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A B S T R A C T

In recent years, the concept of the business model has received substantial attention in the strategy literature, where a number of qualitative approaches to describe, represent, and evaluate business models have been proposed. We contend that while helpful to understand a firm's overall logic of value creation and capture, qualitative methods must be complemented with quantitative analyses. The development of quantitative methods for the study of business models, however, has trailed that of their qualitative peers. In this paper, we develop an analytical framework based on the theory of index numbers and production theory to provide quantitative insight on the link between a firm's business model choices and their ultimate profit consequences. We apply the method to Walmart. Using evidence from annual reports, research papers, case studies, and books for the period of 1972-2008, we build a qualitative representation of Walmart's business model. We then map that representation to an analytical model that quantifies Walmart's sources of competitive advantage over a 36-year period. Although Walmart's business model remained the same during the years of our study, we find that the different CEOs pulled a number of business model *levers* differently, which partly explains the variation in Walmart's performance throughout the years. Under Sam Walton, the company's performance improved due mainly to the adoption of new technologies as well as low prices obtained from vendors. David Glass's tenure was characterized by business model choices aimed at increasing volume such as building new stores, increasing product variety, everyday low prices (EDLP), and high-powered incentives for store managers. Input and output prices played a smaller role under David Glass than under Sam Walton. Finally, Lee Scott loosened EDLP and modified Walmart's human resource practices by offering better benefits and wages to associates in response to growing social pressure. Overall, our analysis suggests that the effectiveness of a particular business model depends not only on its design (its levers and how they relate to one another) but, most importantly, on its implementation (how the business model levers are pulled).

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1. Introduction

In recent years the strategy field has become increasingly interested in the study of business models.¹ Although the expression was introduced long ago by Peter Drucker,² academic work on business models began just a decade ago in the context of the Internet boom, where entrepreneurs were asked to explain how their ventures would create value (the wedge between customer willingness to pay and supplier willingness to sell, see Brandenburger and Stuart, 1996) and how value would be captured as profit. Indeed, the most common definition of business model is “the logic of the firm, the way it operates, and how it creates and captures value for its stakeholders.”³

Casadesus-Masanell and Ricart (2008, 2010, 2011) and Casadesus-Masanell and Zhu (2010) operationalize this notion by decomposing business models into two fundamental elements: *choices*—such as policies, assets, and governance of policies and assets—and the *consequences* of these choices. The causal links between choices and consequences help explain the logic of the firm, how it creates and captures value for its stakeholders. These authors also propose a methodology to represent business models qualitatively.

While business model representations help improve an analyst’s understanding of a firm’s value logic, the methodology proposed offers little guidance on how the causal links between choices and consequences can be quantified. Without quantification, a detailed study of a firm’s business model is incomplete because there is often too much freedom on how to interpret relationships between firm choices (such as low prices, heavy investment in technology, or high-powered incentives for managers) and their consequences (such as volume, bargaining power with suppliers, or a culture of frugality).

In this paper we propose a novel approach to quantify the link between a firm’s choices and their consequences and, ultimately, for gaining a better understanding of the virtues and weaknesses of a firm’s business model. The method builds on recent advances in production theory and index numbers by Grifell-Tatjé and Lovell (1999, 2008, 2012) and relates business model choices to profit variations over time. Its starting point is the observation that profits raise and fall for two reasons: changes in either prices or quantities. In particular, a firm’s profits could increase for any of the following reasons: (a) selling goods at higher prices; (b) paying less for inputs, such as labor or capital; (c) selling more goods while holding constant

their cost markup; or (d) using fewer inputs per unit of good produced/sold. Note that (a) and (b) are related to prices whereas (c) and (d) are related to quantities. Our method quantifies how much of a firm's profit variation is due to price and how much is due to quantity effects. These two effects, in turn, are determined through business model choices.

[INSERT FIGURE 1 ABOUT HERE]

Indeed, the key to our approach is the realization that, at heart, business models create and capture value by acting on prices and volumes. For instance, Ryanair—a company that competes through a generic low-cost strategy—has made business model choices, such as flying to secondary airports or the use of a standardized fleet of 737s, that have led to lower input *prices*. Likewise, Ryanair has chosen to maximize the number of seats in its aircraft by offering coach service only and removing the kitchenette, which has led to larger *volumes*. Thus, a quantification Ryanair's profit variation over time due to prices and to volumes shall provide valuable information on how the firm's business model works.

As noted, the analytical framework that we propose combines the theory of index numbers and production theory, uses publicly available information about realized prices and volumes, and has two levels of analysis.⁴ The first level uses index numbers to produce an aggregated estimate of the price and quantity effects.⁵ In particular, we build Bennet-type indicators for prices and quantities of inputs (e.g., labor and capital) and outputs (e.g., final products).⁶ The price effect obtained through index numbers is useful to quantify, for example, the impact of business model policies that affect prices of inputs and outputs (e.g., product range or new supply sources) on profits. The quantity effect, in turn, captures the impact of policies that affect quantity (e.g., hiring more staff or investment in larger stores) on the bottom line.

The second level of analysis builds on new developments in production theory to decompose the quantity effect into an operational efficiency effect, a technological change effect, and an activity effect. To do this, we build on well-established techniques in production theory. This requires the assembly of a dataset that records information about other firms in the industry. We use production frontiers as reference points for computing the operational efficiency, technological change, and activity effects.

The *operational efficiency effect* measures how much profit variation over time is due to better use of input quantities; that is, how close the firm is to the production possibility frontier. The *technological progress effect* captures profit variation caused by the introduction of technological improvements that allow firms to produce with fewer inputs. Conceptually, technological progress corresponds to an expansion of the production possibility frontier. The *activity effect* measures how much the variation of profits over time is due to sales volume and the volume of inputs employed. This corresponds to a movement along the production possibility frontier. Our method quantifies these three effects. The additional level of detail obtained helps us better understand how a firm's choices leading to growth contribute to higher profits. It also helps us explore the effects of technological progress and the firm's efforts to achieve higher efficiency levels.

One important advantage of our approach is that it uses widely available accounting data—of the focal firm and main competitors—and can therefore be applied broadly. If fine-grained proprietary data are available, the framework can be refined further to deliver more nuanced, less aggregated quantifications. To demonstrate how the method can be applied to aggregate data to produce insights on how a firm's business model operates, we apply the methodology to study the evolution of Walmart's business model since its IPO in 1971 through 2008.

Walmart constitutes an ideal setting to apply our approach and demonstrate its value because: (i) there is a wealth of qualitative information about the company, which allows us to build a detailed business model representation, and (ii) being a public company, the accounting data that we need for the analysis are readily available. The company began operations in 1962, when Sam Walton and his brother Bud failed to persuade Ben Franklin—Sam Walton's franchisor at the time—to open discount retail stores in rural America. The unlikely success of this business venture had profound consequences worldwide. Fishman (2006) points out that Walmart's influence is felt everywhere, even in countries where there are no Walmart stores. Indeed, Walmart alters other retailers' business practices, provokes changes in product features, affects urban space, sets industry standards, changes market structure, and influences the consumer habits of millions of people worldwide. Walmart's sales in 2010, worth \$420 billion, placed the company as the 25th largest economy in the world if its sales were likened to a country's GDP.

Using evidence from annual reports, research papers, case studies, and books on Walmart, we describe the company's business model choices over time. We then build a quantitative model that can be used to determine the effect of Walmart's choices on its competitive advantage. For the quantitative analysis, we construct a dataset that includes the largest firms in the American discount retailing industry to define—using methods developed in the literature on production theory—a best practice production frontier. Specifically, we use labor and capital as inputs, and value added as the measure of output. We compute the effect of operational efficiency, new technological improvements, level of activity, and prices on Walmart's profits during the period 1972-2008. During this period Walmart had three CEOs: Sam Walton (until 1988), David Glass (from 1988 to 2000), and Lee Scott (from 2000).

We find that input and output prices, technological progress, and the level of activity played different roles across the three CEOs. Under Sam Walton (1972-1988), Walmart deepened its policy of everyday low prices (EDLP), which led to negative *output* price effects. These were somewhat offset by favorable *input* price concessions obtained from vendors. While price reductions to customers hurt profits, more favorable purchase prices from vendors had a substantial positive effect. The analysis also reveals that under Sam Walton, Walmart increased its profits substantially through the adoption of new technology (such as investment on a satellite system, uniform product codes, or automated distribution centers) that pushed the production possibility frontier outward. Finally, the activity effect—variations in the volume of outputs and inputs that led to economies of scale, changes in the product mix and changes in the input mix—explains the remainder profit variation during this period.

More than 100% of profit variation under David Glass (1988-2000) is explained by the activity effect. Thus Walmart's success during this period was due, primarily, to business model choices aimed at increasing volume such as building new stores, increasing product variety, setting low prices, and implementing high-powered incentives for store managers. Technological improvements explain only a small fraction of the company's profit variation over this period. Output and input price effects played substantially smaller roles than during Sam Walton's tenure.

Our analysis reveals that Lee Scott (2000-2008) loosened EDLP and cost controls. Indeed, value added per dollar sold and input prices—labor costs, mainly—were on the rise

under his tenure. Finally, our study indicates that by the early 1980s Walmart had become the most efficient discount retailer in the United States (U.S.), a position it held through the end of our sample. Thus, for most of the years of analysis Walmart was *on* the production possibility frontier; only early during Sam Walton's tenure profit variation was partly explained by gains in operational effectiveness.

The rest of the paper is organized as follows. In Section 2 we review the literature on business models. In Section 3, we describe and discuss Walmart's most important business model choices. In Section 4 we present our method for quantifying the relationships between choices and consequences to connect the business model choices to data. In Section 5 we describe the dataset for the analysis. Section 6 presents the results. Section 7 concludes with a discussion of the advantages and drawbacks of our method.

2. The Concept of Business Model

The notion of business model is recent in the scholarly literature. In the 1990s, as new ways of doing business that subverted established logics of value creation and value capture emerged, practitioners employed the phrase to describe the ways in which untried e-business ventures were to operate (Chesbrough and Rosenbloom, 2002; Magretta, 2002). The term was thus used to describe a wide diversity of novel, heterodox e-commerce firms.

While helpful to refer to "the logic of the firm," the notion is not free from controversy. Porter (2001), for instance, has described the term as imprecise. This ambiguity has prompted many attempts to establish its boundaries and define its components. Mäkinen and Seppänen (2007) observe that most of these attempts were carried out in isolation from one another, which partially explains the current state of fragmentation in definitions. Magretta (2002) considers the terms "strategy" and "business model" not clearly separated and suggests that concerted efforts to define them should be made. More recently, Lecocq, Demil, and Ventura (2010) argued that the business model concept shows features of a research program based on Lakatos's viewpoint of scientific progress. In particular, the business model research program has a "hard core" (fundamental assumptions concerning an object), a set of "protective hypotheses" (hypotheses that are being debated and/or tested but do not yet constitute generally accepted assumptions), and it is "dynamic." Nevertheless, the authors claim that the theorization stage is still in its infancy and, to make progress, it is necessary to operationalize

the concept. They conclude that new developments should aim at determining how business models must be observed, qualified, and measured.

Despite these objections, the concept of a business model is useful for integrating different, related elements. To Chesbrough and Rosenbloom (2002), for instance, a business model is a device that establishes a link between technological development and economic innovation. Hedman and Kalling (2003) regard the notion as an integrative concept that connects the resource-based view and the industrial organization perspectives on strategy. And Amit and Zott (2001) propose a unifying definition “that captures the value creation from multiple sources.”

Although there are myriad definitions of “business model,” for the most part they are similar. Magretta (2002), for example, defines it as a description of how the parts of a business fit together. Hedman and Kalling (2003) characterize the concept as a description of the key components of a business. The idea of business models composed of a predetermined collection of elements seems to be hovering over most definitions. Several studies have attempted to provide a definitive list of what a business model should include. Morris et al. (2005) and Hedman and Kalling (2003) examine diverse suggestions for the components of a business model. The range spans between three and eight elements. Morris et al (2005) suggest a business model concept that answers six questions and has three different levels, while Hedman and Kalling (2003) suggest seven components. The vocabulary employed to describe these components differs considerably from definition to definition, reflecting the lack of consensus among researchers.

