. He does this by identifying the influence mutual commitment has on governance choice in his own study, and by comparing the marginal effects (partial derivatives) of the independent variables in his own study with the previous studies. Klier uses a binomial probit model in the form of

$$\textbf{Probability (vertical integration)} = \alpha + \beta_1 \cdot \textbf{human asset specificity} + \beta_2 \cdot \textbf{physical asset specificity} + \beta_3 \cdot \textbf{site specificity} + \beta_4 \cdot \textbf{mutual commitment} + \beta_5 \cdot \textbf{frequency} + \beta_{6-9} \cdot \textbf{control variables} + \varepsilon$$

where **vertical integration** is 1 if there is vertical integration and 0 if there is quasi-integration or no integration, the **specificity** and **frequency** variables are according to Williamson's framework[11] and **mutual commitment** is the new variable Klier wants to test.

There are a few problems with this approach. First, Klier has to collapse "quasi-integration" and "no integration" into one state since the earlier studies did not make the distinction between these two states. This

[11] See earlier discussion in Section 4.2.1, above.

reduces his ability to draw inferences from the analysis. He circumvents this problem by looking at the marginal effects of the independent variables. Unfortunately, he is only able to calculate the marginal effect of human asset specificity.

Second, even though he states that the two earlier studies used a binomial probit method, only Monteverde and Teece did. Masten, Meehan and Snyder use OLS, two-limit tobit, and logit methods. It is unclear from the text if Klier has made adjustments for this.

Third, there is confusion about the data source for marginal effects for Masten, Meehan and Snyder. Klier is using their 1991 study of a naval construction shipyard,[12] not the 1989 study of the automotive industry. It is unclear why this is the case.

An alternative approach is, in my mind, to work solely with the Monteverde and Teece data and to expand the data set used when comparing with Klier. The original article uses the independent variable **specific**, which indicates if a part is specific to a single assembler. This could possibly have been used as an operationalisation of physical asset specificity. The way to do this practically is to convert Klier's five-point

[12] See page 74 in Klier. Not referred to in Klier's reference list.

scale for physical asset specificity into a dummy variable matching Monteverde and Teece's definition. Alternatively, perhaps Monteverde and Teece's data can be appended to fit Klier's more rigorous definition.

5.3.2 Just-in-Time's Impact on Governance

The second part of Klier's statistical analysis aims at showing whether the introduction of just-in-time techniques has changed the relationship between vertical parties. The choice of models for this part of the research is not controversial. The three states are clearly ordered and the use of an unordered probit model would destroy information. Consequently, he uses two multinomial choice models: ordered probit and sequential probit. These models allow Klier to use three states in the dependent variable: vertical integration, quasi-integration, and no integration. The benefit is that he can thus estimate to what extent just-in-time techniques, with its dependence on mutual commitment, leads to quasi-integration as predicted in his hypothesis. The ordered probit model is used under the assumption that the buyer and supplier decide at one point in time which governance model to use. The sequential probit model assumes that a first choice is made between internal and market transaction. Only later, in the case of market transactions, is a choice made between quasi-integration and no integration.

Klier uses a similar latent regression as in the binomial probit.[13]

Probability (vertical integration) = $\alpha + \beta' \cdot x + \varepsilon$

where **vertical integration** is 0 for no integration, 1 for quasi-integration, and 2 for vertical integration, **b'** is the coefficient vector and **x** is the independent variable vector. The key estimation problem is to identify the threshold value at which no integration becomes quasi-integration.[14]

One way to improve on Klier's statistical analysis is to follow Masten, Meehan and Snyder's (1991) approach. In their analysis of make-or-buy decisions at a shipyard, they used a censored regression model. This allowed them to incorporate cost data for those parts that were made internally at the shipyard (i.e. vertical integration), while not having to collect similar data for external parts. The approach makes it possible to quantify in monetary terms the impact of different vertical relationships. Clearly, Klier does not have access to such data from the OEMs he surveyed, and it is unlikely that he can get it. This approach suggests a way to carry the research on just-in-time's impact on vertical relationships forward. Perhaps Klier should also have made reference to this approach in his thesis.

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[13] Klier's definition on page 77 is incorrect. It should include α.

[14] The findings section later show that this is not a problem in this analysis.

5.4 MEASUREMENT OF VARIABLES

Klier operationalises his variables in a reasonable way. Human asset specificity is measured as engineering effort, following the original definition by Monteverde and Teece (1982, 210). Physical asset specificity agrees with Masten, Snyder and Meehan's (1989, 269) definition of specificity as either due to the car's style or due to the technical design. Site specificity is measured as the distance between the supplier's plant and the plant of the auto assembler, in line with Spiller (1985).

The mutual commitment variable does not have a precedent in research. Klier argues that a reasonable way to operationalise the variable is to use to frequency of delivery between supplier and OEM. The frequency of delivery is a key characteristic of just-in-time operations (see Helper 1991) and it qualifies as a proxy for mutual commitment. However, Helper identifies four other proxies for commitment: the average number of firms competing to produce a product for a given customer, the average contract length, supplier costs of switching customers, and criteria used to choose suppliers. Klier can possibly use one of these instead of frequency of delivery since they arguably are more important characteristics of just-in-time operations than his proxy is.

