Received: 29 September 2017 | Revised: 28 April 2019 | Accepted: 1 June 2019 | Published on: 29 November 2019

DOI: 10.1002/smj.3102

SPECIAL ISSUE ARTICLE

STRATEGIC MANAGEMENT JOURNAL WILEY

The origins of firm strategy: Learning by economic experimentation and strategic pivots in the early automobile industry

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Abstract

Research Summary: We explore the effectiveness of economic experimentation as a learning mechanism through a historical exploration of the early automobile industry. We focus on a particular subset of economic experiments, called strategic pivots, that requires irreversible firm commitments. Our quantitative analysis suggests that strategic pivoting was associated with success. We then use historical methods to understand whether this association is reasonably interpreted as a causal link. We identify lessons that could only plausibly have been learned through strategic pivoting and document that those firms that were able to learn from the strategic pivots were most likely to succeed. We discuss the generalizability of our findings to build the hypothesis that strategic pivots and economic experiments originate firm strategy.

Managerial Summary: We explore the effectiveness of experimentation as a learning mechanism through a historical exploration of the early automobile industry. We focus on a particular subset of experiments, called strategic pivots, that requires irreversible firm commitments. Our analysis suggests that strategic pivoting was associated with success. We identify lessons that could only plausibly be learned through strategic pivoting and document that those firms that were able to learn from the strategic pivots were most likely to succeed. Even though firms may use lean techniques, market solutions may only be discovered through strategic pivots whose outcomes are unknowable ex-ante. Therefore, successful strategies reflect an element of luck.

KEYWORDS

automobile, lean startup, learning by economic experimentation, strategic decisions, strategic pivot

1 | INTRODUCTION

Perhaps the canonical, and most well-known, instance of an economic experiment in the early auto industry was Henry Ford's decision to focus on Model T:

> In 1909 I announced one morning, without any previous warning, that in the future we were going to build only one model, that the model was going to be 'Model T', and that the chassis would be exactly the same for all cars, and I remarked: Any customer can have a car painted any colour that he wants so long as it is black. I cannot say that any one agreed with me. The selling people could not of course see the advantages that a single model would bring about in production. More than that, they did not particularly care. They thought that our production was good enough as it was and there was a very decided opinion that lowering the sales price would hurt sales, that the people who wanted quality would be driven away and that there would be none to replace them. The general comment was: 'If Ford does that he will be out of business in six months.' (Ford, 1922, p. 72)

Ford's historically famous statement about color is, well, colorful, and perhaps retrospectively self-serving. However, the focus on color misses the more important strategic decision to focus on a single model. Ford committed to this strategic direction based on the entirety of his experience producing cars—an experience that included founding three firms, launching 10 models, and making numerous prototypes. It was not possible, however, to predict the outcome of the single-model experiment; it was unknown if there would be sufficient demand to replace higher-value customers.[1] Ford's fundamental strategy that is the moving assembly line was discovered through an extended process of high stakes trial and error at Ford's prior firms, and its implementation was itself an audacious bet. We reason that this is the best explanation of strategy origination and implementation in the early automobile industry and then hypothesize the conditions under which we should expect a similar pattern of strategic discovery through economic experimentation.

Entrepreneurs in the early automobile industry occupied a messy space. An initial reading of the historical record revealed that entrepreneurs offered a variety of products as they sought to figure out what to produce. That is, like Ford, they experimented. However, this behavior highlighted a puzzle: prior research on early automotive races conjectured that firms entered competitions to certify competence (Rao, 1994). Nevertheless, firms that won races entered

[1]We thank an anonymous reviewer for suggesting we focus on this particular economic experiment as a canonical example.

additional models into subsequent races rather than simply continuing to produce their winning products. Why did these companies continue to search after their competence had already been certified? Did this experimentation with different models provide additional benefits? Was experimentation good strategy? If so, why?

These questions led us to re-discover the complete Ford quote above as we sought to understand the role of experimentation in the early history of the automobile industry. To this end, we collected and analyzed a sample of all auto manufacturers who produced automobiles and displayed them in the New York Auto Show between 1901 and 1918. We are able to observe not only entry and exit, but also detailed technical attributes of each manufacturer's models, list prices of each model, and estimates of annual quantities produced by the firm. We then document a correlation between the extent to which an early automobile firm experimented—as measured by the number of new, distinct model introductions—and three outcome variables: survival, technical performance, and production efficiency.

Armed with this statistical regularity, we turned to the historical record. We created novel combinations of archival records to construct narratives of the nascent automobile industry: to understand how model attributes were chosen, what was required to organize the production process, whether the outcomes of these decisions were understood ex ante, and whether these correlations can be understood—at least in part—as causal. The historical record revealed that in the early history of the automobile industry, model experimentation revealed a host of unanticipated lessons related to customer preferences, challenges of use, techniques and logistics of production, and the interdependent nature of product design, manufacturing and sales. Interacting with the market allowed firms to not only identify which products would sell in the marketplace, but also to experiment with systems necessary to support the use of the product.

In this sense, new model introductions are best understood as Rosenbergian Economic Experiments. Rosenberg (1994, p. 88) argued that economic experiments are necessary when both the market solution and an understanding of interdependencies are difficult to deduce from "first principles". We infer that indeed in this context entrepreneurs found it difficult to know the best way forward, because the historical record reveals that even firms that proved, ex post, to be on the right track were, ex ante, unsure that they were making the right choices. The interdependencies associated with producing and selling new models implied substantial irreversible commitments. In this sense, automobile entrepreneurs were subject to the "paradox of entrepreneurship" (Gans, Stern, & Wu, 2016).[2] That is, the outcome of each experiment was unknowable, and the choice to conduct certain experiments foreclosed future options.

We then note that the selection of attributes of new models are strategic decisions as defined by Leiblein, Reuer, and Zenger (2018) in that (a) they affect other firm decisions (interdependency), (b) their outcomes are affected by and affect competitors' choices, and (c) they constrain future decisions (commitment). Given that the outcome of each strategic decision was unpredictable ex ante, it follows that successful firms validated their strategies through economic experimentation. We label this subset of economic experimentation *strategic pivoting*. Moreover, the choice of how to strategically pivot was informed by the outcome of prior experiments in a process of *learning by economic experimentation*. Our ability to document that firms learned and validated their strategies through

[2]Gans et al. (2016, p. 16) define the paradox of entrepreneurship as "choosing between equally viable alternative strategic commitments" when doing so "requires knowledge that can only be gained through experimentation and learning of the type that inevitably results in (at least some level) of commitment that forecloses particular strategic options." They refer to learning through experimentation under the paradox of entrepreneurship as "Learning by Commitment."

experimentation leads us to claim that in the early automobile industry, strategy was discovered through a process of economic experimentation.

Because certain capabilities and types of knowledge could only be acquired in the course of costly, irreversible strategic commitments that precluded other directions, it follows that in this industry, many lessons would not have been possible to learn through low-cost trials recently associated with, for instance, the practitioner-focused Lean Startup approach (Ries, 2011, 2017). In this sense, we augment the theory of Entrepreneurial Strategy, providing boundary conditions regarding the types of knowledge that can be learned and the extent of change that can follow from that knowledge. Nevertheless, we find some elements of the Lean Startup framework, such as the pivot, useful in our context. In this sense, the paper complements other efforts to critically incorporate practitioner ideas into the strategy literature (Levinthal & Contigiani, 2018).

We reason that in the early automobile industry, the best explanation of observed events is that firm strategy was learned through economic experimentation, and this experimentation was risky because entrepreneurs were making strategic pivots that required irreversible commitment and whose outcomes were unknowable. However, ours is a single-industry study. While the automobile industry was the exemplar high-tech context of the early twentieth century, the question of whether economic experimentation is the best way to identify firm strategies generally remains unknown. However, we argue that we should expect this to be the process in other industries, and there are examples where this is the case (e.g., Greenstein, 2007). We hope and expect that this study will spur further studies to explore the external validity of our claims in other, significant contexts.

The organization of this article reflects the fact that we used historical methods to inform our thinking about economic experimentation, strategic decisions and strategic pivots. We seek to avoid the impression that we are using historical evidence to test a theory that we proposed ex ante when, in fact, we engaged in a process of abduction. First, we reasoned to the best explanation based on a casual reading of the history and statistical analysis. This initial account led us to wonder what, precisely, was being learned through model introductions and whether it is reasonable to interpret the observed correlations as causal. We then returned to the historical record to identify clear documentation of ex ante uncertainty and ex post learning from economic experimentation. We also identify cases where experimentation exhausted firm resources, even when the firm identified reasonable product positioning. We thus demonstrate the use of historical methods to complement econometric analyses to reason to the best theoretical understandings in the absence of dispositive tests of causality. As Stinchcombe (2005, p. 1) recognized, historical methods are "one of the four main methods of addressing causal questions in social science." In this spirit, we demonstrate how historical methods and other modes of explanation can work together.

To proceed, in Section 2 we discuss and better define economic experiments, propose the conditions under which an economic experiment may be considered a strategic decision, and establish the relationship between these decisions and the practitioner-based language of pivots. We also describe how the lessons from strategic pivoting differ from other forms of learning. While many of the ideas in this section were inspired by our historical and statistical analyses, we present these ideas first to improve the clarity of our exposition. In Section 3, we rely on historical accounts to establish a role for economic experimentation in the early industry. In Section 4, we document a statistical association between new model introductions and both firm survival and product improvements. We discuss in Section 5 why we view these introductions as strategic pivots and document the irreversible firm commitments that are needed for these introductions. Our statistical analysis does not establish causality. Therefore, following the sequence of our inquiry, in Section 6, we return to the historical record to describe the many lessons that were learned through economic experimentation. In Section 7, we summarize our findings, discuss future research avenues, and conclude.