In this study, we employ the conceptual framework developed by Casadesus-Masanell and Ricart (2010). According to this view, a business model is composed of two types of elements: *choices* made by the management and the *consequences* of these choices. There are three types of choices: policies, assets, and governance of assets and policies. Policy choices refer to courses of action that the firm adopts for all aspects of its operation. Examples include opposing the emergence of unions; locating plants in rural areas; encouraging employees to fly tourist class, providing high-powered monetary incentives, or airlines using secondary airports as a way to cut their costs. Asset choices refer to decisions about tangible resources, such as manufacturing facilities, a satellite system for communicating between offices, or an airline’s

use of a particular aircraft model. Governance choices refer to the structure of contractual arrangements that confer decision rights over policies or assets. For example, a given business model may contain (as a choice) the use of certain assets such as a fleet of trucks, which leads onto a governance choice for the firm as to whether it should own the fleet or lease it from a third party. Consequences can be flexible or rigid. The flexibility of a consequence is determined by how fast it changes as the choices that produced it vary.

Casadesus-Masanell and Ricart's framework is simple, flexible, and bridges industrial organization and the resource-based view, two alternative perspectives for the study of competitive advantage. According to the resource-based view, what determines a firm's success is control over valuable, rare, and imperfectly imitable resources (Barney, 1991). The industrial organization perspective, developed by Porter (1980, 1985), portrays the firm as a collection of activities on which competitive advantage resides. This author describes two generic strategies (low cost and differentiation) that translate into homonymous types of competitive advantage. Casadesus-Masanell and Ricart (2010) and Zott and Amit (2010) recognize the importance of activities (policies) and assets as descriptors of a firm's business model. And, by incorporating the governance of assets and policies, Casadesus-Masanell and Ricart (2010) also consider insights from transaction cost economics.

The framework has two important additional elements. First, there is the idea that consequences are sometimes rigid—meaning that some choices made by the firm have a cumulative effect. This provides the “longitudinal dimension” explicitly sought by Hedman and Kalling (2003). The second element is the inclusion of causal relationships between choices and consequences. Choices produce consequences. Furthermore, consequences may create other consequences, or enable choices. The *causal loop diagram* is the device proposed to represent business models.⁷ A feedback loop occurs when the consequences of some choices also make these same choices possible. Virtuous cycles are “feedback loops that in every iteration strengthen some components of the model.”⁸ This second element can also be found in the dynamic RCOV framework developed by Lecocq, Demil, and Warnier (2006). These authors identify three different components to every business model: resources and competencies (RC), internal and external organization (O), and a value proposition (V). These components are linked creating virtuous cycles.

The level of detail in each business model depends on the objectives of the practitioner or researcher. It is important to bear in mind the tradeoff between tractability and realism mentioned by Casadesus-Masanell and Larson (2009) when choosing the degree of precision in the representation. Casadesus-Masanell and Ricart (2008, 2010) describe two methods of simplifying a business model representation. One is *aggregation*, which consists of grouping choices and consequences into larger constructs. The other is *decomposability*, which refers to the analysis of parts of a business model that are not related to other choices and consequences. In what follows, we make use of aggregation and decomposability.

3. Walmart's Business Model

In this section we build a qualitative business model representation for Walmart. Toward this end, we have gathered and analyzed publicly available information on the company—facts disclosed in its annual reports (years 1971-2008), academic papers, case studies, and books.⁹ A detailed description of Walmart's business model is the starting point for the empirical analysis of Sections 4, 5, and 6.

Several papers and books claim to have established *the key* to Walmart's success as if it was due to a single silver bullet. Consistent with Porter (1996), our view is that what explains the firm's superb performance is an integrated set of choices. After reviewing the literature we have identified eight distinctive categories of choices (the levers) that define the generic discount retail business model: pricing, pressure over vendors, investment in technology, human resource practices, expansion policies, product selection, cost consciousness, and customer service.

Walmart's performance has been impressive. Figure 2 presents the evolution of real profits. In 2008 profits were nearly \$1.8 billion 1970 dollars, 436 times greater what the company earned in 1972. The compound annual growth rate was 17.82% for a 38-year period. Moreover, value added increased from \$29.52 million constant dollars in 1971 to \$17.14 billion in 2008. Additionally, average productivity grew by 2%.

[INSERT FIGURE 2 ABOUT HERE]

3.1 Levers defining the discount retail business model

We first review the most important *levers* used by discount retailers in their operations (the categories of choices as defined in Porter's value chain—see Porter, 1985). Firms make particular choices to *configure* each of these levers (see Porter and Siggelkow, 2008). Different choices generate different consequences. Therefore, a particular set of choices affects the success or failure of a business model.

1. Pricing. Discount retailers determine the prices of their merchandise and whether or not to price discriminate.

2. Pressure over vendors. Discount retailers choose how much pressure to exert over vendors to obtain favorable terms and conditions. They also look to build mutually beneficial partnerships with suppliers with the goal to create more value.

3. Investment in technology. Discount retailers choose how different tasks are executed. At one extreme, they may incorporate the latest technologies in their daily processes (investments in satellite systems, uniform product codes, RFID...) and, at the other, may follow “artisanal” procedures (e.g. manual inventory systems).

4. Human resource practices. Discount retailers set different policies that characterize their relationships with employees: compensation policies, power of incentives, screening of new employees, and so on.

5. Expansion policies. Discount retailers choose whether to locate their stores in rural, suburban, or urban areas and the rate at which new stores are added to the company.

6. Product selection. Discount retailers must choose the mix of goods they sell: private labels vs. national brands, selection of product categories, and selection within categories.

7. Cost consciousness. Discount retailers seek to minimize overhead expenditures to boost profits. However not all retailers do it the same way or with the same intensity. For example, some have lavish headquarters while others choose austere offices.

8. Customer service. Discount retailers choose how to treat their customers. Some retailers create a family atmosphere where customers are welcomed to the premises and

persuaded to buy certain articles or actively handheld. Others offer more leeway and only interact directly with customers if they demand information. The “customer service” lever also includes store appearance, customer support, return policy, and complaint management.

[INSERT FIGURE 3 ABOUT HERE]

In what follows, we describe how the different Walmart CEOs pulled these levers (i.e., *configured* their activities) during their respective tenures. We note that while these eight levers did not change throughout the history of the company (as Walmart remained a traditional discount retailer), different leaders made dissimilar choices for some of the levers.

3.2 Business model choices under Sam Walton

Sam Walton and his brother Bud franchised several Ben Franklin variety stores in the early forties. Walton wanted more freedom in the administration of these stores and when Ben Franklin rejected his idea of big stores in small towns, Walton decided to create his own chain. The first Walmart store opened in 1962 in Roger, Arkansas. Walton was CEO and Chairman almost uninterruptedly from 1962 to his retirement in 1988—Walton ceded his position as CEO to Ronald Mayer, a former Executive Vice President of Administration and Finance, in 1974. Walton resumed control in 1976—and tailored Walmart following his beliefs on how to run a discount retailing business. Walton also travelled across the U.S. and abroad searching for innovative practices to copy; he found many, but usually implemented them differently. Walton’s original vision is reflected in the choices he made for the levers described above.

1. Pricing. Early in his career, Walton realized that by setting low prices, he could boost sales growth by much more than the percent reduction in markup. When he entered the discount retailing business, he applied this principle obsessively, always trying to beat the competition on this dimension. He dubbed this choice: “Everyday low prices (EDLP).” The main difference with other retailers was that Walmart always offered its merchandise at the lowest price possible instead of offering promotional discounts. This choice created a low-price reputation for Walmart which increased sales volume as well as reduced the need of frequent advertisement.

2. Pressure over vendors. While Walmart developed a reputation for bargaining hard with its vendors, the concept of “vendor partnership” was developed under Walton. The idea was to strengthen the business relationship between Walmart and its vendors by exchanging information about sales and inventory levels thus creating more value by cutting transaction costs and increasing efficiency. Walmart strategically located its own distribution centers to solve the replenishment problem that the company faced in its early days. This allowed the firm to save money by obtaining discounts from vendors for bulk purchasing. In addition, EDLP resulted in huge sales volume and Walmart quickly became a major distribution channel for many of its vendors. In 1985, no vendor accounted for more than 2.8% of the company’s total purchases.

3. Investment in technology. Ronald Mayer, Walmart’s CEO from 1974 to 1976, was a strong advocate for the use of technology to reduce costs. Upon his return to the helm of the company, Walton adopted Mayer’s ideas. Walmart was an early adopter of uniform product codes (UPC) at the point of sale which allowed Walmart to know the location of every item at all times. The roll out of UPCs began in 1983 and ended in 1988, two years ahead of Kmart (at the time, a company larger than Walmart). Walmart’s satellite system was set up in 1983 at a cost of \$20 million. Walmart’s investments in technology helped enhance communication between headquarters, stores, and vendors. Inventory costs decreased and inbound logistics became more efficient.

4. Human resource practices. Walton’s view of human resource practices at Walmart is manifest in the following quote: “If you want the people in the stores to take care of the customers, you have to make sure you’re taking care of the people in the stores.”¹⁰ Indeed, under Walton, Walmart was recognized as one of the 100 best companies to work for in America. The company put in place a diverse array of high-powered incentives to attract talent, especially store managers. Initially, Walton lured talent from other companies by offering them a percentage of the profits made by the store. Later, when Walmart went public, a stock ownership plan was set up. After some years, recruitment was mainly from within the company.

5. Expansion policies. According to Walton, an important determinant of Walmart’s success was its location choices: “Our key strategy was to put good-sized stores into little one-

horse towns which everybody else was ignoring.”¹¹ At least as important was Walmart’s method of geographic expansion. Walmart started in rural areas in the southern region of the country, grew by building stores close to existing distribution centers, and then expanded to other regions. Walmart would always push from the inside out rather than making long jumps and later backfilling. The main advantage of this policy was the development of a dense distribution network that allowed the firm to spread costs and exploit economies of density.

6. Product selection. Walmart sought to project an image “as the competitive, one-stop shopping center for the entire family where customer satisfaction is always guaranteed.”¹² Consequently, the company extended the product categories offered in the stores by including jewelry, shoes, photo labs, and pharmacies, as well as automotive centers. Early forays in groceries were undertaken under Walton. The company offered national brands and for some products (such as apparel, health and beauty care, and dog food) also had private brand offerings. Various retail formats were tested to attract customers with specific needs. These alternative retail formats had more limited product selection across categories. The most successful of these ventures was Sam’s Club, a warehouse club that targeted customers who purchased wholesale quantities. Another significant aspect of Walmart’s product selection was the “Buy American” program, set up in 1985, to sell American products and reduce the U.S. trade deficit.

7. Cost consciousness. Walton emphasized cost cutting as one of the pillars of Walmart’s culture. This was accomplished through the systematic elimination of superfluous expenses. Many accounts exist of how tightly Walmart controlled costs. For example, managers (including Sam Walton) shared hotel rooms and walked instead of taking taxis, whenever this was possible. Likewise, Walmart made it a practice to call its vendors collect.

8. Customer service. Walmart implemented policies aiming to create a friendly shopping environment where customers felt they were part of a family. Walton reminded all employees in 1989 that customers should be treated as guests. Walmart began formally implementing the “Aggressive Hospitality” program in 1984:¹³ customers were received by “people greeters” and they enjoyed benefits such as extended opening hours, free parking, no-hassle refund and exchange policies, speedy checkout lanes, wider aisles, and clean stores. The company sponsored social programs in the communities where the firm was present.

3.3 Walmart under Glass and Scott

David Glass (1988-2000)

Walton stepped down as CEO in 1988. His successor, David Glass, had joined Walmart in 1976 where he served as CFO, COO, and President prior to his appointment as CEO. Walton remained involved with the company until his death in 1992. If Walton was the visionary leader, David Glass was the operational wizard who expanded his vision to transform the company into the world's largest discount retailer. Glass continued to use the business model inherited from Walton, but pulled some levers differently.

