Drivers and Consequences of Short-Term Production Decisions: Evidence from the Auto Industry*

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> I know we can't turn [the production strategy] around in a year or two. If we're going to change, that's a long-term view, and there's going to be a long period in there — four to eight years probably that would be required to try to turn that around. But four to eight years of hurt. Can we afford that?
>
> Big Three U.S. auto industry manager

1. Introduction

The objectives of this study are twofold. The first objective is to gain an understanding of the role of management accounting — specifically, traditional absorption cost accounting and performance measurement systems — in the decision to produce in excess of market demand. Prior research suggests that absorption costing encourages managers to increase production levels in order to increase short-term accounting profits (Roychowdhury 2006; Gupta, Pevzner, and Seethamraju 2010; Zimmerman 2009). Management accountants argue that if the cost of excess capacity is separated from current production and the responsibility for excess capacity is assigned to the individuals that have control over such excess capacity, the tendency to overproduce will be mitigated (Cooper and Kaplan 1992). However, many firms continue to overemphasize short-term accounting profits (Ittner, Larcker, and Meyer 2003) and fail to separate excess capacity costs in their evaluation and rewarding of managers. The first part of this paper uses field interviews from one

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U.S. auto manufacturer to provide insight into the effect of traditional absorption cost accounting and performance measurement systems on production decisions.

The second objective of this study is to investigate the association between excess production and tangible as well as intangible costs. Prior research documents that inventory increases in excess of sales increases are associated with *lower* firm value. This research attributes the decline in value to investor beliefs that excess production reflects short-term earnings manipulation as opposed to expectations of future demand increases (Lev and Thiagarajan 1993; Abarbanell and Bushee 1997). We explore whether an additional reason for the observed decline in firm value in the presence of excess production is brand image erosion. We conjecture that, although the tangible costs of excess production may be well understood by managers, the effects of production decisions on the intangible asset of brand image are likely not incorporated in any meaningful way into production decisions. A reason for this omission is that intangible assets are difficult to identify and measure, often requiring the use of nonfinancial measures that are not commonly reported in traditional accounting systems. However, to obtain a comprehensive understanding of the economic impact of short-term production decisions it is important to examine tangible as well as intangible outcomes that accrue from such decisions. The second part of this paper uses archival data from the North American auto industry to examine the impact of excess capacity on excess production and the effect of excess production on discretionary tangible costs that are identifiable by the accounting system such as customer incentives (e.g., rebates), advertising spend, and inventory buildup, as well as an important intangible cost, that is, brand image that may not be captured by traditional accounting and reporting systems. The field interviews enable provision of a nuanced understanding of the context within which excess production decisions are made, while the archival analyses allow for statistical testing and calibration of the tangible and intangible costs of such excess production.

The auto industry provides an excellent research setting to examine the determinants and economic effects of excess production for three reasons. First, the auto industry in general, and the North American auto industry in particular, had high levels of excess capacity during the period of study (2005–2006). Second, the industry is characterized by high fixed costs. Excess production coupled with absorption costing allows the spreading of these fixed costs over a larger number of units and confers short-term performance benefits. Third, firms in this industry, especially the "Big Three" U.S. automakers, have a short-term-oriented incentive structure that focuses on improving short-term financial costs and margins.[1] Indeed, industry

1. For example, although Chrysler's market share fell from 14.5 percent in 2006 to 12.9 percent in 2007, the chief executive officer (CEO) stated that the profit target of 5 percent return on sales would not be altered for 2007 (Kiley and Edmondson 2007).

analysts have observed the tendency for U.S. automakers to overproduce vehicles relative to demand and to use liberal customer incentives to sell the excess production (Boudette and White 2007). These analysts express concerns about the implications of overproduction on the long-term viability of U.S. automakers (Ingrassia 2002).

Our field interviews with managers of a Big Three U.S. automaker indicate that improper accounting for the fixed overhead cost of excess capacity combined with a performance measurement system that focuses on short-term costs and profits results in overproduction relative to "free" (i.e., nonincentivized) market demand. The excess capacity in this firm arises from several factors such as potentially suboptimal capacity investment decisions, a decline in the market share, and long-term labor and supply contracts. As such, the excess capacity is outside the control of the firm's middle- and lower-level managers and should be excluded when unit costs are computed for performance measurement and evaluation purposes. However, excess capacity costs are not excluded from the costs of current production. Moreover, the firm evaluates performance of production managers and executives using a balanced scorecard that places considerable emphasis on short-term unit costs and profits but does not separately assign responsibility for excess capacity costs. Our interviews also reveal that, although many managers are aware that overproduction can have potential adverse consequences on intangible assets, calibrating these consequences is challenging, and the relations between overproduction and intangible assets such as brand image are difficult to estimate. In sum, our field interviews indicate that, in the firm we study, managers focus on the short-term benefits of increased production and fail to incorporate into the production decision (i) the resulting increase in tangible costs necessary to dispose of the excess inventory (which are captured in the accounting system but at a different point in the value chain) and (ii) the potentially harmful effects on brand image (not captured in the accounting system).

We next use archival industry data to conduct an empirical analysis at the level of the product nameplate.[2] We find an association between excess capacity and excess production. Every percentage point of excess capacity is associated with a 0.49-percentage-point increase in excess production. Next, we find a positive association between excess production and customer incentives and conclude that firms are indeed using incentives to dispose of excess production (as opposed to using customer incentives as an overall sales strategy).[3] We also find that excess production is associated with an

2. Automakers use the nameplate as the unit of analysis for decision making. Each company has several brands, and each brand has several nameplates. For example Buick, Cadillac, and Hummer are brands of General Motors (GM). Nameplates for the Cadillac brand include Deville, Eldorado, and Escalade.

3. If incentives were a part of an intentional sales strategy, then we would not expect to find an association between excess production and sales incentives. Rather, an incentive sales strategy would suggest that all products — regardless of the level of excess production — would have high incentives.

increase in the tangible costs of advertising spend and inventory buildup. Finally, we find that higher customer incentives and inventory buildup are negatively associated with our measure of brand image, the J.D. Power Automotive Performance, Execution, and Layout (APEAL) Index. Specifically, every additional one percent of rebate is associated with a two-point decline in the APEAL index; a one-percent increase in rebate penetration is associated with a 0.2-point decline in the index.

While existing literature in accounting examines the effect of accounting and performance measurement systems on a variety of outcomes such as managerial effort, earnings management, budget padding, and so on, the intangible effects of short-term decisions are relatively unexplored. This study makes a contribution to the literature in this area. In addition, this study responds to recent calls (e.g., Ashton 2005) for the identification and testing of value-based financial and nonfinancial measures that can be used by managers within and outside the firm for identifying, measuring, creating, and monitoring intangible assets. Specifically, an important implication of this study is that the inclusion of nonfinancial measures of intangible assets such as brand image into the incentive structure may improve production decisions. Finally, there is a significant body of accounting research related to ex ante capacity planning decisions (e.g., Balachandran, Balakrishnan, and Sivaramakrishnan 1997; Balakrishnan and Sivaramakrishnan 2001, 2002; Banker and Hughes 1994; Buchheit 2003).[4] Our study contributes to this literature by examining, not the capacity decision itself, but the subsequent production decisions that are made as the result of excess capacity in the context of firms' accounting and performance measurement systems.

The reminder of the paper is organized as follows. Section 2 discusses the theory and research questions, and section 3 describes our research setting and the insights of our field interviews. Section 4 provides the results of our archival analysis. Section 5 concludes.

2. Theory and research questions

We first examine factors driving firms' decisions to produce in excess of market demand. There are several reasons a firm may choose to produce in excess of current demand. Increased production may reflect a firm's estimate of growth in future demand and can signal optimism to investors. Jiambalvo, Noreen, and Shevlin (1997), for example, find that overproduction can lead to a positive stock market reaction if investors perceive such overproduction as an early indicator of increase in future sales. Further, firms may overproduce to avoid a curtailment in production that may result in layoffs and unwanted political costs associated with labor contracts. We examine the role that incentives derived from the cost accounting and

4. See also Kouvelis, Chambers, and Yu 2005 and Van Mieghem 2003 for reviews of capacity planning research in the operations literature.

performance measurement systems play in the decision to produce in excess of demand.

Accounting systems in most manufacturing firms are based on absorption costing in which fixed manufacturing overhead is allocated to product costs (i.e., product costs fully "absorb" all costs of production, including fixed costs). Accounting theory suggests that allocations should be based on practical capacity and that the cost of excess capacity should be separated and treated as a period cost. Further, the responsibility for excess capacity costs should be assigned to the managerial level at which the capacity decision is made (Cooper and Kaplan 1992). Separately identifying responsibility for capacity costs makes the effect of excess capacity on costs more salient and can contribute to improved decision making (Buchheit 2004).[5]

Statement of Financial Accounting Standards (FAS) 151, "Accounting Costs", appears to be consistent with accounting theory. Effective in fiscal years beginning after June 15, 2005, *FASB Statement No. 151* (Cairns 2005) "requires that allocation of fixed production overheads to the costs of conversion be based on the normal capacity of the production facilities". The statement further directs that "abnormal" excess capacity should be charged to the current period and not included in inventory. However, the definition of "normal capacity" remains vague, leading to a disconnect between what accounting theory prescribes and what is observed in practice. The FAS 151 guidelines provide enough leeway for a range of denominators to be used in the computation of fixed overhead allocation rates. It is this leeway that provides an opportunity for firms with excess capacity to lower unit costs with increased production and thereby improve short-term financial performance. Thus, we posit that managerial accounting practices that burden current production with the cost of excess capacity moderate the relation between excess capacity and excess production.