Finally, Klier operationalises the frequency of transaction variable with the same proxy as above, frequency of delivery. This is not wholly logical since frequency of transaction in Williamson's (1985, 60) definition refers to frequency of contracting. Fortunately, frequency has been shown to be secondary to asset specificity in importance (Williamson 1985, 52).

In summary, Klier operationalises his variables based on previous research and theory. There is only limited reason to suggest modifications.

5.5 QUALITY OF STATISTICAL ANALYSIS

The statistical methods are applied rigorously and all key results are reported in tables. The discussion of the results is thorough and leaves nothing to ask for. Klier also tests the validity of the results and documents most of the standard measures of interest such as correlation coefficients, standard deviations, and significance levels (Klier 1993, 109). The results are also compared with Monteverde and Teece (1982) and Masten, Meehan and Snyder (1991) and are found to correlate fairly closely (Klier 1993, 75, 101).

Klier also discusses problems with his analysis, for example:

> ...several caveats apply to such a comparison. For example, different sampling procedures were used across studies...In

addition, each of the studies probably received its information from a different set of respondents at the automobile company. (Klier 1993, 76)

6. FINDINGS

Klier wants to test whether the introduction of just-in-time techniques has changed the nature of vertical relationships in the US automotive industry. He discusses the findings in Chapter 4B and 5 (pp. 98–119). His overall conclusion is that the vertical relationships have shifted from a short-term, arms-length model to a long-term, mutual commitment model. He finds that his proxy for mutual commitment, frequency of delivery, is consistently inversely related to the probability of vertical integration, in line with his hypothesis. Thus, he argues that the strong anecdotal evidence built over the previous decade has been validated by his empirical findings. The question is how robust and significant these findings are. To understand this it is necessary to once again review the theoretical construct, the operationalisation of the hypothesis, the statistical significance of the findings, and the quality of the data, to create a complete picture.

The theoretical construct is highly robust and anchored in previous research. While the discussion of the theory misses some of the alternatives, it is still likely that Klier would have picked the same theoretical foundation in the end. There is a plenitude of research along similar lines and Klier builds on the work of giants.

When Klier operationalises the theory the robustness decreases significantly. The use of frequency of delivery as a proxy for commitment is questionable and there are several alternatives, referred to in Section 5.4, above. Commitment is the most important variable in Klier's hypothesis and one can argue that frequency of delivery is nothing else than frequency of delivery. The other proxies are more solid, but also less important.

As discussed in Chapter 5, above, Klier's analysis is somewhat, but not highly, statistically significant. The binomial probit analysis has a high level of significance for mutual commitment and human asset specificity (p. 99). However, this analysis is not optimal since it does not explicitly take into account quasi-integration. Moreover, it is only by studying the partial derivatives of the variables that comparisons can be made over time. The ordered probit and sequential probit analyses are less significant but do not refute the hypothesis.

Finally, the quality of the underlying data is moderate. The survey is qualitative and leaves room for interpretation, the data is difficult to compare to earlier studies, and the sample size is not wholly adequate.

On balance, Klier's findings are not robust but they do add insights on the margin. The results are in line with earlier research and contribute to the

overall picture of transaction cost economics ability to shed light on vertical integration issues. But as always, more research will be required. One avenue for this is to replicate Klier's study but with a different set of dependent variables. Another is to do a more in depth study of one automotive company, using inside data. This will allow a quantification of the economic impact, and the granularity of the analysis can be improved. Perhaps this particular aspect of the vertical integration problem has been exhausted, though.

7. THESIS LAYOUT

The thesis covers 119 pages (excluding two short appendices) and roughly half of it is dedicated to the literature survey, the rest to building and testing the hypothesis. This composition is appropriate since it gives sufficient attention to all parts of the research.

The mechanics applied are excellent. Klier uses good academic grammar, there are few—if any—spelling errors, and quotes and footnotes are correct and relevant. The reference list is mostly accurate, although the source for Coase (1937) is wrong (should be Economica, not Econometrica), and both Eckard (1984) and Masten, Meehan and Snyder (1991) is referred to in the text but is missing in the references. A minor point is that the graphical layout is unappealing and it is difficult to follow chapters, headings, etc., since one typeface and font size is uniformly applied.

The main objection to the layout is the structure of Chapters 2 and 3. Chapter 2 covers most of the review of transaction cost theory. However, this review continues in the beginning of Chapter 3 and Klier then continues to describe his hypothesis at the end of Chapter 3. This creates both repetitiveness and it somewhat hides the hypothesis.

In addition, the description of the choice of statistical methods is either overly detailed (if the aim is to give a summary description) or too short (if Klier hopes to explain the intricacies of the choices he makes).

On balance, though, the power and clarity of the language makes the thesis accessible and interesting.

8. CONCLUSION

Klier has identified an important problem, articulated a strong hypothesis, and offers compelling, but not conclusive, evidence to support the hypothesis. The whole thesis is targeted at this task and there is little excess discussion. The findings are in line with earlier findings although the weak underlying data makes it difficult to see far-reaching implications.

Overall, Klier has furthered our knowledge of the implications of just-in-time techniques and contributed to making transaction cost theory more operational.

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