COMMITMENT, PRODUCT MARKET DIVERSITY, AND PERFORMANCE: AN INTRAINDUSTRY ANALYSIS

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ABSTRACT

Previous empirical diversification research has largely ignored the combined effect of input- and output diversity as drivers of financial performance. In view of this gap, the present paper provides an empirical analysis of the link between intraindustry commitment, diversity of the firm's product market portfolio and performance. We suggest that commitment constrains the ability to diversify, and that product market diversity can be evaluated with respect to the extent that increases in diversity lead to increases in coordination costs. Our results suggest that commitment to physical assets and technology choice drives product and product line diversity. Furthermore, financial performance increases in product diversity and tends to decrease in the number of product lines.

Keywords: Resource-based view; Diversification; Commitment; Product Market Diversity.

Running header: Commitment, product market diversity, and performance.

COMMITMENT, PRODUCT MARKET DIVERSITY, AND PERFORMANCE: AN INTRAINDUSTRY ANALYSIS[1]

Strategy research has identified a broad range of causes for diversification. These may conveniently be grouped into three comprehensive perspectives that synthesize a number of individual points (Montgomery, 1994): the market power view, the agency view, and, the resource-based view.

The market power view refers to the possibility of gaining conglomerate power by broadening the firm's operations to multiple markets (see e.g. Montgomery, 1994). If successful, then diversification can be exploited to yield higher performance. The market power-view, however, tends to ignore the causes for diversification as well as important alternative effects associated with efficiencies.

By contrast, the agency view, identifies causes for diversification in managerial self-interest. For example, empire building might increase the manager's subjective utility and the value of her reputation, demand in the manager's particular skills might be increased by idiosyncratic diversification and managers might pursue diversified expansion as a means to reduce their personal employment risk by reducing total firm risk. Thus, by pursuit of diversification, managers might, for various different reasons, increase their personal utility at the expense of the firm's shareholders (Ibid.). Emphasizing the cases where managerial interests in

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diversification are not aligned with value maximization, the agency view predicts that value decreases in diversification.

Finally, the resource-based view suggests that causes for diversification are to be found in the firm's resource stock. Thus, diversification is seen as a function of the commitment to specialized resources necessary for competing in specific product markets, i.e., the higher the commitment, the more focused the firm's product market activities[2]. Even though the resource base – product market connection has been downplayed in most contributions (see e.g. Ghemawat, 1991b), the resource-based view seems to suggest that product market focus is inversely related to commitment (Ibid.).

Despite the great interest in the market power view, it has failed to meet its promise due to lack of theoretical sophistication and empirical success (Montgomery, 1994). Montgomery (1994) finds that both the agency view and the resource-based view hold considerable more promise, however, warns against the temptation of seeking simple causes for diversification. By tracing diversification to more disaggregated levels than previous research (i.e. a complete listing of product lines, and, products belonging to each product line), the present paper pursues a resource-based line of inquiry. Although a comparative test of resource-based and agency theory would be useful, as suggested by Montgomery (1994), a more narrow focus on resource-based theory allows us to fill a gap in previous diversification research by pursuing

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[2] We define commitment in terms of the salvageability of a factor's value, i.e., the firm's sunk cost commitments (Caves, 1984; Ghemawat, 1991a). Also note that we use the term commitment throughout the present paper although our definition of commitment is identical to the notion of factor immobility favoured by resource-based writers (see e.g. Peteraf, 1993).

causes for diversification at a rather detailed level of analysis. Thus, we provide an empirical test of the relation between resource specialization, product portfolio diversity (disaggregated to the level of individual products and product-lines) and performance.

According to the resource-based view, firms encounter opportunities to expand and diversify their businesses and product-lines, partly in response to underutilized resources and partly in search for more profitable resources. The strategic choice concerns the question of allocative efficiency implied by opportunities to expand operations (Wernerfelt, 1984; Dierickx & Cool, 1989). Should idle resources be employed or should unused capacity be tolerated? As Montgomery (1994) makes clear, the critical question is whether or not diversification stops when its net present value is zero. The reason why this question is interesting is that imperfectly divisible resources entail excess capacity and that specialized resources constrain the scope of activities which may efficiently be pursued.

According to arguments favoured by the resource-based view, the firm's extant resource-base constrains the set of strategic choices available to the firm, including its choice of product market diversity (Penrose, 1959; Wernerfelt, 1984). The constraints may emerge from a number of sources. First, due to commitment to specialized resources, technological constraints limit the ability to extend the existing resource-base to wider uses (Wernerfelt & Montgomery, 1988). Second, the costs of coordinating activities increase in diversity due to the associated environmental and organizational complexity (cf. Galbraith, 1973; Duncan, 1972). Also, the time costs of organizational and individual learning constrain the speed of adaptation. In sum, these constraints may be seen as frictions which limit and direct the expansion of the firm's resource-base and the diversity of its product portfolio.

Two important and related research questions emerge from previous research. The first concerns how the firm's resource-base influences the extent of diversification, and the second concerns the performance of diversified firms. A third question concerning the link between the expansion of the firm's resource-base (factor inputs) and product portfolio diversity (outputs) has largely been ignored. Despite the recognition of the importance of this issue by a at least some authors (e.g. Ghemawat, 1991), most contributors to resource-based theory have focused on inputs and downplayed the context of competition, the firm's choice of product market portfolio (with the notable exception of Barney, 1991). For this reason, it is perhaps not a surprise that we have found no empirical work (in the strategy literature) which combines input- and output diversity in the analyses of differential performance. In view of this gap in previous research, the present paper provides empirical analyses that link intraindustry commitment to diversity as causes for differential performance in the Danish textile industry.

The paper is organized as follows. The first section develops hypotheses concerning the relationship between the firm's resource-base, its product market diversity, and financial performance. The next sections describes the data. Subsequently we perform our empirical analyses. The paper concludes with a discussion of the results and their implications for further research.

Technological constraints on diversification

Penrose (1959), Teece (1982) and Montgomery (1994), among others, emphasize the role that unused resources (excess capacity) have in shaping the growth and diversity of firms. Excess resources are difficult to trade or rent in markets, entailing internal organization rather than other types of arrangements (Teece, 1982). Moreover, resources differ in their degree of specialization to a specific context and highly specialized resources have a limited scope of efficient application (cf. Williamson, 1985). Although specialization influences the firm's ability to obtain a sustained competitive advantage (Peteraf, 1993), highly specialized resource bundles or strategies are only likely to support a narrow scope of product market diversity (Barney, 1991). Thus, a specialized resource-base both constrains expansion opportunities in product markets but also forms a necessary condition for obtaining a sustained competitive advantage. Previous empirical research suggests that the trade-off between specialization on the input side and the drive to expand into diverse product markets may be solved by choosing related over un-related diversification.

Montgomery and Harihan (1991) analyzed the relationship between the direction of diversification and the firm's extant resource-base. They found that firms tended to diversify into markets (industries) where the resource-requirements were similar to the markets the firms currently competed in. In particular, firms that were capital intensive tended to acquire other capital intensive firms, firms that were R&D intensive tended to acquire other R&D intensive firms, and so on. Ravenscraft and Scherer (1987) found that internally generated diversification was most prominent in R&D driven industries and Lemelin's (1982) results suggest that similarities between distribution and marketing channels were significant predictors of the direction of diversification. MacDonald (1985) obtained comparable results, where similarities in the share of sales going to the consumer market and similarities in R&D intensity were related to industry diversification patterns. In sum, the empirical results indicate that a specialized resource-base, including physical assets and technology, influences the diversification opportunities available to a firm by reducing the feasible number of product markets the firm can efficiently serve.

Investments in physical assets, such as plant and machinery, are often specialized to a specific industry context or to manufacturing particular products (Williamson, 1975). As aforementioned, strategic choices can be explained as an expansion of a resource base in response to changed product market conditions. Because of commitment to specialized resources, both the path of resource expansion and product market diversity may be constrained. Product diversity will be limited in the specialized resources embodied in the existing process equipment (physical capital) as well as the firm's technology (means by which inputs are transformed to outputs). Considering physical capital, increased commitment refers to a higher proportion of assets that cannot be replaced without considerable costs, i.e., at the limit investments in physical capital are irreversible. Since product diversity is limited by physical capital which is costly to replace, product market diversity will decrease in the ratio of physical capital to total capital.

H.1. Commitment to physical capital decreases product market diversity.

As aforementioned, we consider two levels of product market diversity, encompassing a complete listing of product lines, and, products belonging to each product line. It is difficult to specify whether the effect should be most important regarding product market diversity at the level of product lines or individual products. Product line diversity can for example be managed by employing *divisible* technologies and adopting appropriate organizational structures. However, it is likely that these countermeasures are costly to implement, at least in the absence of scale or scope advantages. At the product level, diversity can be managed, e.g. by training workers to become more flexible. Since such activities are also costly, we suspect, at both levels of aggregation, that commitment to physical assets decreases product market diversity due to coordination costs.