Performance measurement systems also moderate the relation between excess capacity and excess production in that they exacerbate managers' incentives to engage in excess production. Most firms have performance measurement systems which evaluate managers relative to budgetary goals that use expected production as the denominator, instead of practical capacity as prescribed by accounting theory. This provides incentives for managers to increase production even in excess of expected demand, as long as the variable accounting cost of production is lower than the expected marginal

5. Buchheit (2004) provides experimental evidence that even a very simple change in fixed cost reporting format can produce relatively significant changes in pricing strategies. Experimental participants who were provided cost reports that included fixed costs charged lower prices and also reported that they felt greater pressure to reduce prices relative to participants who received cost reports in a contribution margin format.

accounting revenue.[6] Such excess production decisions may improve short-run accounting profit but be detrimental to the economic value of the firm.

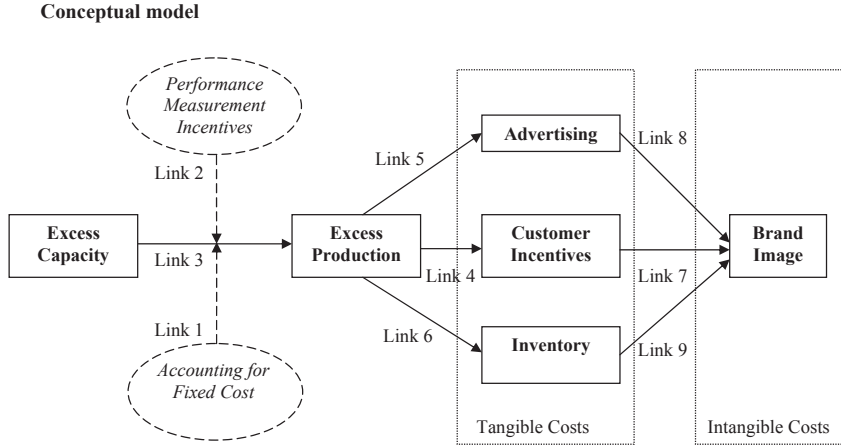
Taken together, a combination of accounting system shortcomings and a short-term decision orientation induced by performance measurement systems can lead to a persistent tendency among firms with excess capacity to increase production volume to cover fixed costs and lower total unit costs.

Next, we investigate the consequences of excess production on both tangible costs (i.e., captured by traditional accounting and reporting systems) as well as intangible costs (i.e., not captured by traditional accounting and reporting systems). Specifically, we posit that excess production will be positively associated with the tangible cost of inventory buildup and with discretionary tangible costs associated with efforts to move the excess inventory including customer incentives (e.g., rebates) and advertising spend. We further predict that excess inventory is associated with deterioration in brand image when that inventory is readily observable by customers (e.g., autos stored in mall parking lots). Customer rebates are likely to be negatively associated with the intangible cost of brand image erosion based on prior research that associates higher prices with superior quality and discounts with inferior quality (Styhre and Kohn 2006). Advertising also likely influences brand image, but the direction of the influence is unclear. On the one hand, advertising can increase brand image, especially when it focuses on the firm and other strong brands. On the other hand, excessive advertising of rebates can reduce brand image. In sum, we posit that excess production will be positively associated with tangible costs of inventory buildup, customer incentives, and advertising spend. Inventory buildup and customer incentives will, in turn, be negatively associated with brand image.

The relations that we examine in this research are shown in Figure 1. Our primary research questions are as follows. First, do firm-level factors such as accounting for fixed cost of excess capacity (Figure 1, Link 1) and performance measurement systems that provide incentives for short-term cost reduction (Figure 1, link 2) lead to a relation between excess capacity and excess production (Figure 1, link 3)? Second, does excess production influence tangible costs such as customer incentives (Figure 1, link 4), advertising spend (Figure 1, link 5), and excess inventory cost (Figure 1, link 6)? Finally, what is the effect of these tangible costs on the intangible cost of brand image erosion (Figure 1, links 7, 8, and 9)? We use field interviews from a Big Three U.S. automaker to provide insights regarding Figure 1,

6. Misperceptions regarding scale economics may also drive the mentality to overproduce. Prior research indicates that most firms overestimate scale economies because these tend to be very visible and salient (Hambrick 1983). For example, within the relevant capacity range, if a firm is operating below capacity, it can increase output without the need to increase its plant and equipment cost, or with the same level of personnel. Pil and Holweg (2003) note that in most industries executives have a ''minimum efficient scale'' mindset and assume that scale of production can act as a barrier to entry. This mindset provides additional incentives to overproduce.

Figure 1 Conceptual model.



links 1–6. Links 3 through 9 are tested using archival data from the North American auto industry. Field insights also provide a richer context within which the results of the archival analysis of the tangible and intangible costs of excess production (Links 3 through 9) can be interpreted.

3. Field evidence on the determinants and consequences of excess production

Research setting

We examine our research questions using field evidence and archival data from the North American auto industry during the period 2005 to 2006. The auto industry provides an attractive context to examine the determinants and consequences of excess production for at least three reasons. First, the auto industry has been undergoing significant changes in recent years. Some of these changes include a substantial increase in international competition, increase in customer information because of the Internet, rapidly changing technologies in safety as well as style features, and the increase in customer segmentation and niche markets such as customers with a preference for hybrid vehicles (Power Report 2003). As a result of increased competition, the market share of the U.S. auto industry has decreased, leading to excess capacity, estimated at about 20 percent (Anonymous 2003).

Second, automakers have a cost structure that is highly leveraged (i.e., a greater proportion of fixed costs relative to variable costs). A significant fixed-cost burden for Big Three automakers (and to a lesser extent foreign automakers producing in the United States) accrues from health care and pension costs of retired employees (i.e., ''legacy costs''), as well as committed contracts with labor. For example, health care–related costs account for approximately $1,500 for every vehicle produced by GM (Murray 2005) and every employee supports two-and-a-half pensioners (Klier 2004).

Finally, incentive structures in the auto industry encourage excess production. Most North American automakers have performance measurement systems that place considerable emphasis on short-term cost reduction, and managerial compensation is based on short-term accounting performance measures (Tay 2007), which exacerbates the incentives to overproduce. In addition, automakers recognize revenue when the product is shipped to the dealer, rather than when the product is sold to the final customer. Hence, in the short term, excess production allows a firm to report greater revenues as well as lower unit costs. Cost and production efficiencies are also widely and publicly reported throughout the industry. The annual *Harbour Report* (e.g., Oliver Wyman 2003) computes its "hours per vehicle" (HPV) production efficiency metric as total labor hours from all hourly and salaried workers divided by total production. This widely publicized report provides additional incentives for automakers to increase production.

As anecdotal evidence of these production practices, in October 2006 Chrysler executives revealed to analysts and investors that the company had been producing far in excess of demand in order to fill capacity (Henry 2007). Auto analysts had already noticed in the summer of 2006 that over 100,000 Chrysler vehicles were idling in the Detroit area (Maynard 2006). Similarly, during December 2006, GM had more than one million vehicles in stock in the United States. In 2006, GM had about 41,000 vehicles for every one percent market share in the United States, whereas Toyota had only 16,000 vehicles of inventory per percent of its market share (Boudette and White 2007). According to a *Business Week* article on Chrysler, "Even though Zetsche [CEO of Daimler Chrysler] said in 2003 that the overproduction of vehicles 'would never happen again', the same scenario did recur, only worse, at the end of 2005 and in 2006" (Kiley and Edmondson 2007). Moreover, the business press has noted the correlation between overproduction and provision of incentives (Maynard 2006). A *Wall Street Journal* article notes: "Detroit automakers still tend to push sales using big discounts, a tactic that undermines both brand image and the resale value that customers get when they trade in or sell their car" (Boudette and White 2007).

Interview protocol

To obtain detailed insights into the organizational dynamics that encourage excess production, we conducted field interviews at one of the Big Three automakers. Our objective was to discern the role of accounting and performance measurement systems in encouraging excess production in the presence of excess capacity. We further sought to obtain managers' perceptions regarding the consequences of any such excess production. We describe the insights from our field interviews below. Although we followed field study protocol, the results described in this section are gleaned from interviews at one automaker and therefore should be interpreted with caution.

The vice president of strategy was our preliminary contact for the project and assisted in identifying appropriate interviewees from various functional departments, including human resources (HR), marketing, manufacturing, quality reporting, and production planning. At our request, he identified interviewees who were familiar with the motivations for current production decisions and could provide insights into the consequences of those decisions from the unique perspective of their functional department. Interviews were facilitated by the strategy group within the organization and were conducted over a two-day period in late 2006 with 10 managers having titles of directors of strategy, HR, finance, production planning, costing, market research, sales, transportation, and dealer management. Each interview lasted approximately one-and-a-half hours.

Although a basic interview protocol was followed with a standardized set of questions, the interviews were primarily open ended to allow interviewees to provide their perspectives on the issue of overproduction by the firm. The interviews included discussions about production strategy, motivations for that strategy, and the consequences of the strategy employed. The research team was careful not to provide any leading questions, using the interview protocol to guide the discussion. Sometimes in the course of the interviews, data were provided; at other times we requested data that were collected and provided at a subsequent meeting. The interviews were tape recorded and transcribed by a professional transcribing firm. These transcriptions were read and interpreted by multiple members of the research team in order to gain consensus regarding the important insights they provided and to identify representative passages that best reflect those insights for inclusion in the study.

Following these interviews, we held weekly phone meetings with two key contacts from the strategy group from January 2007 through June 2007. These meetings were used to clarify insights from the interviews and to facilitate data collection and interpretation. The weekly phone meetings were also required because quantitative data for some of the subsequent archival analysis had to be collected from various parts of the organization and required coordinated efforts to collect, combine, and interpret. In the following subsection, we describe insights gleaned from our interviews with key decision makers in the firm regarding production planning, performance measurement, and accounting practices.

Field evidence on the determinants of excess production

Our interviews revealed that the accounting system encourages an excessive focus on short-term financial performance and hampers long-term strategic thinking. The firm uses a standard absorption costing system. Labor rates are obtained from the industrial engineering department, and the manufacturing finance department provides the overhead burden rate. The manager of product costing said that the overhead burden rate is based on estimated overhead cost divided by *expected* plant production

volume. When we inquired whether excess capacity costs were separately identified, the product manager responded that "excess capacity costs are not separated".