One of the most important aspects of Glass's tenure was a more intense use of technology. Walmart invested heavily in information technologies to link stores with vendors. These investments boosted customers' satisfaction (by reducing stockouts) and simultaneously decreased inventory costs.

Glass also strengthened pressure over vendors. As the company grew, vendors became increasingly dependent on Walmart. For example, in 1987 10% of Procter & Gamble's (P&G) sales went through Walmart. However, P&G represented less than 3% of Walmart's total revenue. This pressure was so intense, that many vendors chose to outsource production to low-wage countries. Relatedly, Glass discontinued the "Buy American Program."

There were also changes in product selection. During the Glass years, Walmart expanded the use of private brands. Walmart developed these brands to offer opening price points—the lowest price available in the store for an item—to customers.¹⁴ The use of private brands was well aligned with the Walmart's pricing lever (EDLP, just as under Walton). Walmart also moved decisively to include groceries in its product offering through Supercenters.¹⁵ A supercenter was a discount store combined with a grocery store and other small departments. When Walton left the company there were three supercenters; after Glass left the company, the number of supercenters had reached 721.

Under Glass, Walmart continued Walton's growth strategy in the U.S. and opened stores in all fifty states. The number of stores increased from 1,364 in 1988 to 3,989 in 2000. However, there were also changes in the geographic expansion policies he had inherited from Walton. Specifically, Glass built more of its stores in suburban locations, which implied more

competition and forced even lower prices. Walmart also invested heavily abroad. In 2000, a fourth of all Walmart stores were located outside the U.S.

While human resource practices did not change much, the company became the largest private employer in U.S. and the largest retailer in Mexico and Canada. As a consequence, Walmart's human resource practices were under increased public scrutiny.

Lee Scott (2000-2008)

Lee Scott became Walmart's CEO in January 2000. With the exception of human resource practices, Scott did not significantly alter the configuration of Walmart's business model levers. However, he had to wrestle with important changes in the external environment. At the same time, Walmart's size made it particularly vulnerable for criticism. Moreover, Kmart's 2002 bankruptcy affected public perception of the company in profound ways.

During Scott's early tenure as CEO, Walmart faced a number of criticisms regarding its human resource practices. Claims were made that the company mistreated non-managerial workers by paying them low wages and providing poor benefits. The company was also accused of favoring men over women in a lawsuit filed in 2001.¹⁶ Furthermore, Walmart opposed two attempts at unionization (meat cutters in Jacksonville, Texas in 2000 and workers from a Quebec Walmart store in 2005). As a consequence of these challenges, the company offered improved health benefits to employees and implemented new job and salary structures for non-managerial workers.

Walmart continued to build new stores in the U.S., but the main source of growth came from the international stores.¹⁷ Likewise, Scott transformed many existing discount stores into supercenters, which altered the merchandise mix by further expanding into groceries. At the same time, Sam's Club faced increased competition from Costco which surpassed Sam's in sales volume. Sam's Club tested several defensive strategies (such as offering luxury item and focusing on business customers exclusively) with mixed results.

To increase margins, Scott expanded Walmart's global sourcing activities. Specifically, the company began to manage its global procurement directly instead of relying on third parties. This measure sought to further reduce vendors' prices. Relatedly, Walmart's investment in technology deepened the company's leadership in managing vendor inventories.

Finally, during this period Walmart intensified its philanthropic activities and its efforts to improve its public image. The company assisted New Orleans following hurricane Katrina, became largest charitable contributor in the U.S., invested heavily in advertising, and created a webpage to fend off criticism.

4. Quantifying the Effect of Business Model Choices

We now present a method that relies on the theory of index numbers and production theory to assess the impact of Walmart's choices on the evolution of profits over time. The purpose of index numbers is to aggregate information (see endnote 4). Production theory allows us to study the effect of technical change, operating efficiency, and the level of activity on profit. Contrary to neoclassical approaches to the analysis of the firm, our framework does not require the assumption of profit maximization.¹⁸ The method that we propose has two levels of analysis. The first level uses publicly available information on Walmart's prices and quantities to explain variation in profits through index numbers. The price effect measures the impact of Walmart's policies affecting input and output prices on profits. The quantity effect measures the impact of decisions on output or input quantities on profits. Recently, Boussemart et al. (2012) present a method that uses index number theory to compare profits between different firms. Hence, index numbers are useful not only to evaluate the effectiveness of a particular business models and its implementation but also to understand interactions among competitors.

The second level of analysis decomposes the quantity effect. To do this, we introduce concepts like the set of production possibilities and the production possibility frontier. Production theory allows us to explain the quantity effect using well-known economic performance measurement concepts. This level of detail helps us understand how Walmart's growth policies contributed to higher profits. In addition, we can explore the effects on profits of technological progress and efforts to achieve higher efficiency levels. The empirical application of this second layer of analysis requires the construction of a dataset with information about other firms in the retailing industry.

The rest of this section provides technical details on both levels of analysis.

(A) First level

The first level of analysis decomposes change in profits into a quantity effect and a price effect. We define profit (π) as the difference between revenue and operating cost where revenue is given by $R = p^T y = \sum p_m y_m$ and operating cost by $C = w^T x = \sum w_n x_n$. Output vectors are represented by $y = (y_1, \dots, y_M)$ and input vectors by $x = (x_1, \dots, x_N)$. In addition, output price vectors are denoted $p = (p_1, \dots, p_M)$ and input price vectors $w = (w_1, \dots, w_N)$. Profit is expressed as $\pi = R - C = p^T y - w^T x$, and profit change, from period t to period $t+1$, is defined as

$$\pi^{t+1} - \pi^t = [\bar{p}^T(y^{t+1} - y^t) - \bar{w}^T(x^{t+1} - x^t)] + [\bar{y}^T(p^{t+1} - p^t) - \bar{x}^T(w^{t+1} - w^t)]. \quad (1)$$

The vectors \bar{p} , \bar{y} , \bar{w} and \bar{x} are averages of current and next period vectors, where $\bar{p} = \frac{1}{2}(p^t + p^{t+1})$, $\bar{y} = \frac{1}{2}(y^t + y^{t+1})$ and so on. The first term on the right hand side of expression (1) is the *quantity effect*, showing the impact of quantity changes on profit change. The second term is the *price effect*, which shows the impact of price changes on profit change. Each expression has two components. In the case of the price effect, the first component, $\bar{y}^T(p^{t+1} - p^t)$ quantifies the variations in the prices of outputs; as we discuss below, in our application this is the change in value added per unit of output. The second component, $\bar{x}^T(w^{t+1} - w^t)$, measures the impact on profit of variations in input prices. Equation (1) expresses changes in profit using Bennet quantity and price indicators (\bar{p} , \bar{y} , \bar{w} and \bar{x}) (see endnote 6).

(B) Second level

Using production theory (see Grifell-Tatjé and Lovell, 1999, 2008, 2012 and De Witte and Saal, 2010), the second level of analysis further decomposes the quantity effect into an *activity effect*, an *operating efficiency effect*, and a *technical change effect*:

$$\begin{aligned} \bar{p}^T(y^{t+1} - y^t) - \bar{w}^T(x^{t+1} - x^t) &= [\bar{p}^T(y^{t+1} - y^t) - \bar{w}^T(x^C - x^B)] && \text{Activity Effect} \\ &+ \bar{w}^T(x^t - x^A) - \bar{w}^T(x^{t+1} - x^C) && \text{Operating Efficiency Effect} \\ &+ \bar{w}^T(x^A - x^B). && \text{Technical Change Effect} \end{aligned} \quad (2)$$

We represent the technology available at time t by that period's production possibility frontier F^t and its convex hull $h(F^t)$, the set of feasible input/output combinations given F^t . See Figure 4.

[INSERT FIGURE 4 ABOUT HERE]

Input vectors x^A , x^B , and x^C are theoretical. Specifically, x^A is the efficient amount of input needed to produce the realized output level y^t with technology F^t ; x^B is the efficient amount of input needed to produce the realized output level y^t with technology F^{t+1} ; and x^C is the efficient amount of input needed to produce the realized output level y^{t+1} with technology F^{t+1} .

[INSERT FIGURE 5 ABOUT HERE]

Figure 5 (which is for the case $M = N = 1$) is helpful to understand the decomposition. The *activity effect* measures how much variation in profits is due to changes in sales volume and change in the volume of inputs employed (using efficiently the latest available technology in the retailing industry). This corresponds to a movement along the production possibility frontier of period $t+1$ and is indicated by the arrow connecting operating-efficient vectors (x^B, y^t) and (x^C, y^{t+1}) . The activity effect contributes to or detracts from profit depending on whether the change in outputs exceeds or falls short of the corresponding change in the efficient quantities of inputs, with the changes being evaluated at Bernet output and input prices, \bar{p} and \bar{w} . Grifell-Tatjé and Lovell (1999) have shown that in a situation with multiple outputs and inputs, the activity effect also reflects changes in the mixes of outputs and inputs.

The *operating efficiency effect* measures the change in the difference between the chosen amount of inputs to produce the observed level of output and the efficient amount of inputs needed to produce that level of output. To produce a cost valuation of the operating efficiency of the firm, we multiply these differences in inputs by the Bernet input price index, \bar{w} .

The *technical change effect* measures the change in the efficient amount of inputs needed to produce output y^t when moving from technology F^t to technology F^{t+1} . To produce a monetary valuation that we can relate to the evolution of profits, we multiply the change in

efficient input combinations by the Bennet input price index. Productivity is defined as the sum of operating efficiency and technical change effects (Grifell-Tatjé and Lovell, 1999).

The calculation of the activity, operating efficiency, and technical change effects require estimates of the unobserved input vectors: x^A , x^B , and x^C . Figure 5 shows that these vectors lay on the frontiers F^t and F^{t+1} . We now show that these vectors can be expressed in terms of observable inputs and easy-to-estimate distance functions.

We define the *same-period input distance function* as $D^t(y^t, x^t) = \max\{\theta: (y^t, x^t/\theta) \in F^t\}$. We have that $D^t(y^t, x^t) \geq 1$ because when x^t is producing the maximum feasible output with period t 's technology ($x^t \in F^t$), we have $\theta = 1 = D^t(y^t, x^t)$. The *adjacent-period input distance function* $D^{t+1}(y^t, x^t)$ is obtained by replacing F^t with F^{t+1} . Because some input/output combinations in period $t+1$ may not be feasible under period t 's technology, we have that $D^{t+1}(y^t, x^t) \geq 1$.

Input vectors x^A , x^B , and x^C are radial expansions of the observed quantity vectors (x^t, y^t) and (x^{t+1}, y^{t+1}) . It is easy to see that the technically efficient period t input vector x^A can be expressed as $x^t/D^t(y^t, x^t)$. Likewise, the technically efficient period $t+1$ input vector x^C is given by $x^{t+1}/D^{t+1}(y^{t+1}, x^{t+1})$. Finally, x^B is a radial scaling of x^t to the boundary of F^{t+1} ; therefore, $x^B = x^t/D^{t+1}(y^t, x^t)$. Thus, if we calculate the input distance function $D(x, y)$, we will be able to produce estimates of x^A , x^B and x^C , which is all we need to compute the activity, operating efficiency, and technical change effects.

Estimating $D(x, y)$

To estimate the function $D(x, y)$ we use Data Envelopment Analysis (DEA), a technique introduced by Charnes *et al.* (1978) and extended to production theory by Färe *et al.* (1985). DEA constructs best-practice frontiers, which provide empirical approximations to the production possibility frontiers F^t and F^{t+1} . These frontiers allow us to measure the performance of a producer relative to the best practice observed in the sample. We assume that the feasible set F^t includes all observations from period 1 to period t . Hence, the best-practice production possibility frontier in year t is constructed using data from all producers in all years prior to and including year t . In other words, best practices in previous years are remembered

and remain available for use in the current year. Note that this approach does not allow for technical regression and implies that $x^A \geq x^B$ always (as in the example of Figure 5).