2 | ECONOMIC EXPERIMENTATION, STRATEGIC DECISIONS, AND PIVOTS

Nathan Rosenberg (1994, p. 87) conceived of economic experiments quite generally, as "experimentation with new forms of economic organization as well as the better known historical experiments that have been responsible for new products and new manufacturing technologies." Rosenberg was vague with respect to what, specifically, constitutes an economic experiment except to say that it encompassed things that were learned through interaction with the market and were of an "economic" as opposed to purely technical nature. Greenstein (2007, p.2) suggests that an economic experiment is "any market experience that alters knowledge about the market value of a good or service …". Greenstein is also careful to note that such learning cannot take place in a laboratory by building a prototype or by interviewing potential customers and vendors. Moreover, economic experiments "lead to changes in business operations and organizational procedures that translate technological innovation into market value" (Greenstein, 2007, p. 2).[3] Stern (2005) gives purpose to economic experiments by arguing that they influence the value captured from a particular technology by resolving market, technological, and organizational uncertainties. Value capture from market interactions may require organizational design including finding team members and developing organizational routines to guide members' interactions. When outcomes of such organizational activities are uncertain, these organizational experiments are a type of economic experiment (Stern, 2005).

Economic experiments reveal that which "cannot be known in advance or deduced from some set of first principles (Rosenberg, 1994, p. 88)." Thus, the key feature of economic experimentation, and perhaps the most important aspect that distinguishes it from other forms of learning (discussed in more detail in Section 2.2), is that the learning that happens through market participation cannot be replaced by laboratory experiments, manufacturing prototypes, marketing reports, or conducting surveys of potential customers (Greenstein, 2012). Indeed, ex ante uncertainty about market outcomes is the key factor that determines whether a market action is an economic experiment or not. As stated in Rosenberg and Birdzell (1986, p. 29), "the only known device for resolving the uncertainties surrounding any given innovation proposal is to experiment, up to and including manufacture and marketing of the product… the failure to undertake [experiments] excludes the possibility of innovation." While market participation often—even generally—happens after uncertainties are mostly resolved, what distinguishes an economic experiment from a simple product introduction is that when there is more uncertainty, the future of the idea depends on the market lessons.[4] Economic experimentation has the potential to reveal the *unknown unknowns*; it not only reduces known ignorance but also fosters spontaneous discovery through unanticipated learning (Foss & Foss, 2002).

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[3]By implication, the startup firm in and of itself can be considered an economic experiment (Rosenberg, 1994). This logic has been taken up by Murray and Tripsas (2004) and Kerr, Nanda, and Rhodes-Kropf (2014).

[4]One could always argue that there is *something* that cannot be deduced from first principles through market interaction. However, our focus—and indeed Rosenberg's—is on settings where uncertainty is high, and it is plausible to believe, *ex ante*, that the lessons garnered from market experimentation will lead to important and significant changes in company products, strategy, business model, operations, and, of course, firm outcomes.

2.1 | Strategic pivots

Arrow (1973, p. 4) points out that under high uncertainty, it will be beneficial to the firm to maintain maximum flexibility while researching the setting to ascertain the best possible choice. However, if economic experimentation is needed to resolve this uncertainty, the commitment required may limit future flexibility. With a focus on this tension, the recent Lean Startup methodology (Lean) proposes that much can be learned with minimal organizational commitment, that is, low commitment research and experiments. Lean favors "experimentation over elaborate planning, customer feedback over intuition, and iterative design over traditional 'big design up front' development" (Blank, 2013). To maintain maximum flexibility, Lean offers other flexible tools like "customer discovery" and "minimal viable products" that entrepreneurs can use to eliminate many of their initial hypotheses without costly commitment. However, channeling Rosenberg, the theory of Entrepreneurial Strategy maintains that entrepreneurs reach a point where commitment-free experimentation is no longer an option and further learning requires economic experimentation in the market and the corresponding organizational commitments (Gans et al., 2016).

The theory of Entrepreneurial Strategy calls this stage, where firms have reduced the number of viable options to $1 < n < N$, the "paradox of entrepreneurship" (Gans et al., 2016). In this stage "choosing between alternative strategic commitments requires knowledge that can only be gained through experimentation and learning, yet the process of learning and experimentation inevitably results in (at least some level) of commitment that forecloses other strategic options" (Gans et al., 2016, p. 4). Faced with equally viable n options to move forward, to gain meaningful feedback about the viability of technologies and associated capabilities, a firm will need to make irreversible commitments while considering the threefold interdependencies between contemporaneous decisions, decisions by other economic actors, and future decisions.

Thus, the theory of Entrepreneurial Strategy maintains that there are limits to *leanness*. Gans et al. agree that much can be learned without commitment. However, Rosenberg's argument that some things can *only* be learned through market interactions sits at the foundation of the strategy scholar's response to Lean. At some point, the firm must make an irreversible strategic decision.

Decisions subject to the paradox of entrepreneurship are strategic as defined by Leiblein et al. (2018), a definition we adopt here. For Leiblein et al., a decision is strategic when it requires the firm to consider the threefold interdependencies between the focal actor's other contemporaneous decisions, the decisions by possible competitors and suppliers, and the decision's impact on future market interactions. This threefold interdependency implies significant organizational commitment. As the outcome of most strategic decisions is uncertain, the implementation of strategic decisions is also an economic experiment. As we discuss below, the reverse is not necessarily true. The subset of economic experiments that are also strategic decisions we label *strategic pivots*. A strategic pivot implies testing hypotheses regarding a combination of technological, organizational, or market aspects of the firm through market participation. If the implied commitment is large relative to the firm such that it is not possible for the firm to pursue more than one path at once, we can say that strategic pivots are strategic choices made under the paradox of entrepreneurship.

To better understand our definition of strategic pivots, it is useful to consider when economic experiments are not strategic decisions. Often, "relatively small dollars invested can reveal information that results either in a valuable project going forward or preventing a mistaken investment" (Nanda & Rhodes-Kropf, 2016, p. 6). Technological advancements such as crowdfunding platforms and online sales channels allow entrepreneurs to test ideas even in the absence of formal organizational capabilities thereby allowing them to fail fast and cheaply. A/B tests are economic experiments, because it is not possible to deduce the result of such tests from first principles. However, implementing them requires minimal organizational commitment, and hence conducting them is not a strategic decision, and the result of an A/B test is not a strategic pivot.

The irreversibility of strategic pivots often implies substantial risk to the firm's existence. Note that a firm may perish even though the pivot led to positive feedback because strategic implementation may also require solving complementary organizational design problems. Put another way, *part of the economic experiment is the organization itself*. If the strategic pivot reveals pathologies of the strategy, such as very difficult organizational challenges of implementation, or pathologies of the organization, such as poor team composition, then the firm may not have access to the resources necessary to implement the strategic change implied by the updated hypothesis. This leads to two key implications: First, only firms that have resources to pivot can benefit from economic experimentation. Second, prior strategic pivots constrain future pivots. Therefore, firms with limited resources will be constrained to limited strategic pivots, and firms with greater resources will be able to choose from a wider array of potential strategies. Thus, the degree and frequency of pivots is constrained by the resources of the firm.

Finally, a strategic pivot is a particular type of "Lean pivot". The Lean framework defines a pivot vaguely as "a change in strategy without a change in vision" (Ries, 2017, p. 108). In the early stages of a venture, a firm might pivot many times. In the Lean framework, an entrepreneur may change, say, the firm's proposed position in a value chain, or addressable submarket in response to what was learned during customer discovery. Such "Lean" pivots are only strategic pivots if their evaluation requires confronting the paradox of entrepreneurship.

2.2 | How economic experimentation differs from theories of learning

Firms learn about both their organizations and their environments through strategic pivots. As such, it is important to understand how learning through strategic pivots differs from other forms of learning. Our theory is strongly grounded in firm behavior and experience. This grounding reveals gaps in expectations about what can be learned, with particular attention to the idea that successfully experimenting firms learn across multiple dimensions simultaneously. Thus, strategic pivots teach lessons about interdependencies that are fundamentally different from the lessons offered by other forms of learning.

For example, learning by doing (Argote & Epple, 1990; Arrow, 1971; Dosi, Grazzi, & Mathew, 2017; Jovanovic & Nyarko, 1998) focuses on productivity (i.e., labor costs per unit of output) gains of firms as they improve their processes in the course of making a particular product. Absorptive capacity (Cohen & Levinthal, 1989; Mowery & Oxley, 1995; Zahra & George, 2002) focuses on how a firm's knowledge base predicts the nature of future technological advances (Lane, Koka, & Pathak, 2006) and influences innovation speed, frequency, and magnitude (Lewin, Massini, & Peeters, 2011). This framework implies a passive assimilation of knowledge from observing the environment; absorptive capacity is a capability, while economic experiments are actions that firms undertake. Learning by searching (Malerba, 1992) and learning from scientific advances (Boerner, Macher, & Teece, 2008) conceive of the knowledge generation process as formalized as R&D and basic scientific research respectively, as opposed to experimentation in the market. Similarly, Thomke's (2003) iterative Design-Build-Test-Analyze cycle of experimentation is relatively narrow in that it generally precludes strategic pivots. Thomke's framework has been applied to settings where (a) experiments are conducted prior to market launch and are catered towards internal testing, (b) learning is anticipated due to managerial discretion in setting testable parameters, and (c) actors are not subject to the paradox of entrepreneurship.

None of these frameworks describe how complex interdependencies between design, production and marketing are discovered. They do not forecast strategic pivots. Instead, these frameworks predict only incremental, iterative adjustments that would not qualify as strategic decisions. Furthermore, because these approaches emphasize the R&D phase of the product development process, they do not address knowledge generation from participation in product markets.