At the most aggregate level of analysis, the firm's process for transforming inputs to outputs may be described as a production function consisting of capital and labor inputs (Varian, 1992). We assume that labor, in general, is less specialized and more adaptable than the firm's capital stock. For example, workers with new skills may be hired if the firm wants to change its skill base, whereas the capital stock (primarily the firm's physical capital) is difficult to redeploy or sell if it is specialized to particular products or uses. Furthermore, we assume that as capital intensity increases, worker specialization also increases. Therefore, the firm's capital intensity, measured by the capital to labor ratio (the technical rate of substitution), indicates that a firm has specialized its production function towards a relatively inflexible capital stock. As the firm's technology becomes more capital intensive, its commitment to a specialized technology therefore increases, and, following our general argument, product market diversity should decrease.

H.2. Capital intensity is negatively related to product market diversity.

Product market diversity and performance.

At any time, the breadth of the firm's product market scope will be related to key properties of the firm's resource base in terms of its specialization and flexibility. A number of studies have shown that broadening the firm's product market scope entails lower average profitability when product market scope is evaluated at the corporate level of analysis (Montgomery and Wernerfelt, 1988; Wernerfelt and Montgomery, 1988)[3]. Furthermore, resource-relatedness between businesses have also been found to influence profitability positively (Markides and Williamson, 1994).

Wernerfelt and Montgomery (1988: 250) argued that performance differences due to corporate diversification "...can be explained by efficiency differences firms experience in transferring competencies to varying markets." Diversification into markets with similar resource requirements lowers the costs of transferring knowledge and skills between businesses (Markides and Williamson, 1994). Consequently, a firm does not need to invest in search and experimentation activities aimed at adapting procedures and skills to new market demands. In particular, efficiencies due to product market similarities may arise from the ease of communication and coordination between organizational members who share the same frame of reference and a common organizational code (Arrow, 1974; Kogut and Zander, 1992). Indeed, Rumelt (1982) found that diversifiers with connected activities *around a*

[3] Clearly, since increases in diversity also presents an opportunity for risk reduction, there exists a delicate balance between specialization and diversity, where some corporations have been found to be more efficient diversifiers (Amit and Livnat, 1989). We will not addres the issue of risk reduction associated with increased diversity although it is clearly important. Rather, we seek to disentangle the causes and effects of diversity at different levels of analysis.

common organizational skill or resource had higher performance than both very specialized firms and unrelated diversifiers.

Rumelt's (1982) and most other empirical studies of diversification have analyzed diversity at the corporate level of analysis. Typically, diversity has been conceptualized in terms of some continuous or categorical measure based on two or four digit SIC-codes and an analysis of the relationship between business units. The arguments for the efficacy of related diversification usually refers to some degree of similarity between *businesses* in terms of the required resources. However, the explanations given for this enhanced efficiency refer to underlying similarities between resources and processes at lower levels of organization, and the similarity between business units is used as a proxy for unobserved similarity at these lower levels of organization. For example, the cost or difficulties of transferring knowledge between organizational sub-units is often evoked as an explanation why related diversifiers outperform unrelated diversifiers (Montgomery, 1994).

The question is whether the performance effect of similarity at lower levels of analysis is real or imagined. Clearly, the opportunities for reaping economies of scope depends on the ease with which informational and resource-based advantages "travel" across internal organizational boundaries. The costs of internal transfer reflect coordination costs whereas benefits emerge from the ability to share information and resources. When this process is carried out within a product line it is likely that the coordination costs increase at a lower rate than the benefits. In fact, it is conceivable that average unit costs should decrease. Between product lines, it is likely that coordination costs rise faster than the benefits. In particular, the ability to share physical resources will decrease (it is highly unlikely that the same machinery can be used), and, the administrative costs associated with serving heterogenous market segments increase. Moreover, it becomes increasingly unlikely that brands, sales force, and distribution channels can be shared, and possibilities for taking advantages of complementarities decrease (Milgrom and Roberts, 1990).

To conclude, increased diversity within a narrow product line is associated with higher performance. This would be the case if addition of products within a product line entails small increases in organizational or environmental complexity while enhancing opportunities to reap economies of scale and scope in manufacturing, marketing or distribution (for example cost or marketing advantages due to umbrella branding). By contrast increases in the number of product lines should be associated with increased organizational costs as organizational and environmental complexity increases.

Most studies of diversity have focused on the relationship between product market diversity and financial performance and found a negative relationship. However, these studies have also been carried out at a fairly high level of aggregation, namely the corporate level. Increasing product portfolio diversity at the corporate level entails costly measures, for example divisional structures with extensive duplication of administrative functions (Chandler, 1962). Similar effects may result from increasing product line diversity *within an industry*. Often, separate departments need to be set up for the design, manufacturing, and selling of different product lines. This means that organizational complexity increases and the cost of organizing becomes higher.

H.3. Product line diversity is negatively related to financial performance.

At the product level, more products within a product line can be designed and manufactured using the same equipment, sold and shipped through regular channels and so on. Therefore, increasing the number of products *within* product lines is more likely to be associated with economies of scale and scope, and therefore likely to be positively related to profitability.

H.4. Diversity within product lines is positively related to financial performance.

Figure 1 about here

Figure 1 shows a summary of the hypothesized relations as well as the paths estimated to control for the influence of 3^rd^ variables. The most interesting relations, in terms of adding to prior theory, seems to be the effects associated with intraindustry diversity, summarized in hypotheses 3 and 4.

The control variables were included to test for obvious alternative reasons for diversification and financial performance. Apart from size and age effects we employed firm-level controls for past performance (ROA, 1996) and industry diversity (the number of distinct industries in which the firm is present).

Clearly, the decisions concerning product market scope and the firm's resource-base need to be considered simultaneously. Therefore we use structural equation modelling to obtain a simultaneous estimate of the hypothesized effects. Moreover, the possible effect of size and age on industry-level diversification has been examined in a number of theoretical and empirical studies referred to in the above. For example, the resource-based view endorses the hypothesis that capacity will tend to be under-utilized due to indivisibilities in inputs (Penrose, 1959; Montgomery, 1994). Often, the firm may find advantage in seeking occupation of unused capacity in new industries (Montgomery and Harihan, 1991). Industry-level diversification may, therefore, increase in size and age.

The control for past performance was included to test whether the causal relation runs counter to our hypotheses. It may well be that diversity in product space is best viewed in dynamic terms of a dynamic process of cumulative causation. The question is whether the present level of product diversity is caused by performance in the immediate past (cumulative causation) or, the alternative hypothesis favored in the present study, that the cause for diversity is commitment to technology (H1) and physical capital (H2). We use ROA for the immediate past (1996) to test these competing hypotheses.

The measure of industry diversity controls for the effects of industry diversification on diversity in product space and present performance (ROA). It may well be that the firm which increases the number of different industries in which it chooses to compete does so because it has lower costs in coordination of diverse activities. Perhaps such comparative advantage in coordination of diverse activities may also be utilized to increase scope in each of the industries within which it competes. Alternatively, the firm which chooses to compete in a number of different industries may choose to narrow the scope within each of the industries where it is present. Thus, the influence of industry-level diversification on diversity in product space and

ROA offers an alternative explanation to the commitment hypothesis tested in the present study. Therefore, we control for these effects.

DATA

The empirical test of commitment should, ideally, be designed to exclude possible sources of variation and covariation that may influence conclusions by confounding measurement and estimation. In particular, it seems important, when testing performance implications of commitment (H3 and H4), to minimize the bias of intra-firm transfer of funds. In the choice of sample for the empirical test, we were looking for an industry where all firms are independent business units so corporate effects could be excluded.

It would further be ideal if the data offered the possibility of controlling for commitment effects (irretrievable investments in physical assets) across industry boundaries. Otherwise, the empirical test may be obscured by exogenous effects caused by the basic conditions of third industries and endogenous effects caused by complementary investments across industry boundaries. Furthermore, we were looking for a mature industry, so the pertubations which are usually associated with founding effects could be excluded. Finally, since we study diversification on the level of products and product lines, we chose to focus on a single industry in order to distinguish *meaningfully* between different products and product lines.

In view of these considerations, the Danish textile industry seemed a good choice. It is an old industry (the first record of an incorporated firm dates back to 1608 although this firm is no longer in existence), virtually all firms are small independent business units and it was possible to obtain objective data which permitted control of commitment effects across industry boundaries. Diversification data and financial data were obtained from two independent and publicly available, sources.

The diversification data include a product space in terms of a complete list of the industry's products and their location in a total of eight product lines. These data were obtained from the 1997 directory of the industry association "Dansk Textil og Beklædning" which offers a complete listing of the firm's position in product space. The directory of textile firms lists the number of product lines each firm is active in, and the different products that each firm offers within the product lines within which they are active. Thus we use two nested measures of product market diversity.

Financial data were obtained from the electronic database, CD-Direct, which is published by Købmandstandens Oplysningsbureau, a purveyor of credit information about businesses. The database contains the publicly available accounting data and information about industry participation, employees, and founding year. Due to Danish legislation concerning privacy of information about individuals, Købmandsstandens Oplysningsbureau is only allowed to keep data for a 5 year period. We gathered financial data for the period 1993-1997, the years prior to, and including, the year for which we had access to diversification data for the textile industry.

The following measures were obtained to test the hypothesized model:

Financial performance

ROA: return on assets, where income is measured before tax but after interest payments and depreciation. The dependent variable is ROA for 1997.