The unobserved input distance function $D^t(y^t, x^t)$ of retailer ‘o’, is calculated by solving the following linear program:

$$\begin{aligned}
 [D^t(y^{ot}, x^{ot})]^{-1} &= \min \phi^A \\
 &\quad \phi^A, \lambda^s \\
 \text{s.t.} \quad X^s \lambda^s &\leq \phi^A x^{ot}, \quad y^{ot} \leq Y^s \lambda^s, \quad \lambda^s \geq 0, \quad \sum_i \lambda_i = 1.
 \end{aligned} \tag{3}$$

Consider period t . At time $s \leq t$ we have I_s retailers; $Y^s = [y^{1s}, \dots, y^{os}, \dots, y^{I_s s}]$ is an $M \times \sum_{s=1}^t I_s$ matrix of M outputs produced by all I_s retailers in each of periods $s = 1, \dots, t$, and $X^s = [x^{1s}, \dots, x^{os}, \dots, x^{I_s s}]$ is an $N \times \sum_{s=1}^t I_s$ matrix of N inputs used by the I_s retailers in each of periods $s = 1, \dots, t$. The data matrices Y^s and X^s are sequential, i.e., they include output and input quantity data for all producers from the beginning of the sample through period t ; λ^s is a $\sum_{s=1}^t I_s \times 1$ activity vector and, finally, the convexity constraint $\sum_i \lambda_i = 1$ allows the approximating technology F^t to satisfy variable returns to scale, and to envelop the data tightly. This program is solved $\sum_{s=1}^t I_s$ times, once for each retailer in each year, although we report only Walmart’s results.

The outcome of the linear program (3) is ϕ^A , which enables the calculation of the unobserved input quantity vector x^{oA} as $x^{oA} = \phi^{oA} x^{ot}$. The value of the input distance function $D^t(y^{ot}, x^{ot}) = 1/\phi^{oA}$. The estimation of $D^{t+1}(y^{t+1}, x^{t+1})$ is similar to $D^t(y^t, x^t)$. We need to replace (x^{ot}, y^{ot}) with (x^{ot+1}, y^{ot+1}) and $s = 1, \dots, t$ with $s = 1, \dots, t+1$ in (3). Thus the solution of this new linear program is ϕ^{oC} which, as before, permits the valuation of x^{oC} as $x^{oC} = \phi^{oC} x^{t+1}$. In the case of $D^{t+1}(y^t, x^t)$ we replace $s = 1, \dots, t$ with $s = 1, \dots, t+1$ in (3) and the outcome of this linear program is ϕ^{oB} and $x^{oB} = \phi^{oB} x^t$. As before, the value of the input distance function $D^{t+1}(y^{ot}, x^{ot}) = 1/\phi^{oB}$. We calculate the activity, operating efficiency, and technical change effects by replacing x^A , x^B , and x^C in equation (2).

5. Data

Walmart went public in October, 1970.¹⁹ For the first level of analysis, our empirical investigation covers the period 1971 to 2008. Because calculations of best-practice frontiers require substantial amounts of data, the second level of analysis covers the period 1977 to 2008. To estimate best-practice frontiers, we use data from Walmart and six additional discount retailers: Kmart, Target, Sears, May, Costco, and Bradlees. See Table 1. The data comes from annual reports and publicly available financial statements. We also used the Osiris database and analysts reports (from Thompson-Financial) to build a time series of employee counts and to complete information about Sam’s Club. In the 31-year period for which we construct best-practice frontiers, some discount retailers went bankrupt, some were taken over, and some merged with other firms. We treat firms after a merger or an acquisition as new companies.²⁰

[INSERT TABLE 1 ABOUT HERE]

Our measure of performance is operating profits, or profits from revenues generated from the firm’s retail operations. Thus the accounting record “other income” (which averages to about 1% of total sales) is not included in our calculations. To obtain operating profits, we subtract cost of sales, operating, general & administrative expenses, and capital cost from revenue. Using the consumer price index, we deflate all figures to 1970.

Consistent with their consideration inside of Walmart, we treat discount stores and Sam’s Club as separate entities. Thus we define two outputs: y_1 = average of beginning-of-year and end-of-year real discount stores sales (deflated to 1970) and y_2 = average of beginning-of-year and end-of-year real Sam’s Club sales (deflated to 1970). We use value added per dollar of sales by store format (discount stores and Sam’s Club)—defined as sales minus cost of intermediate goods—as our measure of price for each of the two outputs (p).²¹ The use of value added simplifies and homogenizes outputs in an industry characterized by great heterogeneity in disclosure policies among retailers.

We define two inputs: labor and capital. We capture labor quantity, x_1 , by the average beginning-of-year and end-of-year number of employees. Total labor cost would be the ideal price variable w_1 for x_1 . Unfortunately, there is no publicly available data on labor cost for

Walmart. Drogin (2003) has gathered sparse labor cost data and other researchers have used Drogin's data to project total labor costs at Walmart. We cannot follow the same approach because our study begins in 1971. Therefore, we chose real operating, general & administrative expenses as a proxy for labor costs. Thus w_1 is the ratio of real operating, general & administrative expenses to the average number of employees each year.

The second input is capital. We follow the standard approach to quantify it: capital in period t equals capital in period $t-1$ minus amortization expenses plus investment in period t . Data on capital was obtained from annual reports where a measure of net property and equipment is provided. The amortization expense is calculated as the difference between the accumulated amortization and depreciation expenses from period t to period $t-1$. Quantity of capital, x_2 , is then the average of beginning-of-year and end-of-year of capital (computed as we just described). The price of capital, w_2 , is the ratio of the sum of current depreciation and amortization expenses plus the net interest paid to the quantity of input capital for the period.

[INSERT TABLE 2 ABOUT HERE]

Table 2 presents averages for each of the variables as well as their rates of growth. In general terms, we see a moderation in growth rates as the company increased in size. We present summary statistics for each one of the three CEOs. In February 2009 Mike Duke was appointed Walmart's fourth Chief Executive Officer. He is therefore not included in our study. Since we lack data before Walmart's IPO, we cover seventeen years (1971-1987) of Walton's tenure, a period in which Walmart grew rapidly. Growth is noticeable in the double-digit growth in output, capital and labor. Capital prices increased moderately, while output and labor prices fell. Glass's term is similar, though less aggressive: capital costs decreased and labor costs increased by less than 1%. Finally, under Scott, Walmart's discount stores sales grew an average of 8.6%, markedly less than under Walton and Glass. Output prices (value added) grew an insignificant 0.4%. Capital and labor prices showed similar behavior to that under earlier CEOs. The increase in Sam's Club sales was less than that experienced by Walmart's discount stores. Average capital input growth was higher than labor input growth for all three periods; thus, there has been a trend towards substituting capital for labor throughout Walmart's history.

6. Results

Table 3 presents our decomposition of profit variation.²² Columns 3 and 4 show the results of the first level of analysis (equation 1), the decomposition of change in profit into aggregated price and quantity effects. Of course, the sum of these two columns equals column 2. The results from the second level of analysis (equation 2) are shown in columns 5, 6, and 7. There, we decompose the quantity effect into the activity, operating efficiency, and technical change effects. These three effects add up to column 4, the quantity effect. Table 4 gives further detail on the price effect by breaking it down by outputs and inputs. Table 5 gives similar additional detail on the quantity effect.

In general terms we observe an increase in the values of the components of profit change, although the series are steady. The price effect is generally negative, and the quantity effect is positive, as expected (see the aggregate information at the end of Table 3). The quantity effect more than compensated for the price effect, so the resulting change in profit was positive. A closer look to the quantity effect in Table 5 reveals that the output quantity effect grew faster than the input quantity effect. On the other hand, Table 4 shows that the output price effect was generally negative during Walton's and Glass's tenure, but positive under Scott. Capital input prices decreased, while labor prices increased (with the exception of Walton's years). In summary (last row of Table 4), the change in capital prices decreased costs by \$341.24 million (constant 1970 dollars) while labor prices increased costs by \$1,134.84 million over the period 1972-2008. Finally, the productivity and activity effects were mostly positive.

Sam Walton 1972-1988:

Walmart registered increasing real profits during Sam Walton's tenure.²³ The price effect was insignificantly negative, while the quantity effect was notably positive. Table 4 reveals that the output price effect was in general negative, which implies a reduction in value added per item sold. The input price effect was also negative, which is consistent with cost consciousness and the human resource practices as applied by Walton. Since the price effect is defined as the difference between output price effect and input prices effect, then for some years the firm enjoyed positive price effects because it did not pass on all the savings obtained by controlling costs to customers. Negative output price effects are associated with EDLP,

pressure over vendors, and investing in technology. It was precisely during this period when Walmart computerized the management of inventories, deployed the UPC system, and set up its satellite system.

The activity effect was generally positive, with the exception of the period 1983 to 1985. A negative activity effect means, in this context, that the increase in efficient inputs costs exceeded that of value added. This negative activity effect was compensated by a positive productivity change in those years.

The productivity effect was initially negative due to operational inefficiencies that were later corrected. The company enjoyed positive technical change during Walton's last four years. In aggregate, improvements in productivity were more important than increments in activity levels in explaining the quantity effect. In Figure 3 we observe that five levers are linked to the activity effect and only one to technical change. Our empirical results show that technology was the most important lever during Walton's years. It accounted for more than 58.20% of the change in profits. The company was not only operationally efficient but it also innovated, and pushed outwards the boundaries of the production possibility frontier.

The year 1981 was special, as reflected in Tables 3, 4 and 5 (for the period 1980-1981). This year Walmart made its first major acquisition: Kuhn's Big K stores. Sam Walton made the following statement referring to this event: "But we'd never bitten off anything close to this size before, and we didn't know what it would be like trying to digest it" (Walton, 1992, p. 197). This acquisition mainly affected the output price and the price of capital. The year 1986 was also exceptional due to an increase in sales of 41% (in nominal terms). This increase is the second largest of the complete series (the largest increase in sales occurred in 1972-1973 period).

David Glass 1988-2000:

Contrary to Walton's era, change in profit during Glass's period was due mainly to the activity effect. The company experienced few technological improvements and no changes in efficiency levels (observe David Glass's subtotal row in Table 3). When Glass left, Walmart's sales were 12 times greater than when Walton stepped down. The analysis reveals that Glass's secret of success was his emphasis in all levers related to the activity effect while keeping

Walmart operationally efficient. Table 5 reveals that output and input quantities were all positive during Glass's years. Output quantities grew faster than input quantities. In Table 4 it can be observed that the output price effect was mainly negative (as in the case of Walton), while the input prices of capital and labor followed different trends. Specifically, the labor input price effect was positive (in aggregate terms), contrary to what had happened in the previous period. Labor prices therefore increased under Glass's administration, a result of changes in human resource practices. On the other hand, the capital input price effect was negative for the whole period.

As described in Section 3, David Glass pulled some business model levers differently than Sam Walton. Glass discontinued the "Buy American" campaign, opening the doors to overseas suppliers. He also spurred the expansion of the company by deploying new retail formats and building new stores in the U.S. and abroad. The main difference between Walton and Glass was in the decomposition of the quantity effect. Walton's years were characterized by the importance of technology, while in Glass's years the main component was the activity effect. Another difference comes from the fact that in Glass's last years, output prices effect increased (the only exception being the last year of Glass's tenure).²⁴

Three years (1991, 1995, and 1997) deserve separate discussion. In 1991, the price effect decreased substantially (although the activity effect more than compensated for it). In December 1990, Walmart completed the acquisition of McLane (a company that provided and distributed goods to different retail stores, including Walmart). Also at that time, Walmart was fully deploying Sam's Club nationwide.²⁵ Both Sam's Club and McLane had lower markups than Walmart. This explains why the value added of the company decreased substantially in 1991. The strong positive activity effect in 1991 is explained by the fact that Sam's Club and McLane had higher sales volumes relative to the amount of inputs used. Sam's Club was a no-frills store where items were sold in bulk.

Walmart had a difficult year in 1995. In prior years, sales were growing at rates greater than 20% but in 1995 the growth rate was only 13%. The company was investing heavily outside the U.S. with mixed results. Sam's Club was not performing as expected. In 1993 the warehouse franchise registered \$14.7 billion in sales (current dollars), one year later that figure was \$19 billion; in 1995, Sam's Club reported \$19.068 billion in sales. The growth rate

was below inflation. Walmart's 1996 annual report states that the company was refocusing Sam's Club strategy. However, Table 5 reveals that the output quantity effect for Sam's Club never recovered the growth levels prior to 1995.