Perhaps unsurprisingly, the most closely related framework is Rosenberg's (1982) learning by using. Learning by using describes the knowledge generated by the final user through the usage of products with a high degree of systemic complexity. Firms that follow a single strategic course of action continue to learn by using and this may lead to a virtuous learning cycle that generates more ideas. Firms may then make fundamental technological changes to an existing product or launch new products based on long-term feedback that comes from learning by using. Learning by using is essential when scientific knowledge of the developer cannot accurately predict "the performance of a durable capital good … involving complex, interdependent components or materials, [when it is] subject to varied or prolonged stress in extreme environments" (Rosenberg, 1982, p. 122). Specifically, Rosenberg argued that this mechanism generates two types of knowledge: (a) about optimal product design that can be embodied into the hardware, and (b) about maintenance and operational practices that can either lengthen useful life or reduce operating costs. It offers "increasing returns to adoption in that the more [products are] adopted, the more experience is gained with them, and the more they are improved" (Arthur, 1989, p. 116). It results in design changes to improve the durability of an already functioning technological solution that has already succeeded in the market. It not only allows firms to improve their existing products but also generates new hypotheses that they can develop. Learning by using is clearly an overlapping but narrower concept than economic experimentation. It differs in that it does not consider the strategic nature of firm positioning in market segments and the relationship between this positioning and the positioning of the firm's competitors. Decisions related to learning by using may be strategic pivots, but Rosenberg did not consider the strategic aspects of learning by using. Learning by using is also narrower in that it has been conceived as a mechanism for learning about the technical performance of a technology in use, as opposed to the viability of the organization itself, preferences of the market, or the means to structure the organization.

3 | CONTEXT AND TIMELINE: ECONOMIC EXPERIMENTATION IN THE NASCENT AUTOMOBILE INDUSTRY

We now consider the role of economic experiments and strategic pivots in the context of the early automobile industry in the United States. Born in 1895, the early industry was characterized by high uncertainty and significant entry and exit (Smith, 1968). Early entrepreneurs offered gasoline, steam and electric powered automobiles. However, rapid progress in internal combustion engine technology resulted in the dominance of gasoline fueled vehicles by 1905. In 1909, the population of manufacturers peaked at 272 firms. In the shakeout that followed, the industry experienced an exit rate of over 10% (Klepper, 2007).

The uncertainty was fundamental. Many attributes of the early industry were unsettled and took several decades to work out. For example, the French design, which put the engine in the front, emerged as a standard feature of most cars in 1907 (Wells, 2007), while the all-steel, closed body became dominant in 1923 (Suarez & Utterback, 1995). As we discuss below, our analysis focuses on

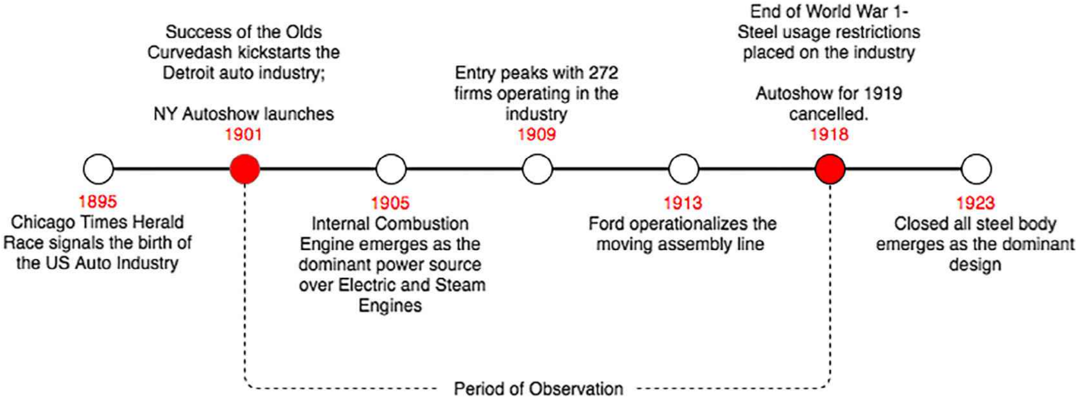

FIGURE 1 Automobile industry timeline [Color figure can be viewed at wileyonlinelibrary.com]

the period up to 1918. Figure 1 provides an overview of the timeline of the early development of the automobile industry.

For our purposes, we are interested in understanding whether the best design, as well as production and sales techniques, could have been, as Rosenberg (1994) put it, "known in advance or deduced from some set of first principles." A cursory review of the historical record strongly suggests that, indeed, such designs and techniques would have been very difficult to deduce based on what was known before entry into the market. The shift from horse-drawn carriages to horseless carriages was a major shock that resulted in many complex interrelated design and manufacturing problems. The solutions to these problems were difficult, if not impossible, to deduce from first principles. Indeed, as we document below, many of the problems were completely unanticipated by the automobile manufacturers prior to the launch of their products.

Contemporary observers noticed the profound business uncertainty that encumbered early automobile entrepreneurs. Manufacturers were unable to divine "what to make and how to make it, when to change and how much to change, to which class of consumer the product is to go and how to get it there, when to be bold and when to be conservative" (Epstein, 1928, p. 182). Reflecting on the initial days, one press report stated, "the truth is that neither the steel men, rubber men, nor even the body men knew any too much about the real requirements of the new speed demons, and for the very good reason that they had no precedents, nothing at all to go by" (Smith, 1928, p. 24). Alfred P. Sloan (1964, p. 239) observed that it was not possible to deduce consumer preferences, implying that economic experimentation was critical to the industry: "automobile customers never knew whether they like the product well enough to buy it until they can actually see the real thing". It is not surprising, therefore, that entrepreneurs had fundamentally different visions on basic questions such as what the source of power for the horseless carriage should be, what the general shape of the automobiles should be (choice between runabouts, high wheelers, and French designs), and even whether the cars should be privately owned or be managed by fleet operators (Kirsch, 2000).[5]

At the time of its introduction, the automobile was arguably the most complex durable consumer technology ever produced. What made the automobile unprecedented was that the engine and the connected transmission system were complex, non-modular technologies that required an

[5]A runabout was a one- or two-cylinder gasoline vehicle with a rear- mounted motor and seating for two. A high-wheeler was a farm wagon with large-diameter wheels, low HP, high road clearance, and a rear-mounted engine, whereas a French design resembles the modern automobile with the engine placed up front (Wells, 2007).

extraordinary degree of interdependence for a mass market product. For example, the Model T, often known for its simplicity, contained approximately 5,000 parts that had to interact in a coordinated manner (Raff & Scranton, 2017, p. 141). One implication of this technical complexity was that, at a time when contemporary modeling tools were absent, the only way to ensure that technical design choices would yield a usable automobile was to actually build the car. Meaningful improvements required changes to the entire automobile. As stated by Epstein (1928, p. 181), “the transition to [different] powers and weights involved the necessity of redesigning not only the engine, but often also the axles, transmission, and the rest of the running gear … [This process required] new dies, jigs, templets [sic], or even new machinery”.

This technical complexity also implied that design of the automobile mandated the resolution of a slew of interrelated engineering problems that required advanced technical competency. Manufacturers had to generate sustained power from a fuel source and convert this power to rotary motion while overcoming substantial inertia caused by the weight of the vehicle and passengers. They needed to connect a rotating shaft to a mechanism that would allow the operator to steer, propel and stop the vehicle, would keep parts lubricated, prevent overheating, and would mediate road surface roughness to ensure passenger comfort (Raff & Trajtenberg, 1996). The initial technical challenges were so profound that, “[e]very comfort initially was a secondary matter. Engineering was the dominant activity” (Pagé, 1917, p. 265).

Most early manufacturers were in fact assemblers. This added further complexity to the process of building a new automobile. For instance, Ransom Olds sourced parts for his famous Curved Dash Oldsmobile, arguably the first mass-produced American automobile, from numerous suppliers: bearings from New Jersey, wheels from New York, coach work from Everitt (who would subsequently enter the auto industry by co-founding EMF), engines from Leland (who later founded Cadillac) and Dodge brothers, and steel from Briscoe (who afterward co-founded Maxwell-Briscoe Motors). Similarly, Ford, during the Model T era (1908–1927), was believed to have maintained supplier relations with about 6,000 firms (Raff & Scranton, 2017, p. 142). Designing new models required changes to many sourced parts and thereby coordination with the suppliers. Managing this level of coordination was a monumental task. For example, Eugene Lewis, an early financier of the industry, observed: “[i]t took several years for many of [the manufacturers] to learn that they could not design a car in December and have it on the market early in the following summer” (Lewis, 1947, p. 40). The delay in getting the designs out to the market was risky for the manufacturers since “consumers' taste, income and spending habits may all have changed radically” (Sloan, 1964, p. 239).

Automobiles were also much more difficult to use than the horse-drawn carriages they replaced, and certainly more difficult to drive than the modern automobile. Not only were there additional controls compared with today's automobiles, their use was much more sensitive to minor deviations in driver behavior. Early drivers needed to operate the throttle, the spark, the clutch, and the gear simultaneously. A series of inconveniently arranged levers varied the timing of the spark in the cylinder, regulated the amount of gas supplied (throttle), and controlled the gearing (Pagé, 1917, p. 957). Manipulation of these three levers in tandem was not intuitive because each of these levers had multiple possible positions. Depending on the terrain and speed, the spark lever, the throttle, and the gear had to be in certain positions for the automobile to even move, let alone perform as desired. Lacking full instrumentation, user feedback was generally limited to the noise the engine made and the physical vibrations of the product (White, 1908). Speedometers to measure speed and tachometers to measure engine revolutions were optional in the 1900s and only became standard in the 1910s. The cumbersome nature of early products dictated that it was difficult to predict which aspects users would find most challenging. Hence, not only was it difficult to anticipate expected problems in assembling interrelated parts, it was also difficult to anticipate how the resulting products would be used in the market.

Especially during the early stages, the automobile "was only just emerging from its original crudities and a year made a material difference in the average run of cars …. [T]he rapid advance in engineering, design and mechanics rendered models a year old obsolete" (Doolittle, 1916, p. 416). Due to the interdependencies of the product components, changes to the engine design brought about significant alterations to how that automobile was constructed thereby requiring manufacturers to create new models to test new engines. Even from a production perspective, "standard practice predicates machine tools, jigs, dies and templates to carry out manufacturing and a minor change or two in specifications wrecks the whole idea [i.e., of the production process]" (Doolittle, 1916, p. 228).