The failure of the accounting system to separate excess capacity costs results in variability in costs arising from fluctuations in production that may or may not reflect demand fluctuations. Because of unit cost targets included in the balanced scorecard and tied to rewards, managers at various levels of the organization, including production planners, have an incentive to increase production to lower unit costs. In 2006, the company was operating at only 56 percent of its installed capacity and about 50 percent of total manufacturing costs were fixed. Managers admitted that the high fixed costs and low capacity utilization encouraged them to "build more to reduce unit costs".

Lack of accounting for excess capacity has a salient effect early in the production planning process, when the firm is in the process of forecasting demand. The production planning department uses the projections of "free demand" (i.e., demand absent any customer incentives) generated by the economics department as the starting point for determining production quantity. It then consults with marketing/sales to obtain an estimate of sales quantity. Based on these two numbers, if the production quantity is "not good enough" (i.e., production is inadequate to absorb the costs to obtain the targeted cost per unit), the production planning managers explore options such as offering additional features or tweaking the price to increase demand. Based on the production planning department's estimates of the potential increase in demand that can be generated via these changes, a new free demand estimate is generated. Note, however, that although these are referred to as free demand numbers, they are not free in the sense that they have already been inflated. Although these final demand estimates are already optimistic, a combined decision is made to produce "a little more — to fill capacity". The manager of strategy remarked, "basically we talk ourselves into overproduction". Thus, our interviews suggest that failure to account for excess capacity moderates the relation between excess capacity and excess production (Figure 1, link 1).

The performance measurement system at this firm also moderates the relation between excess capacity and excess production in that it exacerbates the tendency for excess production. The firm uses a balanced scorecard to evaluate and reward the performance of managers at corporate, divisional, and plant levels. At the corporate level, performance measures such as operating margins (computed using absorption costing) and number of vehicles per employee are used. The performance measures that are used to evaluate manufacturing include: fixed cost, program spending, material cost, plant cost, variable cost, HPV, and cost per vehicle. As a result, there is an incentive to overproduce to improve cost per vehicle and justify the expenditures on fixed cost, program spending, and plant cost. All these costs have a fixed

component that declines on a per-unit basis when production volume (the denominator) increases. As a result, even though production managers are aware that the demand estimates are optimistic, the performance measurement system discourages reducing production quantity if demand is lower than expected, because then unit costs increase. As one manager remarked, "profit targets would not be met". Thus, based on the incentives and performance measures established by corporate management, overproduction seems to fulfill short-term goals of the organization.

Indeed, a factor that further encourages excess production is that upper-level managers (and, indeed, even board members) at the firm are held strictly accountable for short-term profit targets. As a result, as long as there was a nonzero short-term financial contribution margin per unit, excess production increased short-term financial performance. The excessive focus on short-term financial performance was apparent in many interviews. The manager of production planning remarked:

> The issue is that when the executive committee approves those volumes, they have been overly optimistic — extremely overly optimistic. And this is where the truth comes out. And again, this is the crux of the problem — in order to make the money — the profit targets — you have to build more units. So, even though the [marketing department managers] come back and say, "Listen, we really can't sell that many units", they are told: "You have to sell more units, because otherwise we can't hit the profit number." And so we find a way to sell more units.

Thus, although it is likely that there exist other reasons for excess production (e.g., to prevent costly layoffs; Kugler and Saint-Paul 2004), our field evidence suggests that the performance measurement system contributes at least in part to excess production (Figure 1, link 2) at our field site.[7] Moreover, evidence from Securities and Exchange Commission (SEC) Form DEF 14A filings available for two of the Big Three automakers reveals a focus on short-term financial performance and suggests that other auto

7. Before 2003, this firm was not excessively focused on cost because it was following a differentiation and flexibility policy. Beginning in 2004, however, this firm shifted its focus as well as its strategy toward cost cutting. Thus, most of the measures in the revised corporate and divisional scorecards now focus on cost. The manager of transportation and inventory remarked that the change in production behavior in response to the change in strategy was very evident. For example, in 2004, the extent of inventory holding costs increased tenfold compared to 2003 and previous years. In addition, new vehicle transportation was a profit center until 2003, but beginning in 2004 it was treated as a cost center to deal with the excessive increase in new vehicle transportation cost. The effect of excess production on additional transportation costs was very visible to the managers. In 2006, the company spent $343 million in storage costs alone. Vehicles that are sent to storage take, on average, 7.3 additional transit days (company sources).

manufacturers are likely to have similar accounting and performance measurement systems.[8]

Field evidence on the consequences of excess production

While managers felt that there were few options beyond increased production to meet the performance targets, they also acknowledged that excess production was costly in terms of both quality-related warranty costs and inventory holding costs. One manager commented: "No one will argue that [warranty cost] increases as vehicles sit in our storage yards, collecting dust." An internal study done in 2004 showed that vehicles that were stored for 360 days cost the company $50 more per vehicle in warranty than those sold within 60 days, primarily arising from body repairs, cleaning dirty interiors, and replacing drained batteries, cracked windshields, or tires.

The manager of one of the manufacturing plants remarked in a presentation to other managers in December 2006 on the increased inventory holding costs:

> Conservatively estimating that approximately one-fourth of the vehicles sold in 2004 sat longer than 60 days, this translates to a $5 million loss in 2004. Knowing that we pushed and held even more vehicles the following years, the numbers can't be prettier for 2005 or 2006.

Managers were also aware that excess production was hurting long-term revenues and costs via its impact on residual values and its impact on customer expectations. The manager of fleets and residual values remarked:

> The residual value piece of it is a lagging cost. And it's also a hidden cost that doesn't get accounted.. .. We go out and we talk to ALG [Automotive Lease Guide], and we tell them what a great vehicle we have, and we tell them that we're going to build 50,000 of these things. And they say: "Oh, if you're going to build 50,000 then I think your residual is 48." And they come back, and they look at the volumes that we're actually producing, and they see that we didn't build 50,000, we built 75,000 units. Well, they lose faith. So they say: "You know what? We thought 48 was the right number. I think, really, 43 is the right number, because I don't know where these guys are going to stop

8. For example, SEC Form DEF 14A filed by GM for 2006 states: "As in previous years, management recommended that the Committee establish aggressive performance targets for 2005. We tied the payment of annual incentive awards to meeting specific levels of corporate net income and operating cash flow." Ford states: "Performance results against target levels established for each of these criteria were weighted 75% for total Company and business unit pre-tax profits and 25% for business unit cost performance, market share and quality." Chrysler did not file DEF14A reports during the period of the study because it was an affiliate of Daimler. SEC Form DEF 14A is filed by or on behalf of a registrant when a shareholder vote is required at an upcoming meeting (www.sec.gov).

> [producing].'' So then you've got to bridge between 43 and 52 [estimate of actual RV], instead of 48 and 52. So that's the direct impact [on residual values] that is sort of hidden today.

Managers also remarked that once the firm is locked into an excess production and sell-via-incentive mindset, it becomes very difficult to get out of this process. The manager of strategy remarked: ''You don't necessarily want to fall on your sword for the sake of a long-term profit down the road, because you may not be the one that's in the chair when those long-term profits come to roost. So, we get into this short-term cycle.'' Thus, the excess production strategy persists despite the fact that, as one manager notes, ''It degrades the product''. Discussing the relation between excess production and rebates, one of the managers remarked: ''As our [performance] target slips further away, our reaction is to increase incentives, thus deteriorating the total cost of ownership.. .. This sales strategy is a short-term strategy that has obviously run its course.'' Practitioner evidence suggests that discounting behavior to dispose excess production is present in other U.S. automakers as well (Taylor 2001). For example, in an article in *The Economist* (Anonymous 2005), Joe Phillippi of AutoTrends remarks: ''The big long-term challenge [for U.S. automakers] is to get back to 'rational pricing'.''

In 2006, a team of production managers and suppliers came to the following conclusions, which were presented to the firm's executive committee:

> Remember that the [omitted $] billion cost that we identified is just the tip of the iceberg. There are other costs of considerable magnitude associated [with excess production] that are yet to be considered and that could make this a [omitted $, 10X] billion cost.. .. We've shown you why this model contradicts every pillar of our corporate strategy, which defines how we should operate to be successful today *and tomorrow*.. .. Establishing realistic sales targets will help us avoid falling into a heavy ''push'' situation again. We need to build based on what the customer wants and the market will take. We cannot continue to stumble over and over and not learn the lesson, and our executives need to demand realistic targets... we need the discipline to measure our progress to those targets, and raise the flag when we are in trouble.. .. We need to make sure that decisions being made along the way, every day, by all of us, are aligned to our corporate strategy, and judged for their short term benefits as well as their *long term effects*. (Emphasis added)

Taken together, our field interviews suggest that it is the complex interplay between production planning, performance measurement, and accounting practices within this organization that evolved into the currently observed practice of producing in excess of (free) demand and then selling via costly customer incentives. While these managers intuited that this

pattern has detrimental brand image effects as well, they had no empirical evidence of this damage, nor did they have an incentive to document this damage because the intangible costs of brand image erosion are not incorporated into the performance measurement and accounting system.

4. Archival analysis of the determinants and consequences of excess production

In this section we use monthly and annual data at the nameplate level for the period 2005–2006 to examine the association between excess capacity and excess production and between excess production and the tangible costs of advertising spend, customer rebate incentives, and inventory build-up. The sample comprises 2,364 monthly observations. Included in these data are 132 nameplates: 103 nameplates from the Big Three U.S. automakers and 29 nameplates from foreign automakers (Table 1, panel A). Table 1, panel B provides details of the distribution of observations by auto segment. Big Three automakers have a disproportionate number of observations in the sport utility vehicle (SUV) and van segments, relative to the foreign automakers. Our brand image analyses use annual data and consist of 157 nameplate-year observations. Below we define the variables used in the archival analysis (i.e., measured variables in Figure 1) and the sources for data collection.

