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Competition from Specialized Firms and the Diversification–Performance Linkage

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ABSTRACT

In this study, we show that the effect of diversification on performance is not homogeneous across industries and explore analytically and empirically the implications of this finding for the diversification literature. Diversified firms perform better in industries with a small number of nondiversified competitors or, equivalently, when specialized firms have a small combined market share, but worse as the presence of specialized firms increases in the industries in which they compete. The results are robust to the use of methods that alleviate the self-selection problem and call for a reassessment of the diversification–performance relationship.

Firm diversification has been widely researched both theoretically and empirically in the fields of Corporate Finance, Industrial Organization, and Strategic Management for more than 30 years. The main common goal of this work has been to determine the effect of diversification on the creation or destruction of firm value. Thus, the research focus has been on the relative performance of diversifiers versus specialized firms (i.e., nondiversifiers that operate only in one industry). However, few studies directly address the fundamental question of how the diversification–performance linkage varies across industries. The underlying argument in our paper is that diversification strategies could systematically create shareholder value in some industries but destroy it in others.

Previous studies overlook this point focusing on the estimation of an average effect of diversification on performance that is homogeneous across industries. Our goal is to investigate how the effect of diversification on performance varies depending on the industry. We then consider how our results affect the interpretation of previous findings on this topic. In this paper, we report clear evidence that diversified firms observe a diversification discount *if and only if* they compete in industries with a large number of single-segment companies or, equivalently, when specialists hold a considerable market share. In contrast, diversified firms enjoy a premium in those industries in which only a few nondiversified firms compete or, by the same logic, in those industries in which specialists capture a small market share.

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Apart from some technical adjustments, our findings do not challenge the identification strategy of the earlier literature on the diversification discount as long as we reinterpret the evidence as an average effect of diversification across industries with the limitations that this implies. However, our arguments may affect more substantially some of the instruments that the more recent diversification literature employs to address self-selection problems (Campa and Kedia (2002), Villalonga (2004a)), as we discuss intuitively in Section VI and formally in Appendix B. Our results are robust to the use of different specifications including econometric techniques that control for the existence of self-selection.

The rest of the paper is structured as follows. In Section I, we briefly review the literature on the diversification discount. Section II discusses more extensively the theoretical arguments about how and why different industry characteristics could affect the relative performance of diversified versus specialized firms. Section III discusses the methodology, and Section IV describes the data and empirical findings. Section V tests the robustness of our findings with different specifications. Section VI concludes the paper with a discussion of the key findings in this study and their implications for the diversification–performance relationship.

I. The Diversification–Discount Literature

A large body of literature has studied the so-called diversification discount.[1] Lang and Stulz (1994), Berger and Ofek (1995), and Servaes (1996), for instance, provide strong evidence that conglomerates trade at a discount compared with specialized companies. The interpretation of this empirical finding has been that "diversification destroys value." Among other reasons discussed in the literature (Martin and Sayrak (2003)), this value destruction could be due to inefficient internal capital markets (Stulz (1990)) or to influence costs that arise as a result of internal power struggles (Rajan, Servaes, and Zingales (2000)).

However, the logic and the evidence on the intrinsic superiority of specialists over diversifiers are far from conclusive. Maksimovic and Phillips (2002) report that conglomerates have lower productivity than single-segment firms of similar size. In contrast, Schoar (2002) estimates that conglomerates are more productive than stand-alone firms. Gomes and Livdan (2004) reconcile theoretically the existence of a conglomerate discount with conglomerates being more productive than nondiversified firms. Both Gomes and Livdan (2004) and Maksimovic and Phillips (2002) propose a model with no agency costs in which firms maximize shareholder value but this behavior diversification is compatible with the existence of a discount. Both articles are based on different investment opportunities being available to conglomerates from those that are available to specialized firms. Maksimovic and Phillips (2002) also show that conglomerates allocate resources optimally across segments based on the relative efficiency of divisions. Thus,

[1] See Martin and Sayrak (2003) for a recent survey.

some theoretical and empirical evidence suggests that diversification may not be such a destructive corporate strategy after all.

The empirical methodology frequently used to estimate the diversification discount has been formally questioned by recent research. Campa and Kedia (2002) and Villalonga (2004a) point out that firms do not randomly become diversified, but rather endogenously choose to do so. This literature shows that diversified firms trade at a discount prior to becoming diversified and, once they control for self-selection, the diversification discount either disappears or becomes a diversification premium. In the same direction, Graham, Lemmon, and Wolf (2002) show that segments acquired by diversifying firms already trade at a discount before the acquisition and that this could explain the presence of a diversification discount, even if diversification actually creates value. Furthermore, Villalonga (2004b) shows that the diversification discount may be an artifact of segment-level data. Using a unique database, she is able to build more precise measures of firm diversification and finds evidence of a diversification premium.

More recently, however, Mackey and Barney (2005) compare the diversification decision versus the decision to pay dividends or repurchase firm stock. They find that diversification destroys value when compared to alternative payout policies. Their finding is robust to the use of econometric techniques that control for self-selection of the diversification decision.

As we can see from this brief discussion of the literature, a number of previous empirical studies estimate the effect of diversification on performance across a large variety of industries, this may have contributed to the conflicting results and interpretations. Furthermore, this literature studies the general effect of diversification on firm performance without considering the possibility that diversification could confer a competitive advantage on some industries but not in others, that is, they estimate the average effect of diversification on performance under the implicit assumption that such an effect either is homogeneous across industries or varies randomly across them. In this study, we first replicate the procedures used for the estimation of the diversification discount and obtain similar results to existing research. We then take into account the possibility that diversified firms may perform systematically better or worse than specialized firms only in a subset of industries. Before doing so, in the next section, we discuss why we expect that industry heterogeneity may moderate the diversification–performance linkage.

II. Analytical Framework

The literature has identified various reasons for diversification to have either a positive or a negative effect on firm performance. The potential benefits of diversification usually arise from the existence of economies of scope when operating in multiple industries (Teece (1980) and (1982)), while the potential costs of diversification are mainly associated with the larger internal governance costs incurred when managing multibusiness corporations (Roberts (1995), Rajan et al. (2000)). However, both the benefits and the costs of diversification need not be homogeneously present across all industries. Indeed, they are likely to depend crucially on the intrinsic characteristics of each industry. We argue in this section that an absolute optimal degree of diversification common to all industries is not likely to exist as a result of industry heterogeneity; instead, both the optimal diversification strategy and the diversification–performance linkage are likely to depend on the particular set of industries that we consider.

To support our claim about industry heterogeneity moderating the diversification–performance linkage, we briefly analyze two industry characteristics that could affect either the benefits or costs of diversification. Our goal is not to provide an exhaustive and detailed list of all industry features that can potentially affect the competitive advantage of diversified versus specialized firms. Nor do we suggest that we enumerate all the potential effects of a given industry characteristic on the costs and benefits of diversification. Rather, we simply discuss two straightforward mechanisms as illustrations of why the impact of diversification on corporate performance is likely to be heterogeneous across industries.

In the case of conglomerate diversification, the relative importance of hard versus soft information may determine the extent to which diversifiers or specialists are more competitive in a given sector. In this regard, there is an increasingly large literature on the role of soft information in organizations. Stein (2002) and Faure, Laffont, and Marimon (2002) define soft information as information that cannot be credibly communicated to an outside agent.[2] This literature works out the implications of using hard versus soft information on the organizational structure of firms in a given industry (Liberti (2002), Stein (2002), Berger, Demsetz, and Strahan (1999)). It seems reasonable to expect that both soft and hard information may be easier to obtain in some environments rather than being equally costly across all industries. Given that soft information might be easier to transmit inside rather than outside of a given company (Shleifer and Vishny (1991), Servaes (1996), Williamson (1986)), the corporate headquarters of a conglomerate could have access to valuable information unavailable to external capital markets. Because of this capital market imperfection, cross-subsidization could allow a division belonging to a diversified firm efficient access to financial resources, while a specialized company operating in an industry in which soft information is particularly important might be financially constrained and forced to conform to a less than optimum level of investment. In sum, in industries in which soft information is important, diversified firms might realize a superior financial performance because of better access to financial resources.[3]

[2] According to Petersen (2002), hard information is numerical, it is gathered in an impersonal way, and it is valued in the same way by different people.

[3] Yet Stein's (2002) model suggests that the large hierarchies associated with conglomerates perform better in those environments in which hard information can be costlessly passed along inside the firm. Thus, conglomerates may enjoy competitive advantages over specialized companies in industries in which information can costlessly be hardened. Note that for our purposes, it is not important if conglomerates have a competitive advantage or disadvantage in those industries in which soft information plays a prominent role. For our ends, we just need industry variability in the competitive advantage of diversified firms over specialists no matter in which direction.

From a different point of view and based on arguments from the literature on transaction costs and incomplete contracts, the market structure of vertically connected industries should affect whether specialists or diversifiers that internalize the transactions between them should have a competitive advantage or disadvantage. When there is a small number of buyers and/or sellers, the buyer–seller relationship is more likely to be affected by hold-up problems because of a small number type of bargaining problem (Williamson (1985)). For example, in the extreme case of two monopoly industries that are vertically related, there exists a bilateral monopoly with a single buyer and a single seller. As a consequence of this bilateral monopoly, all investments specific to the industry are also specific to an individual exchange relationship and, following the transaction costs logic, there might be underinvestment in those specific assets if long-term contracts are not able to solve this problem. In this case, vertical integration could provide the right incentives for the optimal degree of asset-specific investment through the proper reassignment of property rights (Hart (1995)). Thus, vertically integrated firms might enjoy a larger competitive advantage over specialized companies in more concentrated industries because of their lower transaction costs in dealing with industries with only a few players.