Commitment to physical assets

FA/TA: the physical (or fixed) assets divided by total assets in a fiscal year. Data were obtained for each year in the period 1993-97.

Commitment to technology (capital intensity)

C/L: the ratio between the firm's total assets (C) and the total number of employees (L).

C^{a1}/L^{a2}: An alternative measure which corrects for scale effects and relative importance of capital and labor. The measure was computed as the ratio between the firm's total assets (C) and the total number of employees (L) under the assumption of Cobb-Douglas technology. Capital was corrected by raising C to the power of the exponent a^1 and labor by raising L to the power of the exponent a^2. The estimation of Cobb-Douglas production functions employed turnover as a proxy for output (Y), total assets as a proxy for capital (C) and number of employees as a proxy for labor (L).

Both C/L measures were computed for each year in the period 1993-97.

Product line diversity

A simple counting of the number of product lines within which the firm is active. Data were obtained for 1997. According to the industry index, textile firms can be active in up to eight product lines but the firms producing products listed in two of these (product line 7 and 8) typically have significant activities in other industries also. To examine the effects associated with these products, we computed three separate measures of product line diversity: P. Div (6) which included the firm's number of product lines out of the six product lines where activities were not associated with activities in other industries, and P. Div (7) and P. Div. (8), the categories where activities were increasingly associated with activities in other industries than the textile industry.

Product diversity

We used an adapted version of Jacquemin & Berry's (1979) entropy measure to compute an index of diversification relatedness in product space. Since we did not have data for allocation of turnover on each product, we computed the product diversification index under the assumption of linear distribution of turnover on products. The following index was computed on basis of product level diversification data for 1997: $d = \sum S_{ij} \ln(1/S_{ij}), \sim S_{ij} = k_{ij}/K_j$

Firm *i* has *k* products in product line *j* and there is a total of *K* products in *j*. Note that the linear assumption will bias estimates by exaggerating product level diversity. We computed three measures of product diversity corresponding to the inclusion of products in six, seven and eight product lines as described in the above paragraph. Note that the sum of shares do not sum to one, as in most diversification studies. As the product categories are about the same size in numbers of products, we assume that sales are evenly distributed across and within product categories. Therefore, the difference reduces to a scaling issue.

Our measures of commitment relies on the commonly used approximation of fixed costs to operationalize what is interchangeably referred to as sunk cost commitments or immobility (Caves, 1984, 1998; Ghemawat, 1991a). Commitment to physical assets is measured by the fixed asset component of total assets. We do not know whether the value of the fixed assets for our sample can be recouped without loss, however, find it reasonable that this is not so. The primary argument in support of this assumption is that both buyer and seller would incur high switching costs because the typical process equipment is specialized to the individual plant. Similar reasoning underlies the employment of the C/L measure to indicate technological commitment.

We employed the following control variables: (1) size of the firm measured as the total number of employees, (2) the age of the firm (in 1997), (3) industry diversity measured as the total number of industries the firm participates in, and (4) ROA for 1996, financial performance prior to the year we use to estimate our model. As can be seen in Table 1, below, the corrected C/L measures exhibited severe departure from normality for all years and so did ROA and size. We use these measures in estimation of all models but to test for the effects of departure from normality, employ transformed measures that do not deviate from univariate normality ($p > 0,05$). Univariate normality, however, is a necessary but not sufficient condition for obtaining unbiased maximum likelihood estimates in structural equation modeling. We also need to demonstrate multivariate normality. We shall return to this issue in the paragraphs concluding our analyses.

Table 1 about here

As shown in Table 1, on average the firms were about 21 years old (in 1997) and employed a little less than 60 people. During the period included in our data (1993-97), the Danish economy experienced an upturn and its effect is present in our data for the textile industry. On average, the firms experienced increases in ROA, turnover and total assets. The increase in total assets was associated with an increase in both fixed and current assets. How would this development influence the 1997 firm-level diversity in product space?

Clearly, 1997 is a good year also for textile firms, and, due to the expansion in capacity (fixed assets) and turnover, we should expect a relatively high level of diversity in product space. In 1997, the firms had, on average, 1,29 out of the first six product lines associated with a narrow focus on activities in the textile industry. Across the firms, however, there was large variation in the number of product lines; the standard deviation was almost in the same order of magnitude as the mean (std. dev. 0,93). The maximum number of product lines employed in the first six categories were four. Including product line categories number seven and eight, the maximum was five product lines. Note that the number of activities pursued outside the textile industry increases in categories seven and eight. If these non-textile activities draw on separate technologies and have independent effects on performance, we expect that our models loose explanatory power and decrease in overall fit as we include product lines number seven and eight. There should, however, be no change in the signs of the estimated coefficients. By contrast, if there are significant synergies between outside activities and those in product line seven and eight we may find that the signs of our estimates change as the diversity measures which include these product lines are employed.

Since the period from 1993 to 1997 exhibited an economic upturn and expansion in the Danish textile industry, the firms may have added products to existing lines and perhaps new product lines during this expansion. Unfortunately, we have no measure of the dynamics in product space, however, 1997 is clearly a year where a relatively high degree of diversity in product space should be expected due to the combined effect of increases in turnover and fixed assets from 1993 through 1997. Moreover, the expansion in fixed assets during the period introduces a bias against the commitment hypotheses when all the years prior to 1997 are included in the test. As described in the following, we use structural equation modeling employing a nested design to systematically uncover such effects. The consequence of the relatively high diversity in product space to be expected in 1997, combined with the expansion in fixed assets in the years prior to 1997, introduces a bias in favor of rejecting the commitment hypotheses. As firms expand, they should tend to include also new products and product lines. Contrary to our hypotheses (H1 and H2), this speaks in favor of a positive sign between the commitment variables and product diversity. If the empirical test fails to reject our hypotheses in the face of conditions biased against them, the support for our results will be strong. Clearly, 1997 is a good year to test our model on data from the Danish textile industry.

ANALYSES

Missing data

Our sample included a total of 405 firms with ten or more employees. We have financial data for 255 of these firms but data on turnover was limited to only 67-72 firms (depending on year)[4]. Of those 255 firms which had registered financial data, it was possible to obtain diversification data for 112 firms. So, we use this subset of 112 firms to estimate the model which provides a test of H1-H4. To examine whether these 112 firms systematically differed in characteristics from the firms excluded due to missing data, a series of ANOVA analyses were conducted[5]. The dependent variables were, for each of the five years 1993-97: ROA, turnover, total assets, fixed assets, current assets, number of employees (size). The independent variable was inclusion (>0 products registered) or exclusion (0 products registered).

The ANOVA analyses showed that the 143 excluded and the 112 included firms did not differ significantly with respect to ROA, turnover, total assets, fixed assets and current assets. By contrast the included firms on average employed 58 people and were thus significantly larger than the excluded firms which on average employed 46 people ($p < 0,05$)[6]. In consequence, apart from expecting a bias in terms of reduced size effects, it should be safe to generalize our findings to the sample of 255 firms, 63% of all Danish textile firms with 10 or more employees.

Similar ANOVA analyses were conducted to examine whether the 67-72 firms for which turnover data were available differed from the rest. It is the data for these firms which were used to estimate production functions. There were no significant differences with respect to ROA, however, all other variables exhibited significant deviation ($p < 0,00$). The firms included

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4 According to Danish legislation, public disclosure of annual turnover is voluntary for smaller firms. Most of our firms fall into this category.

5 These analyses can be obtained from the first author.

6 A supplementary test for homogeneity of variance (Levene statistics) showed little deviation in the variance between excluded and included firms for variation in ROA ($p > 0,37$ for all years), turnover ($p > 0,73$ for all years), total assets ($p < 0,05$ for two years), fixed assets ($p < 0,05$ for two years) and current assets ($p < 0,05$ for one year). There were significant differences in variance of employees for excluded and included firms.

on basis of turnover were larger, not only in terms of employees but also had higher levels of total assets, fixed assets and current assets. Therefore, we use the C/L ratio derived from estimation of production functions with caution.

Estimation of production functions

Since our data only include firms which may be characterized as business units (rather than corporations), the estimation of production functions should yield a very abstract but valid picture of the relation between the firms' current levels of capital and labor. If we can find a functional form, such as Cobb-Douglas technology, which yields robust estimates across the years, 1993-97, we may use the estimates to compute a better C/L ratio as a measure of the firm's technology. Using this improved C/L measure in the test of our model should reduce noise and thus yield more reliable estimates and stronger effects.

There is one problem with this approach, however, which should be mentioned. A C/L measure corrected for the exponents of the Cobb-Douglas function introduces non-linearities into the model. So, the combined effect should be a less noisy model (exhibiting stronger effects) and, due to an increase in non-linearities, a reduced fit. As explained in the ensuing section, it is possible to absorb the increase in non-linearities if the model employs a covariance structure which spans more years.

Table 2 about here

As shown in Figure 2, the estimation of Cobb-Douglas production functions yielded good fit. For each of the five years, at least 90% of the variation in output was explained. Moreover, the estimation of the exponents yielded comparable and (apart from the 1996 and 1997 exponents for L) significant results for each of the five years. As expected for a stable industry solely occupied by small firms, the results indicate that the firms experience decreasing returns to scale (mean value for $a^1 + a^2 = 0{,}79$). On average for the period, the impact of capital on output is four times the impact of labor. Therefore, using an estimate of the C/L ratio which implicitly assumes an equal impact of capital and labor may be seriously misleading. We use the value estimated for each year to compute corrected C/L ratios.