Variable definitions and data sources

Excess Capacity: Excess capacity is the difference between nameplate-level production capacity and normal production levels (i.e., prior to decisions to push production levels beyond demand forecasts). Because we are interested in the effect of excess capacity on production decisions and because field interviews indicate that production scheduling commences approximately one year ahead of production dates, we base the computation of excess capacity on information known one year in advance of the production date. We assume that capacity investment decisions are known well in advance and thus use contemporaneous (to the actual production date) annual capacity estimates (divided by twelve to convert to monthly capacity) as the capacity measure. Annual capacity estimates were obtained from the Autofacts database (PWC Automotive Institute, http://www.pwcautomotive institute.com/).

Because actual production data are already pushed, we use two proxies for normal production levels: (i) nameplate production forecasted by a third party one year prior to the actual production date and (ii) actual nameplate production in the same month of the prior year, scaled by monthly nameplate production capacity. Forecasted production data were acquired from Global Insight (http://www.globalinsight.com/). Actual production data were obtained from the PWC Autofacts database. Thus, our two measures of excess capacity are the difference between monthly nameplate production capacity and each of our two planned production proxies. These variables

TABLE 1
Sample description

Panel A: Automakers and nameplates

	Nameplates[c]		Monthly observations	
Firm	*N*	Percent	*N*	Percent
GMC	6	4.6	117	5.0
BUICK	7	5.3	120	5.1
CADILLAC	9	6.8	136	5.8
CHEVROLET	17	12.9	341	14.4
HUMMER	2	1.5	30	1.3
PONTIAC	10	7.6	142	6.0
SAAB	1	0.8	10	0.4
SATURN	2	1.5	21	0.9
FORD	17	12.9	316	13.4
LINCOLN	5	3.8	69	2.9
MAZDA [a]	3	2.3	60	2.5
MERCURY	7	5.3	128	5.4
CHRYSLER	5	3.8	109	4.6
DODGE	8	6.1	160	6.8
JEEP	4	3.0	83	3.5
"Big Three" U.S. automakers	103	78.0	1,842	77.9
HYUNDAI	2	1.5	29	1.2
ISUZU	1	0.8	9	0.4
MITSUBISHI	4	3.0	79	3.3
NISSAN	8	6.1	180	7.6
SUBARU	3	2.3	40	1.7
SUZUKI [b]	1	0.8	6	0.3
TOYOTA	8	6.1	153	6.5
VOLKSWAGEN	2	1.5	26	1.1
Foreign automakers	29	22.0	522	22.1
Total	132	100.0	2,364	100.0

Notes:

[a] 33% ownership as of November 2007.

[b] 2.5% ownership by GM as of November 2007.

[c] Each firm has several brands, and each brand has several nameplates. For example, Buick, Cadillac, and Hummer are brands of GM. Nameplates for the Cadillac brand include Deville, Eldorado, and Escalade.

(The table is continued on the next page.)

TABLE 1 (Continued)

Panel B: Auto segments

		Foreign automakers	"Big Three" U.S. automakers	Total
SUV	Frequency	130	665	795
	Percent	5.50	28.13	33.63
	Row Pct	16.35	83.65	
	Col Pct	24.90	36.10	
Van	Frequency	44	228	272
	Percent	1.86	9.64	11.51
	Row Pct	16.18	83.82	
	Col Pct	8.43	12.38	
Compact	Frequency	64	129	193
	Percent	2.71	5.46	8.16
	Row Pct	33.16	66.84	
	Col Pct	12.26	7.00	
Large	Frequency	0	36	36
	Percent	0.00	1.52	1.52
	Row Pct	0.00	100.00	
	Col Pct	0.00	1.95	
Luxury	Frequency	0	115	115
	Percent	0.00	4.86	4.86
	Row Pct	0.00	100.00	
	Col Pct	0.00	6.24	
Midsize	Frequency	161	363	524
	Percent	6.81	15.36	22.17
	Row Pct	30.73	69.27	
	Col Pct	30.84	19.71	
Pickup	Frequency	103	241	344
	Percent	4.36	10.19	14.55
	Row Pct	29.94	70.06	
	Col Pct	19.73	13.08	
Sporty	Frequency	20	65	85
	Percent	0.85	2.75	3.60
	Row Pct	23.53	76.47	
	Col Pct	3.83	3.53	
Total	Frequency	522	1842	2364
	Percent	22.08	77.92	100.00

are *Excess Capacity (%) - forecast* and *Excess Capacity (%) - actual*, respectively.

Excess Production: We measure monthly *Excess Production* as actual nameplate production minus one-year-ahead forecasted production, scaled by one-year-ahead forecasted production. Actual production data were obtained from the PWC Autofacts database.

Customer Incentives: We measure customer incentives as *Rebate %*, which is the customer rebate as a percentage of final sales price. For example, in June 2006, the Chrysler PT Cruiser had a list price of $29,700 and a postrebate price of $26,813, which implies that the discount was 10.77 percent of the final price (Saranow and Chon 2006). Monthly data on rebate percentage are obtained from the J.D. Power and Associates Topline Report.

Advertising: Monthly advertising spend data were acquired from TNS Media Intelligence (http://www.tns-mi.com/). These data are for nameplate-specific advertising across all media forms (i.e., print, television, radio). We use both a measure of total spend (*Advertising Spend*) and a measure of spend per unit sold (*Advertising Spend per Unit*).

Inventory Buildup: Inventory buildup is associated with increased storage and transportation costs. We use a measure of days sales in inventory as a proxy for inventory buildup. *Days Inventory* is defined as the number of days it takes to sell (using actual subsequent sales) the current month's production. This variable has a minimum value of zero where zero implies that the current month production is less than or equal to the current month sales. Monthly nameplate level sales for all automakers were obtained from our field research partner.

Brand Image: We measure brand image with the J.D. Power APEAL index. The APEAL Index is based on annual surveys of approximately 95,000 customers (in 2006) during the first two to six months of ownership. The APEAL survey is a widely used brand image measure that rates the features that people find most appealing about their new vehicles using 100 vehicle attributes related to the vehicle's design, features, comfort, driving dynamics, engine performance, safety, and fuel economy (see the Appendix for item details).

Control variables: For the monthly analysis of the associations between production capacity and excess production and between excess production and the tangible costs of advertising, customer incentives, and inventory buildup (proxied by *Days Inventory*), we use a number of controls. These include: (i) an indicator variable identifying the Big Three U.S. automakers (*Big Three Indicator*), (ii) an indicator variable equal to one for any month in which production is zero for a given nameplate (*Suspended Production*), (iii) a measure of the number of plants that produce a given nameplate (*Number of Plants*), (iv) auto segment indicator variables, (v) two economic indices collected from the U.S. Bureau of Labor Statistics (http://www.bls.gov/) (*CPI Index* and *Gas Index*), and (vi) monthly indicator

variables. In addition, for the tangible cost models, we also control for *Rebate %* (except in the *Rebate %* model) and *Rebate Penetration* as measured by the percentage of all sales that are rebated. *Rebate Penetration* can range from 0 percent, which implies no units are sold at a rebate, to 100 percent, which implies that all sales are rebated.

In our annual tests of the associations between customer rebates, advertising, and inventory buildup and the APEAL Index, we again include controls for Big Three U.S. automakers, suspended production, auto segments, and a time period indicator (in this case, an indicator for the year 2006, *Year 2006*). In addition, we control for production quality, financing terms, and customer demographics. First, in the auto industry the J.D. Power and Associates Initial Quality Survey (IQS) serves as the industry benchmark for assessing new vehicle quality (Selko 2006). The IQS measures quality problems experienced by owners at 90 days of ownership. The IQS captures two categories of quality: design quality and quality of production (i.e., defects and malfunctions). We use the J.D. Power *IQS PP100* (problems per 100) data to control for product quality. Second, we include two financing term variables, the percentage of sales in which financing is done through the automaker (*Finance - Captive*) and the mean down payment (*Finance - Total Down*). Finally, to control for differences in customer demographics across nameplates, we include measures of average customer age (*Demographic - Avg Age*) and the percent of female customers (*Demographic - Gender (F)*) for a given nameplate. The finance terms and customer demographic data were collected from the J.D. Power and Associates Topline Report.

Table 2, panel A provides variable definitions; panel B provides the descriptive statistics for the monthly data; and panel C contains the correlations among monthly variables. Panels D and E contain the descriptive statistics and correlations for the annual data.

Empirical models

Figure 1, link 3 predicts that *Excess Capacity* in our setting is associated with *Excess Production*. We use the following linear model with an AR(1) disturbance, clustered by nameplate for the period January 2005 to December 2006:

$$\begin{aligned} \textit{Excess Production} = {} & \alpha + \beta_1[\textit{Excess Capacity}] + \beta_2 \textit{Big Three Indicator} \\ & + \beta_3 \textit{Suspended Production} + \beta_4 \textit{Number of Plants} \\ & + \beta_{5-11} \textit{Segment Indicators} + \beta_{12} \textit{CPI Index} \\ & + \beta_{13} \textit{Gas Index} + \beta_{14-24} \textit{Month Indicators} + \varepsilon_1 \end{aligned} \quad (1),$$

where *[Excess Capacity]* is measured as capacity relative to either one-year-ahead forecasted production, *Excess Capacity (%) - forecast*, or actual production in the same month of the prior year, *Excess Capacity (%) - actual*. We use the following vehicle type indicator variables: *Van*, *Compact*, *Large*,

TABLE 2
Descriptive statistics

Panel A: Variable definitions

Variable		Description
Capacity	=	monthly nameplate production capacity.
Production	=	actual nameplate monthly production.
Forecast (12-month ahead)	=	12-month ahead forecasted nameplate production.
Excess Capacity (%) - forecast	=	monthly nameplate production capacity less nameplate production forecasted by a third party one year prior to the actual production date, scaled by one-year-ahead forecasted production.
Excess Capacity (%) - actual	=	monthly nameplate production capacity less actual nameplate production in the same month of the prior year, scaled by one-year-ahead forecasted production.
Excess Production (%)	=	actual nameplate monthly production minus one-year-ahead forecasted production, scaled by one-year-ahead forecasted production.
Rebate %	=	nameplate mean customer rebate as a percentage of final sales price.
Rebate Penetration (%)	=	the percentage of all nameplate sales that are rebated.
Advertising Spend (000s)	=	monthly nameplate advertising spend.
Advertising Spend per Unit	=	monthly nameplate advertising spend per unit sold.
Days Inventory	=	the number of days it takes to sell (using actual subsequent sales) the current month's nameplate production.
APEAL Index	=	annual nameplate J.D. Power Automotive Performance, Execution and Layout Index. The APEAL Index is based on annual surveys of approximately 95,000 customers (in 2006) during the first two to six months of ownership.
Control Variables		
Big Three Indicator	=	1 for the Big Three U.S. automakers; 0 otherwise.