Note that the two arguments presented earlier are not new or controversial. Precisely for this reason, it is somewhat surprising that the diversification literature has not studied explicitly the importance of industry heterogeneity when estimating the diversification–performance linkage. Previous work has considered the possibility that industry characteristics might affect the diversification decision, but not the link between diversification and performance. For example, Campa and Kedia (2002) and Villalonga (2004b) consider explicitly how industry characteristics might affect the probability of becoming a diversified firm. Similarly, Maksimovic and Phillips (2002) show how generic industry shocks could affect in an asymmetric way investment decisions of conglomerates and single-segment firms. Yet, earlier research (including these papers) does not consider explicitly the notion that diversified firms might perform better in some industries than others due to their different underlying characteristics, such as the level of concentration in the industry or the importance of soft versus hard information. As long as the level of these structural variables varies across different industries, diversifiers or specialists would be favored in some cases but not in others. This would result in the type of moderation of the diversification–performance linkage driven by industry heterogeneity that we study in this paper.

We now explain our empirical strategy to identify the effect of industry heterogeneity in the diversification–performance linkage.

III. Methodology

Notwithstanding the arguments above, for our purposes it is not necessary to specifically identify the particular characteristics that determine whether the performance of diversified firms is expected to be better or worse than the performance of specialized companies. As we pointed out before, there may be a large number of industry characteristics that could tilt the balance in favor of or against the competitive advantage of diversified firms for each competitive context. A detailed analysis of different industry characteristics probably deserves to be the exclusive focus of future research on the benefits and costs of diversification.

Our strategy to bypass these difficulties consists of using a single proxy to estimate whether industry heterogeneity may moderate the relative performance of diversifiers versus specialists. The selected proxy is the number of specialized players active in a given industry and year. Later, we replicate the analysis using the relative market share of diversifiers and specialists as the moderating variable in order to overcome some of the limitations of this proxy. Thus, we will compare the relative performance of diversified firms in industries dominated by a large number of specialized competitors versus their performance in industries with just a few specialized companies.

Our rationale for this procedure is twofold. On the one hand, if a large number of specialized companies are operating in a given industry, or if together they hold a large share of the market, it seems reasonable to infer that in that particular sector they will have a competitive advantage over diversified firms driven by a process akin to natural selection. Otherwise, diversified firms would have gained market share and would have drastically reduced the number of specialized companies in the industry and their market share.

On the other hand, prior literature often uses a variable construction procedure that changes the industry definition depending on the number of specialized competitors that compete in the industry. This procedure could bias the estimation of the parameter of interest, especially if the diversification–performance linkage varies across industries, as we will analyze in greater detail later. Thus, for comparison purposes we report how past estimations of the diversification–performance linkage change when executed in several subsets of industries characterized by a different number of specialized competitors.

In the section below, we replicate a well-known study in the diversification–discount literature (Berger and Ofek (1995)), but using different subsamples based on the number of single-segment firms active in the industries under analysis. Next, using the whole sample, we estimate the usual diversification–discount regressions explicitly including a moderator variable of the diversification indicator to capture how the effect of diversification on performance changes with the number of specialized competitors in the industry. Finally, we conduct a variety of robustness checks to see whether, indeed, the diversification–performance linkage is systematically affected by the relative strength of diversifiers and specialists in the sample industries, controlling for different alternative explanations and explicitly considering the possible endogeneity of the diversification decision.

IV. Data and Empirical Results

Both firm and segment information come directly from Compustat for the period 1993–2001. In their paper, Berger and Ofek (1995; hereafter BO) introduce a methodology for sample construction and variable computation that has been extensively used in the literature on the diversification discount. We replicate the BO procedure to construct our sample and to compute the variables in our empirical analysis, but with a single critical exception. We describe the standard BO procedure for sample and variable construction in Appendix A. Below we detail our departure from the BO methodology.

BO compute a representative industry measure of firm performance in two steps. First, BO select a subsample of nondiversified firms reporting operations exclusively in that given industry. Second, BO compute the median of this subsample as the industry representative. When it comes to the question of industry definition, BO use alternative industry characterizations according to the number of nondiversified or specialist firms in a given industry and year. In particular, the BO procedure widens the industry definition when the number of specialists in a four-digit SIC code in a given year is less than five, considering instead all single-segment companies operating in the same three-digit SIC code. If in this enlarged three-digit SIC code subsample, the number of specialists is still less than five, BO consider an even wider industry definition that comprises all nondiversified firms that operate in the same two-digit SIC code.

We depart from the BO procedure only in respect to their industry definition since our purpose is to compare the effects of diversification in industries populated by a large versus a small number of specialized firms. In particular, our industry definition is the four-digit SIC code independent of the number of specialized firms in the industry or their market share. Later on, we investigate how the industry definition used may affect the results. We are aware that by proceeding in this way, we are potentially introducing larger measurement errors whenever only a few observations are available to compute the industry median, as BO argue. Yet, we believe that varying the industry definition according to the number of specialized firms has much worse drawbacks since doing so may introduce a bias in the estimation of the parameters of interest. As discussed earlier, diversification is more likely to create value in precisely those industries with fewer specialized companies. By adjusting the industry definition to include always at least five specialists, we would be artificially making it harder to find a positive effect of diversification on performance.

For firm financial performance, we use the same measures as in the previous literature on diversification: industry-adjusted market to book and industry-adjusted market to sales. These are the excess values in the BO paper. The adjustment is conducted using the usual "chop-shop approach," as summarized in Appendix A. Descriptive statistics for the sample are displayed in Table I.

Few variables from Table I require further explanation. In particular, the variable "Number of specialized competitors in the industry" is computed as follows. From Compustat, we collect all companies that report operations exclusively in one segment in a given year. We then group these companies according to the four-digit SIC code in which they report operations. The total number of these companies by SIC code and year comprises the number of specialized competitors in a given industry-year. The average number of specialized

Table I
Descriptive Statistics, 1993–2001

	Mean	*SD*	Observations
Industry-adjusted market to sales	0.01	0.71	24,330
Industry-adjusted market to book	0.05	0.54	24,330
Assets (in millions of dollars)	1,394.8	5638	24,330
Capital expenditures over sales ratio	0.12	0.30	23,927
EBIT over sales ratio	0.10	0.28	24,242
Diversification dummy, DIV	0.14	0.34	24,330
Number of industry specialized competitors[a]	2.85	1.21	24,330
Market share of specialized competitors[b]	0.55	0.28	24,330?
Industry concentration index (*CONC*)[c]	0.25	0.22	24,330
Log of industry size (*ISIZE*)[d]	9.97	1.75	24,330

[a]This variable measures the natural logarithm of the total number of specialized (nondiversified) companies active in a given four-digit SIC code. For diversified companies that operate in multiple industries, this variable is computed as a weighted average of the natural logarithm of the total number of specialized competitors in each of the industries in which the diversified firm is active. The weights used are segment sales over total sales.
[b]This variable measures the proportion of sales of specialized (nondiversified) companies in a given four-digit SIC code. For diversified companies that operate in multiple industries, this variable is computed as a weighted average of the market share of specialized competitors in each of the industries in which the diversified firm is active. The weights used are segment sales over total sales.
[c]This variable measures the industry concentration using the Herfindhal–Hirschman Index in a given four-digit SIC code. For diversified companies that operate in multiple industries, this variable is computed as a weighted average of the index of concentration in each of the industries in which the diversified firm is active. The weights used are segment sales over total sales.
[d]This variable measures the natural log of total industry sales in millions of dollars in a given four-digit SIC code. For diversified companies that operate in multiple industries, this variable is computed as a weighted average of the log of industry size in each of the industries in which the diversified firm is active. The weights used are segment sales over total sales.

competitors in the whole sample is 19.3. Partly because the distribution of this variable is highly skewed (the maximum is 72 specialized companies for SIC code 4813, "Telephone Communicators except Radiotelephones"), we use the logarithm in the empirical analysis. The number of four-digit SIC codes with less than five specialized competitors varies between 140 in 1994 and 121 in 1997, while the number of industries with more than five specialized competitors is lower at 145 in 1997 and just 83 in 2001.

We replicate the BO regressions for both industry-adjusted market to book and market to sales as dependent variables, using the BO measure of diversification: a dummy variable equal to one if the firm is diversified. We also include the same BO controls: firm size, EBIT divided by sales, and capital expenditures over sales. In addition, we run the same BO regressions for two different industry subsamples. One subsample only includes observations of those firms that carry out their activities in four-digit SIC codes with five or more specialized companies. The other subsample only includes observations of those firms that operate in four-digit SIC codes with one to four specialized competitors. Those diversified firms that operate simultaneously in different SIC codes, some SIC codes with one to four specialized competitors and some SIC codes with five or more specialized competitors, are excluded from both subsamples. The reason for choosing five as the cutoff number is that the industry definition of the BO procedure changes when there are five specialized competitors.

The results of the BO least-squares regressions are displayed in Table II both with market to book and market to sales as dependent variables. Table II displays the results for the whole sample and the two subsamples. Note that the number of observations in the subsample that includes those industries with less than five specialized competitors is significantly lower. This is not because there is a large difference in the number of industries included, but rather because the number of observations per industry is larger in those industries with more than five specialized competitors.