This discussion indicates that it was difficult to predict the outcomes of new model introductions by deduction from first principles. As such, we consider each model an economic experiment. Each model represented a vision of market need and the corresponding set of solutions that the manufacturer implemented to address the engineering problem presented by this vision. We will argue in Section 5 that some model introductions are best understood as the subset of economic experiments that are also strategic pivots.

4 | STATISTICAL ANALYSIS

We first establish that firms that introduced more models, which we interpret as indicating more economic experiments, were, on average, more likely to survive, improve their products and also, offer such improvements at lower prices. We view our results as consistent with the premise that economic experimentation is useful; however, we cannot, and do not, interpret these results as causal. An ideal experiment would randomly determine which firms conducted economic experiments and which did not, whereas the degree of economic experimentation itself was a strategic decision informed and likely enabled by other considerations such as entrepreneurial ability and access to resources. Absent an instrument that changed the costs or benefits to economic experimentation exogenously, we are unable to econometrically identify a causal effect. Instead, we will rely on the historical record to advance knowledge at the margin of inference.

4.1 | Sample

Our sample consists of all models entered into the NY Automobile Show from 1901 to 1918. Launched in 1901, the Automobile Show of the Automobile Club of America was the first automotive exhibition in North America, and by 1905 it was the leading industrial exhibit in the United States (Flink, 1988, p. 25). Entry into the show required a functioning vehicle that could be sold. As the marquee annual event at which the public could see what the industry had to offer, the show attracted most automobile firms who could exhibit a functioning automobile. And because it was the premier launch pad for new models during the nascent period of the automobile industry, firms often announced new models at the show (Ford, 1922). The auto show generated considerable publicity for new products before the purchase season started in the spring (Smith, 1968, p. 49). For our purposes, the extensive press coverage of the show allows us to extract comprehensive, model-level specifications of all automobiles that were exhibited.

We rely upon the Raff and Trajtenberg (1996) dataset that assembled model-level information from the January editions of automotive trade magazines such as *Horseless Age*, *Motor Age*, and

Automobile Trade Journal.[6] We observe information about the list price, number of cylinders, engine bore (diameter of the cylinders), engine stroke (range of lateral movement) and reported engine horsepower for each model that was displayed at the auto show in the study period.[7] Because most models at the time were named using their cylinder count—horsepower-vehicle length combination, we take advantage of these norms to define model uniqueness.

4.2 | Independent variable

We measure the degree of economic experimentation as the cumulative number of unique models released to date by the firm (Cum. *Model Count*), where a unique model is measured based on the uniqueness of its cylinder count (Cyl)—horsepower (HP)—vehicle length (measured in inches) combination. For example, assume that in its first year of operation a firm launched models with the following specification: 6Cyl-20HP-110in, 6Cyl-10HP-110in, 4Cyl-15HP-110in and 6Cyl-20HP-110 in. Because 2 out of 4 of these models have the exact same specifications, the cumulative, unique model count is calculated as 3. If the firm launched 2 more unique models in its second year of operation, then the cumulative, unique model count would be 5. Thus, we measure the aggregate number of new model economic experiments that the firm has conducted over time. We round body length and horsepower to the nearest 5 or 0 before comparison to prevent minor variations from being considered as a new model.[8]

As noted in Section 2, not all economic experiments are strategic decisions. Only economic experiments that meet the requirements set forth in Leiblein et al. (2018) qualify as strategic; only this subset of economic experiments should be treated as strategic pivots. In the early American automobile industry, between 1895 and 1918, firms launched 5,090 automobile models. While each new model may be considered an economic experiment due to the tremendous market uncertainty that accompanied them, we only consider a subset strategic pivots because many did not require substantial enough organizational commitment to be strategic decisions. By the definition above, only 3,237 model introductions were truly new and unique, and only these are considered strategic pivots. Therefore, only these 3,237 model introductions are counted in the *Cum. Model Count* variable. While these new model introductions can certainly be interpreted as economic experiments, we present historical evidence in the Section 5 to justify why we treat them as strategic pivots.

4.3 | Dependent variables

If each economic experiment and interrelated decisions implies an exploratory attempt to configure firm resources to the market, then firms that conduct and are able to learn from more experiments will be more likely to discover successful products and organizational configurations, i.e., strategies. Accordingly, we expect firms that experiment more to learn to produce higher quality automobiles at

[6]One of the authors worked as a research assistant on this earlier project. We thank Daniel Raff and Manuel Trajtenberg for generously sharing their data.

[7]Following the U.S. entry into World War I, the NY Auto Show was canceled in 1919 in response to a request from the War Industries Board (Motor Travel, 1918), though it continued afterwards.

[8]For example, 6Cyl-20HP-110in and 6Cyl-20HP-112in would be considered the same model, whereas 6Cyl-20HP-110in and 6Cyl-20HP-115 in would be considered different models. Horsepower differences are judged as different by the same criteria. However, cylinder count must be identical to be considered the same model. Clearly, there is considerable judgment in this empirical decision. We find qualitatively similar results when rounding to the nearest 10 for the second two attributes. Notably, our conclusions do not rely solely on the empirical analysis, but also on the accompanying historical record.

any particular price point. We relate two measures of automobile quality—both related to engine performance—to past experimentation of the firm.

First, we measure the price to reported engine horsepower (price:HP) ratio. The importance of this measure is evident from ads placed by various companies touting their ability to charge a lower price for the same horsepower due to their superior production techniques that, they claimed, were gained from their experience. We calculate the price:HP ratio for each unique model. Since the analysis is at the firm-year level, we take the average price:HP ratio of all the unique models for each manufacturer in a given year (*Price Ratio*).

The second measure, *Engine BMEP*, takes into account that an engine has two important technical measures that can be improved: (a) the horsepower (HP) generated and (b) displacement (engine volume). The Brake Mean Effective Pressure (BMEP) of an engine is the ratio of horsepower to displacement (multiplied by a constant). Improving an engine constitutes increasing horsepower while reducing its volume; i.e., better engines have higher BMEP. Thus, BMEP provides an estimate of the engine efficiency. To generate a conservative estimate of improvement over time, the BMEP of the worst engine produced by the manufacturer in each year is selected for analysis. An historical example demonstrates the importance of increasing horsepower per unit volume: engineers from Leland and Faulconer, through closer machining alone, were able to increase the power of the one-cylinder Curved Dash Oldsmobile engine from 3 HP to 3.7 HP and then to 10.25 HP. After Olds chose not to use this engine in subsequent models, Leland and Faulconer merged with the Detroit Automobile Co. to establish the Cadillac Motor Company in 1903. Cadillac subsequently experienced considerable market success by using the same, improved engine in their Model A.

4.4 | Control variables

Timing of entry, age, quality and size of the firm might also have determined a firm's technical and cost reduction capabilities. We collect entry and exit year information from the Standard Catalogue of American Cars (Kimes, and Clark, 1989). We use production estimates generated by Raff and Trajtenberg (1996). Raff and Trajtenberg collected production figures from known sources and estimated distributions of production across years when only total aggregate production of individual firms is known. When production figures were unknown, estimates were generated based on written descriptions of the firms in the Standard Catalogue. We use the annual production of the firm (*Ln*(*Annual Prod.*)) to proxy for the ability to experiment in the future and the underlying quality of the firm's automobiles. Because production often commenced after a customer paid a deposit to reserve a vehicle, we assume that for each year the number of cars produced is a reasonable proxy for the number of cars sold. Of course, the use of past performance as a proxy for underlying quality is problematic as we expect this measure to be related to underlying managerial ability, which is also likely related to a firm's ability to experiment. This presumed correlation prevents us from interpreting any coefficients as causal. The analysis is conducted at the firm-year level.

We control for the price class in which the firm competed and their timing of entry. Because firms serving different price classes were expected to have differing strategies, four price class dummy variables were created using historical market categories Firms were categorized into one of four classes to "embrace what might be termed 'non-competing groups of cars'" (Epstein, 1928, p. 74). That is, these categories were selected because "they differed sufficiently in price to serve different markets" (Davis, 1988, p. 21). The price class variables 1, 2, 3 and 4 represent average annual prices of $750

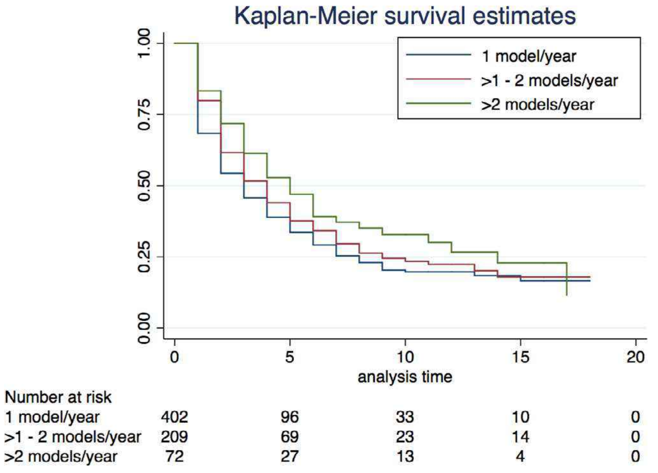

FIGURE 2 Kaplan–Meier survival analysis [Color figure can be viewed at wileyonlinelibrary.com]

or below (*Price Class 1*), $751–1,500 (*Price Class 2)*, $1,501–3,000 (*Price Class 3*), and over $3,000 (*Price Class 4*) respectively.[9]

4.5 | Results

A Kaplan–Meier survival analysis estimates the relationship between model count and survival (Figure 2). As mentioned above, production of more models may also represent past success and decisions to diversify into other market segments. To mitigate this problem, we focus upon initial firm experimentation strategies and include only the cumulative model count from the first 2 years of the firm's existence. The analysis shows that the 5-year survival rate of firms that produced 2 or fewer models, 3–4 models, and more than 4 models over this 2-year period were 34.5, 51, and 61% respectively. Similarly, the 10-year survival rates were 11, 17 and 24%. Thus, firms that conducted more strategic pivots by introducing more models in their first 2 years tended to survive longer.