Empirical Test of the Hypothesized Model

We use structural equation modeling employing a series of nested models as suggested by Anderson & Gerbing (1988). We estimate five classes of models:

(0) The independence model (null structural model).

(1) The next most likely constrained model which *excludes* the effects of commitment measures in years prior to 1997. A total of six models are estimated, three for each of the two C/L measures that we employ. For each C/L measure, three models are estimated

employing the product-level diversity measures estimated for products in the first six, seven and eight product lines, respectively.

(2) An alternative to the next most likely constrained model which adds the effect of immediate past performance (ROA 1996) to the model estimated in (1). We estimate two models, one for each C/L measure.

(3) The target model which *includes* the effects of commitment measures in years prior to 1997. Two models were estimated, one for each C/L measure.

(4) The next most likely unconstrained model, including controls. Due to the added number of variables, the corrected C/L measure introduced non-linearities which resulted in an unacceptable bad fit. Therefore, we only estimate one model employing the conventional uncorrected C/L measure.

We employ sequential chi-square difference tests under the null hypothesis of no significant difference between two nested structural models (see Steiger et al., 1985). The chi-square difference between two nested models is itself asymptotically distributed as chi-square (Steiger et al., 1985). In addition to assessment of overall model fit by sequential chi-square difference tests, we used three incremental fit indices, Bentler's (1990) comparative fit index (CFI), the Tucker & Lewis (1973) index (TLI) and Bollen's (1986) relative fit index[7]. These three indices

[7] A relative fit index (as opposed to the absolute model assessment implied by the chi-square test) compares the fit between the target model and the independence model. The relative fit indices are normed within in the bounds [0,1] and 0 indicates the fit of the null model (the worst possible). 1 indicates a perfect fit.

were employed since all correct for degrees of freedom, an important requirement for the test of nested models. The CFI has been suggested as the most promising relative fit index (in the sense that it overcomes sample size dependence) but neglects the relative parsimony of alternative models. We, therefore supplement by the TLI which puts a premium on parsimony.

We used maximum likelihood estimation and subsequently evaluated the fit of the models. Table 3 presents the results for the models of class (1). To identify these models, we fixed the weights of five error terms to unity. As expected, the three first models which employ the conventional uncorrected C/L measure provide a better overall fit but have (slightly) weaker effects in terms of overall explanatory power, squared multiple correlations (SMC). As the models all have three degrees of freedom, it is clear from inspection of all goodness-of-fit indices that model 1(6) provides the better fit of the six models reported in Table 3.

Table 3 about here

When the three models that employ the conventional C/L measure are compared, it is seen that the measure of product-level diversity based on the first six product lines provides the better fit. Including seven and eight product lines as basis for computation of the diversity measure increases the noise in the data but does not change the sign of the estimates. The estimated effects are robust but weakened as noise is introduced into the diversity measure. This is especially the case when the diversity measure based on the eighth product lines is employed. The firms which have products belonging to product line seven and (especially) eight are firms which typically engage in (substantial) activities in other industries. The stability of our results when including these firms' products in the diversity measure indicates that some faith can be invested in the validity of our results. Having examined this issue on models of class (1), we concentrate on models which use the better diversification measure (including products from the first six product lines only) in the ensuing.

Next, we examined models of class (2) in order to assert whether causality runs from diversity to performance or *vice versa*. To identify these models, we fixed the weights of six error terms to unity. Of course, ROA for 1996 should influence the next year and thus increase explained variance in ROA 1997. The interesting question, however, is whether ROA for 1996 has a significant influence on either measure of diversity in product space. This is tested in models 2(6) employing the traditional C/L ratio and model 2*(6) employing the corrected C/L ratio. We report the test that uses the diversity measure for products in the six first product lines since the tests that employed the diversity measure computed for seven and eight product lines exhibit the same pattern as reported in Table 3. The effects and the model fit decreases monotonically as we add the diversity measure computed for the seventh and eighth product line.

Table 4 about here

As shown in Table 4, the result indicates that diversity drives performance and causality does not run in the reverse direction. We can thus exclude that diversity changes because of short term performance considerations such as success- or failure-induced changes in the number of products within a product lines. As expected, the explained variance in ROA 1997 increases dramatically (from 0,12 to 0,29) compared to model 1(6), the better model reported in Table 3. The explained variance in product diversity increases slightly (from 0,16 to 0,18) compared to model 1(6) but since models 2(6) and 2*(6) both show an unacceptable low fit on the incremental fit indices (below 0,90) this may be a spurious effect. Note further that the estimated coefficients do not change sign and are comparable in size to the previous models; although relatively weaker than those estimated for model 1(6). The unchanged signs combined with the perfectly consistent pattern of change in the sizes of the estimated coefficients show that our results are very robust, an indication of high reliability. Comparing models 2(6) and 2*(6) shows a decrease in model fit as the corrected C/L measure is used for estimation, a result comparable to the difference between the results for model 1(6) and 1*(6) reported in Table 3. This raises the question whether the corrected C/L measure is useless due to the non-linearities it introduces? This seems to be the case unless we can specify a model which can absorb these non-linearities.

Model 3(6) and 3*(6) uses all five years in the period 1993 to 1997 to specify a saturated covariance structure for the measure of commitment to fixed assets and for the two C/L measures, i.e., we estimated a total of ten correlation coefficients between the five data points available for each measure. This is our target model. To identify it, we fixed the weights of five error terms to unity and the covariances of the five measures of lock in to physical assets were assumed identical as were the five covariances of the C/L measures. An inspection of the fit indices show that model 3*(6), employing the corrected C/L measure, does indeed provide the better fit. Looking at the size of the correlation coefficients provides a partial answer to why model 3*(6), using the corrected C/L measure, contrary to all previous models, outperformed model 3(6) which employed the traditional C/L measure. Comparing the size of the correlation coefficients for the C/L measures shows that the lowest of the ten coefficient increase in size from 0,77 to 0,95. Since the only difference between model 3(6) and 3*(6) is the C/L measure, it seems safe to conclude that the covariance structure absorbs the noise introduced by the nonlinearities. This can only be so since the goodness-of-fit improves considerably on all indices when the more reliable (but problematic) corrected C/L measure is introduced in model 3*(6). So, what is the result of using the more reliable corrected C/L measure when its non-linear variation is absorbed?

First, we see that model 3*(6), our target model, provided the superior overall goodness-of-fit on incremental fit indices (they are all 0,97 or above), root mean square of approximation (RMSEA) and probability that the population RMSEA is greater than 0,05, an indication that the model provides a close fit (Pclose). In fact only models 1(6), 1*(6), 3(6), 3*(6) and 4(6) can be accepted on the basis of the cut-off values for these indices. A model comparison that provides a statistical test of the difference in goodness-of-fit between these models is presented in the ensuing (Table 5). Second, the improvement from using the corrected C/L measure appears as a stronger positive, and now significant, effect on product diversity. This effect is identical to the one reported in model 1*(6), Table 3, but without the loss of the model's goodness-of-fit. Third, due to the better estimate of C/L on product diversity, the explained variance of the latter variable increases slightly (from 0,16 to 0,18) when model 3*(6) is compared to model 3(6)[8].

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[8] Model 1*(6) exhibited the same result but this model could not be accepted due to its low goodness-of-fit.

Having established that the corrected C/L measure works well for our target model, it remains to be seen whether the statistical model-comparison suggests that it must be rejected in favor of model 1(6), the better alternative of the models reported in Table 3. Before turning to this issue, we shall evaluate model 4(6) which included all control variables. Model 4(6) employs the same covariance structure and assumptions about error terms as our target model, however, to identify the model we fix the weights of nine error terms to unity. Although all hypothesized effects are weakened by the inclusion of the control variables they do not change sign. The cofficients of the hypothesized effects are smaller in order of magnitude and it remains an issue for futher analyses to establish whether: (1) the number of product lines influence ROA negatively, and (2) whether commitment to technology (C/L) influences product level diversity positively. Especially, the rather large coefficients associated with the effects of diversity and performance suggest that either deviation from normality, confounding of the two diversity measures, or both, may influence the estimates. We shall return to this issue in the following. As expected, the sample selection procedure excluded size and age effects but we see that between-industry diversity influences diversity in product space within the textile industry. The diversity in products space within the textile industry increases in the number of different industries the firm participates in. The overall conclusion from examining the effects of the control variables is that we can safely conclude that the hypothesized effects are not confounded by size, age and industry-level diversity.

But how do the models compare in fit? To shed light on this question we both compared the models' absolute and relative fit (CFI-, TLI- and RFI-indices). As can be seen in Table 5 below, models 2 and 4 must be rejected in favour of models 1 and 3, both in terms of absolute and incremental fit. Model 1 cannot be rejected in favour of model 3*(6), our target model, on absolute fit, but it performs better on the relative fit indices.