The third and fourth columns of Table II obtain the traditional diversification discount using a pooled data OLS regression in the subsample of industries with more than five specialized competitors. The statistically significant discount using the market to book ratio and the asset multipliers is −0.12. This number is identical to the discount reported by BO in the period 1986–1991 and also to the discount reported by Campa and Kedia (2002) when they replicate the BO regressions for the period 1978–1996. The third column of Table II reports a diversification discount of −0.28 when using market to sales as a dependent variable. This discount is larger than the −0.14 reported by BO and the −0.13 found by Campa and Kedia (2002) when using the same dependent variable. This last discrepancy could be due to a variety of reasons. We are using a time period in which the reporting requirements of the SEC are distinct from those of these studies. Also, as explained in detail earlier, we are not replicating the BO procedure exactly. In the third and fourth columns of Table II, we are excluding from the sample those firms that operate in sectors with less than five competitors, while the BO procedure changes their industry definition but retains those firms in their sample. Despite these minor discrepancies, we obtain very similar results to the existing literature on the diversification discount when we disregard the potential heterogeneity across industries.

More important for our purposes, Table II presents clear evidence of how the BO estimation of the effect of diversification on performance varies crucially depending on the type of industries we exclude from the sample. If we study the effect of diversification only in those industries in which there are one to four specialized companies, we find a significant diversification premium both for the industry-adjusted market to sales (+0.14) and for the industry-adjusted market to book (+0.18). Of course, these coefficients are statistically significantly different from the ones reported above at the 0.01 level (−0.12 and −0.28, respectively). Finally, if we consider all industries without any exclusion, the effects of diversification on the destruction of value are mixed since whether we find a diversification premium or a discount depends on the dependent variable used. These results provide clear evidence that the diversification–performance link is more complex than has been considered by prior research,

Table II

Berger and Ofek (1995) Regressions in Different Subsamples

Dependent variable is industry-adjusted market to book and industry adjusted market to sales. All observations correspond to the period 1993–2001.

	Subsample of industries with one to four specialized companies[a]		Subsample of industries with five or more specialized companies[b]		Full sample	
	Dependent variable is industry-adjusted market to sales	Dependent variable is industry-adjusted market to book	Dependent variable is industry-adjusted market to sales	Dependent variable is industry-adjusted market to book	Dependent variable is industry-adjusted market to sales	Dependent variable is industry-adjusted market to book
Intercept	−0.39***	−0.08***	−0.45***	−0.03**	−0.43***	−0.03***
	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
DIV[c]	0.14**	0.18***	−0.28***	−0.12***	−0.12***	0.02***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Log of assets	0.06***	0.01*	0.08***	0.01***	0.08***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Cap. exp./sales	0.34***	−0.05	0.36***	0.01*	0.37***	0.01
	(0.06)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
EBIT/sales	0.41**	0.27***	−0.06***	0.16***	−0.02*	0.16***
	(0.06)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
R^2	0.09	0.04	0.08	0.01	0.07	0.01
Obs	2,860	2,860	19,064	19,064	23,853	23,854

Standard deviations of the coefficients are reported in parentheses. Asterisks indicate significance at the 10% (*), 5% (**), and 1% (***) levels.

[a]From this subsample are eliminated all those observations corresponding to companies that have more than 5% of their sales or more than 10% of their assets in segments that operate in industries with five or more specialized competitors.

[b]From this subsample are eliminated all those observations corresponding to companies that have more than 5% of their sales or more than 10% of their assets in segments that operate in industries with less than five specialized competitors.

[c]Dummy equal to one if the firm operates in more than one four-digit SIC code.

and that this relationship is affected by the type of industries included in the sample.

Next, to take explicitly into account the hypothesized moderating effects, we use the whole sample and introduce in the BO regressions the interaction between the diversification dummy and a measure of the number of specialized competitors in the industry, *NSC*. Because diversified firms operate by definition in more than one industry, for these multi-industry companies, we compute the number of specialized competitors as the weighted average of the natural log of the number of specialized competitors in the different industries in which they compete. The weights are the proportion of segment sales over total firm sales. Therefore, *NSC* is computed by $NSC_{it} = \sum_{I=1}^{N} \omega_{itI} \log(n_{It})$, where ω_{itI} is the proportion of segment sales over total firm sales corresponding to the segment that operates in industry I at time t that belongs to firm I, and $\log(n_{It})$ represents the natural log of the number of specialized competitors that operate in industry I at time t. For example, assume company A operates in two industries: X and Y. In industry X, company A sells 10% of its total sales, while the other 90% is sold in industry Y. In industry X, there are 15 specialized competitors, and in industry Y, there are just three specialized competitors. In this case,

$$NSC = 0.10 * \log(15) + 0.90 * log(3) = 1.26.$$

We use a natural logarithmic function of the number of specialized competitors since the effect of competition on behavioral variables is usually nonlinear and much more important for low levels of competition than for high levels of competition.[4] Hence, we conjecture that an increase in the number of specialized companies has a larger influence on the performance of diversified firms when there are fewer, as opposed to more, of them in the industry. The logarithmic function captures this nonlinearity.

Table III presents the results of these regressions with the new interaction term. The effect of diversification common across industries is now clearly positive for both the industry-adjusted market to sales and market to book ratios. As expected, the interaction between the diversification dummy and the weighted average of the number of specialized companies is negative and strongly statistically significant. Diversification has a more negative effect on performance as the number of specialized firms in the industries under study increases. Note also that we have included the number of specialized competitors in the industry as a control variable in the regressions. As expected, this variable is never statistically different from zero. The reason is that the chop-shop approach we are using already accounts for any general industry effects on firm financial performance.

All coefficients on the interaction term reported in Table III are both statistically and economically significant. Whenever the number of specialized

[4] For an example, see Bresnahan and Reiss (1987).

Table III

Berger and Ofek (1995) Regressions Controlling for Weighted Average of the Number of Specialized Companies, 1993–2001

Dependent variable	Industry-adjusted market to sales	Industry-adjusted market to book	Industry-adjusted market to sales	Industry-adjusted market to book
Constant	−0.03**	0.01	−0.46***	−0.07***
	(0.01)	(0.01)	(0.02)	(0.01)
DIV[a]	0.32***	0.27***	0.23***	0.26***
	(0.02)	(0.02)	(0.02)	(0.02)
Numb_specialized_ companies[b]	0.01***	0.01***	0.01**	0.01***
	(0.00)	(0.00)	(0.004)	(0.00)
Numb_specialized_ companies*DIV	−0.15***	−0.10***	−0.16***	−0.10***
	(0.01)	(0.00)	(0.01)	(0.00)
Log of assets			0.08***	0.01***
			(0.00)	(0.00)
Cap. exp./sales			0.38***	0.01*
			(0.01)	(0.01)
EBIT/sales			−0.02	0.16***
			(0.01)	(0.01)
R^2	0.00	0.00	0.08	0.01
Obs	24, 330	24, 330	23, 854	23, 854

Standard deviations of the coefficients are reported in parentheses. Asterisks indicate significance at the 10% (*), 5% (**), and 1% (***) levels.
[a]Dummy equal to one if the firm operates in more than one four-digit SIC code.
[b]Weighted average of the log of the number of specialized companies that operate in the industries in which the firm is active. The weights are the proportion of segment sales over total firm sales.

competitors doubles, the industry-adjusted market to book (market to sales) of diversified firms decreases by 7% (11%).[5] We depict the functional form of the diversification–performance linkage in Figure 1 using the coefficients estimated in the third column of Table III. Figure 1 shows clearly how diversification "creates value" when there are few specialized competitors, while it "destroys value" when diversification takes place in industries that consist of a large number of specialized competitors.

Table IV replicates the same regression as in Table III year by year for the whole (1993–2001) period and therefore displays the results of nine different cross-sectional regressions. The results are qualitatively the same as those found with the pool-data regression. The coefficient on the diversification dummy is always positive and statistically different from zero in 17 out of 18 cases while the coefficient on the interaction between the diversification variable and the number of specialized competitors is always negative and significantly different from zero in the 18 different specifications.

Next, we test the robustness of our findings to the caveat that firms do not randomly become diversified or specialized and there might be unobserved

[5] The 7% comes from multiplying 0.10 * log(2) and the 11% from multiplying 0.16 * log(2).