(The table is continued on the next page.)

TABLE 2 (Continued)

Variable		Description
Suspended Production	=	1 for any month in which nameplate production is zero; 0 otherwise.
Number of Plants	=	the number of plants that produce a given nameplate.
SUV	=	1 for vehicles in the SUV segment; 0 otherwise.
Van	=	1 for vehicles in the van segment; 0 otherwise.
Compact	=	1 for vehicles in the compact segment; 0 otherwise.
Large	=	1 for vehicles in the large vehicle segment; 0 otherwise.
Luxury	=	1 for vehicles in the luxury vehicle segment; 0 otherwise.
Midsize	=	1 for vehicles in the midsize vehicle segment; 0 otherwise.
Pickup	=	1 for vehicles in the pickup segment; 0 otherwise.
Sporty	=	1 for vehicles in the sporty vehicle segment; 0 otherwise.
CPI Index	=	the U.S. Bureau of Labor Statistics monthly Consumer Price Index.
Gas Index	=	the U.S. Bureau of Labor Statistics monthly gas price index.
IQS PP100	=	the nameplate J.D. Power IQS PP100 index. This is a measure of the problems per 100 vehicles as reflected in design quality and quality of production (i.e., defects and malfunctions).
Finance - Captive	=	the percentage of nameplate sales in which financing is done through the automaker.
Finance - Total Down	=	the nameplate mean down payment.
Finance - APR	=	the nameplate mean annual percentage rate for financed vehicles.
Demographic - Avg Age	=	the nameplate mean customer age.
Demographic - Gender (F)	=	the nameplate percent of female customers.

(The table is continued on the next page.)

TABLE 2 (Continued)

Panel B: Descriptive statistics for monthly data

Variable	*N*	Mean	Std Dev	25th Pctl	Median	75th Pctl
Capacity	2,364	11,839.040	11,960.330	3,770.250	8,787.750	15,744.170
Production	2,364	9,639.230	10,863.480	2,798.500	6,415.500	13,055.500
Forecast (12-month ahead)	2,364	10,204.980	10,760.620	3,424.000	7,106.500	12,897.000
Excess Capacity (%) - forecast	2,355	2.564	54.842	−10.699	10.012	29.638
N > 10%	2,355	0.500	0.500	0	1	1
N > 20%	2,355	0.372	0.483	0	0	1
Excess Capacity (%) - actual	2,355	3.465	101.375	−14.934	9.941	40.399
N > 10%	2,355	0.499	0.500	0	0	1
N > 20%	2,355	0.403	0.491	0	0	1
Excess Production (%)	2,364	−2.397	89.456	−36.503	−9.979	16.125
N > 10%	2,364	0.306	0.461	0	0	1
N > 20%	2,364	0.220	0.414	0	0	0
Rebate %	2,364	10.305	5.865	5.778	9.274	13.778
Rebate Penetration (%)	2,364	57.230	21.598	44.475	61.483	74.617
Advertising Spend (000s)	2,336	3,378.560	5,590.930	36.850	973.150	4,352.200
Advertising Spend per Unit	2,223	0.476	0.867	0.008	0.142	0.512
Days Inventory	2,251	32.384	15.376	24.168	32.269	40.681
Control Variables						
Big Three Indicator	2,364	0.779	0.415	1	1	1
Suspended Production	2,364	0.071	0.257	0	0	0

(The table is continued on the next page.)

TABLE 2 (Continued)

Variable	*N*	Mean	Std Dev	25th Pctl	Median	75th Pctl
Number of Plants	2,364	1.282	0.719	1	1	1
SUV	2,364	0.336	0.473	0	0	1
Van	2,364	0.115	0.319	0	0	0
Compact	2,364	0.082	0.274	0	0	0
Large	2,364	0.015	0.122	0	0	0
Luxury	2,364	0.049	0.215	0	0	0
Midsize	2,364	0.222	0.415	0	0	0
Pickup	2,364	0.146	0.353	0	0	0
Sporty	2,364	0.036	0.186	0	0	0
CPI Index	2,364	198.369	3.877	194.600	198.700	201.800
Gas Index	2,364	2.487	0.341	2.257	2.359	2.801

(The table is continued on the next page.)

TABLE 2 (Continued)

Panel C: Pearson correlations for monthly data

	Excess Capacity - forecast	*Excess Capacity - actual*	*Excess Prod*	*Rebate %*	*Rebate Pen*	*Adv Spend*	*Adv Spend per Unit*	*Days Inv*	*Big Three*	*Susp Prod*	*No of Plants*	*CPI*	*Gas*
Excess Capacity (%) - forecast	1 2,355												
Excess Capacity (%) - actual	**0.411** 2,355	1 2,355											
Excess Production (%)	**0.273** 2,355	**0.103** 2,355	1 2,364										
Rebate %	**−0.079** 2,355	**−0.133** 2,355	−0.026 2,364	1 2,364									
Rebate Penetration (%)	**−0.120** 2,355	**−0.074** 2,355	−0.002 2,364	**0.190** 2,364	1 2,364								
Adv Spend	**0.109** 2,327	**0.124** 2,327	**0.161** 2,336	**−0.113** 2,336	0.050 2,336	1 2,336							
Adv Spend per Unit	**0.065** 2,214	**0.150** 2,214	**0.068** 2,223	**−0.188** 2,223	−0.005 2,223	**0.634** 2,223	1 2,223						
Days Inventory	0.013 2,242	**0.029** 2,242	**0.295** 2,251	**−0.084** 2,251	**−0.091** 2,251	**0.112** 2,223	**0.134** 2,223	1 2,251					
Big Three Indicator	−0.027 2,355	**−0.056** 2,355	−0.044 2,364	**0.303** 2,364	**0.126** 2,364	**−0.130** 2,336	**−0.131** 2,223	−0.047 2,251	1 2,364				

(The table is continued on the next page.)

TABLE 2 (Continued)

	Excess Capacity - forecast	*Excess Capacity - actual*	*Excess Prod*	*Rebate %*	*Rebate Pen*	*Adv Spend*	*Adv Spend per Unit*	*Days Inv*	*Big Three*	*Susp Prod*	*No of Plants*	*CPI*	*Gas*
Suspended	**−0.139**	**−0.267**	**−0.239**	**0.151**	0.031	**−0.112**	**−0.097**	**−0.382**	**0.096**	1			
Production	2,355	2,355	2,364	2,364	2,364	2,336	2,223	2,251	2,364	2,364			
Number of Plants	**0.061**	**−0.087**	**0.082**	**0.062**	**0.160**	**0.321**	−0.052	0.028	**0.063**	**0.077**	1		
	2,355	2,355	2,364	2,364	2,364	2,336	2,223	2,251	2,364	2,364	2,364		
CPI Index	**0.104**	**0.084**	−0.027	0.015	**−0.216**	−0.043	−0.014	−0.020	−0.026	−0.002	−0.036	1	
	2,355	2,355	2,364	2,364	2,364	2,336	2,223	2,251	2,364	2,364	2,364	2,364	
Gas Index	**0.076**	**0.792**	−0.029	**−0.061**	**−0.113**	**−0.066**	**−0.061**	−0.017	−0.018	0.033	−0.024	**0.799**	1
	2,355	2,355	2,364	2,364	2,364	2,336	2,223	2,251	2,364	2,364	2,364	2,364	2,364

Note:

Correlations in bold are significant at $p < 0.01$, N in second row.

(The table is continued on the next page.)

TABLE 2 (Continued)

Panel D: Descriptive statistics for annual data

Variable	*N*	Mean	Std Dev	25th Pctl	Median	75th Pctl
APEAL Index	157	853.178	29.383	830.030	856.900	870.720
Rebate %	157	9.849	4.899	5.915	9.129	12.834
Rebate Penetration (%)	157	55.771	16.684	48.633	57.733	67.900
Advertising Spend (000s)	157	41,263.220	46,124.870	4,989.600	24,349.700	61,487.300
Advertising Spend per Unit	157	0.495	0.587	0.099	0.308	0.647
Days Inventory	157	33.409	7.763	29.759	32.397	36.807
Control Variables						
Big Three Indicator	157	0.764	0.426	1	1	1
IQS (PP100)	157	121.174	22.003	106.94	117.28	134.76
Suspended Production	157	0.580	1.784	0	0	0
Number of Plants	157	1.268	0.592	1	1	1
SUV	157	0.331	0.472	0	0	1
Van	157	0.108	0.312	0	0	0
Compact	157	0.108	0.312	0	0	0
Large	157	0.000	0.000	0	0	0

(The table is continued on the next page.)