Table 5 about here

The main conclusion from the model comparison is that our target model must be accepted in favour of the alternatives. In terms of the hypothesized effects, the preliminary and cautious conclusion is that: (1) product-level diversity decreases in commitment to fixed assets (supporting H1) and increases in commitment to technology (rejecting H2), (2) product line diversity decreases in commitment to fixed assets (supporting H1) but is not influenced by commitment to technology (rejecting H2), (3) financial performance decreases in product-line diversity (supporting H3), and increases in product-level diversity (supporting H4). As aforementioned, the departure from normality is a source of concern that must be addressed before we can invest confidence in these conclusions.

Departure from normality. Three variables departed severely from univariate normality and further caused a large departure from multivariate normality (see Appendix B). By applying suitable transformations, it was possible to obtain univariate normality in these variables (see Table 1) and strongly reduce the departure from multivariate normality (Appendix B). We further conducted an outlier analysis, and, using Mahalanobis D, identified five extreme observations. We then re-estimated models 1(6), 1*(6), 3(6) and 3*(6) to test whether our previous findings were consistent with estimates based on the transformed data, and the exclusion of extreme observations.

Table 6 about here

The first two models and shown in Table 6, 1**(6) and 3**(6), were estimated on the basis of the transformed data. Remembering that the transformed C/L measure was inverted, both the signs and the order of magnitude of the effects were remarkably robust across the estimations. Bearing the inversion of the C/L measure in mind, all effects across the models employing the raw and the transformed measures have identical signs and comparable order of magnitude. Also the overall fit is comparable between models employing raw and transformed data. It is better, however, in the models employing raw data. Although models 1**(6) and 3**(6) reduced the deviation from multivariate normality, also the extreme observations identified through outlier analysis had to be excluded in order to obtain multivariate normality.

Turning to models 1***(6) and 3***(6) which excluded the extreme observations, we see that the coefficients of the estimates of both commitment to fixed assets and technology are largely unchanged. By contrast, both the coefficients estimating the effects of diversity in product space on performance decrease. Since model 1***(6) is estimated under multivariate normality, it must be concluded that product-level diversity influences performance positively but the effect of product-line diversity is more complex. Through all models, the coefficient of product-level diversity is negative but inflated, and when the five extreme observations are excluded, it looses significance. We conducted a separate ANOVA analysis (not reported here) to obtain univariate estimates of the effects of product-line and product-level diversity on performance. This ANOVA-analysis confirmed the negative sign of product-line diversity (p= 0,14) and the positive sign of product-level diversity (p= 0,01). Moreover, the interaction term between product-level and -line diversity was not significant. A further analysis showed that the exclusion of the 52 firms which only have one product-line did not influence these conclusions. The explanation for the inflated coefficient of product-line diversity on performance thus turned out to be that the a few extreme observations swamped the estimates of these coefficients.

It thus turned out that the combined effects of departure from normality, extreme values and swamping of the product-level effect by a few extreme observations was the cause of the inflated measures of product-diversity on performance. As these biases were excluded, the effects remained remarkably stable indicating that, with some confidence, we can conclude: (1) product-level diversity decreases in commitment to fixed assets (supporting H1) and increases in commitment to technology (rejecting H2), (2) product-line diversity decreases in commitment to fixed assets (supporting H1) but is not influenced by commitment to technology (rejecting H2), (3) financial performance increases in product-level diversity (supporting H4) and decreases in product-line diversity (supporting H3) but for most firms the latter effect is not significant (rejecting H3).

A remark on the rejection of H2 may be called for. Clearly, C/L turned out to be a bad indicator for commitment to a specialized technology, a fact which was supported by a supplementary repeated measures ANOVA-analysis (not reported here). This analysis showed that the variation in C/L across years is significant wherease the variation in the ratio of fixed to total assets is not. Our results show that product-level diversity, and thus performance, increases in capital-intensity (C/L). The number of product-lines employed also increases in capital-intensity but this effect is not significant. In short, since product-level (and perhaps product-line) diversity increases in the C/L measure, it must probably be viewed as a measure of flexibility rather than commitment. Note that our industry sample is an industry where outsourcing of many manufacturing activities to low labor cost nations is often chosen. Use of outsourcing will tend to decrease the number of employees to current assets, and most likely also fixed assets. Thus *in our particular sample*, we may experience a mediating effect of organizational form (outsourcing). This issue seems worth pursuing in future research, a topic we consider in the following section.

DISCUSSION AND CONCLUSION

In this paper, we provided an empirical analysis which helps to fill a gap in previous resource-based diversification research. The resource-based view suggests that the causes for diversification should be found in the firm's resource stock, however, suffers from its neglect of the combined effect of product market and factor market imperfections' influence on performance (Ghemawat, 1991b). Our results suggest that this neglect is problematic and that future diversification research needs to take on the difficult task of considering the trade-offs between supply and demand-side causes for diversification. A first step in this direction is suggested by the findings in the present paper.

According to our results, product market diversity is inversely related to commitment; the theoretical link suggested by Ghemawat's (1991a, 1991b) argument concerning the relation between factor market investments and product market positions.

The results speak in favor of the interpretation that commitment affects product market diversity at the level of individual products within product lines. The higher the commitment to physical capital, the more narrow the scope of the product portfolio, both at the level of product lines and individual products within product lines. By contrast, the more specialized the technology (higher C/L ratio), the less the diversity at the level of individual products. Moreover, our data showed that technology did not influence diversity at the level of product lines.

Since our results further show a clear positive performance-effect of increased diversity at the level of products within product lines, the conclusion seems straightforward. More flexible technology increases financial performance through advantages of product market scope whereas higher commitment to physical capital (sunk costs) reduce product market diversity and, therefore, financial performance. The latter effect may be attributed to flexibility in the sense that commitment to physical capital is flexibility reducing. Even if the effect is weak, it is further remarkable that diversity at the level of product lines is negatively related to financial performance.

A fundamental question is the reliability of the results obtained in the present analysis and the extent to which the results can be generalized to a wider context. As reported, a detailed reliability assessment was conducted. It included estimation of a number of models which provided an elaborate test for the effect of third variables, i.e., our results were not confounded by size, age, industry-level diversity and past performance. We also examined how the analyses employing transformed measures (adjusted so univariate and multivariate normality was obtained) compared to those using raw measures. The finding that the results remained stable across raw and normality-adjusted measures indicate high reliability. Moreover, we tested a series of models that used measures for six, seven and eight product lines, the significance of which is that unrelated activities increase in product lines seven and eight. Since the results remained unbiased (signs did not change) but weakened when measures of unrelated activities were included, a further indication of high validity was obtained. In sum, it seems safe to conclude that our results cannot be attributed to control variables, deviation from normality or the influence of activities in unrelated industries. Since the hypotheses developed in the paper were not dependent on a specific industry context, our results provide a first step towards generalization.

However, it is worrying that our results also rejected H2, i.e., by showing that the actual relation between capital intensity and the diversity of individual products (within product lines) was significant and positive (models: 3*, 1*** and 3***). One possible explanation for this finding is the existence of industry specific factors which mediate the proposed relationship. Alternatively, the finding may be explained by the tendency for outsourcing to increase the value of the capital intensity measure. This would tend to be the case since outsourcing unidirectionally reduces the number of employees and, at the same time, reductions in manufacturing equipment are offset by increased investments in logistics and possibly the inventory of finished goods. If true, our findings regarding H2 could be read as suggesting that performance increases in oursourcing. Finally, the positive relation between capital intensity and diversity may simply be explained by the increased flexibility of better technology. Future research clearly needs to explore the underlying processes and mechanisms of this relation, i.e., by employing more detailed measures of costs or benefits associated with product market diversity.

We have provided a first step in this direction. Further steps may proceed along the outlined path, focusing on the delicate balance between resource specialization and product market diversity. This line of research may be viewed as a complement to the existing interest in corporate diversification found in the resource-based view. A general conclusion emerging from our results is that the sources of competitive advantage should not be sought solely in the firm's resource base, neither at the industry level but in the interaction between the two. A proposition that is supported by the strong positive effect of industry diversity on both product and product line diversity found in our empirical test.

The main contribution of the present paper is to provide empirical evidence for the causes for and influence of diversity at a very detailed level of analysis. Moreover, our results point towards a link between business unit level research and corporate level research on diversity. Potentially this involves theoretical as well as empirical research which pursues identification of causes for diversification in the relation between organizational microprocesses, commitment, product market diversity and performance. An endeavour which has barely begun. Following Montgomery's (1994) review of diversification research, this admittedly ambitious research agenda may usefully include a comparative test of competing explanations for diversification provided by the resource-based view and agency theory.