The price effect became positive after 1997. Table 4 reveals that the output price effect (which used to be negative) was positive at that time. Several systems that improved inventory management and a change in the merchandise mix were implemented during those years and these improvements reduced the cost of sales.²⁶ Despite Walmart obtaining higher value added per dollar sold, the activity effect remained strong although smaller than in previous years.

Lee Scott 2000-2008:

Scott's tenure was characterized by a moderation in growth rates. Walmart's profit increased not only because of changes in activity levels, but also because of productivity improvements due to technical change (see subtotal in Table 3). The company enjoyed substantial technical progress and the price effect had a similar negative impact as in the previous period. Nevertheless, the output price effect (Table 4) changed sign, becoming positive. This result signals a laxer implementation of EDLP. However, the labor input price effect was the component that showed the most striking shift. Labor prices increased significantly during this period. Company records relate increases to insurance and payroll-related costs.²⁷ Our analysis indicates that out of all the levers "pulled differently" by Lee Scott as described in Section 3, it was changes in human resource practices that had the largest effect on Walmart's performance.

Table 5 reveals that the importance of Sam's Club (in terms of contribution to profits) diminished during this time. Under Glass's administration, Sam's Club contributed \$820 million to profits. Under Scott's tenure, it was only \$392.9 million. The company applied different measures to mend Sam's performance but, these policies did not deliver the desired results.

The year 2003 deserves separate analysis. McLane was sold that year for \$1.5 billion and the company recorded extraordinary income of \$151 million after taxes. Walmart sold McLane because it did not fit with its core business. McLane sales in 2002 were \$14.9 billion,

so its influence on the company's financials was substantial. The components of profit change most affected by this sale were output quantities and prices.

The last year of the series shows negative change in real profits. In current dollars, Walmart registered an increase in profits. However, profit grew less than inflation. The main reason for the poor performance was a disappointing year for Sam's Club and the negative impact of the exchange rate for international operations.

Scott followed the lead of Walton and Glass. By 2000, however, Walmart was no longer invisible. It was a giant charged with underpaying workers and other questionable aggressive practices. Abroad, the company found able competitors that emulated its strategy. Scott had to manage Walmart in a much more hostile and difficult environment than his predecessors. When Walton was leading, Kmart was the rival to beat. Under Scott, Walmart became the target.

7. Conclusions

The aim of this paper has been to contribute to the extant literature on business models. We have argued that business models are composed of *levers* and that a central task of the top management team is to choose on how to configure (i.e., pull) each lever. Part of the reason why we often observe heterogeneity of performance of companies with similar business models is that management has chosen to configure business model levers differently. Overall, our analysis suggests that the effectiveness of a particular business model depends not only on its design (what levers are part of the business model) but, most importantly, on its implementation (how each lever is configured).

The literature is rich in theoretical frameworks that help analysts describe business models qualitatively, but little progress has been made in developing micro-founded methods to quantify business model performance. Ours is a first step in this direction. The method we propose provides a clear assessment of the impact of a company's choices on profits. We rely on theory of index numbers and production theory. Production theory provides the fundamentals required to define and quantify concepts central to strategy such as productivity, technical change, or operating efficiency in the context of economic performance assessment. These are linked to consequences of firm choices and are naturally used as explanatory variables of profit change, our measure of performance. One strength of our approach is that

we do not assume that firms maximize profits as none of our derivations relies on this assumption (which is controversial in strategy).

Books, journal articles, case studies, and TV documentaries have presented diverse descriptions for how from humble beginnings Sam Walton built Walmart, the world's most successful discount retailer. We have constructed a business model representation based on these sources as well as information published by the company, and have quantified the effect of business model choices by the first three CEOs on Walmart's performance.

Overall, we have found that the price effect has been mostly negative but the quantity effect has been positive. Essentially, the company grew by selling more goods at very low prices. Under Sam Walton, investments in technology and improvements in efficiency had the largest effect on Walmart's profit growth. With David Glass, it was increases in activity levels: the firm created a vast network of discount stores, supercenters and neighborhood markets in the U.S. and abroad to reach ever-larger numbers of consumers, it expanded its selection of goods by including groceries in its stores, and exerted pressure over its vendors which allowed the company to reduce prices and boost sales volume. In more recent years, Walmart's human resource practices were the target of criticism which put pressure on Lee Scott to raise salaries and improve benefits to associates.

One important limitation of our analysis is that although we have included Walmart's competitors in building the production possibility frontier, we have not considered explicitly the effects of interactions with competitors on Walmart's profitability over time. For tractability reasons, we have not looked at explicit interactions between competitors and we leave this issue for further research. However, we should also say that the fact that Walmart chose to operate in dispersed, rural locations also meant that it interacted less with other discount retailers. Walton acknowledged in his memoirs that this strategy shielded Walmart from competition.

Our research has revealed that in the years 1971 to 2008 Walmart's business model remained that of a traditional discount retailer. While the first three CEOs pulled Walmart's business model levers differently, these did not change. Perhaps the most important challenge currently faced by Michael Duke (CEO since 2009) is deciding whether to continue Walmart's traditional business model (and consider pulling levers differently) or to come up with a

different, original set of levers that fundamentally redefines what it means to compete in discount retail. For example, how important should the online channel be to Walmart and what should the company do to have a competitive advantage in that space? Or should Walmart be active in banking and provide credit to customers and suppliers? Or should Walmart's adopt elements of multi-sided platforms in addition to those of a merchant? It is our hope that the method that we have presented in this paper can help inform attempts by the company to innovate in its business model and to quantify the effects of such innovations.

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Figure 1. Generic links between business model choices and their consequences.

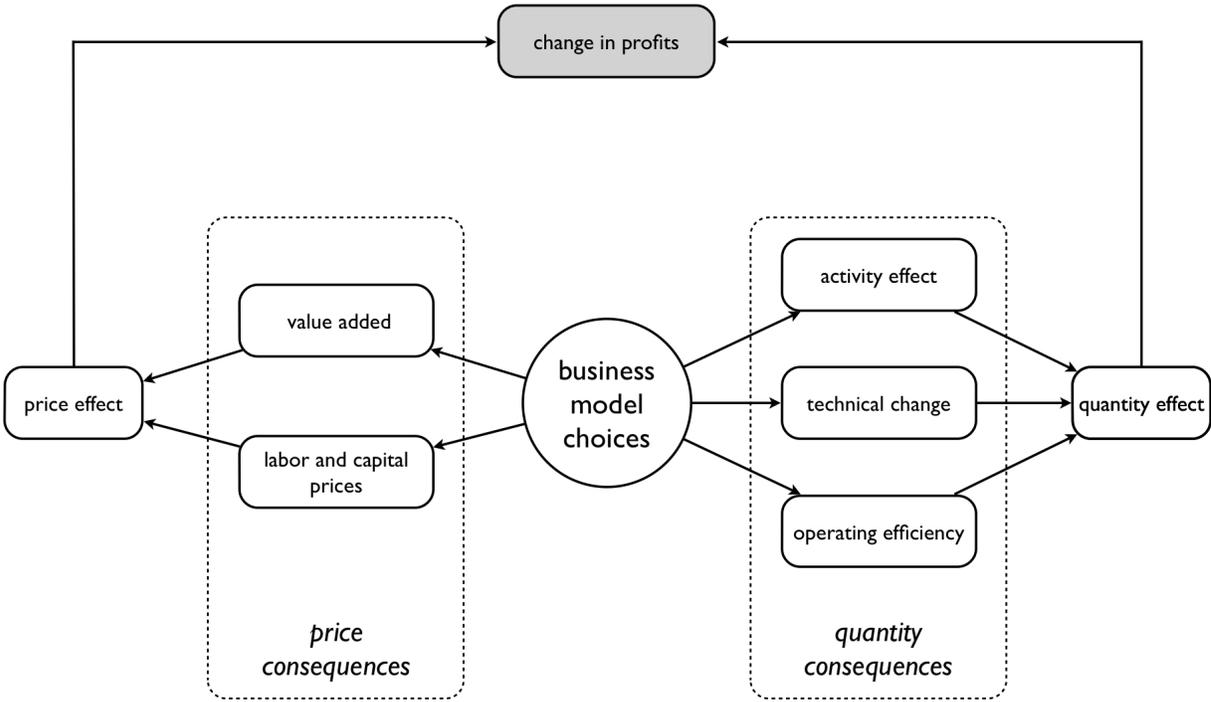


Figure 2. Walmart’s real profits from 1972 to 2008.

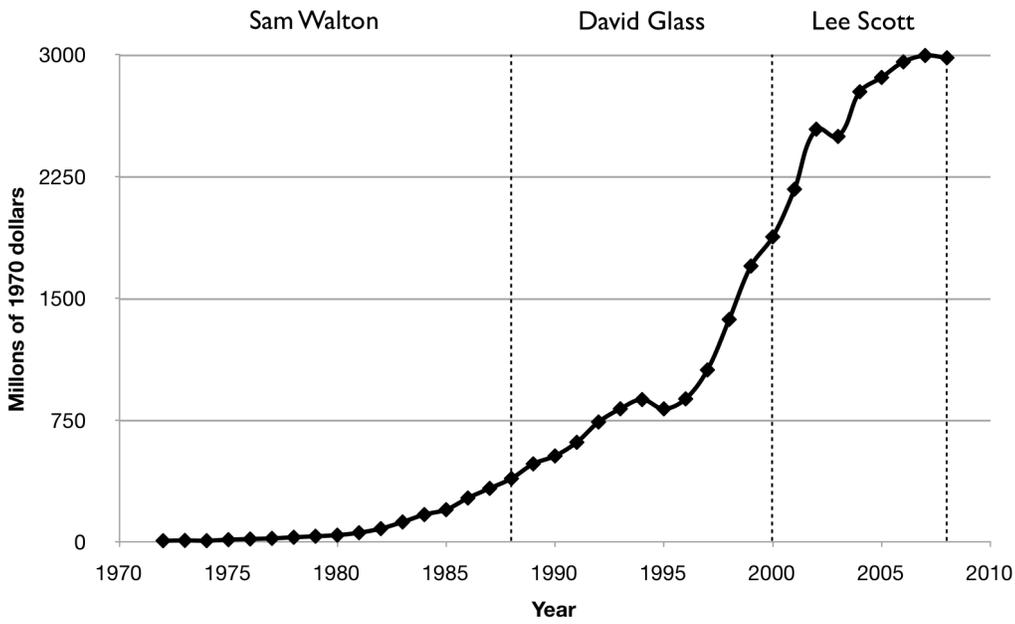


Figure 3. Walmart’s discount retailer business model.