TABLE 2 (Continued)

Variable	*N*	Mean	Std Dev	25th Pctl	Median	75th Pctl
Luxury	157	0.051	0.221	0	0	0
Midsize	157	0.236	0.426	0	0	0
Pickup	157	0.121	0.327	0	0	0
Sporty	157	0.045	0.207	0	0	0
Finance - Captive	157	0.536	0.171	0.389	0.538	0.679
Finance - Total Down	157	6550.220	3245.860	4204.500	5409.500	8099.360
Finance - APR	157	0.071	0.015	0.062	0.070	0.081
Demographic - Avg Age	157	46.283	5.462	42.700	44.743	48.150
Demographic - Gender (F)	157	0.358	0.102	0.287	0.360	0.445

(The table is continued on the next page.)

TABLE 2 (Continued)

Panel E: Pearson correlations for annual data ($N = 157$)

	APEAL Index	*Rebate %*	*Rebate Pen*	*Adv Spend*	*Adv Spend per Unit*	*Days Inv*	*Big Three*	*IQS*	*Susp Prod*	*No of Plants*	*Captive*	*Total Down*	*APR*	*Avg Age*
APEAL Index	1													
Rebate %	**−0.408**	1												
Rebate Penetration (%)	**−0.315**	**0.495**	1											
Advertising Spend	0.191	**−0.232**	−0.003	1										
Advertising Spend per Unit	**0.375**	**−0.320**	−0.037	**0.525**	1									
Days Inventory	−0.077	**−0.305**	**−0.275**	0.172	0.164	1								
Big Three Indicator	−0.035	**0.384**	**0.217**	−0.193	−0.202	−0.127	1							
IQS (PP100)	**−0.281**	0.019	0.090	−0.108	0.027	0.170	0.046	1						
Suspended Production	−0.150	**0.297**	0.152	−0.163	−0.137	**−0.334**	0.164	−0.015	1					
Number of Plants	−0.090	0.113	0.162	**0.363**	−0.113	0.016	0.023	**−0.238**	**0.216**	1				
Finance - Captive	−0.012	−0.156	0.052	0.198	0.159	0.015	−0.061	−0.111	−0.105	0.041	1			
Finance - Total Down	**0.508**	0.011	0.044	−0.084	0.096	**−0.240**	**0.298**	**−0.232**	0.080	0.088	0.187	1		
Finance - APR	**−0.247**	**0.371**	−0.010	−0.093	**−0.246**	−0.073	0.030	0.038	0.035	−0.039	**−0.443**	**−0.449**	1	
Demographic - Avg Age	0.167	**0.236**	0.009	−0.203	−0.057	**−0.238**	**0.377**	**−0.219**	0.133	−0.091	0.127	**0.517**	**−0.276**	1
Demographic - Gender (F)	−0.156	0.098	−0.059	−0.013	0.089	0.160	**−0.231**	0.105	0.086	**−0.221**	−0.092	**−0.477**	**0.216**	−0.107

Note:

Correlations in bold are significant at $p < 0.01$.

Luxury, *Midsize*, *Pickup*, and *Sporty* (SUV indicator omitted). Because we use monthly data for the 24 months of 2005–2006, we fit a general linear model (using the STATA xtgee command) specifying the within-group correlation as an AR1 variance-covariance and adjusting standard errors for nameplate clustering (Wooldridge 2002). We model an AR1 correlation structure because of significant intragroup serial correlation (p-value $<$ 0.001); 46 nameplate groups are omitted due to missing time-series observations.[9] We expect the coefficient on the *Excess Capacity*, β_1, to be positive, indicating that excess capacity is associated with excess production.

We expect that excess production is associated with a number of tangible costs, including customer incentives (Figure 1, link 4), advertising (Figure 1, link 5), and inventory buildup costs (Figure 1, link 6). We estimate the following model using monthly data at the nameplate level for 2005–2006 to examine the association between excess production and each of three categories of tangible costs.

$$\begin{aligned}[Tangible\ Cost] = {} & \alpha + \beta_1 Excess\ Production + \beta_2 Rebate\% \\ & + \beta_3 Rebate\ Penetration + \beta_4 Big\ Three\ Indicator \\ & + \beta_5 Suspended\ Production + \beta_6 Number\ of\ Plants \\ & + \beta_{7-13} Segment\ Indicators + \beta_{14} CPI\ Index \\ & + \beta_{15} Gas\ Index + \beta_{16-26} Month\ Indicators + \varepsilon_1 \qquad (2),\end{aligned}$$

where *[Tangible Cost]* is either *Rebate %*, *Advertising Spend*, *Advertising Spend per Unit*, or *Days Inventory* (in the *Rebate %* model *Rebate %* is omitted as an independent variable). We expect the coefficient on *Excess Production*, β_1, to be positive in all the models, indicating that excess production is associated with higher rebate percentage, higher advertising spend, and greater number of days in inventory. To the extent advertising is needed to inform the customers about the presence of incentives, we expect advertising to be driven, in part, by increased incentives. Therefore, in e(2), when the dependent variable is advertising, we include *Rebate %* as an additional control variable. We also include *Rebate %* in the *Days Inventory* regression to control for inventory effects of increased rebates. The different tangible costs may be associated; for example, the decision to provide rebates could require additional advertising about the rebate. As a result, the error terms in (2) for the four tangible costs could be correlated. To control for this association, and to improve the efficiency of estimation, we estimate the four tangible cost equations in one system of equations using seemingly unrelated regression (SUR) estimation.

Next, we examine the effect of the tangible costs of excess production on the intangible cost of brand image erosion. We use the following model

9. All results for the estimations of (1) and (2) are similar when these 46 nameplate groups are included and a fixed effects model is estimated.

to test the effect of customer incentives, advertising, and inventory buildup on brand image:

$$\begin{aligned} APEAL\ Index = {} & \alpha + \beta_1 Rebate\% + \beta_2[Advertising] + \beta_3 Days\ Inventory \\ & + \beta_4 Rebate\ Penetration + \beta_5 Big\ Three\ Indicator + \beta_6 IQS \\ & + \beta_7 Suspended\ Production + \beta_{8-13} Segment\ Indicators \\ & + \beta_{14} Captive + \beta_{15} Total\ Down + \beta_{16} Avg\ Age + \beta_{17} Gender \\ & + \beta_{18} Year\ 2006 + \varepsilon_1 \qquad (3), \end{aligned}$$

where *[Advertising]* is either *Advertising Spend* (i.e., raw dollars) or *Advertising Spend per Unit* produced. We expect the coefficient on *Rebates %*, β_1, to be negative (Figure 1, link 7). In addition, we expect the coefficient on *Days Inventory*, β_3, to be negative (Figure 1, link 9). This model is estimated using ordinary least squares with errors clustered by nameplate.

Empirical results

Table 3 provides the results of testing Figure 1, link 3 (equation 1) and examines the association between excess production levels and excess capacity.[10] The results indicate a significant positive coefficient on excess capacity measured using forecasted production, *Excess Capacity (%) - forecast* (model 1) and using actual production in the same month of the prior year, *Excess Capacity (%) - actual* (model 2). A one-percentage-point increase in *Excess Capacity (%) - forecast* (*Excess Capacity (%) - actual*) is associated with a 0.495 (0.111) percentage point increase in *Excess Production* (p-value < 0.01 for both coefficients). Thus, these results suggest that, when firms have excess capacity, they produce in excess of one-year-ahead production forecasts. This link between excess capacity and excess production provides archival evidence consistent with link 3 of our model (Figure 1).

The results in Table 3 also indicate that *Number of Plants* has a positive coefficient. Thus, even controlling for excess capacity, excess production is greater for nameplates produced at multiple plants, as compared to those produced at only one plant. These results suggest that number of plants is likely to be another indicator of excess capacity.

Next we examine the association between excess production and the tangible costs of customer rebates, advertising, and inventory buildup (2). The results of the SUR estimation in Table 4, model 1 indicate that *Excess Production* is associated with higher rebates as a percentage of total sales price, *Rebate %* (coefficient of 0.003, p-value < 0.01). The results also

10. There is a loss of observations in Table 3 due to the use of the AR1 variance-covariance model with robust errors clustered by nameplate. The AR1 variance-covariance model estimates a unique parameter of random effects, as well as a common factor. It adds lagged values to correct for seasonality in demand. If an observation is not available, the lag cannot be calculated and thus both the observations before and after the missing observation are dropped.

TABLE 3
Excess production as a function of excess capacity

$$Excess\ Production = \alpha + \beta_1 Excess\ Capacity + \beta_2 Big\ Three\ Indicator + \beta_3 Suspended\ Production + \beta_4 Number\ of\ Plants + \beta_{5-11} Segment\ Indicator + \beta_{12} CPI\ Index + \beta_{13} Gas\ Index + \beta_{14-24} Month\ Indicator + \varepsilon_1$$

	Predicted sign	Dependent variable: *Excess Production* (%) (1)	(2)
Intercept		44.131	−130.421
Excess Capacity (%) - forecast	+	0.495***	
Excess Capacity (%) - actual	+		0.111***
Control Variables			
Big Three Indicator		−0.157	−1.275
Suspended Production		−83.409***	−86.361***
Number of Plants		14.023**	18.030***
Van		2.203	10.795
Compact		38.894	52.915
Large		−29.877	−11.042
Luxury		−20.224*	−15.734
Midsize		0.685	5.261
Pickup		−20.630**	−16.458**
Sporty		−10.348	−6.213
CPI Index		−0.303	0.573
Gas Index		5.154	3.119
< monthly indicator variables omitted >			
N		1,569	1,569
χ^2 statistic		251.71***	397.63***
OLS Adjusted-R^2		14.55%	8.58%

Notes:

***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively (one-sided *p*-values for coefficients with predicted signs, two-sided otherwise). Column 1 measures excess capacity as production capacity relative to forecasted production, and column 2 measures excess capacity as production capacity relative to actual production in the same month of the previous year. Each model is estimated with the STATA xtgee command. This command is used to fit a general linear model specifying the within-group correlation as an AR1 variance-covariance and adjusting standard errors for nameplate clustering. Forty-six nameplate groups are omitted due to missing time-series observations. Results are similar when these 46 nameplate groups are included and a fixed effects model is estimated. OLS = ordinary least squares.