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TABLE 1

DESCRIPTIVES

	Mean	Std. Deviation	Skewness	Kurtosis	KS-Test**** P
ROA, 97	5,86	13,21	-0,48	4,40	0,05
ROA, 96	4,54	13,97	-1,55	4,00	0,03
ROA, 97*	1,14	0,27	0,62	4,20	0.14
ROA, 96*	1,11	0,26	-0,81	1,75	0,20
Product diversity, 6 PL	0,36	0,28	0,91	1,16	0,00
Product diversity, 7 PL	0,41	0,26	1,17	2,07	0,00
Product diversity, 8 PL	0,46	0,28	1,25	1,46	0,00
No. of product lines, 6 PL	1,29	0,93	0,61	0,16	0,00
No. of product lines, 7 PL	1,46	0,88	1,12	2,18	0,00
No. of product lines, 8 PL	1,63	0,92	1,45	2,43	0,00
C/L, 97	761,01	466,22	1,58	4,39	0,15
C/L, 96	707,13	474,99	1,85	4,86	0,03
C/L, 95	669,60	471,05	1,77	3,37	0,00
C/L, 94	629,18	474,55	2,05	4,72	0,00
C/L, 93	621,57	464,43	1,78	3,06	0,00
Corrected C/L, 97	319,68	251,03	2,77	10,72	0,00
Corrected C/L, 96	389,52	327,27	3,13	14,20	0,00
Corrected C/L, 95	170,93	106,19	2,20	7,10	0,02
Corrected C/L, 94	370,92	272,90	2,49	8,85	0,00
Corrected C/L, 93	477,05	363,61	2,52	9,42	0,01
Corrected C/L, 97**	0,42	0,05	0,23	-0,20	0,80
Corrected C/L, 96**	0,41	0,05	0,09	-0,43	0,92
Corrected C/L, 95**	0,47	0,05	0,18	-0,32	0,98
Corrected C/L, 94**	0,41	0,04	0,17	-0,32	0,97
Corrected C/L, 93**	0,39	0,04	0,26	-0,36	0,77
Fixed Assets/ Total Assets, 97	0,36	0,22	0,79	0,28	0,16
Fixed Assets/ Total Assets, 96	0,36	0,21	0,70	0,44	0,26
Fixed Assets/ Total Assets, 95	0,36	0,21	0,71	0,48	0,30
Fixed Assets/ Total Assets, 94	0,36	0,21	0,71	0,15	0,26
Fixed Assets/ Total Assets, 93	0,36	0,21	0,60	0,07	0,51
Age	20,75	9,13	0,12	-1,23	0,10
Size	57,77	78,63	4,19	23,92	0,00
Size***	0,04	0,03	0,46	-0,91	0,21
Industry Diversity	2,28	0,71	0,31	-0,34	0.16

*ROA_{9x}, transformed =$[1+(ROA_{9x}/100)]^2$.

**C/L_{9x} adjusted, transformed = Log $[1/(C/L_{9x})]$.

***Size, transformed = 1/Size.

****KS-Test, P: P-value, one-sample Kolmogorov-Smirnov test for normality.

TABLE 2

CAPITAL/ LABOUR: ESTIMATION OF COBB-DOUGLAS EXPONENTS

Year	Exponents*								
	a^1	Cfi. L**	Cfi. U	a^2	Cfi. L	Cfi. U	a^1+a^2	R^2	n
1997	0.6	0.48	0.71	0.13	-0.01	0.28	0.73	0.91	68
1996	0.61	0.5	0.73	0.1	-0.04	0.25	0.71	0.93	67
1995	0.57	0.46	0.67	0.19	0.07	0.32	0.76	0.93	68
1994	0.65	0.54	0.76	0.2	0.08	0.31	0.85	0.94	72
1993	0.68	0.56	0.8	0.21	0.09	0.34	0.89	0.94	72
Mean	0.62	---	---	0.17	---	---	0.79	---	---

*$Y = C^{a1} L^{a2} \epsilon$; Y≡ Turnover, C≡ Capital, L≡ Labour, ϵ≡ Error.

**Asymptotic 95% confidence interval; Cfi. L: Lower bound, Cfi. U: Upper bound

TABLE 3

	Model 1 (6)		Model 1 (7)		Model 1 (8)		Model 1* (6)		Model 1*(7)		Model 1*(8)	
	Std.	**P**	**Std.**	**P**	**Std.**	**P**	**Std.**	**P**	**Std.**	**P**	**Std.**	**P**
P. Div. ---> ROA	0,72	0,00	0,63	0,00	0,60	0,01	0,72	0,00	0,64	0,00	0,60	0,01
No. P. Lines ---> ROA	-0,43	0,06	-0,34	0,07	-0,35	0,07	-0,43	0,06	-0,34	0,07	-0,35	0,07
FA/ TA ---> P. Div.	-0,39	0,00	-0,31	0,00	-0,14	0.07	-0,39	0,00	-0,31	0,00	-0,15	0,06
FA/ TA ---> No. P. Lines	-0.36	0	-0,25	0,00	-0,11	0,12	-0,36	0,00	-0,25	0,00	-0,11	0,11
C/ L ---> P. Div.	0,12	0.08	0.16	0,04	0,10	0,13	0,16	0,04	0,17	0,03	0,16	0,04
C/ L ---> No. P. Lines	0,10	0,14	0,13	0.08	0.08	0,20	0,09	0,15	0,10	0,14	0,09	0,17
Correlations												
No. P. Lines <---> P. Div.	0.94	0,00	0,92	0,00	0,93	0,00	0,94	0,00	0,92	0,00	0,93	0,00
Goodness-of-Fit												
D.f.	3		3		3		3		3		3	
χ^2	5,80	0,120	5,96	0,11	8,69	0.03	8.54	0	8.93	0,03	11,30	0,01
Cmin/d.f.	1,93		1,99		2,90		2,85		2,98		3,77	
NFI, RFI, IFI, TLI, CFI	0,93		0,92		0,88		0,90		0,88		0,85	
RMSEA	0,09		0,09		0,13		0,13		0,13		0,16	
Pclose	0.21		0.2		0.08		0.08		0.07		0.03	
SMC												
Product diversity	0,16		0,12		0,03		0,18		0,13		0,05	
No. of product lines	0,14		0,08		0,02		0,14		0,07		0,02	
ROA, 97	0,12		0,12		0,09		0,12		0,12		0,09	

Number in parantheses: the number of product lines included in the test.

*In these models the C/L ratio is corrected for returns to scale, c.f. estimates of Cobb-Douglas functions.

TABLE 4

Year		Model 2		Model 2*		Model 3		Model 3*		Model 4	
97	P. Div. ---> ROA	0.57	0,01	0.57	0,01	0.72	0,01	0.72	0,00	0,52	2
97	No. P. Lines ---> ROA	-0.35	0.08	-0.35	0,08	-0,43	0,06	-0,43	0,06	-0,31	0,10
97	FA/ TA ---> P. Div.	-0,38	0	-0.39	0	-0.39	0,00	-0,39	0,00	-0,33	0,00
97	FA/ TA ---> No. P. Lines	-0,35	0	-0.35	0	-0.36	0,00	-0,36	0,00	-0,29	0,00
97	C/ L ---> P. Div.	0,09	0.12	0.12	0.08	0,12	0.08	0,16	0,04	0,06	0,23
97	C/ L ---> No. P. Lines	0,07	0.22	0.06	0.24	0,10	0.14	0,09	0,15	0,04	0,31
	Correlations										
	No. P. Lines <---> P. Div.	0.94	0	0,94	0	0,94	0,00	0,94	0,00	0.94	0,00
93-97	93-77, all years: FA/ TA	---	---	---	---	>0,81	0	>0,79	0	>0,81	0
93-97	93-77, all years: C/L**	---	---	---	---	>0,77	0	>0,95	0	>0,77	0
	Size <--> Age	---	---	---	---	---	---	---	---	0,23	0.01
	Controls										
96-97	ROA, 1996 ---> ROA, 97	0.44	0,00	547	0	---	---	---	---	0,43	0
96-97	ROA, 1996 ---> P Div.	0.13	0,07	1,36	0.09	---	---	---	---	0.09	0.14
96-97	ROA, 1996 ---> No. PL	0.11	0,13	1,21	0.11	---	---	---	---	0,08	0.18
97	Age ---> P. Div.	---	---	---	---	---	---	---	---	-0,06	0.27
97	Age ---> No. P. Lines	---	---	---	---	---	---	---	---	-0,01	0.48
97	Age ---> ROA	---	---	---	---	---	---	---	---	-0,04	0.31
97	Age ---> Industry diversity	---	---	---	---	---	---	---	---	0,00	0.5
97	Size ---> P. Div.	---	---	---	---	---	---	---	---	0,03	0.38
97	Size ---> No. P. Lines	---	---	---	---	---	---	---	---	-0,04	0.32
97	Size ---> ROA	---	---	---	---	---	---	---	---	0.06	0.26
97	Size ---> Industry diversity	---	---	---	---	---	---	---	---	0.06	0.26
97	Industry diversity ---> P. Div.	---	---	---	---	---	---	---	---	0,24	0
97	Industry div. ---> No. P. Lines	---	---	---	---	---	---	---	---	0,25	0
97	Industry diversity ---> ROA	---	---	---	---	---	---	---	---	0,03	0.38
	Goodness-of-Fit										
	D.f.	5	0,03	5	0.01	51	0,03	51	0,12	94	0,00
	χ^2	12.24		14.4		71.1		62.95		140	
	Cmin/d.f.	2,45		2,88		1.39		1,23		1,49	
	NFI, RFI, IFI, TLI, CFI	0,89		0,87		0.95		0,97		0,92	
	RMSEA	0,11		0,13		0.06		0.05		0.07	
	Pclose	0.09		0.04		0.3		0.55		0.12	
	SMC										
	Product diversity	0,17		0,18		0,16		0,18		0.18	
	No. of product lines	0,14		0,14		0,14		0,14		0,15	
	ROA, 97	0,29		0,29		0,12		0,12		0,28	
	Industry diversity	---		---		---		---		0,00	

All models test 6 product lines.