Model 1 predicts that, associated with every new model introduction, is an increase of 0.0004 HP per cubic inch of engine volume. To interpret this relationship, consider that a four-cylinder engine with a 4.5 in. bore and a 4 in. stroke—fairly typical at the time—will have a volume (which equals the number of cylinders times the volume of each cylinder or four cylinders $\times \pi \times (\text{bore}/2)^2 *$ stroke) equal to 254 cubic inches. When a firm that has already released 10 models releases a new model with a 254 cu. in. engine, it is able to increase the horsepower of that engine by (254 cu. in * 0.0004 * 10) ~1 HP. This improvement is substantial; on average most engines fell in the 20–25 HP range—and much less early in our sample period. Similarly, Model 2 predicts that a price reduction of ~50 cents per horsepower is associated with every new model introduction. This finding means that, following the introduction of 10 models, a firm is able to release a 25 HP vehicle at $0.50 less per HP (~0.50 * 10 * 25) or $125 less compared to a firm that had not experimented at all. This effect was economically meaningful, considering that the average car sold for under $1,000 at the time. Thus, firms that introduced more models also sold their cars at a price advantage (Tables 1 and 2).

[9]We also experimented with controlling for entry timing using the dummy variables cohort 1, 2, and 3, which represents firms that entered the industry until 1904 (*Entrance Cohort 1*), between 1905 and 1909 (*Entrance Cohort 2*), and 1910 or after (*Entrance Cohort 3*) respectively (Klepper, 2007). The years were selected based on important industrial trends: dominance of gasoline technology by 1905 and the popularity for low-cost French style gasoline vehicles by 1910. Multicollinearity precluded estimating models with cohort dummies and year-fixed effects. We report the results with year fixed effects, however the results are similar with cohort dummies.

TABLE 1 Descriptive statistics

	Mean	*SD*	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Price Ratio	78.33	37.1	12.5	384.62	1												
(2) Engine BMEP	0.1	0.02	0.02	0.23	−0.45	1											
(3) Cum. Model Count	9.05	10.29	1	63	−0.01	−0.07	1										
(4) Age	4.42	3.78	1	18	−0.05	−0.05	0.92	1									
(5) Ln(Annual Prod.)	5.21	2.11	0	13.51	−0.16	−0.02	0.51	0.51	1								
(6) Ln(# of Active Firms)	5.1	0.33	3.56	5.52	−0.44	0.33	0.07	0.08	0.09	1							
(7) Entrance Cohort 1	0.11	0.31	0	1	0.44	−0.31	−0.22	−0.26	−0.22	−0.71	1						
(8) Entrance Cohort 2	0.32	0.47	0	1	0.04	0.09	−0.21	−0.25	−0.2	0.21	−0.24	1					
(9) Entrance Cohort 3	0.56	0.5	0	1	−0.31	0.08	0.34	0.4	0.33	0.25	−0.4	−0.79	1				
(10) Price Class 1	0.11	0.31	0	1	−0.18	0.16	−0.16	−0.15	−0.1	−0.07	0.06	0.07	−0.1	1			
(11) Price Class 2	0.27	0.45	0	1	−0.24	0.14	−0.06	−0.06	0.1	−0.11	0.1	−0.13	0.06	−0.21	1		
(12) Price Class 3	0.35	0.48	0	1	−0.05	−0.07	0.04	0.03	0.05	0.11	−0.09	−0.01	0.07	−0.26	−0.45	1	
(13) Price Class 4	0.21	0.41	0	1	0.43	−0.17	0.19	0.18	−0.03	0.12	−0.09	0.13	−0.06	−0.18	−0.31	−0.38	1

TABLE 2 Regression analysis

Variable	M1: Engine BMEP (HP/volume)	M2: Price ratio (price/HP)
Cumulative Model Count	0.0004	−0.480
	[0.0002, 0.0007]	[−0.806, −0.154]
Age	−0.002	0.672
	[−0.004, −0.0003]	[−1.692, 3.036]
Ln(Annual production)	−0.003	0.042
	[−0.004, −0.002]	[−1.228,1.311]
Price Class 1	0.014	
	[0.008, 0.019]	
Price Class 2	0.007	
	[0.003, 0.010]	
Price Class 3	0.002	
	[−0.001, 0.005]	
Firm fixed effects	Included	Included
Year fixed effects	Included	Included
Observations (firm-year)	1,721	1,898

Note: 95% confidence intervals in parentheses.
Abbreviation: BMEP, Brake Mean Effective Pressure.

5 | INTERPRETING NEW MODEL INTRODUCTIONS AS STRATEGIC PIVOTS

In 1912, Abbott Detroit launched a four-cylinder model in 1912 for $1,275 and a six-cylinder model in 1914 for $3,500. Clearly, these two cars required different production technologies and market positioning. In 1916, even though the industry had settled on 4- and 6-cylinder engines, Packard introduced a 12-cylinder model called "Twin-Six". While the 4- and 6-cylinder models sold under $3,500, the 12-cylinder models were sold for $5,000. More generally, the strong correlation that model prices have with cylinder count (0.38) and horsepower (0.68) indicates that changes in cylinder count and horsepower were associated with competition in different market segments. The historical record supports that these engine attributes provided meaningful differentiating information to consumers. Even a cursory examination of advertisements from the era reveals that the number of cylinders and the horsepower of a given model were often featured prominently. Increases in cylinder count and horsepower were touted as important technical achievements.

Importantly, the historical record indicates that these choices did not simply reflect changes in marketing; rather, they were strategic pivots. Changes in cylinder count and horsepower were each associated with resource, organizational and reputational commitments and thus constrained future choices. And these decisions were often made without a clear ability to predict their potential outcome. That is, new model introductions—as we have defined them—were economic experiments conducted under the paradox of entrepreneurship. Of course, the outcome of such commitments was also related to competitors' choices. To see this, first consider the relationship between the engine itself and other automotive components. We assess the novelty of a given model based on the uniqueness of its cylinder count (Cyl)—horsepower (HP)—vehicle length (measured in inches) combination.

Engine improvements were one of the biggest technical challenges that automobile manufacturers faced. Increasing the number of cylinders required fundamental changes to engine construction. Similarly, increasing horsepower required manufacturers to increase either the width or height of the existing cylinders, both of which required related adjustments to the engine as other components needed to be scaled appropriately. For example, Cadillac, known for their ability to produce superior engines through precision manufacturing, "introduced processes that allowed castings to be machined to closer tolerances [often 1/100,000 of an inch] than their competition found possible to duplicate" (Flink, 1970, p. 262). Accomplishing this technical feat required Cadillac to design innovative tools, train personnel in new processes, and reorganize their entire production process. In addition, increasing engine power required changes to the transmission system; larger engines were heavier, requiring changes to the strength and perhaps even the overall dimensions of the car. That is, changing measured engine attributes implied a cascading series of interrelated design changes.

Adjusting the external dimensions was often no easier. For example, "the lengthening of the wheelbase to 127 inches [by Mitchell in 1916 from 115 inches in 1915] has permitted the fitting of a more roomy body … and extra seats which fold out of sight when not in use" (Mitchell, 1916). Body length changes permitted manufacturers to offer additional features that were of interest to customers and charge for it. For example, in the prior case, the longer wheelbase allowed Mitchell (1903–1924) to increase the price by $75 (or 5%) (Mitchell, 1916). Increasing vehicle length not only resulted in modifications to the vehicle body, corresponding alterations to parts of the transmission system, and additional power requirements needed to handle the additional weight, but it also imposed costly manufacturing changes. Castings of parts, and the metal-cutting tools used to grind, drill, and buff rough castings and forgings into precision parts had to be changed in the factory to accommodate changes. Thus, changes in the vehicle length had major implications with respect to both customer appeal and production processes. For firms with resource constraints, the magnitude of these changes had the potential to limit the new model launches.

We should only consider new model introductions strategic pivots if they required costly changes to the organization. This was often the case. Because new models were introduced with anticipation of increased sales, factory extensions and new production facilities were often introduced to align with the production of new models (Boston Daily Globe, 1912). These further organizational changes were necessary because, when scaling needs did become evident, firms needed to scale quickly to satisfy demand. Manufacturers sometimes had plants that were exclusively dedicated to a single model. For example, EMF produced their two models in two separate plants: one with an annual output of 15,000 cars and another with an output of 25,000 cars (Chicago Daily Tribune, 1910). Thus, model introductions implied more than mere technical changes; rather, firms made strategic investments to support new models.

Model introductions embodied the strategic choices firms made as a result of lessons they learned from their own prior experience and lessons they learned vicariously from others (Srinivasan, Haunschild, & Grewal, 2007). With each model introduction firms attempted to balance the interdependencies between the demands of their customers, their response to competition, and alignment with the firm's future plans. For example, Pierce-Arrow declared that it was their policy "to make anything demanded by a majority of customers" part of their models (Pierce-Arrow, 1912). When the manufacturer Mitchell launched their Model Six, their ads stated that they had designed their cars after examining which features were popular among the 257 models that participated in the New York Auto Show the previous year (Mitchell, 1916). Adams-Farwell designed the first side entrance to a rear seat compartment in the United States in its 1905 models based on the positive feedback it received at the 1904 auto show (Thomas, 1966, p. 49). Launching a new model called the Town Car, Peerless stated that the vehicle was a direct response to the "demand for a lighter car … especially adapted to city and suburban use" (Peerless, 1910). To emphasize the significance of the feedback they received from the previous Rambler models, the company declared that its latest model was "tested by three seasons' continuous service and perfected by the knowledge gained from twelve thousand Ramblers in daily use" (Rambler, 1908a, 1908b, p. 1). Launching its Model X, Studebaker's ads stated that that the model was a direct response to the demand for larger, moderately priced vehicles (Studebaker, 1908). Moreover, a careful analysis of the first 25 years of the Society of Automotive Engineers (SAE) Transactions (established in 1905) revealed that "U.S. engineers portrayed their design practices as simply responding to customer wishes" (Mom, 2014, p. 305).