TABLE 4
Tangible costs of excess production

$$[Tangible\ Cost] = \alpha + \beta_1 Excess\ Production + \beta_2 Rebate\% + \beta_3 Rebate\ Penetration + \beta_4 Big\ Three\ Indicator + \beta_5 Suspended\ Production + \beta_6 Number\ of\ Plants + \beta_{7-13} Segment\ Indicators + \beta_{14} CPI\ Index + \beta_{15} Gas\ Index + \beta_{16-26} Month\ Indicators + \varepsilon_1$$

Dependent Variable: Predicted sign	(1) *Rebate %*	(2) *Advertising Spend* (000s)	(3) *Advertising Spend per Unit* (000s)	(4) *Days Inventory*
Intercept	−18.129**	6,158.098	−1.451	37.976**
Excess Production (%) +	0.003***	6.646***	0.001***	0.032***
Control Variables				
Rebate %		−68.599***	−0.020***	0.002
Rebate Penetration	0.060***	12.484**	0.003***	−0.090***
Big Three Indicator	3.833***	−1,656.280***	−0.225***	0.526
Suspended Production	3.033***	−2,098.620***	−0.251***	−20.095***
Number of Plants	−0.148	2,601.748***		1.463***
Van	1.075***	−1,381.490***	−0.401***	3.578***
Compact	1.944***	−1,662.040***	−0.499***	3.086***
Large	11.092***	−1,195.720	−0.288*	0.304
Luxury	−1.329***	352.204	0.111	−2.281
Midsize	0.569**	1,491.906***	−0.071	−0.534
Pickup	0.886**	−185.346	−0.332***	−1.809*
Sporty	−1.631***	−65.625	−0.026	−1.472
CPI Index	0.135***	−23.383	0.015**	
Gas Index	−3.721***		−0.222***	0.527
<monthly indicator variables omitted>				
N	8,828			
System Adjusted-R^2	23.95%			

Notes:

***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively (one-sided p-values for coefficients with predicted signs, two-sided otherwise). The presented estimation uses the seemingly unrelated regression (SUR) technique using SAS Syslin Procedure. Omitted variables from the models are to ensure efficiency gains from the SUR procedure. Forty-six nameplate groups are omitted due to missing time-series observations.

indicate that the Big Three automakers provide significantly higher rebates relative to foreign automakers (coefficient on *Big Three Indicator* is 3.833, *p*-value < 0.01). *Rebate Penetration* is also positively associated with

Rebate % (0.060, *p*-value < 0.01). It is notable that, even after controlling for the proportion of vehicles that are sold at a rebate, excess production influences *Rebate %*, indicating that *Rebate %* appears to be a deliberate strategy to deal with excess production. In sum, these results provide support for link 4 in Figure 1 that excess production is associated with increased customer incentives.

The association between excess production and advertising is provided in models 2 and 3 of Table 4. In both columns, *Excess Production* is positively associated with advertising spend as predicted in Figure 1, link 5 (coefficients of 6.646 and 0.001 for models 2 and 3, respectively, *p*-value < 0.01 for both). *Rebate %* is negatively associated with *Advertising Spend* and *Advertising Spend per Unit* (−68.599 in model 2 and −0.020 in model 3, *p*-value < 0.01 for both). This result suggests that, although automakers increase their advertising expenditures when they have to create demand for excess production, the additional advertising dollars are not tied to promotion of customer incentives and, in fact, may be in lieu of customer incentives. Finally, Table 4, model 4 indicates a positive association between *Excess Production* and *Days Inventory* (0.032, *p*-value < 0.01), which is consistent with link 6 in Figure 1. The results also indicate that *Rebate Penetration* is negatively associated with *Days Inventory* indicating that over a period of time, rebates are helpful in moving inventory.

We next examine the effects of rebates, advertising, and inventory buildup on the intangible cost of brand image as measured by the APEAL Index. Table 5 contains the results of testing Figure 1, links 7–9 (3). It is the increase of rebates, advertising, and inventory buildup in the presence of excess production (i.e., production in excess of demand) that is posited to lead to a decline in brand image. When rebates are provided in the presence of excess demand (i.e., when demand is greater than production), we do not necessarily expect products to suffer from an erosion of brand image and consequent decline in the APEAL Index. Therefore, as a sensitivity test we partition the sample based on whether the nameplate had excess demand or excess production and estimate (3) separately for the subsample of observations with excess production. Models 1 and 2 of Table 5 use the full sample while models 3 and 4 are restricted to the sample with excess production. Models 1 and 3 present the results when *Advertising Spend* is included as an explanatory variable, and models 2 and 4 present the results with *Advertising Spend per Unit* as an explanatory variable.

In all four models, the coefficient on *Rebate %* is negative and statistically significant, consistent with link 7 in Figure 1. Every 1-percent increase in *Rebate %* is associated with about approximately a two-point decline in the APEAL Index (*p*-value < 0.01 in all four models). Interestingly, untabulated results show that when (3) is restricted to observations without excess production (i.e., likely excess demand observations), *Rebate %* is no longer associated with *APEAL Index*. Thus, as expected, when rebates are provided in the presence of excess demand, the products do

TABLE 5
Intangible costs of excess production

$$APEAL\ Index = \alpha + \beta_1 Rebate\% + \beta_2[Advertising] + \beta_3 Days\ Inventory + \beta_4 Rebate\ Penetration + \beta_5 Big\ Three\ Indicator + \beta_6 IQS + \beta_7 Suspended\ Production + \beta_{8-13} Segment\ Indicators + \beta_{14} Captive + \beta_{15} Total\ Down + \beta_{16} Avg\ Age + \beta_{17} Gender + \beta_{18} Year\ 2006 + \varepsilon_1$$

		Dependent variable: *APEAL Index*			
		All observations		Only observations with excess capacity	
	Predicted sign	(1)	(2)	(3)	(4)
Intercept		868.321***	884.801***	835.914***	856.877***
Rebate %	–	−2.004***	−1.802***	−2.133***	−1.964***
Advertising Spend	?	6.3E-05**		6.8E-05**	
Advertising Spend per Unit	?		10.022***		8.701***
Days Inventory	–	−0.314*	−0.390**	0.112	0.062
Control Variables					
Rebate Penetration		−0.166*	−0.236*	−0.090	−0.150
Big Three Indicator		4.754	7.158	7.424	9.623*
IQS (PP100)		−0.070	−0.117	0.000	−0.036
Suspended Production		−1.949**	−1.928**	−1.831	−1.793
Van		−9.386	−6.969	−27.445***	−25.470***
Compact		−5.486	−1.945	−13.384*	−8.394
Luxury		14.620*	14.058*	8.548	7.270
Midsize		16.721***	17.713***	7.824*	10.430*
Pickup		11.906	14.984*	−6.104	−2.136
Sporty		16.709*	13.088	12.996*	9.318
Finance - Captive		−24.430**	−26.342***	−24.571*	−28.284**
Finance - Total Down		0.006***	0.006***	0.005***	0.005***
Demographic - Avg Age		−0.598	−0.726*	0.023	−0.236
Demographic - Gender (F)		62.976**	56.245*	34.057	24.220
Year 2006		3.578	1.848	5.120	3.248
N		157	157	103	103
F-statistic		14.98***	16.41***	12.45***	13.27***
Adj-R^2		61.74%	64.00%	66.89%	68.40%

Notes:

***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respec tively (one-sided *p*-values for coefficients with predicted signs, two-sided otherwise). Models estimated with ordinary least squares with errors clustered by nameplate.

not suffer from an erosion of brand image and consequent decline in the APEAL Index.

In addition, examination of the control variables indicates that *Rebate Penetration* also has a negative influence on APEAL in models 1 and 2; a 1-percent increase in *Rebate Penetration* is associated with about a 0.2-point decline in the APEAL Index (p-value < 0.10 in both). *Advertising Spend* and *Advertising Spend per Unit* are positively associated with an increase in brand image. *Days Inventory* is negatively associated with *APEAL Index* in both model 1 (−0.314, p-value < 0.10) and model 2 (−0.390, p-value < 0.10), indicating that brand image is harmed by inventory buildup (link 9 in Figure 1).

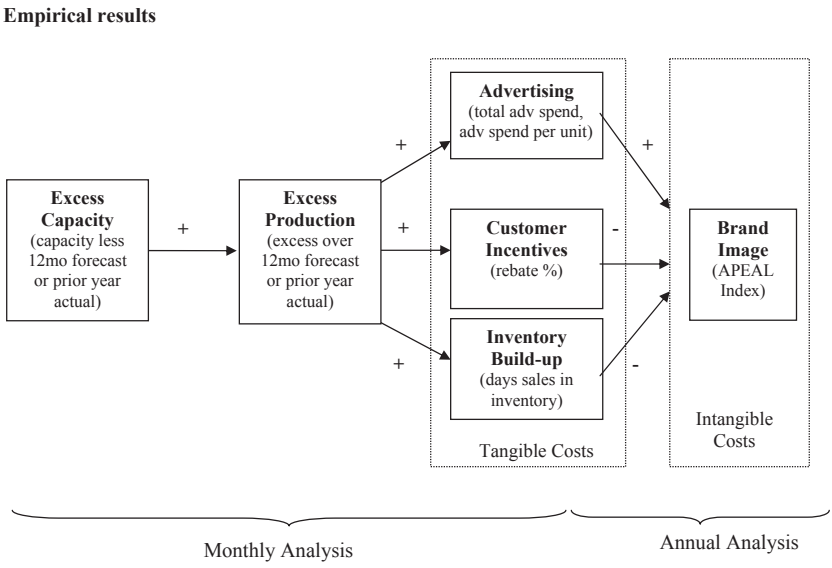
Robustness tests

Because (1) and (2) use panel data, we employed a number of tests to ensure the robustness of our analysis to alternate econometric specifications. We reestimate (1) and (2) using the following alternative specifications: (i) random-effect linear model with an AR1 disturbance, (ii) fixed-effects model clustered by nameplate, and (iii) difference model with fixed effects that allows for correlation between unobserved heterogeneity and variables of interest (Wooldridge 2002). Our results are largely robust to the type of estimation method used. To strengthen the test of the association between rebates and brand image (Table 5 and (3)), we added previous-year APEAL as an additional control variable. The results are similar to those reported in Table 5.