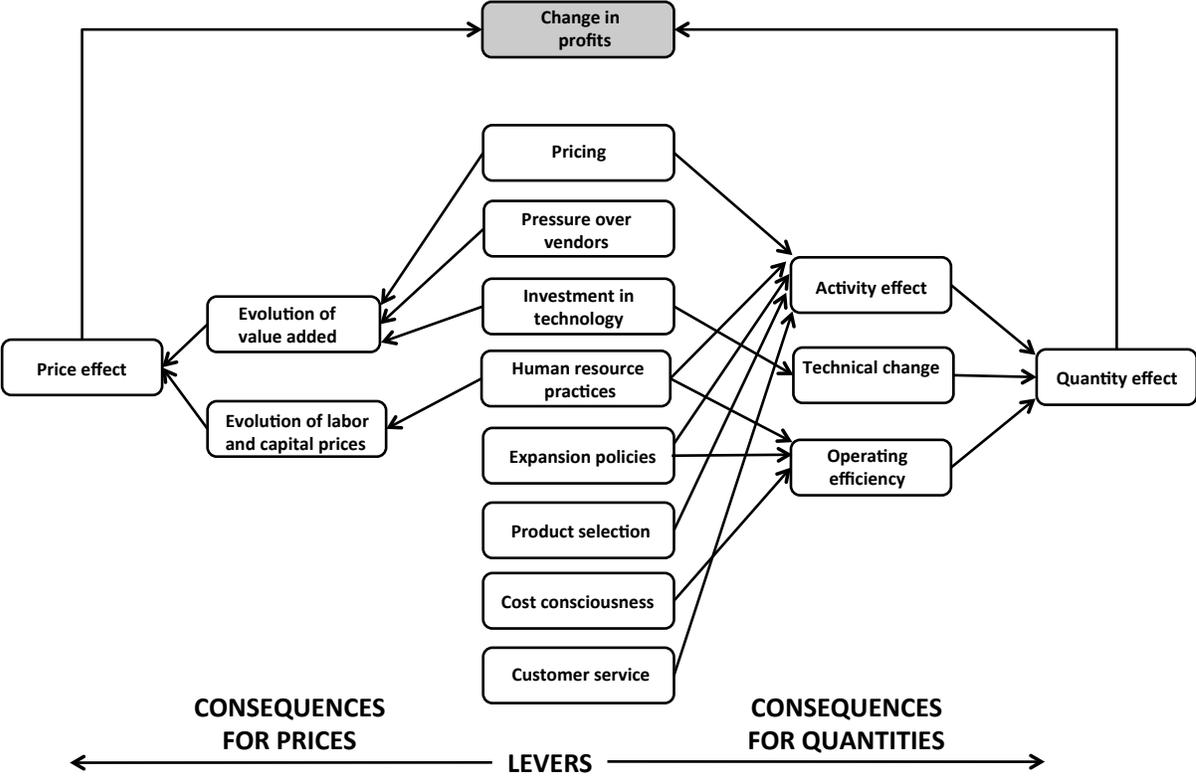


Figure 4. Period t’s technology: Production possibility frontier F^t and its convex hull $h(F^t)$.

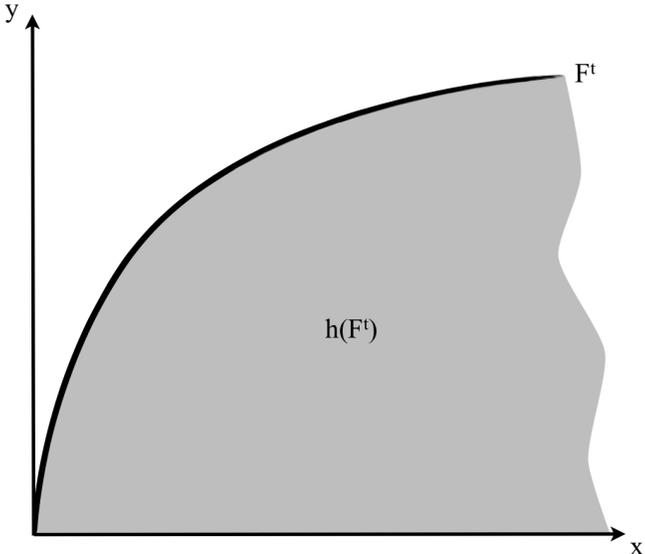
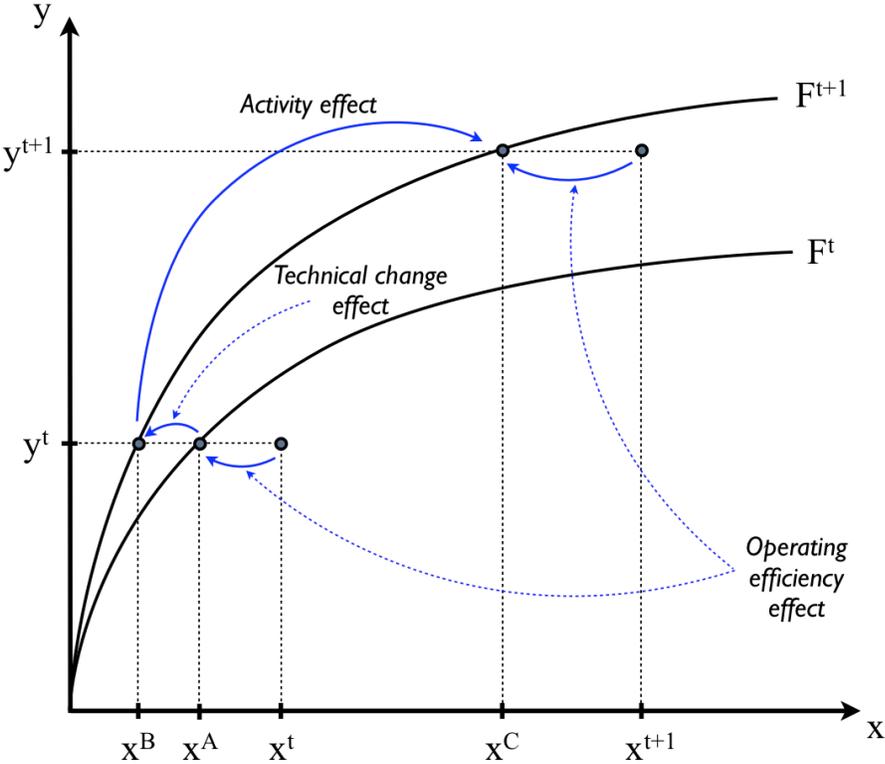


Figure 5. Decomposition of quantity effect for the case $M = N = 1$.



The *activity effect* is captured by the arrow connecting (x^B, y^t) and (x^C, y^{t+1}) .

The *operating efficiency effect* is proportional to the difference between the distance from (x^t, y^t) to (x^A, y^t) and the distance from (x^{t+1}, y^{t+1}) to (x^C, y^{t+1}) .

The *technical change effect* is represented by the arrow connecting (x^A, y^t) and (x^B, y^t) .

Table 1. List of companies analyzed.

Company	Number	Period	Description
Walmart	1	1971-2008	Discount stores (domestic and international)
Sam's Club	1	1983-2008	Warehouse club
Target	2	1971-2008	
Kmart	3	1971-2002	Filed for bankruptcy in 2002
Kmart post-bankruptcy	4	2003-2004	Merged with Sears in 2005
Sears	5	1994-2004	Merged with Kmart in 2005
Sears / Kmart	6	2005-2008	
Costco	7	1984-1992	Ancestor company
Costco	8	1993-2008	Successor company
Bradlees	9	1971-1986	Went bankrupt in 1995 and again in 2000
May	10	1971-1985	Acquired Caldor in 1985
May post-Caldor acquisition	11	1986-2003	Only until 2003

Table 2. Average and CAGR of variables of interest under each CEO.

	Sam Walton (1971-1988)		David Glass (1988-2000)		Lee Scott (2000-2008)		Total	
	Average	Avg. Growth	Average	Avg. Growth	Average	Avg. Growth	Average	Avg. Growth
y ₁	1,164.54	28.5%	15,145.10	18.2%	49,226.15	8.6%	17,389.44	20.09%
y ₂	356.75	162.8%	3,608.18	18.9%	7,282.48	4.6%	4,410.70	31.51%
p ₁	0.29	-0.9%	0.24	-0.8%	0.24	0.4%	0.26	-0.52%
p ₂	0.27	-14.7%	0.17	-2.2%	0.16	-0.3%	0.18	-3.03%
x capital	201.47	34.9%	3,943.43	22.4%	15,636.50	11.4%	5,169.54	24.87%
w capital	0.16	2.1%	0.11	-2.2%	0.08	-3.0%	0.12	-0.61%
x labor	42.34	32.2%	548.04	16.7%	1,616.33	8.1%	589.22	21.01%
w labor	6.45	-3.3%	5.26	0.8%	5.83	1.1%	5.91	-0.83%

Variable	Measurement
y ₁	Discount store sales expressed in millions of 1970 dollars
y ₂	Warehouse club sales expressed in millions of 1970 dollars
p ₁	Value added per dollar sold in 1970 dollars.
p ₂	Value added per dollar sold in 1970 dollars.
x capital	Capital valued at prices of 1970 (in millions)
w capital	Cost of capital per dollar invested in capital in 1970 dollars
x labor	Number of workers (thousands)
w labor	Operating, General & Administrative expenses per 1,000 employees in millions of 1970 dollars

Table 3. Decomposition of change in profits (millions of 1970 dollars).

	Period	Change in Profits [2]	Price Effect [3]	Quantity Effect [4]	Activity Effect [5]	Technical Change [6]	Operational Efficiency [7]
Sam Walton	1972 – 1973	1.63	-0.41	2.05	N/A	N/A	N/A
	1973 – 1974	-1.34	0.30	-1.64	N/A	N/A	N/A
	1974 – 1975	6.04	6.26	-0.23	N/A	N/A	N/A
	1975 – 1976	4.21	-2.04	6.25	N/A	N/A	N/A
	1976 – 1977	3.81	1.53	2.28	N/A	N/A	N/A
	1977 – 1978	6.88	4.49	2.39	15.96	-	-13.56
	1978 – 1979	6.22	-1.04	7.26	14.62	-	-7.36
	1979 – 1980	6.80	8.29	-1.49	13.44	-	-14.93
	1980 – 1981	14.92	23.47	-8.55	16.22	-	-24.77
	1981 – 1982	25.22	-2.22	27.44	37.47	-	-10.04
	1982 – 1983	40.83	-4.75	45.58	40.11	-	5.47
	1983 – 1984	45.78	1.63	44.15	-26.82	-	70.97
	1984 – 1985	30.13	-17.20	47.33	-12.47	59.80	-
	1985 – 1986	71.83	-0.66	72.49	5.75	66.74	-
	1986 – 1987	59.36	-30.20	89.56	25.76	63.80	-
1987 – 1988	60.59	-29.09	89.67	37.99	51.68	-	
Total 1977-1988		368.56	-47.28	415.84	168.03	242.03	5.78
Total 1972-1988		382.91	-41.65	424.55	N.A.	N.A.	N.A.
David Glass	1988 – 1989	90.15	12.13	78.02	43.11	34.90	-
	1989 – 1990	48.80	-8.94	57.74	48.27	9.47	-
	1990 – 1991	83.97	-134.72	218.68	159.06	59.62	-
	1991 - 1992	125.05	-164.76	289.81	289.81	-	-
	1992 - 1993	81.36	-30.86	112.21	112.21	-	-
	1993 - 1994	56.76	-48.17	104.94	104.94	-	-
	1994 - 1995	-57.01	-224.17	167.16	135.74	31.42	-
	1995 - 1996	61.33	-92.07	153.41	153.41	-	-
	1996 - 1997	178.05	114.28	63.78	63.78	-	-
	1997 - 1998	310.81	99.11	211.70	132.10	79.60	-
	1998 - 1999	328.85	183.66	145.19	145.19	-	-
1999 - 2000	179.69	36.04	143.65	143.65	-	-	
Total 1988-2000		1,487.82	-258.47	1,746.29	1,531.27	215.02	-
Lee Scott	2000 – 2001	293.09	-27.79	320.88	203.12	117.76	-
	2001 – 2002	369.71	-210.09	579.80	444.73	135.07	-
	2002 – 2003	-44.74	-317.76	273.01	273.01	-	-
	2003 – 2004	275.44	703.23	-427.78	-427.78	-	-
	2004 – 2005	87.89	209.36	-121.47	-187.66	66.19	-
	2005 – 2006	95.85	-233.39	329.24	272.79	56.45	-
	2006 – 2007	39.26	-303.61	342.88	192.78	150.10	-
	2007 – 2008	-14.23	-83.59	69.36	66.66	2.70	-
Total 2000-2008		1,102.27	-263.64	1,365.91	837.65	528.27	-
Total 1977-2008		2,958.64	-569.39	3,528.04	2,536.95	985.31	5.78
Total 1972-2008		2,972.99	-563.76	3,536.75	N.A.	N.A.	N.A.

Table 4. Decomposition of price effect (millions of 1970 dollars).