Indeed, firms needed to launch multiple models and thereby pivot multiple times due to changing customer demand and improving technology. Customers may not be able to foresee what is technologically feasible in a quickly advancing industry (Hackman & Wageman, 1995; Bridges, Yim, & Briesch, 1995; Veryzer, 1998), and consumer preferences of lead-adopter segments may not translate well to other segments (Rogers, 1962). Charles Duryea, often referred to as the father of the American automobile industry, is an example of a successful early entrant who fell into obscurity due to his failed strategic pivots. After capturing national imagination with the successes of his four-wheeled Buggynaut vehicle in the late 1890s, Duryea pivoted towards three-wheeled designs, which failed miserably.

As noted in Section 4.2, not all model introductions are strategic pivots. For example, many firms did not make changes to their new models that were large enough to be considered strategic pivots because of their confidence in existing products. Despite the uncertainty associated with the vehicle design and features and despite heavy competition for technical superiority, Rambler claimed in their advertisements that they did not make any changes in its new models because they believed that their vehicles were cutting edge already (Rambler, 1908a, 1908b). Firms such as the Firestone Columbus manufacturing company only made incremental changes to their model; their products failed, and the firm soon exited (Kimes, and Clark, 1989, p.1206). Winton Co. did not change their models in the early 1900s because the founder believed that, "[T]he Winton wagon as it stood was the ripened and perfected product of many years of lofty thought, aided by mechanical skill of the highest grade, and could not be improved in any detail" (Adler, 2004, p. 12).

Similarly, technology prevented manufacturers from introducing new models. From the very beginning, steam car manufacturers were aware of the explosion risks and excessive delays that accompanied the process of steaming up the vehicle to a desirable operating pressure from a cold start. However, either due to technical difficulty, or because of limitations of the steam car firms, only marginal changes were made to address this issue. Indeed, by the time the steam manufacturers adopted the safer and faster flash-boiler, the initial dominance of the internal combustion engine had already been established (Beaumont, 1906, p. 456; Hartford, 1910; Stanley, 1918). After the market preference for internal combustion technology was revealed, Detroit Electric could merely make cosmetic changes to their designs, introducing a false hood and a mock radiator. Evidently, buyers were relatively indifferent to these design elements, but cared more about the inner workings of their vehicles, and the company's sales stagnated (Kimes, and Clark, 1989, p.1206). Gasoline car manufacturers realized that drivers preferred minimal mechanical responsibility and that they had a particular aversion towards shifting gears. While firms such as Sturtevant introduced primitive forms of automatic transmission and started patenting them as early as 1905, useful gear shifting replacements had to wait decades (Sturtevant & Sturtevant, 1905).

We should be cautious in that we cannot observe the organizational changes that accompanied each and every model introduction we measure in the statistical analysis. And, certainly, some new model introductions implied greater organizational investments and irreversibility than others. The precise and detailed operations of many of the early producers are lost to history. This makes it difficult to determine if we are overcounting or undercounting strategic pivots. However, the historical record supports the general premise even if the precise magnitude of the correlation is mis-measured due to our imprecise proxy.

5.1 | Model changes do not capture all strategic pivots

Some strategic pivots escape our statistical measurement but are prominent in the historical record. As mentioned above, by 1905, the dominance of gasoline technology was established in the automobile industry. Three electric and steam car manufacturers attempted to pivot to gasoline vehicles in our sample period, only 1 was successful. Seventy-nine other firms producing steam and electric cars did not try to change the propulsion technology of their cars. While clearly this ratio indicates that statistical analysis is inappropriate to understand strategic pivots of this magnitude, it is helpful to consider briefly each of the cases. Woods Electric (1899–1918) attempted to switch to gasoline vehicles in 1916, but chose to first produce hybrid gas-electric vehicles. Mastering the new technology proved difficult; they produced sub-par gasoline cars with engines that idled when under 15 mph (Kimes, and Clark, 1989, p.1206). They followed this with a failed attempt to market cars using purchased third-party gasoline engines and eventually filed for bankruptcy. White Steam Vehicle Co. (1900–1980) discontinued steam cars by 1911 and sold gasoline vehicles starting in 1910 with limited success (Kimes, and Clark, 1989, p.1206). The company never successfully competed in the gasoline passenger car market, but did eventually pivot to buses, trucks and tractors. White's transition was financed by the White family, which had made their fortune in the late 1800s from the White Sewing Machine Company. Studebaker (1852–1963), the only case of successful transition into gasoline car manufacturing after the failure of its electric car, did so with great difficulty by first entering a joint venture with Garford, then becoming a parts supplier to EMF, and eventually acquiring EMF (Kimes, and Clark, 1989, p.1206). But Studebaker was able to finance this transition because it was an established carriage producer with a deep reservoir of organizational and financial resources at its disposal. At least two of these three firms had above average access to resources to make such a fundamental transition. Clearly, launching a new model with different engine technology is a strategic pivot because it involved trade-offs associated with significant changes to engine and body construction, production process, strategic investments, and outcome uncertainties described above.

Another category of strategic pivots that is missed by our measure is the redrawing of organizational boundaries by firms. For example, the successful formation of General Motors (which included Buick, Oldsmobile, Cadillac, Cartercar, and Oakland (Pontiac), among others) in 1908, and the failure of United States Motor Company (which included Brush, Columbia, Courier, Maxwell, Alden Sampson, and Stoddard Dayton) in 1910, while significant, will not be captured by our measure.

Thus, while new model introductions were often strategic pivots, some changes were associated with greater decision interdependence, irreversibility and competitive implications than others. We now explore the degree of uncertainty associated with these strategic pivots by understanding what was anticipated by early producers and what was unknown prior to introducing products into the market. In so doing, we also reinforce the point that model introductions led to a host of additional organizational changes in the firm.

6 | ECONOMIC EXPERIMENTATION: WHAT DID AUTOMOBILE FIRMS LEARN?

Economic experiments "lead to a better understanding of the relation between specific design characteristics and performance that permit subsequent improvements in design" (Rosenberg, 1982, p. 123). In the automobile context, economic experimentation by new model introduction appears to have elucidated three areas: (a) the internal bottlenecks in design and production, such as development and implementation costs, supplier relations, production resource compatibility, marketing, human capital requirements, financial needs, and communication issues; (b) the way in which firms should navigate the competitive landscape—that is, potential market size, product uniqueness, relative quality, competitive intensity, dominant competitors, and compatibility with complementary technologies; and (c) user needs and preferences, such as product functionality requirements, training requirements, users' perceptions of product complexity, consumer demand, whether consumers use the product the way it was intended, and willingness of consumers to pay. Across all three areas, it was difficult to deduce solutions to these challenges from first principles.

We should be clear that this historical discussion does not rule out the possibility that some of the observed variation in firm behavior and outcomes was caused by factors other than economic experimentation. That is, our approach does not allow careful measurement of the causal treatment effect on the treated. Rather, the goal is to establish if the learning-by-experimentation mechanism operated and what it revealed. The specific types of information discovered through economic experimentation are best considered one-by-one.

6.1 | Interrelatedness

Firms learned valuable lessons on interrelatedness from their new model introductions. Lessons learned about one feature or desired characteristic often interacted with the realities and complexities of producing and selling cars. While some firms did not survive long enough to implement the lessons learned, many used their prior lessons while implementing subsequent pivots. This was particularly important for firms that attempted to respond to the success of Ford's low priced vehicles. For example, Brush Runabout (1907–1912) launched new models that sold for as little as $500. However, to keep costs down, the company used wood for body elements, and the vehicles fell out of favor because consumers complained that it had a "wooden body, wooden axles, wooden wheels and a wooden run" (May, 1975, p. 257). Likewise, to take advantage of the Ford name through marketing, Harry Ford (no relation) launched alphabetically named models for Saxon automobile company that attempted to imitate Henry Ford's strategy. The firm failed because "advertising was no substitute for production" (Rae, 1965, p. 65). Responding to Ford, the Chevrolet 490 was announced in 1914, with the promise that it would sell for $490. Chevrolet was unable to pull it off; when offered for sale, the price had ballooned to over $800 (Kimes, and Clark, 1989, p.1206). However, this experience offered valuable lessons to Chevrolet for their subsequent marketing strategies.

Similarly, after the tremendous response Maxwell received from the rural community in 1909, many auto manufacturers emulated Maxwell's strategy of advertising in farm weeklies and rural newspapers (Berger, 1979, p. 36). However, Maxwell's strategy was not simply to advertise to farmers, but also to produce a car with specific features that farmers wanted. Maxwell launched new models that had a sturdy body made of better quality steel, increased vehicle road clearance to compensate for the poor condition of country roads, and increased vehicle length to provide more storage space and thereby catered to the unique needs of farmers. Only those manufacturers that were able to produce such a car could benefit from strategically pivoting towards launching models that claimed to serve the farming community.

Firms also learned valuable lessons on interrelatedness when they were unable to operationalize the strategic pivot that they decided to execute. For example, even though the consumer preference for light-weight four-cylinder vehicles was evident by 1912, Epstein (1928) observed that “many manufacturers who could not, or did not, successfully adapt their facilities to the production of lighter-weight, four-cylinder vehicles … were obliged to retire from business” (183). Often, such firms did not survive the failed or unimplemented pivot. However, resource-endowed firms often worked for years to address the interdependencies in their model launches. For example, in their own marketing materials, Overland (1917) tacitly admitted to their long-running struggle with achieving scale production, stating that, “this year we apply the economies of vast production for the first time to a comprehensive line of automobiles—an end toward which we have been working for eight years.”