Rebates may be a response to decline in APEAL, raising concerns about endogeneity in Table 5. Results of a Hausman test reveal that two-stage least squares (2SLS) is not more appropriate than an ordinary least squares model (p-value > 0.60). Nevertheless, as a sensitivity test we conduct a 2SLS analysis. In the first stage, we identify variables likely to be associated with *Rebate %* but not with *APEAL Index*. These variables include *CPI Index*, *Number of Plants*, and *Finance APR* (the mean annual percentage rate for financed vehicles). We use the fitted values of *Rebate %* from the first stage as an instrument in the second stage in the analysis of *APEAL Index*. The results (untabulated) from the 2SLS show an even stronger association between *Rebate %* and *APEAL Index*. The coefficient on *Rebate %* is −3.913 (p-value < 0.01) when *Advertising Spend* is included in the model and −3.075 (p-value < 0.01) when *Advertising Spend per Unit* is included.

Days Inventory may be influenced by changes in APEAL if a decrease (increase) in APEAL leads to higher (lower) inventory and thus could also be an additional source of endogeneity in Table 5. A Hausman test again shows that a 2SLS model does not provide a better fit with the data (p-value > 0.60). However, we conduct a 2SLS analysis with *Number of Nameplates* — the number of nameplates within a segment (e.g., van or SUV) — as an instrumental variable for *Days Inventory* in the first stage.

Figure 2 Empirical results.



Results (untabulated) of the second stage are not qualitatively different from the analysis reported in Table 5. The coefficient on *Rebate %* is −2.049 (t-value = −4.69, p-value < 0.01) when *Advertising Spend* is included in the model and −1.823 (p-value < 0.01) when *Advertising Spend per Unit* is included.

In sum, our empirical analyses reveal the following. Excess capacity is associated with excess production, even after controlling for seasonality and for differences in product categories. This excess production is, in turn, associated with higher rebates and with increased advertising and inventory buildup. Higher rebates are associated with lower brand image, as is increased inventory buildup. Advertising, however, is positively associated with brand image as measured by the APEAL Index. The results are summarized in Figure 2.

5. Conclusions

This paper examines the effect of excess production on both tangible and intangible costs, that is, brand image erosion. In the first part of the study, we use field interviews from a Big Three automaker and find that three characteristics of accounting and performance measurement systems in firms contribute to distorted production decisions. The first is the tendency of managerial accounting systems to absorb all costs including excess capacity costs to current production, which increases unit cost when production decreases. The second is the neglect of intangible costs by traditional accounting systems. The third is the tendency for firms to design

performance measurement systems that place a high degree of emphasis on short-term financial costs and margins. The net effect is that managers at all levels benefit in the short run by increasing production. For senior managers, overproduction enables them to reduce cost of goods sold and report higher accounting profit to meet analyst expectations. Lower-level managers (e.g., production planners) likewise benefit from increased incentive pay resulting from lower per-unit costs.

In the second part of the study, we use archival data for the North American automotive industry to show an association between excess capacity and increased production. We further find that increased production is associated with increased costs in the form of higher customer incentives (i.e., rebates), higher advertising expenditures, and greater inventory buildup. Finally, we find that inventory buildup and higher customer incentives are associated with lower brand image. Taken together, the evidence of our field data and interviews and archival analysis reveal how the complex interplay between production planning, performance measurement, and accounting practices in the U.S. auto industry has evolved into observed production and marketing practices.

Our study speaks to the importance of adequately accounting for excess capacity costs. Although absorption costing may provide a reasonable proxy for the economic profit earned by the firm and may also motivate managerial effort (Dutta and Reichelstein 1999), use of absorption costing in internal managerial accounting systems for allocation of fixed capacity costs may not provide incentives consistent with value maximization. Indeed, managerial accounting theory has long promoted the use of practical production capacity as the denominator for computing fixed cost allocation rates and assigning excess capacity costs to the current period rather than ending inventory. However, it is not uncommon for firms to deviate from this in practice and use actual production as the denominator. The result is a distorted incentive to increase production as a means of lowering per-unit costs.

This study also responds to the growing recognition in the academic and practitioner communities of the importance of considering the role of intangible assets in value creation (e.g., Ashton 2005). The study is unique in that we examine the determinants of production decisions and the extent to which production decisions affect one important intangible asset, brand image, which is likely to result in lower future sales. In many industries, like in the auto industry, firms have access to rich sources of brand image data such as the J.D. Power APEAL indices used in this study. Incorporating these indices into performance measurement and reward systems could provide the necessary incentives to ensure that the intangible costs of decisions not captured by the accounting system are internalized by the decision makers within the firm.

While providing important insights, this study is not without limitations. Our study only examines the costs of excess production as we do not

have data on the benefits of production in excess of demand (such as incremental contribution margins). As such, we do not provide a cost–benefit analysis of the total effect of excess production on profitability. However, results indicate that if production decisions are made without a calibration of the effects of excess production on intangible costs, any cost–benefit analysis facilitating those decisions will be incomplete and the chosen production levels may result in a decline in overall firm value. Our analysis does not imply that there are no benefits of excess production, nor does it imply that accounting systems, performance measures, and incentives are the only contributing factors that encourage excess production. Indeed, we do not examine other contributing factors that may encourage excess production; in some instances, excess production may even be a desirable strategy to prevent political costs due to layoffs. Our purpose is to show that some intangible costs of excess production may be neglected because accounting systems do not facilitate the measurement of such intangible costs, and some characteristics of accounting systems may encourage neglect of such intangible costs.

Finally, our study is based on data from one industry, and the results of the field interviews are based on one company, which limits generalizability. However, we believe that the results of our study generalize to other settings in which excess capacity and short-term incentives exist. For example, confronted with high investments in production facilities and increased levels of overcapacity, the semiconductor and chip industry could be facing similar incentives for excess production as the auto industry (Einhorn, Hesseldahl, Edwards, and Ewing 2008). To the extent managers in these other industries also respond to excess capacity and short-term incentives by overproduction, our results will generalize to these other industries.

Appendix

Dimensions of APEAL Index

EXTERIOR	Front-end styling
	Side profile appearance and styling
	Rear-end styling
	Appearance of wheels, rims, and tires
	Appearance of exterior paint
	Sound of doors when closing
INTERIOR	How well exterior and interior colors are coordinated
	Attractiveness of IP/Dashboard
	Look and feel of steering wheel
	Ability to comfortably rest arms while driving
	Interior materials convey impression of high quality
	How well interior colors/materials are coordinated
	Appearance/illumination of gauges/controls
	Overall interior quietness
	Pleasantness of audible signals
	Usefulness of courtesy lights
	Attractiveness of interior lighting
	Smell of vehicle interior
STORAGE & SPACE	Ease of getting in/out of vehicle
	Front seat head/leg/foot room
	Rear passenger head/leg/foot room
	Effectiveness of center console
	Usefulness of glove box
	Usefulness of FRONT cup holders
	Usefulness of REAR cup holders
	Usefulness of FRONT/REAR cup holders
	Location/arrangement of storage spaces
	Amount of trunk/cargo area space
	Ease of loading/unloading trunk/cargo area
SOUND SYSTEM/	Sound clarity at high volume
NAVIGATION/	Operating controls while driving
ENTERTAINMENT	Controls convey impression of high quality
	Ease to see/read audio display
	Ability to play formats I want (MP3, etc)
	Quality of bass (low sounds)
	Gives impression of depth or ''surround''
	Clarity of rear seat entertainment video display
	Ease of operating rear seat entertainment system
	Ease of using navigation system

(The table is continued on the next page.)

APPENDIX 1 (Continued)

	Ability of navigation system to provide desirable route
	Appearance of navigation display
SEATS	Comfort of driver's seat back/lumbar support
	Comfort of driver's bottom seat cushion
	Driver's seat holds you in place while cornering
	How easy to reach/operate seat controls
	Comfort of rear (2nd row) seat
	Ease of operating rear (2nd row) seats
	Comfort of 3rd row seat
	Ease of operating 3rd row seats
	Seat belt comfort/adjustability
	Styling of the seats
	Material conveys impression of high quality
	Ability of seat surfaces to resist soil/lint
	Flexibility of seating configuration
HVAC	Ability to direct airflow
	Ability to maintain desired temperature
	Controls convey impression of high quality
	Quietness of heater/AC fan
	Ability to seal interior from outside odors
	Ease of operating heating/AC controls while driving
	How well defrost/defog interior glass
DRIVING DYNAMICS	Ride smoothness in normal driving
	Quietness over harsh bumps
	Responsiveness/effort of steering system
	Braking responsiveness/effort
	Handling/stability on curves/winding roads
	Handling/stability in adverse conditions
ENGINE/TRANS	Performance during rapid acceleration from stop
	Sound of engine/exhaust during rapid acceleration
	Passing power at highway speeds
	Smoothness of gearshift operation
VISIBILITY/SAFETY	Forward visibility from driver's seat
	Effectiveness of sun visors
	Effectiveness of headlights
	How well wipers/washers clear windshield
	Visibility when changing lanes
	Ease of judging distances when parking
	Ease of seeing/reading controls/displays while driving
	Usefulness of steering wheel–mounted controls

(The table is continued on the next page.)

APPENDIX 1 (Continued)

FUEL ECONOMY	Rating of vehicle's fuel economy (mpg) Driving range between fuel stops Rating of fuel economy/driving range

Source: J. D. Power and Associates

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