*In these models the C/L ratio is corrected for returns to scale, c.f. estimates of Cobb-Douglas functions.

**Numeric values

TABLE 5

MODEL SUMMARY AND MODEL COMPARISONS

Model summary	df	χ^2	P	CFI	TLI	RFI
Fit of model 1 (6 product lines)	3	5,80	0,12	0,99	0,97	0,93
Fit of model 1 (7 product lines)	3	5,96	0,11	0,99	0,96	0,92
Fit of model 1 (8 product lines)	3	8,69	0,03	0,98	0,92	0,88
Fit of model 1* (6 product lines)	3	8,54	0,04	0,98	0,94	0,90
Fit of model 1* (7 product lines)	3	8,93	0,03	0,98	0,92	0,88
Fit of model 1* (8 product lines)	3	11,30	0,01	0,97	0,88	0,85
Independence Model	10	240,66	0,00	---	---	---
Fit of model 2 (6 product lines)	5	12,24	0,03	0,98	0,93	0,89
Fit of model 2* (6 product lines)	5	14,40	0,01	0,97	0,91	0,87
Independence Model	15	275,42	0,00	---	---	---
Fit of model 3 (6 product lines)	51	71,10	0,03	0,99	0,99	0,95
Fit of model 3* (6 product lines)	51	62,95	0,12	1,00	0,99	0,97
Independence Model	78	2222,46	0,00	---	---	---
Fit of model 4 (6 product lines)	94	140,00	0,00	0,98	0,97	0,92
Independence Model	136	2336,82	0,00	---	---	---
Model comparisons	**df**	$\Delta\chi^2$	**P**	**ΔCFI**	**ΔTLI**	**ΔRFI**
Model 1 (6) against model 2 (6)	2	6,44	0,04	-0,01	-0,04	-0,05
Model 1 (6) against model 2* (6)	2	8,60	0,01	-0,02	-0,06	-0,07
Model 1 (6) against model 3 (6)	48	65,30	0,05	0,00	0,02	0,02
Model 1 (6) against model 3* (6)	48	57,15	0,17	0,01	0,03	0,03
Model 1 (6) against model 4 (6)	91	134,20	0,00	-0,01	0,00	-0,02
Model 1* (6) against model 2 (6)	2	3,70	0,16	-0,01	-0,01	-0,02
Model 1* (6) against model 2* (6)	2	5,86	0,05	-0,01	-0,03	-0,04
Model 1* (6) against model 3 (6)	48	62,56	0,08	0,01	0,05	0,05
Model 1* (6) against model 3* (6)	48	57,15	0,17	0,01	0,03	0,03
Model 1* (6) against model 4 (6)	91	131,46	0,00	0,00	0,03	0,01
Model 2 (6) against model 3 (6)	46	58,86	0,10	0,02	0,06	0,07
Model 2 (6) against model 3* (6)	46	50,71	0,29	0,02	0,06	0,08
Model 2 (6) against model 4 (6)	89	127,76	0,00	0,00	0,04	0,03
Model 2* (6) against model 3 (6)	46	56,70	0,13	0,02	0,08	0,08
Model 2* (6) against model 3* (6)	46	48,55	0,37	0,03	0,08	0,10
Model 2* (6) against model 4 (6)	89	125,60	0,01	0,01	0,06	0,05
Model 3 (6) against model 4 (6)	43	68,90	0,01	-0,01	-0,02	-0,04
Model 3* (6) against model 4 (6)	43	77.05	0	-0.02	-0.02	-0.05

Number in parantheses: the number of product lines included in the test.

TABLE 6

MODELS EMPLOYING TRANSFORMED MEASURES

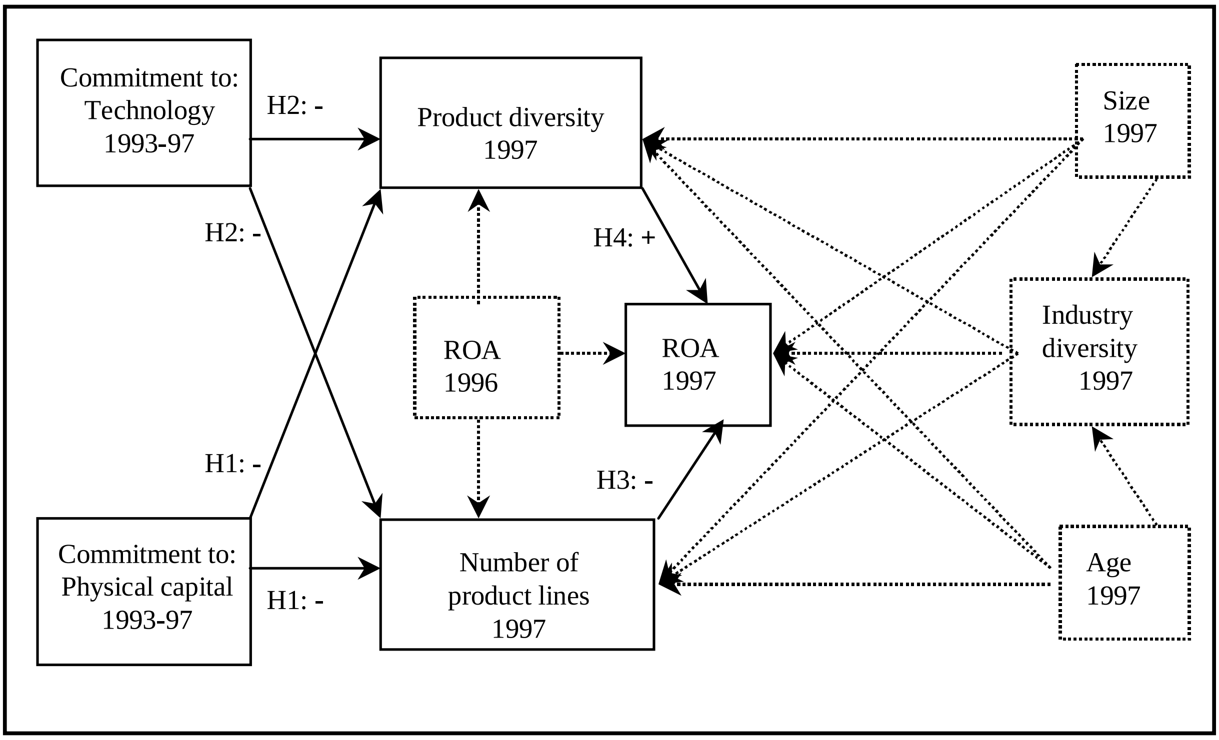
	Model 1**		Model 3**		Model1***		Model 3***	
Year	**Std. est.**	**P**	**Std. est.**	**P**	**Std. est.**	**P**	**Std. est.**	**P**
97 P Div ---> ROA	0,70	0,01	0,70	0,01	0,57	0,02	0,57	0,02
97 No. PL ---> ROA	-0,39	0,07	-0,39	0,07	-0,21	0,22	-0,21	0,22
97 FA/ TA ---> P Div	-0,39	0,00	-0,39	0,00	-0,42	0,00	-0,42	0,00
97 FA/ TA ---> No. PL	-0,36	0,00	-0,36	0,00	-0,37	0,00	-0,37	0,00
97 C/ L ---> P Div	-0,17	0,03	-0,17	0,03	-0,17	0,03	-0,17	0,03
97 C/ L ---> No. PL	-0,10	0,12	-0,10	0,12	-0,10	0,12	-0,11	0,12
Correlations/ covariance								
No. PL <---> P Div	0,94	0,00	0,94	0,00	0,94	0,00	0,94	0,00
93-97 93-77, all years: FA/ TA	---	---	>0,79	0,00	---	---	>0,79	0,00
93-97 93-77, all years: C/L	---	---	>0,96	0,00	---	---	>0,96	0,00
Goodness-of-Fit measures								
D.f.	3	0,09	51	0,01	3	0,06	51	0,01
χ^2	6,59		76,73		7,47		77,37	
Cmin/d.f.	2,20		1,51		2,49		1,52	
NFI, RFI, IFI, TLI, CFI	0,93		0,96		0,92		0,96	
RMSEA	0,10		0,07		0,12		0,07	
SMC								
Product diversity	0,18		0.18		0,20		0,20	
No. of product lines	0,14		0.14		0,14		0,14	
ROA, 97	0,12		0.12		0,14		0,14	
Industry diversity	---		---		---		---	

**Models employing transformed measures of: ROA, Corrected C/L measure and Size.

***Models excluding extreme observations *and* employing transformed measures of: ROA, Corrected C/L measure and Size.

FIGURE 1

MODEL OVERVIEW: HYPOTHESES AND CONTROLS



*Causal relations according to hypotheses, H1-H4. Dotted lines show controls.