An implication of such interdependencies is that firms had to engage in strategic pivoting themselves to be able to learn valuable lessons and could not merely learn by observing (Beckman & Lee, 2017). Even though pivots and their outcomes played out in the market, the ability to observe market successes did not guarantee an understanding of the underlying reasons for those outcomes. For example, George Hanson disassembled a Packard car for good ideas before starting his eponymous automobile company in 1918 (Kimes, and Clark, 1989, p.1206). However, this exercise did not allow Hanson to understand the various organizational elements that were required to produce the Packard, tacit knowledge that could only be learned by actually engaging with the production process. The value of the private information generated, and the time delay involved in its diffusion affected the interpretability of competitor market actions. Moreover, as the complexity of the pivots—and the complexity of the information generated therefrom—increased, the time it took for the outcomes to become incorporated into the industry knowledge base also increased.

Due to interrelatedness of decision-making, firms learned that certain strategic pivots could not be implemented by any single firm alone but required the industry to move together. The move towards standardized parts exemplifies the intra-industry learning that occurred as a result of economic experimentation. The realization of the demand for a sub-$1,000 French style car, together with collective experiences and difficulties in production, triggered a multi-faceted standardization effort by the Society of Automobile Engineers. By 1910, the introduction of Model T and demand for “French” style vehicles selling for under $1,000 made cost cutting a matter of survival. This new market reality heavily influenced the members of the Society of Automotive Engineers (SAE) to undertake an inter-firm standards program (Thomas, 1965). The initiative was led by Hudson Motor Car Company executive Howard Coffin who “knew from firsthand experiences the seriousness of the parts and materials crisis, especially for small manufacturers” (Thompson, 1954, p. 5). According to auto manufacturers, “lack of standards was responsible for nine-tenths of the production troubles and most of the needless expenses” (Society, 1910, pp. 125–126). Standardization substantially reduced the variety of parts used across the industry, thereby generating considerable savings. For example, varieties of lock washers were reduced from 300 to 35 (Clarkson, 1916) and those of steel tubing reduced from 1,100 to 150 (Society, 1911). By 1912, these measures enabled SAE member firms such as Pierce Arrow and King Motor Co. to launch models that took advantage of standardized parts. Thus, economic experiments revealed the importance of standardization and initiated an industry-wide pivot towards using standardized parts.

In this sense, our findings complement those of Pillai (2019), who suggests that firms with founders or early employees who had experience managing machine shops were better able to integrate the results of their experiments into subsequent products. Thus, in the early automobile industry, economic experiments not only provided guidance about what to make, but also how to make it. Further, it is interesting to note that some lessons were not immediately evident. Economic experimentation directs learning and exploration of the interdependent nature of various aspects of bringing a product to the market and allows firms to make holistic changes that involve multiple, interrelated aspects rather than focus exclusively on any single one.

6.2 | Price

The story of the Curved Dash Olds offers insights on how market feedback can lead to innovative products. Ransom Olds, the founder of Oldsmobile, launched his business by selling a car for $1,200 in 1901. However even though the firm thought they "had quite the car", they "soon found that it was too complicated for the public" (Glasscock, 1937, p. 42). Based on this feedback, Olds attempted to build a single cylinder machine "which would weigh about 500 pounds and would sell for around $500" (Pound, 1934, p. 52). This effort resulted in the production of the world's first mass-produced automobile, the $600, 700-pound Curved Dash. As Olds reported, "I have learned the right and the wrong from tens of thousands of users" (May, 1975, p. 232). Even after the initial success of the Curved Dash, it was "tests in operation by all sorts of customers on all sorts of roads [that] brought about important small improvements" (Glasscock, 1937, p. 42) that improved the quality of the automobile.

In our terminology, Olds first made an irreversible strategic commitment to the economic experiment of the $1,200 car. He learned from that and strategically pivoted by making a second strategic commitment to the Curved Dash. The commitment was substantial, as it required factory retooling, establishing new work processes and entering into agreements with numerous suppliers. Had the bet failed, Olds may have needed to close down his venture.

Indeed, many firms that experimented with different price segments did fail due to the costs of engaging in a strategic pivot. For example, Clark Motor Car Co. (1910–1912) from Indiana experimented with two price segments by launching a 2-cylinder, 15-HP car for $650 and a 4-cylinder, 40-HP car for $1,800 in 1910. They learned from the experiment that neither of vehicles satisfied market requirements—one was underpowered and the other too expensive. Hence they pivoted towards manufacturing a 4-cylinder 30 HP vehicle in 1912 for $1,000. Even though they learned valuable lessons and pivoted, the firm underwent involuntary bankruptcy in June 1912 (Kimes, and Clark, 1989, p.1206).

6.3 | Ignition

While the risk associated with automobiles is often thought to be about collisions, during the nascent stage of the industry, the act of starting the automobile was complex and risky. All three primary competing propulsion technologies—gasoline, steam and electricity—had difficulties. Gasoline engines were dangerous to start; steam was time-consuming; and, without proper care, electric cars would not start at all.

6.3.1 | Gasoline

In gasoline cars, internal combustion powers the cylinder movements after the first few vertical movements (strokes). However, these initial strokes need to be supported by an external energy source. Before the widespread adoption of the electric starter, consumers had to physically turn a crankshaft to initiate combustion. Even though manufacturers expected customers to use the crankshaft with ease, only after early drivers started using it were the practical difficulties realized. It was soon evident that if the lever used to crank the engine was not properly placed, it would jerk backwards causing a kickback. Similarly, if "the spark lever is advanced so that an early spark is obtained" (Pagé, 1917, p. 957), premature combustion would also lead to a kickback. In short, it was difficult to position the spark lever correctly, and the resulting kickbacks often resulted in broken bones, and at times, even death. The physically challenging task of cranking the engine also initially deterred women from operating gasoline automobiles. As of 1908, according to accident insurance company statistics presented in the *New York Times*, 30–50% of all injuries caused by automobiles were due to cranking (White, 1908).

Only through economic experimentation did the manufacturers learn about the magnitude of the danger that hand-cranking posed to early automobile users. Firms innovated and produced models that specifically tried to address this problem. For example, the Rambler Model 44 launched a safety spark retarder as a direct response to this market lesson. Rambler's advertisement in the *Horseless Ag*e promised: "Every one who has had the unpleasant experience of premature spark in starting an automobile will appreciate the Rambler safety starting device. This prevents an explosion ahead of center, even though the operator forgets to retard the spark" (Rambler, 1908a, 1908b). Indeed, it was the report of a friend's death resulting from complications caused by a hand cranking injury that motivated Cadillac founder Henry Leland to focus on the problem. Even though Leland "had been improving [other aspects] of the car steadily … no other improvement was so urgent as some kind of mechanical starter" (Leland, Leland, Millbrook, & Leland, 1966, p. 130). Cadillac's introduction of the electric starter in 1913 eliminated the need for manual crankshafts. For this innovation, Cadillac won the prestigious Dewar Trophy that year and also brought to light the superiority of the Cadillac electrical system. Market demand for the electric starter forced the industry to adjust, and versions of the electric starter quickly superseded other competing solutions to the problem such as compressed air starters, spring motor starters, and other potential solutions that competitors tested in the new models that they launched between 1913 and 1914. Within 2 years, electric starters were almost ubiquitous in the market.

6.3.2 | Electric vehicles

Electric cars also faced issues regarding how consumers used them. Even though they were easier to drive than gasoline and steam, owners often struggled with the charging process (Mom, 2004). Owners overcharged and burned the batteries by leaving them charging overnight, vehicles were driven without sufficient charge, or basic maintenance was neglected, resulting in reduced speed and mileage. This behavior led to insufficient performance given the state of the technology at the time. Market participation was essential to reveal the importance of educating the customers to charge the batteries without damaging them. As stated by one electric car dealer, "such a thing as learning how to charge a battery never occurred as essential" (Kimes, 2005, p. 166). Thus, the supposedly simple act of starting the automobile created unforeseen challenges that the manufacturers could not have addressed without market participation.

6.4 | Design

Consumer experience was even necessary to inform manufacturers about requirements for operating on American roads. Early American touring cars had adopted the European practice of positioning the chassis “close to the road to increase stability during rapid cornering” (Wells, 2007, p. 514). Initially, the key attributes of these European vehicles, speed and power, were irrelevant because American drivers did not have access to good roads. Albert Pope, often referred to as the father of the American Good Roads movement, observed that “[t]he American who buys an automobile finds himself confronted with this great difficulty. He has nowhere to use. He must pick between bad roads and worse” (1903, p. 168). In response manufacturers increased ground clearance, strengthened structural features and added power: “The result was the American touring car, a versatile modification which allowed mobility-minded U.S. consumers to drive on even the worst of roads” (Wells, 2007, p. 515). Thus, the driver experience led some firms to pivot by developing a new class of automobiles that benefited from the terrain-specific lessons offered by these economic experiments.

However, engaging in a strategic pivot by switching to the touring car did not necessarily guarantee success, thereby demonstrating the immense uncertainties and tradeoffs that the firms encountered. For example, Autocar (1901–1912) which started off by launching a 2-cylinder, 10-HP car for $800 in 1901, first pivoted towards a 6-cylinder, 60-HP car for $6,500 and then towards a 4-cylinder, 30-HP car for $1,800, before it failed in 1912. Nevertheless, many firms did succeed as a result of the transition to the touring car. For example, Cole (1901–1925) pivoted from their initial 2-cylinder, 15-HP runabouts costing $775 to an 8-cylinder, 60-HP touring vehicle, and in the process weathered the turbulent early years of the industry.

6.5 | Construction

The learning that resulted from reliability tours—long-distance outings that sometimes lasted a week or more—serves as another example of learning about consumer usage preferences. When many elements of the automotive system were still unsettled, the tours served to increase public interest in long-distance travel, thereby crystallizing performance expectations from the automobile. The publicity garnered by these tours ensured that any mechanical issues faced by the participating vehicles received consumer attention. Contestant experience and changing consumer interests revealed during “these reliability runs were productive of immediate results in the way of better, tougher metal throughout the whole mechanism and a very material reduction in weight. Most of all the tire makers discovered and remedied weaknesses inherent in their product” (Smith, 1928, p. 24). Long distance traveling by early consumers helped manufacturers identify problems affecting durability of their products. For example, only after extensive use could the 1903–1904 manufacturers discover that the “tubular front axle would get sort of tired after a thousand miles or so, and, so to speak, relax, a sort of unbending, as it were, which gave the front wheels an air of ‘toeing in’” (Smith, 1928, p. 24).