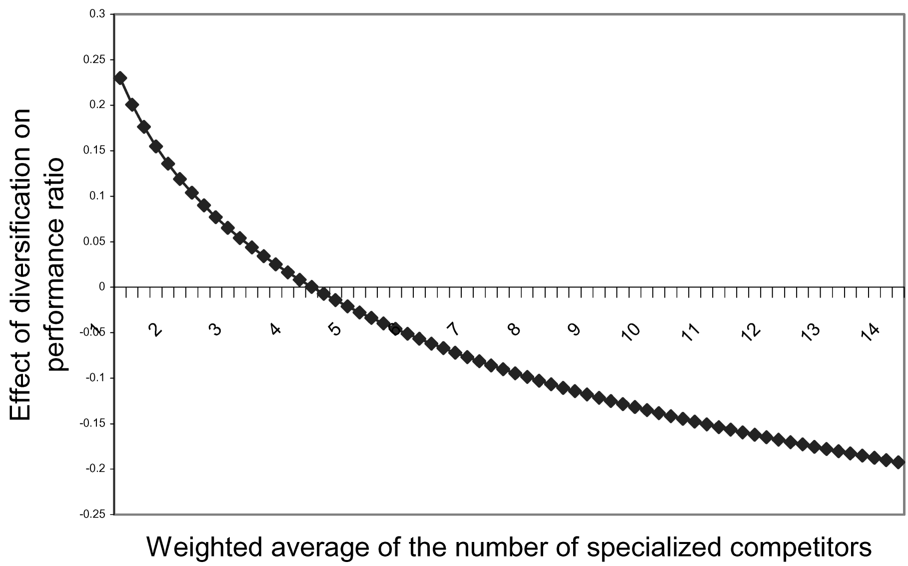

Figure 1. Effect of diversification on performance as a function of the number of specialized competitors in the industry. Figure 1 has been constructed using the functional form estimated in the third column of Table III: $y = 0.23–0.16\log x$, where y is the effect of diversification on performance and x is the number of specialized competitors.

firm characteristics correlated with the diversification decision and with performance. Multiple specifications have been used, for instance, by Villalonga (2004a) and Campa and Kedia (2002), to correct for this self-selection problem. As we discuss in Section VI and Appendix B, some of the instruments they use are questionable if we take into account the effect of industry heterogeneity on the diversification–performance linkage. For this reason, we use a firm fixed effect regression in which we use only those observations that belong to firms that report a change in the number of segments during the 9-year period of our sample: 1993–2001. With this procedure, we just look at the within-firm correlation between changes in performance and changes in diversification. The results are shown in Table V.

Consistent with the results from Campa and Kedia (2002) and Villalonga (2004a), once we control for unobserved firm characteristics, we find a diversification premium instead of discount. In the third and fourth columns of Table V, we can see that the coefficient on the diversification dummy is $+0.13$ for market to sales and $+0.18$ for market to book, statistically significant in both cases. However, we still find that diversification in industries with a large number of specialized competitors affects performance ratios negatively. The positive effect of diversification on firm value will eventually become negative as the number of specialized firms in the industries increases. The coefficients on the interaction term can be interpreted as follows: a 100% increase in the weighted average of the number of specialized competitors in the industries

Table IV

OLS Coefficients in Year by Year Regressions for the Period 1993–2001

Each row reports the estimated coefficients of a cross-section regression in which the dependent variable is either the industry-adjusted firm market to book or the industry-adjusted firm market to sales and the controls are the same as the ones used in Table III: firm size measure by the natural log of firm book value of assets, the capital expenditures over total sales ratio, the EBIT to sales ratio, and the weighted average of the number of specialized firms in the industries in which a given firm operates.

	Dependent variable industry-adjusted market to sales		Dependent variable industry-adjusted market to book	
Year	Coefficient on dummy of diversification	Coefficient on the interaction[a]	Coefficient on dummy of diversification	Coefficient on the interaction[a]
1993	0.45***	−0.23***	0.45***	−0.17***
	(0.08)	(0.03)	(0.06)	(0.02)
1994	0.31***	−0.17***	0.36***	−0.14***
	(0.08)	(0.03)	(0.06)	(0.03)
1995	0.33***	−0.17***	0.36***	−0.14***
	(0.09)	(0.03)	(0.07)	(0.03)
1996	0.51***	−0.23***	0.45***	−0.17***
	(0.09)	(0.03)	(0.07)	(0.02)
1997	0.42***	−0.21***	0.41***	−0.15***
	(0.09)	(0.03)	(0.07)	(0.03)
1998	0.34***	−0.19***	0.35***	−0.15***
	(0.08)	(0.03)	(0.07)	(0.03)
1999	0.30***	−0.20***	0.26***	−0.13***
	(0.09)	(0.04)	(0.08)	(0.03)
2000	0.08	−0.14***	0.17***	−0.09***
	(0.09)	(0.04)	(0.07)	(0.03)
2001	0.41***	−0.28***	0.35***	−0.16***
	(0.09)	(0.04)	(0.06)	(0.03)

Standard deviations of the coefficients are reported in parentheses. Asterisks indicate significance at the 10% (*), 5% (**), and 1% (***) levels.

[a]The interaction is the diversification dummy multiplied by the weighted average of log of number of specialized companies in all industries in which the firm reports operations.

in which a diversified firm operates translates to a decrease of 3% (7%)[6] in the industry-adjusted market to book (sales) ratio. These numbers are smaller than the ones we report in Table III, but still significant both economically and statistically. We conclude that the coefficients reported in Table V provide evidence that our findings are robust to the use of econometric methods that alleviate the biases caused by the endogeneity of the diversification decision. In Section VI, we discuss the implications of this finding for the literature on firm diversification.

[6] The 3% comes from multiplying 0.05 * log(2) and the 7% from multiplying 0.10 * log(2).

Table V

Berger and Ofek (1995) Regressions Controlling for the Weighted Average of the Number of Specialized Companies and with Firm Fixed Effects: 1993–2001

The definition of industry is by four-digit SIC code. We use observations only from 778 firms that report a change in the number of segments during the period 1993–2001.

Dependent variable	Industry-adjusted market to sales	Industry-adjusted market to book	Industry-adjusted market to sales	Industry-adjusted market to book
Constant	0.81**	−0.10***	0.65**	0.64**
	(0.27)	(0.22)	(0.28)	(0.23)
DIV[a]	0.13***	0.10***	0.13***	0.18***
	(0.04)	(0.03)	(0.04)	(0.03)
Numb_specialized_companies[b]	−0.06***	−0.03***	−0.06***	−0.05***
	(0.02)	(0.01)	(0.02)	(0.01)
Numb_specialized_companies*DIV	−0.10***	−0.04***	−0.10***	−0.05***
	(0.01)	(0.01)	(0.01)	(0.01)
Log of assets			0.00	−0.12***
			(0.01)	(0.01)
Cap. exp./sales			0.38***	0.04
			(0.03)	(0.03)
EBIT/sales			0.39***	0.38***
			(0.05)	(0.04)
R^2	0.63	0.53	0.65	0.55
Obs	4,521	4,521	4,447	4,447

Standard deviations of the coefficients are reported in parentheses. Asterisks indicate significance at the 10% (*), 5% (**), and 1% (***) levels.

[a]Dummy equal to one if the firm operates in more than one four-digit SIC code.

[b]Weighted average of the log of the number of specialized companies that operate in the industries in which the firm is active. The weights are the proportion of segment sales over total firm sales.

V. Additional Robustness Tests

In this section, we first replicate the analysis of the previous section using a different proxy to measure the relative competitive advantage of diversified firms versus specialists, namely, the relative market share of specialists versus diversifiers in each industry. We also explore whether our results are robust to the use of an alternative, more aggregated definition of industry. Finally, we investigate the extent to which our results may be driven by specific industry characteristics such as industry size and concentration.

First, note that according to the same "natural selection" arguments used in our empirical strategy above, we could expect similar results using the ratio of sales from specialized firms over total industry sales as the ones we obtain using the number of specialized competitors in the industry. This ratio has the additional advantage of giving a priori the same treatment to, for example, an industry with one diversified and three specialized firms and an industry with 10 diversified and 30 specialized companies. Furthermore, the proportion of industry sales coming from specialized companies does not necessarily depend on total industry size as is the case with the number of specialized competitors. However, in contrast to our previous specification using the number of specialized competitors, this approach cannot be used to observe the potential risks of the Berger–Ofek (1995) sample construction procedure.

For the purpose of checking the consistency of our results, we construct the total market share of specialized companies in each four-digit SIC code in our sample. We do so by adding sales of all segments belonging to diversified companies that operate in a given four-digit SIC code as well as sales of all specialized companies that operate in the same sector. The market share of specialized companies is the resulting ratio. In our sample, for 2001 the following six industries were totally dominated by specialized companies with a market share of 100%: SIC 1044, "Silver Ores;" 3292, "Asbesto Products;" 3451, "Screw Machine Products;" 4013, "Railroad Switching and Terminal Establishments;" 5399, "Miscellaneous General Mercandise Stores;" and 7829 "Services Allied to the Motion Picture Distribution." In each of these six cases, only a single specialized firm was active in 2001, which explains the 100% market share of specialized companies. We find the lowest market share corresponding to specialized companies in the SIC code 2531, "Paperboard Mills," in which the market share of specialized companies was barely 0.35%. In this industry, there were three different companies reporting operations: two diversified companies whose sum of sales in this particular sector was around $7.1 billion, and a small specialized company with sales of only $52 million. Overall, for the whole 1993–2001 period, the average market share of specialized companies was 50% with a standard deviation of 33%.

Next, we run the same BO regressions for two different industry subsamples. One subsample includes only observations of those firms that carry out their activities in four-digit SIC codes with more than 25% of total industry sales accounted for by specialized companies. The other subsample includes the rest of the observations, that is, firms that only operate in four-digit SIC codes with less than 25% of total sales accounted for by specialized companies. Those diversified firms that operate simultaneously in different SIC codes, some SIC codes with more than 25% of total industry sales by specialized firms and some SIC codes with less than 25% of total industry sales accounted for specialized firms, are excluded from both subsamples. We choose the cutoff point of 25% because we want to replicate the same type of asymmetric subsample division we achieved in the previous section, where we clearly identify industries in which there exists a "diversification premium." However, in nonreported results, we run the same subsample regressions using 50% and 33% as cutoff points with the same qualitative results.