	Period	Output Price 1	Output Price 2	Output Price Effect	Input Price K	Input Price L	Input Price Effect	Price Effect
Sam Walton	1972 – 1973	-1.70	-	-1.70	1.10	-2.39	-1.28	-0.41
	1973 - 1974	-1.81	-	-1.81	0.72	-2.83	-2.11	0.30
	1974 - 1975	2.81	-	2.81	-0.62	-2.83	-3.46	6.26
	1975 - 1976	0.93	-	0.93	0.08	2.88	2.97	-2.04
	1976 - 1977	-2.30	-	-2.30	-3.10	-0.73	-3.83	1.53
	1977 - 1978	-0.17	-	-0.17	-0.86	-3.81	-4.66	4.49
	1978 - 1979	-0.71	-	-0.71	-0.88	1.22	0.34	-1.04
	1979 - 1980	-5.02	-	-5.02	-1.29	-12.03	-13.31	8.29
	1980 - 1981	19.79	-	19.79	4.10	-7.77	-3.67	23.47
	1981 – 1982	-1.58	-	-1.58	-0.62	1.25	0.63	-2.22
	1982 – 1983	-2.09	-	-2.09	-5.43	8.09	2.66	-4.75
	1983 – 1984	-14.74	-	-14.74	-0.14	-16.23	-16.37	1.63
	1984 – 1985	-47.54	-5.65	-53.19	-4.57	-31.42	-35.99	-17.20
	1985 – 1986	18.63	-14.04	4.59	4.76	0.49	5.25	-0.66
	1986 – 1987	-50.88	-20.95	-71.83	3.07	-44.70	-41.62	-30.20
1987 – 1988	-48.20	-18.42	-66.62	-1.80	-35.73	-37.53	-29.09	
Total 1972-1988		-134.58	-59.06	-193.64	-5.46	-146.53	-151.99	-41.65
David Glass	1988 – 1989	-10.51	-15.72	-26.23	-11.29	-27.07	-38.36	12.13
	1989 – 1990	-35.59	4.21	-31.38	-8.50	-13.94	-22.44	-8.94
	1990 – 1991	-20.69	-6.89	-27.58	10.56	96.57	107.14	-134.72
	1991 – 1992	-85.45	-20.13	-105.59	-19.86	79.04	59.17	-164.76
	1992 – 1993	2.39	-21.22	-18.83	1.65	10.38	12.03	-30.86
	1993 – 1994	-25.56	27.72	2.16	11.95	38.39	50.34	-48.17
	1994 – 1995	-101.19	-99.45	-200.63	12.65	10.89	23.54	-224.17
	1995 – 1996	-90.75	1.47	-89.28	-46.42	49.21	2.79	-92.07
	1996 – 1997	109.95	6.38	116.33	-42.21	44.27	2.05	114.28
	1997 – 1998	169.32	3.05	172.37	-12.80	86.06	73.26	99.11
	1998 – 1999	144.05	41.71	185.75	19.50	-17.41	2.09	183.66
1999 – 2000	-188.06	-14.97	-203.03	-36.77	-202.30	-239.07	36.04	
Total 1988-2000		-132.09	-93.85	-225.94	-121.55	154.08	32.54	-258.47
Lee Scott	2000 – 2001	-185.09	-10.93	-196.03	-45.71	-122.52	-168.23	-27.79
	2001 – 2002	140.70	-7.73	132.97	-132.89	475.94	343.05	-210.08
	2002 – 2003	17.98	40.41	58.40	-42.97	419.12	376.15	-317.76
	2003 – 2004	559.41	-6.53	552.88	-48.93	-101.41	-150.35	703.23
	2004 – 2005	-5.02	6.09	1.07	-34.25	-174.03	-208.28	209.36
	2005 – 2006	317.84	3.93	321.77	53.86	501.30	555.16	-233.39
	2006 – 2007	-162.34	-2.42	-164.76	45.57	93.29	138.86	-303.61
	2007 – 2008	-12.29	-44.61	-56.90	-8.91	35.60	26.69	-83.59
Total 2000 – 2008		671.20	-21.79	649.41	-214.24	1,127.29	913.05	-263.64
Total 1972 – 2008		404.54	-174.70	229.84	-341.24	1,134.84	793.60	-563.76

Table 5. Decomposition of quantity effect (millions of 1970 dollars).

	Period	Output Quantity 1	Output Quantity 2	Output Qty. Effect	Input Capital	Input Labor	Input Qty Effect	Quantity Effect
Sam Walton	1972 – 1973	10.83	-	10.83	0.62	8.16	8.78	2.05
	1973 – 1974	10.09	-	10.09	0.58	11.15	11.73	-1.64
	1974 – 1975	14.35	-	14.35	0.85	13.73	14.57	-0.23
	1975 – 1976	21.02	-	21.02	1.15	13.61	14.76	6.25
	1976 – 1977	28.09	-	28.09	4.95	20.86	25.81	2.28
	1977 – 1978	30.73	-	30.73	4.61	23.73	28.34	2.39
	1978 – 1979	34.07	-	34.07	3.44	23.37	26.81	7.26
	1979 – 1980	34.32	-	34.32	3.65	32.16	35.81	-1.49
	1980 – 1981	55.87	-	55.87	4.25	60.18	64.42	-8.55
	1981 – 1982	89.94	-	89.94	6.46	56.05	62.50	27.44
	1982 – 1983	116.50	-	116.50	7.94	62.99	70.93	45.58
	1983 – 1984	158.10	-	158.10	9.78	104.17	113.95	44.15
	1984 – 1985	138.08	42.19	180.27	14.68	118.26	132.94	47.33
	1985 – 1986	183.54	69.22	252.76	17.00	163.27	180.27	72.49
	1986 – 1987	242.15	74.43	316.57	18.15	208.86	227.01	89.56
1987 – 1988	249.46	67.13	316.60	20.59	206.33	226.92	89.67	
Total 1972-1988		1,417.14	252.98	1,670.12	118.71	1,126.85	1,245.56	424.55
David Glass	1988 – 1989	261.77	54.94	316.70	24.21	214.48	238.69	78.02
	1989 – 1990	279.81	63.34	343.14	33.99	251.41	285.40	57.74
	1990 – 1991	405.81	106.22	512.03	47.74	245.61	293.35	218.68
	1991 – 1992	512.66	128.32	640.98	77.37	273.80	351.17	289.81
	1992 – 1993	515.72	107.60	623.32	96.40	414.70	511.11	112.21
	1993 – 1994	559.95	132.14	692.09	86.04	501.11	587.15	104.94
	1994 – 1995	570.42	72.44	642.86	80.55	395.15	475.70	167.16
	1995 – 1996	506.16	-6.19	499.97	59.22	287.34	346.56	153.41
	1996 – 1997	520.63	10.80	531.44	56.06	411.60	467.66	63.78
	1997 – 1998	739.63	42.45	782.09	63.49	506.89	570.38	211.70
	1998 – 1999	1,104.43	61.37	1,165.81	136.51	884.11	1,020.62	145.19
1999 – 2000	1,178.11	47.33	1,225.44	161.12	920.66	1,081.78	143.65	
Total 1988-2000		7,155.10	820.75	7,975.85	922.70	5,306.86	6,229.56	1,746.29
Lee Scott	2000 – 2001	1,017.84	52.39	1,070.23	96.56	652.80	749.35	320.88
	2001 – 2002	1,038.64	62.46	1,101.10	92.31	428.98	521.30	579.80
	2002 – 2003	651.43	66.85	718.28	104.60	340.66	445.27	273.01
	2003 – 2004	522.25	63.40	585.66	122.81	890.63	1,013.44	-427.78
	2004 – 2005	834.89	50.25	885.14	128.75	877.85	1,006.61	-121.47
	2005 – 2006	1,027.89	30.62	1,058.51	135.31	593.97	729.28	329.24
	2006 – 2007	1,048.97	31.88	1,080.84	127.62	610.35	737.97	342.88
	2007 – 2008	695.23	35.04	730.26	47.22	613.69	660.91	69.36
Total 2000-2008		6,837.13	392.90	7,230.03	855.19	5,008.93	5,864.12	1,365.91
Total 1972-2008		15,409.37	1,466.63	16,876.00	1,896.60	11,442.64	13,339.24	3,536.75

Appendix: A Review of the Literature on Walmart

Books, research articles and even documentaries have been made about Walmart. The aspects analyzed in these sources vary considerably, as do the standpoints of the authors. This section does not intend to be an exhaustive literature review on the subject of Walmart; we merely concentrate on the most relevant works for our research.

One of the most important sources about Walmart's business model consists of the books written by insiders like Sam Walton and Don Soderquist (former COO). In his memoirs, Walton offers his viewpoint on how he built Walmart. Walton dwelt on the history of the company and gave insight into his decision-making process. Obviously, both Soderquist and Walton portrayed the company in a good light, and gave advice for future entrepreneurs.

Some of the works available are compilations of research articles written by authors from distinct fields of study. "Wal-Mart World" by Stanley Brunn (2006) and "Wal-Mart, The face of twenty-first century capitalism" by Nelson Lichtenstein (2006) are examples of this literature. Several issues are covered in these books ranging from human resource policies to zoning.

Other authors attempt to explain Walmart's success by recognizing particular strategies employed by the giant of Bentonville. "The Walmart Effect" by Charles Fisher and "Walmart Triumph" by Robert Slater are examples. Harvard Business School has published several business case studies on Walmart (Ghemawat, 1989 and 2007; Bradley & Ghemawat, 2002; Ghemawat, Mark & Bradley, 2004 and Oberholzer-Gee, 2006). In this literature, the authors provide facts about the company, describe strategies pursued by the firm, and list challenges and opportunities for future years.

One of the best-known facts about Walmart is its obsession with low prices. "Always low prices, always" was the company's slogan for many years. EDLP is defined "as fixing low prices so the customers could be sure that these prices won't change erratically by frequent promotional activities."^{28,29} Several studies have been carried out in an attempt to demonstrate that Walmart does indeed charge low prices. Basker (2005) finds that Walmart's presence in a given geography lowers prices between 1.5-3% in the short run and 7-13% in the long run. Walmart itself appointed the company Global Insight to conduct a study of the economic

impact of Walmart's operations. The results, presented in 2005, showed that Walmart contributed to lowering the prices of food-at-home (9.1%) and commodities (4.2%) and to the decline of overall consumer prices (3.1%) between 1985 and 2004. Basker & Noel (2009) analyze how prices change in a community when Walmart opens a supercenter (discount store plus groceries). Walmart prices were 10% lower than its competitors, according to the results of the study. In addition, competing stores reduce their prices by between 1% to 1.2%.

Of course, a reputation for low prices could mean a reputation for low quality products as well. According to Hausman and Leibtag (2007), the Bureau of Labor Statistics (BLS) in the United States considers that customers do not receive the same quality service when shopping at Walmart as in other retail stores. The BLS justifies the price gap by this alleged difference in service quality. Following this reasoning, Basker (2005b) conducted a study to determine whether Walmart sells inferior goods in the strictly economic sense. She finds that, *ceteris paribus*, a 1% reduction in personal disposable income increases Walmart's revenue by 0.5%.³⁰ This researcher offers two explanations for these results. On the one hand, it could be that the majority of households view shopping at Walmart as an inferior activity. On the other hand, it may be that the subset of households that hold this view has greater elasticity of demand.

Another topic discussed is the relationship between Walmart and its employees. We have to make a distinction between supervisory/managerial ranks and non-managerial workers. Bradley & Ghemawat (2002) explain that store managers remuneration is based on store sales and profits. In the case of non-managerial workers, besides their salaries, they benefit from a profit-sharing plan to which managers also have access.

One of the issues usually analyzed is whether Walmart creates jobs or destroys them. Two studies, Basker (2005b) and Global Insight (2005), find that Walmart presence increased the number of jobs available in the communities where the company placed its stores. However, several authors have raised the concerns about the quality of these new jobs.

Greenhouse (2003) reported that the average pay of a sales clerk at Walmart in 2003 was \$8.50 per hour, or about \$14,000 a year. This amount was \$1,000 below the poverty line for a family of three. Furthermore, in a 2005 presentation given by Arindrajit Dube and Steve Wertheim (University of California at Berkeley, Labor Center), it was reported that Walmart's

workers' wages were 12.4% lower than those earned by other workers in the retail industry and 14.5% less than the wages paid to employees working in large retail in general.