APPENDIX A

CORRELATIONS

Product diversity, 8 PL													
Sig. (2-tailed)													
Product diversity, 7 PL	0,90												
Sig. (2-tailed)	0,00												
Product diversity, 6 PL	0,82	0,93											
Sig. (2-tailed)	0,00	0,00											
No. Of product lins, 8 PL	0,93	0,83	0,75										
Sig. (2-tailed)	0,00	0,00	0,00										
No. Of product lins, 7 PL	0,83	0,92	0,85	0,92									
Sig. (2-tailed)	0,00	0,00	0,00	0,00									
No. Of product lins, 6 PL	0,76	0,87	0,95	0,82	0,91								
Sig. (2-tailed)	0,00	0,00	0,00	0,00	0,00								
Industry diversty	0,18	0,25	0,33	0,19	0,26	0,33							
Sig. (2-tailed)	0,06	0,01	0,00	0,04	0,01	0,00							
C/L , 97	0,09	0,12	0,08	0,07	0,10	0,05	0,03						
Sig. (2-tailed)	0,36	0,21	0,41	0,48	0,29	0,57	0,71						
C/L, 96	0,01	0,03	-0,03	0,00	0,02	-0,05	-0,07	0,89					
Sig. (2-tailed)	0,94	0,78	0,75	0,99	0,83	0,60	0,49	0,00					
C/L, 95	0,01	0,03	-0,04	0,02	0,05	-0,05	-0,09	0,84	0,96				
Sig. (2-tailed)	0,93	0,71	0,69	0,84	0,63	0,61	0,37	0,00	0,00				
C/L, 94	0,02	0,03	-0,04	0,03	0,05	-0,05	-0,08	0,79	0,91	0,96			
Sig. (2-tailed)	0,87	0,73	0,65	0,72	0,58	0,60	0,39	0,00	0,00	0,00			
C/L, 93	-0,02	0,01	-0,08	0,00	0,03	-0,09	-0,09	0,77	0,89	0,93	0,95		
Sig. (2-tailed)	0,84	0,89	0,41	0,99	0,76	0,36	0,34	0,00	0,00	0,00	0,00		
Corrected C/L, 97	0,14	0,12	0,10	0,07	0,06	0,04	-0,04	0,61	0,60	0,57	0,52	0,48	
Sig. (2-tailed)	0,15	0,19	0,29	0,45	0,50	0,68	0,68	0,00	0,00	0,00	0,00	0,00	
Corrected C/L, 96	0,12	0,11	0,09	0,06	0,05	0,03	-0,04	0,57	0,59	0,57	0,51	0,47	0,99
Sig. (2-tailed)	0,20	0,25	0,37	0,54	0,60	0,79	0,64	0,00	0,00	0,00	0,00	0,00	0,00
Corrected C/L, 95	0,12	0,11	0,07	0,06	0,05	0,01	-0,07	0,64	0,68	0,69	0,64	0,59	0,97
Sig. (2-tailed)	0,22	0,26	0,47	0,55	0,58	0,92	0,44	0,00	0,00	0,00	0,00	0,00	0,00
Corrected C/L, 94	0,09	0,08	0,05	0,03	0,02	-0,01	-0,08	0,62	0,66	0,67	0,65	0,59	0,95
Sig. (2-tailed)	0,33	0,39	0,61	0,74	0,80	0,88	0,39	0,00	0,00	0,00	0,00	0,00	0,00
Corrected C/L, 93	0,08	0,08	0,04	0,02	0,02	-0,03	-0,08	0,61	0,66	0,66	0,63	0,61	0,95
Sig. (2-tailed)	0,41	0,42	0,68	0,85	0,86	0,79	0,38	0,00	0,00	0,00	0,00	0,00	0,00
Fixed Assets/ Total Assets, 97	-0,13	-0,29	-0,37	-0,10	-0,24	-0,35	-0,29	0,12	0,14	0,16	0,16	0,12	0,14
Sig. (2-tailed)	0,19	0,00	0,00	0,28	0,01	0,00	0,00	0,22	0,15	0,09	0,10	0,20	0,14
Fixed Assets/ Total Assets, 96	-0,10	-0,27	-0,33	-0,10	-0,24	-0,32	-0,29	0,09	0,08	0,11	0,10	0,06	0,10
Sig. (2-tailed)	0,27	0,00	0,00	0,29	0,01	0,00	0,00	0,32	0,39	0,27	0,31	0,50	0,27
Fixed Assets/ Total Assets, 95	-0,13	-0,31	-0,36	-0,14	-0,30	-0,36	-0,26	0,09	0,07	0,07	0,06	0,03	0,08
Sig. (2-tailed)	0,17	0,00	0,00	0,13	0,00	0,00	0,01	0,33	0,47	0,46	0,56	0,78	0,38
Fixed Assets/ Total Assets, 94	-0,11	-0,29	-0,34	-0,11	-0,26	-0,32	-0,22	0,18	0,18	0,18	0,17	0,14	0,09
Sig. (2-tailed)	0,24	0,00	0,00	0,27	0,01	0,00	0,02	0,06	0,06	0,06	0,07	0,13	0,35
Fixed Assets/ Total Assets, 93	-0,11	-0,30	-0,35	-0,12	-0,28	-0,34	-0,21	0,18	0,16	0,16	0,15	0,11	0,10
Sig. (2-tailed)	0,24	0,00	0,00	0,21	0,00	0,00	0,03	0,05	0,10	0,09	0,11	0,26	0,30
ROA, 97	0,27	0,32	0,31	0,20	0,25	0,25	0,09	0,17	0,17	0,12	0,15	0,14	0,22
Sig. (2-tailed)	0,00	0,00	0,00	0,03	0,01	0,01	0,35	0,08	0,08	0,19	0,12	0,14	0,02
ROA, 96	0,18	0,16	0,17	0,14	0,13	0,14	0,13	0,26	0,25	0,24	0,25	0,24	0,26
Sig. (2-tailed)	0,06	0,09	0,08	0,14	0,18	0,14	0,18	0,01	0,01	0,01	0,01	0,01	0,01
Age	0,00	-0,04	-0,06	0,03	0,00	-0,03	-0,01	0,21	0,19	0,20	0,20	0,22	0,26
Sig. (2-tailed)	0,99	0,67	0,50	0,76	0,96	0,74	0,93	0,03	0,05	0,03	0,04	0,02	0,00
Size	0,07	0,03	0,02	0,00	-0,03	-0,04	-0,08	0,29	0,33	0,29	0,24	0,21	0,91
Sig. (2-tailed)	0,49	0,75	0,84	0,97	0,79	0,69	0,39	0,00	0,00	0,00	0,01	0,03	0,00

CORRELATIONS, CTD.

Corrected C/L, 95	0,97											
Sig. (2-tailed)	0,00											
Corrected C/L, 94	0,96	0,99										
Sig. (2-tailed)	0,00	0,00										
Corrected C/L, 93	0,96	0,98	0,99									
Sig. (2-tailed)	0,00	0,00	0,00									
Fixed Assets/ Total Assets, 97	0,14	0,14	0,14	0,13								
Sig. (2-tailed)	0,15	0,14	0,15	0,18								
Fixed Assets/ Total Assets, 96	0,10	0,12	0,11	0,10	0,93							
Sig. (2-tailed)	0,28	0,22	0,25	0,29	0,00							
Fixed Assets/ Total Assets, 95	0,09	0,10	0,10	0,09	0,89	0,94						
Sig. (2-tailed)	0,35	0,32	0,31	0,34	0,00	0,00						
Fixed Assets/ Total Assets, 94	0,09	0,11	0,13	0,12	0,81	0,87	0,90					
Sig. (2-tailed)	0,36	0,23	0,18	0,19	0,00	0,00	0,00					
Fixed Assets/ Total Assets, 93	0,09	0,11	0,13	0,11	0,79	0,84	0,87	0,95				
Sig. (2-tailed)	0,35	0,23	0,19	0,24	0,00	0,00	0,00	0,00				
ROA, 97	0,20	0,19	0,20	0,19	-0,21	-0,21	-0,21	-0,17	-0,11			
Sig. (2-tailed)	0,04	0,05	0,03	0,04	0,02	0,03	0,03	0,08	0,25			
ROA, 96	0,25	0,24	0,23	0,22	-0,05	-0,11	-0,13	-0,05	0,03	0,48		
Sig. (2-tailed)	0,01	0,01	0,01	0,02	0,63	0,26	0,17	0,56	0,78	0,00		
Age	0,27	0,29	0,27	0,27	0,11	0,11	0,09	0,15	0,13	-0,04	-0,11	
Sig. (2-tailed)	0,00	0,00	0,00	0,00	0,23	0,23	0,36	0,10	0,17	0,70	0,25	
Size	0,92	0,84	0,85	0,85	0,14	0,10	0,09	0,06	0,05	0,15	0,17	0,23
Sig. (2-tailed)	0,00	0,00	0,00	0,00	0,15	0,31	0,35	0,50	0,60	0,12	0,07	0,01

APPENDIX B

TEST FOR MULTIVARIATE NORMALITY

C/L measure			Transformed measures	Excluding extreme observations	Transformation *and* exclusion
C/L	Model 1(6)	7,78	---	1,28	---
Corrected C/L	Model 1*(6)	11,41	4,68	6,61	1,99
C/L	Model 3(6)	22,43	---	19,56	---
Corrected C/L	Model 3*(6)	26,65	13,06	24,82	13,07
C/L	Model 4(6)	22,72	---	19,55	---
Corrected C/L	Model 4*(6)	22,46	13,25	20,81	12,05

*The tabel shows critical ratios for multivariate normality