In Table VI, we can see that the estimated effect of diversification on performance varies critically depending on which subset of industries we consider. In industries in which the market share of specialized companies is less than 25%, we obtain a diversification premium of +0.18 using industry-adjusted market to book as a measure of performance and a coefficient of +0.09 using the industry-adjusted market to sales ratio. In contrast, in those industries in

Table VI
Berger and Ofek (1995) Regressions in Different Subsamples
All observations correspond to the period 1993–2001

	Subsample considering only industries with market share of specialized companies less than 25%[a]		Subsample considering only industries with market share of specialized companies more than 25%[b]	
	Dependent variable is industry-adjusted market to sales	Dependent variable is industry-adjusted market to book	Dependent variable is industry-adjusted market to sales	Dependent variable is industry-adjusted market to book
Intercept	−0.41***	0.01	−0.42***	−0.02*
	(0.01)	(0.02)	(0.02)	(0.01)
DIV[c]	0.09***	0.18***	−0.23***	−0.10***
	(0.03)	(0.02)	(0.02)	(0.01)
Log assets	0.08***	0.00	0.07***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Cap. exp./sales	0.17***	−0.01	0.56***	0.03*
	(0.02)	(0.01)	(0.02)	(0.02)
EBIT/sales	−0.07*	0.07***	0.01	0.26***
	(0.03)	(0.02)	(0.02)	(0.02)
R^2	0.06	0.01	0.08	0.01
Obs	4,168	4,168	17,768	17,768

Standard deviations of the coefficients are reported in parentheses. Asterisks indicate significance at the 10% (*), 5% (**), and 1% (***) levels.
[a]From this subsample are eliminated all those observations corresponding to companies that have more than 5% of their sales or more than 10% of their assets in segments that operate in industries in which the market share of specialized companies is more than 25%.
[b]From this subsample are eliminated all those observations corresponding to companies that have more than 5% of their sales or more than 10% of their assets in segments that operate in industries in which the market share of specialized companies is less than 25%.
[c]Dummy equal to one if the firm operates in more than one four-digit SIC code.

which specialized firms have a total market share larger than 25%, we find a diversification discount of −0.10 using the industry-adjusted market to book and −0.23 using the industry-adjusted market to sales as a dependent variable. Again, the diversification discount only shows up in the subsample of industries for which specialized firms hold at least 25% of the market share.

In the next step, following exactly the same procedure as that in the previous section with the number of specialized companies, we use the whole sample and introduce in the BO regressions the interaction between the diversification dummy and a measure of the market share of specialized competitors in the industry, *MSSC*. As we did earlier, for diversified companies we compute the market share of specialized competitors as the weighted average of the market share of specialized competitors in the different industries in which they compete. The weights are again the proportion of segment sales over total firm sales. Therefore, *MSSC* is computed by $MSSC_{it} = \sum_{I=1}^{N} \omega_{itI} mssc_{It}$, where ω_{itI} is the proportion of segment sales over total firm sales and *MSSC* represents market share of specialized companies in industry I at time t.

In Table VII, we show the estimated coefficients on the standard BO regressions with the interaction between the diversification dummy and *MSSC*, adding *MSSC* also as a separate control variable. As above, the coefficient on the diversification dummy becomes positive once we introduce the interaction term. The estimated coefficient on the interaction term is negative and both economically and statistically significant. The total effect of diversification on performance follows the functional form $0.21–0.48 * MSSC$ for market to book and $0.11–0.50 * MSSC$ for market to sales. These numbers suggest that when the aggregated market share of specialized companies surpasses 42%, the effect of diversification on performance becomes negative for market to book (22% for market to sales). Figure 2 illustrates this point using the estimated coefficients of the third column in Table VII.

We also check whether these results are robust to the introduction of firm fixed effects. Table VIII displays the results of a fixed effect regression in which we use only those observations that belong to firms that report a change in the number of segments during the 9-year period of our sample: 1993–2001. As before, the results do not vary with the introduction of firm fixed effects and are generally consistent with our previous findings. The estimated coefficient on the diversification dummy is positive and significant, while the coefficient on the interaction is negative and strongly significant.

We now turn to the question of whether alternative industry definitions could be driving the results in our study. To investigate this possibility, we repeat the above analysis using two-digit SIC code instead of four-digit SIC code to identify the industries in our sample. Note that by proceeding likewise, we are drastically reducing the number of industries from an average of 264 four-digit SIC codes in the period 1993–2001 to an average of only 52 two-digit SIC codes for the same time interval. According to this new definition, we consider a given firm diversified if it reports operations in more than one two-digit SIC code, and we consider it specialized otherwise. Naturally, with this more aggregated industry definition, the number of diversified firms in our sample significantly

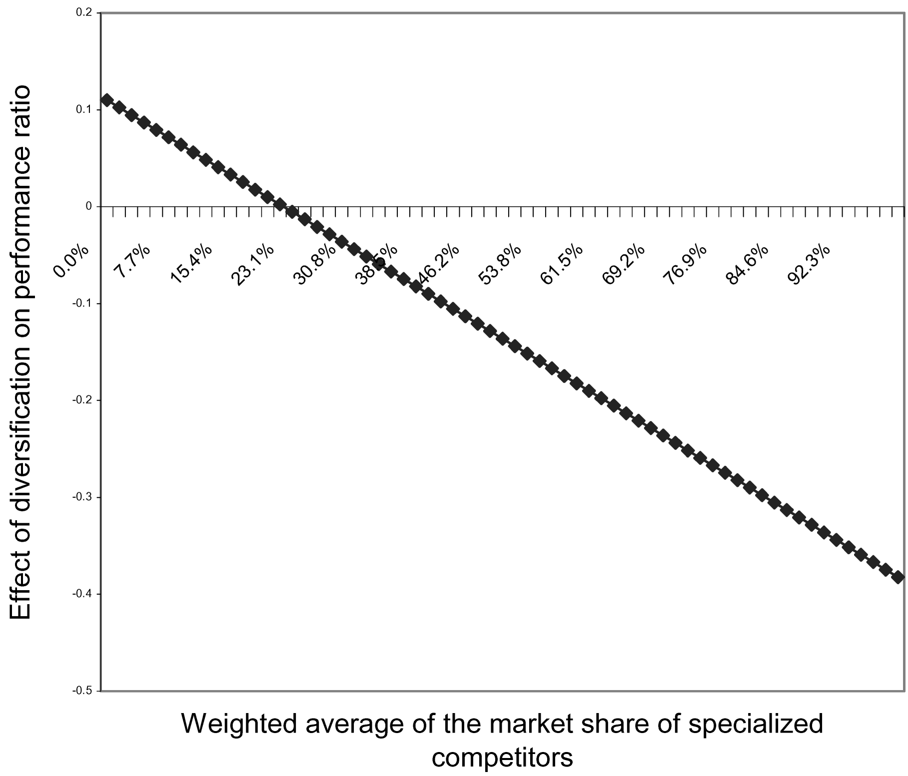

Figure 2. Effect of diversification on performance as a function of the market share of specialized competitors in the industry. Figure 2 has been constructed using the functional form estimated in the third column of Table VII: $y = 0.11–0.5x$, where y is the effect of diversification on performance and x is the market share of specialized competitors.

decreases. Around one-third of the companies that we consider diversified using a four-digit SIC code industry definition turns out to be specialized when we define industries at the two-digit SIC code level.

We construct the market share of specialized companies consistent with this aggregated industry definition by adding sales of all segments belonging to diversified companies that operate in a given two-digit SIC code as well as sales of all specialized companies that operate in the same two-digit sector. The market share of specialized companies is the resulting ratio, which only increases slightly from 50% to 53%. We replicate the BO regressions with these industry categories and report only the results of the regressions with firm fixed effects. As Table IX shows, the results are qualitatively the same. The diversification premium turns into a discount as the market share of specialized firms in the industry increases.

In nonreported results, we run additional tests to assess the robustness of our findings to different industry definitions. First, we replicate our regressions defining an industry by three-digit SIC code. As above, in industries in

Table VII

Berger and Ofek (1995) Regressions Introducing the Weighted Average of Industry Market Share of Specialized Companies, 1993–2001

Dependent variable	Industry-adjusted market to sales	Industry-adjusted market to book	Industry-adjusted market to sales	Industry-adjusted market to Book
Constant	0.01	0.03***	−0.47***	−0.03**
	(0.01)	(0.00)	(0.01)	(0.01)
DIV[a]	0.21***	0.23***	0.11****	0.21***
	(0.02)	(0.02)	(0.02)	(0.01)
Market share of specialized companies[b]	0.02	0.01	0.09***	0.03****
	(0.02)	(0.01)	(0.01)	(0.01)
Market share of specialized companies*DIV	−0.56***	−0.48***	−0.50***	−0.48***
	(0.05)	(0.04)	(0.05)	(0.04)
Log of assets			0.07***	0.01***
			(0.00)	(0.00)
Cap. exp./sales			0.39***	−0.00
			(0.01)	(0.01)
EBIT/sales			−0.03	0.20***
			(0.01)	(0.01)
R^2	0.00	0.00	0.07	0.01
Obs	24,330	24,330	23,854	23,854

Standard deviations of the coefficients are reported in parentheses. Asterisks indicate significance at the 10% (*), 5% (**), and 1% (***) levels.
[a]Dummy equal to one if the firm operates in more than one segment.
[b]The market share of specialized competitors, *MSSC*, is computed as:

$$MSSC_{it} = \sum_{I=1}^{N} \omega_{itI} mssc_{It},$$

where ω_{itI} is the proportion of segment sales over total firm sales and *mssc* represents market share of specialized companies in industry I at time t.

which specialized companies jointly account for 25% or more of total industry sales, diversified firms underperform, and in industries in which specialists account for a lower percentage of industry sales, diversified firms record better financial performance. The results are qualitatively the same if we consider a more aggregated industry definition and we define an industry by two-digit SIC code. We run the same subsample and full sample analysis—with and without firm fixed effects—with industry defined at the two-digit SIC code level, and we also find that both the number of specialists and the market share of specialists critically reduces the diversification–performance linkage. We conclude that our findings hold independent of the level of industry aggregation.