The secrecy of Walmart's labor costs was partially broken as a by-product of proceedings in a court case. In June 2001, six workers filed a lawsuit against Walmart, in what has become the largest class-action lawsuit in United States. As part of the collection of evidence for the case, Professor Richard Drogin was appointed to answer questions raised by the plaintiffs. Walmart submitted valuable information about workers' remuneration. In February 2003, Drogin presented his conclusions.

Drogin (2003) found that although women made up more than two-thirds of the total workforce from 1996 to 2001, they were disproportionately employed in low-earning positions. Furthermore, women working in similar positions to men earned 5% to 15% less than men, after controlling for factors like such as seniority, status, and store. Drogin stated that the disparity increases if performance is included in the study. The company defended itself against this accusation by claiming that women were less likely to apply for managerial positions because these positions required constant moving between cities (as reported in Oberholzer-Gee, 2006). Nevertheless, a highly feminized workforce was coherent with what was explained by Fishman (2006). The author suggests that the management conceived the Walmart workforce as mainly housewives trying to earn a supplementary income for their families. From this perspective, workers clearly needed their spouses' income and the healthcare benefits to survive. Dube and Jacobs (2004) made the claim that when workers cannot cover their basic needs with their spouses' income and healthcare benefits, they have to rely on public assistance. These authors tried to measure the Walmart effect on the public accounts of the state of California.³¹ Hausman and Leibtag (2007) suggest that, when measuring the welfare effects of Walmart, however, its influence on prices should be included in order to gain a complete understanding. They state that the company's low prices more than compensate for its low wages, making the net effect positive.

Besides prices and wages, some papers analyze the expansion patterns followed by Walmart. The idea behind these studies is that Walmart's expansion patterns helped the company reduce costs and compete effectively against its rivals. However, Walmart's presence in some communities implied problems such as urban sprawl.

Basker (2005) estimates that each new Walmart store accounts for the failure of 4 small stores and 0.7 medium size stores after 5 years of entry. Although this appears to be a general trend in the retail sector between 1977 to 2002, the number of “mom-and-pop” stores fell by nearly 40%, and the number of small chains by 75% (Basker et al., 2008). A study carried out by Jia (2008) reported that Walmart’s expansion accounts for approximately 40-50% of the variation in the net number of small stores and 30-40% for all other discount stores.

According to Graff and Ashton (1994), Walmart followed neighborhood expansion diffusion and reverse hierarchical diffusion. This means that the company expanded to locations that were a short distance from its current facilities. The main advantage of this expansion policy is the development of a dense distribution network. Graff (1998) claims that this density allowed Walmart to spread the advertisement costs and reduce distribution costs. This idea is explored by Holmes (2008). Both authors, Holmes and Graff, affirm that the introduction of the “supercenter format” in the late 1980s followed the same path of expansion as the initial discount stores. Holmes (2008) claims that “Walmart never jumped to some far off location to later fill in the area in the inside out” (p. 1). The downside of the “economies of density” in the retail industry is the cannibalization of the sales by the older stores. Walmart estimates that this effect represents 1% of the sales of the stores in 2006 and 1.5% in 2007 and 2008.^{32,33}

The internationalization of Walmart is a new topic that has been explored recently. According to Burt and Spark (2006), three phases can be distinguished in the international expansion of the firm. Firstly, the company opened stores in adjacent markets such as Mexico and Canada. Then it started the “flag-planting phase,” during which the firm started new businesses in a wide range of countries. Some of the new ventures were successful, as in the case of China, and others did not go well (e.g. Indonesia, Hong Kong, and South Korea). There was also stagnation in Germany, Argentina, and Brazil due to regulatory pressure or other barriers. Finally, in the third phase, the company decided to invest carefully, purchasing already successful chains like ASDA in the United Kingdom and Seiyu in Japan.

Another benefit of internationalization is its impact on the supply chain. China has played a major role in Walmart’s expansion as a supplier of cheap goods for sale. Basker and

Pham Hoang (2008) explore this issue and emphasize that Walmart's imports from China accounted for 15% of total US imports of goods from that country. These authors conclude that the combination of low trade barriers and high investment in technology are the main causes of Walmart's growth. According to their calculations, 60% of Walmart's growth is explained by technological innovation and the other 40% is explained by the reduction of input costs due primarily to tariff reductions and changes in sourcing.

The one-stop-shopping effect is an additional element that has been analyzed in the literature about Walmart. Basker, Klimek and Hoang Van (2008) demonstrate that there is a complementary relationship between the economies of scale and scope that benefit Walmart and other big box retailers. The hypothesis is that as the companies increase the number of stores, they gain economies of scale. In addition, these companies offer a broader assortment of products generating economies of scope. The larger diversity of products attracts customers who want to avoid the transport costs inherent in buying at several stores. This situation is known as the "one-stop-shopping effect" or economies of scale on the demand side due to savings in transport costs (Basker et al., 2008). These authors find that, for every store opened, a retail company adds an additional product line to an existing store. Furthermore, when the company incorporates a new line in its current stores, this action entails the opening of 400 new stores competing in more than 8,000 new markets.

Endnotes

¹ The recent *Long Range Planning* special issue on business models (April 2010) received more than 80 submissions and attracted contributions from scholars such as David Teece and Nobel prize winning practitioner Muhammad Yunus. Zott, Amit and Massa (2010) review the growing literature in management on business models.

² Drucker, Peter, *The Practice of Management*, Harper and Row Publishers, 1954. A Google search for "Business Model" in October 2012 yielded 31.1 million hits.

³ See *Long Range Planning* call for papers for the Special Issue on "Business Models" by Charles Baden-Fuller, Ian MacMillan, Benoît Demil, and Xavier Lecocq.

⁴ The theory of index numbers studies different ways in which information may be aggregated. Government statistics departments use index numbers to better understand economic performance and its evolution. The roots of this theory can be traced back to the 19th century. Fisher (1911) made important early developments and Balk (2008) provides an updated revision of the theory.

⁵ Davis (1955) was a pioneer in proposing this scheme, which was followed by Kendrick and Creamer (1961) and Kendrick (1984). Other researchers such as Genescà and Grifell-Tatjé (1992), Kurosawa (1975, 1991), Miller (1984); and Miller and Rao (1989) present further developments.

⁶ Bennet (1920) advocates using the *arithmetic mean* of price and quantities to evaluate change. We follow this approach because Diewert (2005) has shown that the Bennet indicators have a set of properties that make them superior to the traditional Laspeyres and Paasche indicators.

⁷ Choices are represented using bold and underlined fonts; rigid consequences are in boxes and flexible consequences are shown in plain text. The arrows connecting choices and consequences are those provided by theories explaining causal relationships.

⁸ Casadesus-Masanell and Ricart (2008), p. 9.

⁹ For this section of the paper we consulted several research articles: Barbaro and Gills (2005), Basker and Pham Hoang (2008), Basker, (2005a,b), Basker and Noel (2007), Basker, Klimek, and Pham Hoang (2008) Bonacich and Wilson (2006), Bradley and Ghemawat (2002), Burt and Sparks (2006), Drogin (2003), Dube and Jacobs (2004), Dube and Wertheim (2005), Dunnett and Arnold (2006), Fishman (2006), Ghemawat (1989), Ghemawat, Mark and Bradley (2004), Global Insight Inc., (2005), Graff (1998), Graff and Ashton (1994), Hausman and Leibtag (2007), Holmes (2008), Jia (2008) and Oberholzer-Gee (2006). In the appendix, we discuss the literature on Walmart reviewed for this paper.

¹⁰ Walton (1992, p. 80).

¹¹ Walton (1992, p. 109).

¹² Walmart Annual Report (1975, p. 2).

¹³ Elements of “Aggressive Hospitality” had been applied earlier on a non-formal basis.

¹⁴ Walmart also offered premium brands such as “Sam’s American Choice,” which were manufactured in the U.S.

¹⁵ This was an important change in Walmart’s merchandising mix. Food items have lower markups than products traditionally sold by discount retailers.

¹⁶ The U.S. Supreme Court rejected the class-action lawsuit in June 20, 2011. The Court denied that the lawsuit fulfilled the requirements of a “class-action rules.” See Liptak, Adam (2011).

¹⁷ Some of these business ventures failed (e.g. Germany and Korea) which might have encouraged Walmart to change course towards a more painstaking international expansion as related by Burt and Spark (2006).

¹⁸ Although we use production theory, we bypass the very restrictive assumptions embedded in neoclassical microeconomics and, thus, the methodology that we present is applicable to a broad set of institutional contexts. Cyert and Hedrick (1972) characterize this issue correctly when they state: “*The unmodified neoclassical approach is characterized by an ideal market with firms for which profit maximization is the single determinant of behavior*” (p. 400) and also “*Many papers are based on...modifications of the neoclassical method. They extend the model to deal with real-world issues not faced by the simple text-book models, but retain the a priori character, in that all of the detail added is descriptive of the environment,*” (p. 401).

¹⁹ See <http://walmartstores.com/aboutus/297.aspx>

²⁰ In the case of Costco, the company merged with Price in the year 1993. We therefore treat Costco as two separate firms, one prior to the merger and other after the merger. Kmart filed for bankruptcy in 2002. The successor company survived for two years before merging with Sears. Each circumstance was treated as a separate case (three firms). May Department Stores was treated as two separate companies, one before the acquisition of Caldor and the other after the acquisition. We include information about May only until 2003. Kmart, Target and May had multiple retail formats during the period of study. The financial information on these businesses is not separated from the discount retailing activities. We do not consider this a problem, as all these activities are in the same line of business. The same is not true for Sears which had a very broad spectrum of businesses besides retailing (e.g. Dean Witter, Allstate Insurance Company, Coldwell Banker among others). For this reason, it was essential to analyze the merchandise part only. Fortunately, Sears discloses information on each division separately. We therefore include only the retail part of Sears.

²¹ We do not have information about the value added amount for each type of retail format, discount and warehouse club at Walmart. However, we know the total sales and the operating profit obtained by each branch for every year in the sample. We assume that the value added is distributed in the same way as the income variable is distributed each year.

²² Our computations were programmed in the statistical package R. For calculating the input distance functions, we used the package FEAR (Frontier Efficiency Analysis for R) made by Paul Wilson.

²³ The only exception was the period 1973-1974 (see Table 4). The explanation for this fall in profits was the adoption of the LIFO method of costing inventory. The accounting change resulted in a reduction in earnings of 1.8 million 1970 dollars in real terms, although the company profits grew if measured in current dollars.

²⁴ Output prices are measured as value added per dollar of sales.

²⁵ When Walton left the CEO position in 1988, there were 105 Sam's Club stores; by 1991 that number was 205. See the development of the output quantity effect for Sam's Club in Table 5.

²⁶ See Walmart Annual Report 1998, page 5; Walmart Annual Report

²⁷ Walmart applied a new pay structure for U.S. workers in 2004.

²⁸ Wal-Mart. "Annual Report 2006." 2006., p21.

²⁹ Nevertheless, sometimes the company carries out promotional activities, such as Rollback prices. This activity consists of cutting prices even further for prolonged periods of time, sometimes indefinitely.

³⁰ This is an upper boundary. The author claims that a more realistic figure is 0.7%.

³¹ Dube and Jacobs (2004) used Drogin's data plus other sources to calculate the effect of Walmart's presence on the public accounts of California. The researchers concluded that Walmart finances its operations with public money. Walmart's annual cost to California tax-payers was \$86 million dollars, distributed into \$32 million for health-related benefits and \$54 million in other assistance during the year the study was conducted. They estimate that Walmart's employees use 40% more public healthcare money than the average families of all retail employees. The author claims that Walmart's effect on public finances may have been underestimated. For instance, not all the people who are eligible for public assistance apply for it. Dube and Jacobs (2004) comment, that in a program broadcasted by PBS, it was reported that Walmart gave their employees a 1-800 number to determine their eligibility. So, if Walmart instructs its employees on how to obtain public assistance, the total effect would be greater than that reported in the study.

³² Wal-Mart. "Annual Report 2006." 2006, p22.

³³ Wal-Mart. "Annual Report 2008." 2008, p13.