Lessons learned from such endurance races were complex and thereby required manufacturers to make fundamental changes to their new models. Manufacturers had to use new types of steel for construction and make corresponding changes to the treatment processes used on these steels resulting in substantial changes to foundry practices. Moreover, as noted by Henry Souther, chief engineer of the Pope Hartford automobile company and the chairman of the first SAE committee on standardization, to improve overall strength, choosing the right material was not sufficient on its own, rather the design was of much importance (Souther, 1912). Manufacturers redesigned axles and springs to maintain vehicle strength and needed to ensure that subsequent changes aligned with the tensile strength of the axle and springs. Thus, improving strength required interrelated changes to materials, processes, and design in the new models.

7 | DISCUSSION AND CONCLUSION

Understanding the antecedents of competitive advantage is fundamental to strategy. This paper has explored the role of economic experimentation as a key mode of learning that firms use to formulate strategy. While economic experiments may vary in the expected degree of firm commitment or irreversibility, we have focused on a particular subset of economic experiments that requires substantial firm commitment to address the threefold interdependencies between contemporaneous decisions, decisions by other economic actors, and future decisions. We term such economic experiments, that are also strategic decisions as per Leiblein et al. (2018), strategic pivots. Strategic pivots are important to study because they often control the fate of the firm. Startups have finite resources, and bets that do not turn out well can lead to firm failure. Statistically, we demonstrate that automobile firms that produced more unique models survived longer, made greater improvements to technical performance, and thus, were more likely to gain competitive advantage. Based on the historical record, we argue that each new model is best interpreted as a strategic pivot.

We posit that strategic pivoting—and the learning associated with this set of economic experiments—was an important entrepreneurial success factor in the early automobile industry, a context in which entrepreneurs could not deduce a single, appropriate course of action from first principles. New and unique model introductions were strategic pivots because they were: (a) economic experiments with uncertain market outcomes; (b) irreversible commitments subject to the paradox of entrepreneurship because of the substantial technical changes to the product and investments into production technology; and (c) characterized by a threefold interdependency between the choice of the model and other firm decisions, competitors' current and future strategic decisions, and the firm's future strategic decisions. Our historical analysis indicates that the early history of the automobile industry can be understood as the sequential unfolding of a multitude of strategic pivots. However, many firms either chose not to, or were unable to, pivot. Those that did pivot were more likely to survive and improve their offerings.

These correlations drove us to explore the historical record to understand what, if anything, could only have been learned through market interactions. The historical evidence suggests that entrepreneurs relied on market interactions as a learning mechanism to resolve uncertainties and that this learning was the foundation of subsequent products, with further implications for firm structure and industry organization. Those firms that were able to make multiple strategic pivots were more likely to succeed, as those firms were able to learn and internalize many interrelated lessons and to scale. In this sense, firm strategy originated through economic experimentation. The success of these strategies was not predictable ex ante—and many failed. Some firms were able to learn from their own failed strategic pivots, but implementing the pivots required irreversible commitments, and hence, many firms exhausted their resources and failed as a consequence of having conducted them.

Our inference is abductive. We have presented statistical evidence consistent with the premise that economic experimentation—measured as strategic pivots—was an important factor in firm success and historical evidence that economic experimentation not only directly influenced subsequent products but this experimentation was conducted under the paradox of entrepreneurship. Thus, our historical analysis suggests that the axioms proposed by Gans et al. (2016)—that partial commitment is required for learning when resource constrained firms are forced to choose among alternative paths—are reasonable accounts of how entrepreneurs make strategic decisions in the face of necessarily incomplete information.

Having established our findings in the context of the early automobile industry, it is important to ask where else strategic pivots might matter. In general, in nascent industries where uncertainty is high, we believe that the viability of firm strategy will be revealed through a process of economic experimentation. Logically, the necessity of strategic pivots will be greater in the presence of various interdependencies, because in such settings the paradox of entrepreneurship will be binding. When economic experimentation requires interdependent, partially irreversible commitments, strategic pivots will become central to the resolution of strategic uncertainty. Conversely, these conditions also demarcate the limits of the applicability of low-cost strategies for economic experimentation called for by the Lean Startup approach. While firms may receive feedback on their offerings using the minimal strategic commitments advocated by the Lean Startup framework, history supports the Entrepreneurial Strategy assumption that learning may also require costly, partially irreversible strategic commitments. In this sense, although Teece et al. (2016, p. 26) do not consider the role of strategic pivots that we describe above, we concur with their general point that the relevance of the Lean Startup framework is limited: "[i]t is most applicable where product development costs are relatively low and adjustments (revisions) lower still. It fits comfortably for software development, less so for aircraft or even automobiles. Implicitly, it deals with circumstances where irreversibilities do not pose costly challenges to transformation, and where rapid feedback and learning from customers is possible."[10] Similarly, Rosenberg's (1994) theory of economic experimentation is independent of the costs of engaging with customers; rather, he asks whether it is possible to advance without engaging with customers at all. We agree. While some spaces allow economic experiments, not all spaces—retrospectively or prospectively—allow economic experimentation without commitment. Testing the generalizability of these statements will require examining the role and viability of strategic pivots across different industry settings.

We also make a methodological contribution by using historical methods to provide detailed, context-specific evidence that—while not dispositive with respect to the issue of causal inference in our statistical analysis—is complementary to results obtained using multivariate statistics. We emphasize the sequence and context needed to view actors and actions as temporally situated in our study of the emergent automobile industry (Bucheli & Wadhwani, 2014; Forbes & Kirsch, 2011). Historical methods are particularly useful for the purpose of interpretation—"developing theory to reveal the operation of transformative social processes" and explaining "the form and origins of significant contemporary phenomena" (Maclean, Harvey, & Clegg, 2016, p. 612). In this paper, we use historical methods to interpret the strategic pivot as a type of economic experimentation. Rather than offering universal generalizations deciphered from variables relevant at a particular moment in time, we use historical methods to provide embedded claims that are bounded by the limits of the context in which the analysis was developed. Seen in this light, using narrowly constructed historical findings that operate at the margin of inference of our traditional statistical tools is a possible method of establishing the likely explanations of causal mechanisms. The statistical findings narrow our historical analysis to specific settings. In turn, the historical findings prescribe the limits of an acceptable alternative (i.e., competing) explanation of the observed statistical regularities. To invalidate the interpretation of our findings, an acceptable alternative causal mechanism would need to be consistent with the historical account we have presented. Our in-depth exploration of the historical context illuminates the likely boundary conditions of the theoretical explanation and, therefore, the applicability of our theory to other settings. Of course, we cannot test our theory directly. Such a test would require additional samples of early automobile firms, but there are no additional samples because we study the entire population of domestic manufacturers. Therefore, understanding the usefulness of the theory will require making predictions based on the

[10]Teece is referring to the modern automobile industry. Moreover, it is not clear to us that commitments to particular software versions are never strategic pivots.

understanding of the boundary conditions implied by the U.S. automobile industry and then developing and testing these predictions in other settings, or in industries with known similarities and differences.

Our analysis reveals a variety of questions that may be explored in future research. For example, we have not explored the antecedents of economic experimentation: why do some firms experiment and others do not? Klepper (2007) suggests that performance in the early automotive industry was related to better founders who spun-off from other successful companies. Perhaps one attribute that made founders better was their ability to conduct effective economic experiments. Indeed, Pillai (2019) relates success in the automobile industry to the presence of technical capabilities in a firm's founder. Klepper and Simons (1997) proposed that this early advantage was leveraged as production scale economies became important in the industry. Our analysis is consistent with the idea that the private knowledge gained from economic experimentation allowed firms to invest in scale production. Then, as economies of scale kicked in, further strategic pivots would have required mass production capabilities and therefore become more expensive. Higher quality standards and costs would have deterred entry and accelerated exit, perhaps giving those firms that had established the ability to conduct economic experiments a sustainable competitive advantage. But at this stage, these are mere conjectures.

Our findings may also inform research on dominant designs. Our analysis suggests that economic experimentation was an important mechanism through which automotive firms navigated both technical and non-technological uncertainties and their interactions in the quest to achieve a dominant design. A future study that explores the relationship between strategic pivots and the emergence of dominant designs may help address two shortcomings of the dominant design literature: namely, lack of clarity on specific actions that firms may take ex ante to make a design dominant, and the treatment of technology selection as a stochastic process that ignores the role of learning.

Other questions that warrant further investigations include: What determines the first strategic pivot in which a firm engages? Does the timing of strategic pivots change outcomes? How do the benefits of strategic pivots accrued by startups differ from those of large firms? And, how do firms evaluate the outcomes of strategic pivots?

With technological changes making it easier and cheaper to launch new firms, economic experimentation is increasingly in vogue. While economic experimentation has proliferated in practice, management scholars are only now beginning to identify the circumstances under which economic experimentation provides competitive advantage. By proposing the strategic pivot as a type of particularly consequential economic experiment, we have theoretically situated a phenomenon of interest to practitioners and substantiated it using an important historical case. We hope that future studies continue to explore the various aspects of this mode of economic experimentation.

ACKNOWLEDGEMENTS

We thank seminar participants at the University of Maryland, participants at the Israel Strategy Conference 2017, the West Coast Research Symposium on Technology Entrepreneurship, the AoM Tel-Aviv Startup and Scale-up Conference 2018, the editors of SMJ's Historical Methods Special Issue, and two anonymous reviewers for helpful comments.

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How to cite this article: Pillai SD, Goldfarb B, Kirsch DA. The origins of firm strategy: Learning by economic experimentation and strategic pivots in the early automobile industry. *Strat Mgmt J*. 2020;41:369–399. https://doi.org/10.1002/smj.3102