With regard to industry definition, one could question the accuracy of any industry adjustment whenever there are less than five players in the industry.

Table VIII

Berger and Ofek (1995) Regressions Introducing the Weighted Average of Industry Market Share of Specialized Companies and Firm Fixed Effects, 1993–2001

Firm fixed effect regressions of the excess value computed as in Berger and Ofek (1995). Our definition of industry is by four-digit SIC code. We use observations only from 778 firms that report a change in the number of segments during the period 1993–2001.

Dependent variable	Industry-adjusted market to sales	Industry-adjusted market to book	Industry-adjusted market to sales	Industry-adjusted market to book
Constant	−0.33	−0.53***	−0.51***	0.23
	(0.19)	(0.16)	(0.22)	(0.18)
DIV[a]	0.19***	0.19***	0.23***	0.26***
	(0.03)	(0.03)	(0.04)	(0.03)
Total market share of specialized companies[b]	0.04	0.01	0.06	−0.03
	(0.05)	(0.04)	(0.05)	(0.04)
Market share of specialized companies[b]*DIV[a]	−0.44***	−0.33***	−0.48***	−0.39***
	(0.07)	(0.06)	(0.07)	(0.06)
Log of assets			−0.01	−0.13***
			(0.01)	(0.01)
Cap. exp./sales			0.35***	0.03
			(0.04)	(0.03)
EBIT/sales			0.33***	0.34***
			(0.07)	(0.05)
R^2	0.64	0.55	0.65	0.56
Obs	4,521	4,521	4,447	4,447

Standard deviations of the coefficients are reported in parentheses. Asterisks indicate significance at the 10% (*), 5% (**), and 1% (***) levels.

[a]Dummy equal to one if the firm operates in more than one segment.

[b]The market share of specialized competitors, *MSSC*, is computed as

$$MSSC_{it} = \sum_{I=1}^{N} \omega_{itI} mssc_{It},$$

where ω_{itI} is the proportion of segment sales over total firm sales and *mssc* represents market share of specialized companies in industry I at time t.

BO solve this issue by using the narrowest SIC grouping that includes at least five specialist companies. However, our results illustrate the bias of a procedure that systematically changes industry definitions precisely in those sectors in which diversification is more likely to create value. We analyze this point in more detail in the last section of the paper and more formally in Appendix B. In nonreported results, we replicate the regression analysis using the BO procedure to adjust by industry and we still find that the diversification–performance

Table IX

Berger and Ofek (1995) Regressions Using Industry Definition at the Two-Digit SIC Code Level, Introducing the Weighted Average of Industry Market Share of Specialized Companies and Firm Fixed Effects, 1993–2001

Firm fixed-effect regressions of the excess value computed as in Berger and Ofek (1995). Our definition of industry is by two-digit SIC code. We use only observations from 778 firms that report a change in the number of segments during the period 1993–2001.

Dependent variable	Industry-adjusted market to sales	Industry-adjusted market to sales	Industry-adjusted market to book	Industry-adjusted market to book
Constant	−0.45**	−0.51**	0.63***	0.59***
	(0.20)	(0.20)	(0.19)	(0.16)
DIV[a]	−0.06***	0.09**	0.01	0.12***
	(0.01)	(0.05)	(0.01)	(0.04)
Total market share of specialized companies[b]	−0.08	0.03	−0.11**	−0.03
	(0.06)	(0.07)	(0.05)	(0.06)
Market share of specialized companies[b]*DIV[a]		−0.29***		−0.20***
		(0.08)		(0.06)
Log of assets	−0.00	−0.00	−0.14***	−0.14***
	(0.01)	(0.01)	(0.01)	(0.01)
Cap. exp./sales	0.33***	0.33***	0.04	0.04
	(0.03)	(0.03)	(0.03)	(0.03)
EBIT/sales		0.23***	0.24***	0.26***
		(0.06)	(0.05)	(0.05)
R^2	0.71	0.71	0.59	0.60
Obs	4,521	4,447	4,521	4,447

Standard deviations of the coefficients are reported in parentheses. Asterisks indicate significance at the 10% (*), 5% (**), and 1% (***) levels.

[a]Dummy equal to one if the firm operates in more than one two-digit SIC code.

[b]The market share of specialized competitors, *MSSC*, is computed as

$$MSSC_{it} = \sum_{I=1}^{N} \omega_{itI}\, mssc_{It},$$

where ω_{itI} is the proportion of firm sales in a given two-digit SIC code over total firm sales and *mssc* represents market share of specialized companies in industry I at time t.

linkage critically varies depending on the number of specialist companies in the industry, that is, the moderating effect is always significant and in the expected direction even if we follow exactly the same process used by BO.

Finally, to conclude the robustness tests, we explore to what extent our earlier findings related to the number of specialized firms can be explained by other industry characteristics. In particular, we investigate if industry concentration and industry size could account for the observed effect of the number of specialized competitors in the diversification–performance linkage. Both variables are relatively easy to compute with the available data contained in Compustat. In addition, sound analytical arguments explain why these variables could be significant moderators of the diversification–performance linkage.

As we discuss in Section III, concentrated industries could constitute a friendlier environment for diversified firms because of standard hold-up problem type of arguments. In more concentrated industries, almost by definition there is a lower number of players. Market exchanges with this reduced number of firms could create hold-up problems for specialized firms, while diversifiers into this industry would not suffer this problem by internalizing these transactions.

In our sample, we measure industry concentration at the four-digit SIC code level using the standard Herfindhal–Hirschman index, *HHI*.

$$HHI_I = \sum_{i=1}^{N} ms_i^2,$$

where ms_i is market share using sales of firm i and we consider as companies that operate in industry $i = 1, \ldots, N$ all segments of diversified firms that operate in industry I as well as all specialized companies active in the same industry. In our sample, the average *HHI* is 4,281 with a standard deviation of 2,480. Note that this *HHI* is constructed using exclusively information from public companies in Compustat, and therefore it is an upwards-biased estimator of the real *HHI*. However, we still believe that it constitutes a good proxy for industry concentration since larger firms are usually public, and this limits the importance of the bias. Furthermore, a large number of small local private companies may not be competing with large national or international companies even if they operate in the same four-digit SIC code. For this reason, with our in-sample concentration index, we might be capturing better the relevant degree of industry concentration. The maximum degree of our in-sample industry concentration in a given year corresponds to all SIC codes in which we find only a single company in the Compustat database, and therefore the value of the *HHI* is equal to 10,000. For the year 2001, this happens in six four-digit SIC codes. The minimum *HHI* for the year 2001 is 24.8 in SIC 7372, "Prepackaged software." In this industry, there are up to 194 companies in the Compustat database corresponding to the year 2001. As above, for diversified companies, we compute the industry concentration variable, *CONC*, as a weighted average of the different *HHI* in the different industries in which the diversified firm competes. The weights are again the proportion of segment sales over total firm sales. Therefore, *CONC* is computed by $CONC_{it} = \sum_{I=1}^{N} \omega_{itI} \mathrm{HHI}_{It}$, where ω_{itI} is the proportion of segment sales over total firm sales.

With regards to total industry size, ceteris paribus larger industries may attract a larger number of players. As a result, the price mechanism may work better a priori and common ownership might not be necessary to solve potential hold-up problems. Furthermore, a larger market size may increase the returns to firm specialization as happens in the traditional Stigler (1951) model. Both arguments point to a competitive advantage of specialists over diversifiers in larger industries. We measure industry size by total industry sales, *ind_size*. In our sample, the average industry size is \$11.9 billion with a standard deviation of \$30.2 billion. The largest industry in 2001 is SIC code 5411, "Grocery Stores," with an industry size equal to \$177.6 billion, while the smallest industry is 3451, "Screw Machine Products," with total sales of only \$22.6 million.

Given the huge dispersion in the data, in our regressions, we use the natural log of industry size instead of the absolute value. As above, for diversified companies we compute the industry size variable, *ISIZE*, as the weighted average of the different industries in which the diversified firm competes. The weights are again the proportion of segment sales over total firm sales. Therefore, *ISIZE* is computed by $ISIZE_{it} = \sum_{I=1}^{N} \omega_{itI} \log(ind\_size_{It})$, where ω_{itI} is the proportion of segment sales over total firm sales.

In our model, we investigate how *ISIZE* and *CONC* affect the diversification performance linkage by introducing two new interaction terms between the diversification dummy and *ISIZE* and *CONC* in the BO regressions. We also include the main effects *ISIZE* and *CONC* as controls. From all the various specifications we have used, we choose the BO regression with firm fixed effects because it controls for unobserved firm characteristics and also because we do not want to flood the article with more tables that all point in the same direction.

Table X shows how even after introducing these industry characteristics, the number of specialized companies still has a negative effect on the diversification performance linkage. In comparison with the results displayed in Table V, the coefficient on the interaction in the market to book regression changes from −0.05 to −0.02, still negative although it has lost statistical significance, while the coefficient on the interaction in the market to sales regression changes from −0.10 to −0.04, still both economically and statistically significant. When we use the market share of specialized companies as a proxy for specialists having a competitive advantage over diversifiers, we find the same qualitative results. In comparison with the results displayed in Table VIII, the coefficient on the interaction in the market to sales regression drops from −0.48 to −0.11, but is still significant. Similarly, in the market to book regression, the coefficient on the interaction changes from −0.39 to −0.09, but is also still significant. In both cases, the market share of specialized competitors critically affects the diversification–performance linkage. We interpret these empirical findings as evidence that the number of specialized competitors and the market share of specialized competitors capture the effect of industry characteristics, beyond industry concentration and industry size. The existence of a diversification discount or premium still depends on the importance of specialized competitors in the industry, although industry concentration and, to a lesser degree, industry size are two of the key industry characteristics that also drive the relative performance of diversifiers versus specialists.

Table X

Berger and Ofek (1995) Regressions with Firm Fixed Effect for the Period 1993–2001 Introducing Interaction with Additional Industry Characteristics

Firm fixed effect regressions of the excess value computed as in Berger and Ofek (1995). Our definition of industry is by four-digit SIC code. We use observations only from 778 firms that report a change in the number of segments during the period 1993–2001.

	Industry-adjusted market to sales ratio	Industry-adjusted market to sales ratio	Industry-adjusted market to book ratio	Industry-adjusted market to book ratio
Constant	0.52**	0.56***	0.95***	0.98***
	(0.21)	(0.21)	(0.18)	(0.18)
DIV[a]	0.07	−0.01	0.19***	0.14***
	(0.07)	(0.06)	(0.06)	(0.06)
DIV[a]*Number of specialized companies[b]	−0.04**	—	−0.02	—
	(0.02)		(0.01)	
DIV[a]*Market Share of specialized companies[e]		−0.11*		−0.09*
		(0.06)		(0.05)
DIV[a]*ISIZE[c]	−0.00	−0.01	−0.01***	−0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
DIV[a]* CONC[d]	0.22**	0.35***	0.24***	0.30***
	(0.10)	(0.07)	(0.08)	(0.06)
Number of specialized companies[b]	0.00	—	−0.00	—
	(0.02)		(0.01)	
ISIZE[c]	−0.14***	−0.15***	−0.10***	−0.10***
	(0.01)	(0.00)	(0.00)	(0.00)
CONC[d]	−0.34***	−0.44***	−0.40***	−0.43***
	(0.09)	(0.07)	(0.08)	(0.08)
Firm size	0.05***	0.05***	−0.08***	−0.08***
	(0.01)	(0.01)	(0.01)	(0.01)
Cap exp.	0.30***	0.29***	0.01	0.01
	(0.03)	(0.03)	(0.03)	(0.03)

(continued)

Table X—*Continued*

	Industry-adjusted market to sales ratio	Industry-adjusted market to sales ratio	Industry-adjusted market to book ratio	Industry-adjusted market to book ratio
EBIT	0.27***	0.27***	0.29***	0.29***
	(0.06)	(0.06)	(0.05)	(0.05)
Market share of specialized companies[e]				−0.04
				(0.04)
R^2	0.70	0.69	0.61	0.61
Obs	4,521	4,447	4,521	4,447

Standard deviations of the coefficients are reported in parentheses. Asterisks indicate significance at the 10% (*), 5% (**), and 1% (***) levels.

[a]Dummy equal to one if the firm operates in more than one four-digit SIC code.

[b]The number of specialized competitors, *NSC*, is computed as

$$NSC_{it} = \sum_{I=1}^{N} \omega_{itI} nsc_{It},$$

where ω_{itI} is the proportion of segment sales over total firm sales and *mssc* represents market share of specialized companies in industry I at time t.

[c]*ISIZE* is computed as

$$ISIZE_{it} = \sum_{I=1}^{N} \omega_{itI} \log(ind\_size_{It}),$$

where ω_{itI} is the proportion of segment sales over total firm sales and *ind˙size* represents total sales of industry I at time t.

[d]*CONC* is computed as

$$CONC_{it} = \sum_{I=1}^{N} \omega_{itI} HHI_{It},$$

where ω_{itI} is the proportion of segment sales over total firm sales and *HHI* is the Herfindhal–Hirschman concentration index of industry I at time t.

[e]The market share of specialized competitors, *MSSC*, is computed as

$$MSSC_{it} = \sum_{I=1}^{N} \omega_{itI} mssc_{It},$$

where $\omega_{it\mathrm{I}}$ is the proportion of segment sales over total firm sales and *mssc* represents market share of specialized companies in industry I at time t.

VI. Conclusion

In this paper, we discuss why some industries are friendlier environments for diversification strategies while other industries favor specialized companies. This analysis has important implications for the diversification–performance literature. We find empirical evidence that indeed the effect of diversification on performance is not homogeneous across industries. In particular, we show that a diversification discount arises only in those industries with a large number of specialized companies (or when they have a substantial market share), whereas a diversification premium arises in sectors with just a few specialized competitors (or small market share). This finding is robust to the use of different econometric specifications, including procedures that control for self-selection bias. Our results are also robust to the use of different industry definitions and to the inclusion of other industry characteristics that may moderate the diversification–performance linkage, such as industry concentration and industry size.

These findings have relevant implications for the identifying assumptions of prior literature. First, the more traditional diversification discount literature may have obtained biased estimates of the average diversification effect on performance by selectively changing the industry definition whenever there are fewer than five specialized competitors. Specifically, BO calculate the imputed industry benchmark of each segment using the narrowest SIC grouping that includes at least five specialist companies. This means that the BO procedure selectively widens the industry definition precisely for those sectors in which diversification is more likely to create value. Because diversified companies operate in sectors with lower profitability (see Lang and Stulz (1994)), this enlarged industry definition that encompasses other sectors when there are fewer specialist companies systematically decreases the industry-adjusted value corresponding to diversified firms. As a result, the BO procedure downward biases the estimation of an average effect of diversification across industries as our empirical results above show (see Appendix B for a formal treatment of this bias).

Second, Campa-Kedia (2002) and Villalonga (2004a) argue that self-selection might downward bias the traditional BO procedures to estimate the diversification discount because the diversification decision might be associated with unobserved firm characteristics that are negatively correlated with firm financial performance. With regard to this literature, our finding that the diversification–performance linkage varies across industries may call into question the identifying assumptions of instrumental variables techniques employed to control for self-selection, while it does not affect other self-selection correction techniques such as the inclusion of firm fixed effects (see also Appendix B for details). In particular, industry characteristics that measure how attractive an industry is for conglomerates cannot be considered good instruments since not only will they be associated with the decision to diversify, but they will also be correlated with firm financial performance because, as we have shown in this paper, diversified firms tend to perform better in industries dominated by conglomerates.

As a result, this particular instrumental variable estimator is likely to provide an upward biased estimator of the average effect of diversification across industries.

Finally, this paper generates new questions and insights to be addressed by future research. Future work should investigate the consistency of our results with stock market reactions to diversifying moves in industries with a large versus small number of specialized competitors, in a vein similar to the studies of Morck, Shleifer, and Vishny (1990) and Kaplan and Weisbach (1992). Also, further empirical research could shed more light on the key industry characteristics that determine the competitive advantage of diversified versus stand-alone firms and the reasons behind firm diversification in unfavorable industry environments. Finally, our results emphasize the need for more investigation about valid instruments to identify the effect of diversification on performance, which appears to be far more complex than the average effect across industries estimated by earlier research on the topic.

Appendix A

In this appendix, we detail how we construct the sample following Berger–Ofek (1995):

- We eliminate from the sample all firms that are active in a financial sector (SIC between 6000 and 7000).
- We eliminate from the sample all companies that have total sales less than $20 million.
- We eliminate from the sample all those firms that do not report the industry in which they are operating at the four-digit SIC level. If a firm does not report a four-digit SIC code for any of its business segments, we delete the company from the sample.
- We eliminate from the sample all those companies in which the sum of segment sales is different from total firm sales by more than 5%.
- We eliminate from the sample all those companies in which the sum of segment assets is different from total firm assets by more than 10%.

Now we detail how we construct the industry-adjusted market to book/market to sales ratio, again following Berger–Ofek (1995).

- For every firm in the sample, we compute its market value by multiplying the stock price at the end of the year by the number of outstanding shares and adding the book value of short-term debt and long-term debt.
- For every four-digit SIC code, we find all specialized companies that operate exclusively in this four-digit SIC industry. We compute the representative industry market to book/market to sales ratio as the median of the market to book /market to sales ratio of this set of companies.
- For every firm, we compute a "would be" market to book/market to sales ratio, averaging the representative industry market to book/market to sales ratio using all representative industry ratios (as computed in step 1) in

which the firm is active and using as relative weights the percentage of segment assets/sales over total assets/sales of the company.

- The industry-adjusted market to book ratio is computed as the natural log of the real company market to book/market to sales ratio divided by the "would be" market to book/market to sales ratio that was found in step 2. Finally, we eliminate those observations in which the industry-adjusted market to book ratio or the industry-adjusted market to sales ratio computed following this procedure exceeds three in absolute value.

Appendix B

Previous empirical studies specify the following equation to estimate the relationship between firm performance and diversification:

$$Y_{it,1\ldots N} - \sum_{I=1}^{N} \omega_{itI}\overline{y_{tI}} = \delta_0 + \delta_1 X_{it} + \delta_2 D_{it} + v_{it} \tag{B1}$$

where

$Y_{it,1..N}$ represents time t performance of firm i that is operating in industries 1 to N.

ω_{itI} represents the weight for firm i corresponding to its segment that operates in industry I at moment t. In the chop-shop approach, these weights are either the proportion of segment sales or assets over total firm sales or assets. Note that $\omega_{iI} = 0$ whenever firm i is not active in industry I.

$\overline{y_{It}}$ represents average performance in industry I at time t. This average is computed using the performance of specialized companies that operate exclusively in industry I at time t.

X_{it} represents observed firm characteristics of firm i at time t.

D_{it} is a dummy equal to one if firm i is a multisegment company at time t.

v_{it} represents unobserved firm characteristics.

δ_0, δ_x, and δ_2 are parameters to be estimated. In this literature, the parameter of interest is the scalar δ_2, which measures the effect of being diversified on performance.

Note that this so-called chop-shop procedure succinctly described in (B1) accounts for all industry characteristics, K_I, that affect firm performance. The robust and consistent empirical finding across many different samples and time periods is that the estimation of δ_2 is negative and statistically different from zero.

As a first caveat, note that this identification strategy based on the chop-shop approach cannot be applied to diversified firms that carry out their activities in industries in which only diversified firms operate. In these industries, we are unable to construct $\overline{y_{tI}}$. This is not irrelevant since 60% of the four-digit SIC code industries present in the Compustat database in 2001 (before cleaning the sample using the BO guidelines) are populated exclusively by segments of diversified firms. Therefore, this estimation procedure selectively eliminates from the sample those industries in which diversified firms would likely perform better than specialized companies.[7] Thus, our methodology as well as earlier research on diversification probably underestimates the advantages of diversifiers because in many industries that are not included in the empirical analyses, specialists have just disappeared.

We have seen throughout this paper how the effect of diversification on performance varies across industries. We incorporate this fact by considering $\delta_2 = \overline{\delta_2} + \sum_I Ind_{iI}\delta_2^I$, where as before I represents a given industry, Ind_{iI} is an indicator function equal to one if firm i is present in industry I and zero otherwise, and δ_2^I is an industry-specific parameter that represents how well diversified firms perform in that particular industry I. Note the fundamental difference between K_I and δ_2^I. The latter are industry characteristics that affect exclusively the performance of diversified firms, while K_I are industry characteristics that affect symmetrically the performance of all firms—diversified or not—that operate in the same industry. We assume that the parameter of interest in prior literature is the *average effect of diversification across industries*, *AEDI*, on performance. In our specification, *AEDI* is $\overline{\delta_2}$. If we rewrite (B1), we get

$$Y_{it,1..N} - \sum_{I=1}^{N} \omega_{itI}\overline{y_{tI}} = \delta_0 + \delta_1 X_{it} + \overline{\delta_2} D_{it} + v_{it}^* \tag{B2}$$

$$v_{it}^* = v_{it} + \sum_{I=1}^{N} \omega_{itI}\delta_2^I D_{it},^{8}$$

where the only difference with respect to (B1) is the inclusion of an extra error term $\sum_{I=1}^{N} \omega_{itI}\delta_2^I D_{it}$.

A. Analytical Derivation of the Implications for the Traditional Diversification Discount Literature

For simplicity, assume there are no control variables X, and that there are only two industries, I and J. Industry I is the real industry at the four-digit SIC code in which a conglomerate is operating. If there are less than five specialized competitors in industry I, the BO procedure would enlarge the definition of the industry to include specialized competitors both from industry I and also from another four-digit SIC code industry J. If this is the case, we can write the

[7] It is also true that this methodology does not consider those industries populated exclusively by specialized firms. Yet, this is a much less severe problem since in Compustat, only 1% of the industries are populated by only nondiversified companies.

[8] Note that since ωI is equal to zero if the firm is not active in industry I, the indicator function is redundant.

industry average with the enlarged definition, $\overline{y^*_{It}}$, as follows:

$$\overline{y^*_{It}} = (1 - Ind_{L_{It<5}})\overline{y_{It}} + Ind_{L_{It<5}} \times \left[\delta_0 + \delta_3 \frac{L_{It}}{L_{It} + L_{Jt}} K_{It} + \delta_3 \frac{L_{Jt}}{L_{It} + L_{Jt}} K_{Jt} \frac{\sum_i^{L_{It}} e_{itI} + \sum_i^{L_{Jt}} e_{itJ}}{L_{It} + L_{Jt}}\right], \quad \text{(B3)}$$

where $Ind_{L^{It}<5}$ is an indicator function equal to one if the number of stand-alone firms in firm I, L_{It}, is less than five, and zero otherwise. Note that for simplicity, we are assuming that $L_{It} + L_{Jt} \geq 5$. If we follow the chop-shop approach with this BO methodology and we substitute $\overline{y_{It}}$ by $\overline{y^*_{It}}$ in (B2) using (B3), we find that

$$Y_{it,1..N} - \sum_{I=1}^{N} \omega_{itI} \overline{y^*_{It}} = \delta_0 + \delta_2 D_{it} + v^{**}_{it} \quad \text{(B4)}$$

$$v^{**}_{it} = v_{it} + \sum_{I=1}^{N} \omega_{itI} \delta_2^I D_{it} + \sum_{I=1}^{N} \omega_{itI} \delta_3 (K_I - K_J) \frac{L_J}{L_I + L_J} Ind_{L_{It}<5} + \overline{\overline{e}},$$

where $\overline{\overline{e}}$ is a linear combination of error terms that we can safely ignore. With (B4), we can analyze the potential bias of the traditional diversification discount literature. Note that even if $E[v/D] = 0$, $E[v^{**}/D] \neq 0$ and therefore the OLS regression of (B4) will provide biased estimators. We can investigate further the bias of the standard BO regressions when trying to estimate $\overline{\delta_2}$. The bias of the OLS estimator of $\overline{\delta_2}$ will be given by the sign of the expression

$$E\left[D\left(\sum_{I=1}^{N} \omega_{itI} \delta_2^I D_{it} + \sum_{I=1}^{N} \omega_{itI} \delta_3 (K_I - K_J) \frac{L_J}{L_I + L_J} Ind_{L_{It}<5}\right) \Big/ D\right]. \quad \text{(B5)}$$

While the bias arising from the fact that $E[\sum_{I=1}^{N} \omega_I \delta_2^I D/D] \neq 0$ does not have a clear sign,[9] we can manipulate the second term in (B5) since

$$E\left[D\left(\sum_{I=1}^{N} \omega_{itI} \delta_3 (K_I - K_J) \frac{L_J}{L_I + L_J} Ind_{L_{It}<5}\right) \Big/ D\right] = \text{Prob}(D = 1) E\left[\sum_{I=1}^{N} \omega_{itI} \delta_3 (K_I - K_J) \frac{L_J}{L_I + L_J} Ind_{L_{It}<5} \Big/ D = 1\right]. \quad \text{(B6)}$$

There are strong reasons to believe that (B6) will be different from zero, and therefore that the OLS estimator of $\overline{\delta_2}$ will be biased. First, our findings in Section IV suggest that value-maximizing firms will likely diversify in industries

[9] However, ωI (segment share of sales or assets) is probably going to be larger for industries in which $\delta_2^1 > 0$, since companies will optimally devote more resources to those industries or segments in which they are more productive (Maksimovic and Phillips (2002)). If this is the case, $\mathrm{E}\left[D \sum_{i=1}^{N} \omega_1 \delta_2^1 D_t\right] > 0$ and the usual diversification discount regressions such as the ones in Berger and Ofek (1995) or Lang and Stulz (1994) (if we abstract from other biases) would likely generate an upward biased estimator of the average effect of diversification on performance.

with less than five specialized competitors and therefore $E[\, Ind_{L^{It}<5}/D = 1\,] > 0$. Also, Lang-Stulz (1994) report that diversified firms operate in slow-growing industries with lower Tobin's q and this suggests that $K_I - K_J < 0$, which implies that

$$E\left[D\left(\sum_{I=1}^{N}\omega_{itI}\delta_3(K_I - K_J)\frac{L_J}{L_I + L_J}Ind_{L_{It}<5}\right)\Big/D\right] < 0$$

and as a consequence, the BO estimator of $\overline{\delta_2}$ would be downward biased.

B. Analytical Derivation of the Implications for the Self-selection Diversification Literature

A regression model as specified in (1) will give a consistent estimator of $\overline{\delta_2}$ under the standard conditions that $E[v/D, X] = 0$. The self-selection discount literature (Campa and Kedia (2002), Villalonga (2004a)) has convincingly argued why $E[v/X, D] \neq 0$. In particular, there are unobservable firm characteristics that are correlated with performance measures and with the decision to diversify.

An instrument z needs to satisfy two conditions: $E[zD] \neq 0$ and $E[zv^{**}] = 0$. Take v^{**} from (B2) and for simplicity ignore any bias from changing industry definitions when computing the industry-imputed value. Then

$$E[zv^{**}] = E\left[\sum_{I=1}^{N}\omega_I\delta_2^I D\right] = \text{Prob}\,(D = 1)\sum_{I=1}^{N}\omega_I\delta_2^I E\left[Z/D = 1\right] \neq 0. \qquad \text{(B7)}$$

$E[z/D = 1] \neq 0$ because since $E[zD] = \text{Prob}(D = 1)E[z/D = 1]$, if $E[zD] \neq 0$ then $E[z/D = 1] \neq 0$. As a result, if there exists I such that $\delta_2^I \neq 0$, then the instrumental variables will be a biased estimator of $\overline{\delta_2}$.

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