Toward a Dynamic Notion of Value Creation and Appropriation in Firms:

The Concept and Measurement of Economic Gain

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Research Summary: 'Value creation' is central to strategy. Even so, confusion arises because it can be defined in different ways, e.g., as the sum of producer and consumer surplus in a given time period, or as the change in surplus over time. To formalize the latter notion we introduce the concept of economic gain, defined as the increase in total surplus. Economic gain can arise through innovation or when a superior firm displaces competitors. We provide a firm-level measurement framework to quantify economic gain and its distribution among stakeholders, including the firm's shareholders, employees, suppliers, and customers. As an empirical illustration, we compare the creation and distribution of economic gain by Southwest Airlines and American Airlines between 1980 and 2010.

Managerial Summary: Most managers and the business press regard 'value creation' as the increase in shareholder wealth represented by a rise in corporate profit or stock price. A broader conception of value creation goes beyond shareholders to include the value that is distributed to additional stakeholders of the firm, including employees, suppliers, and customers. We develop a mathematical framework that allows this broader notion of value creation and distribution to be assessed and quantified in many cases. We illustrate the framework using historical data on Southwest Airlines and American Airlines over three decades.

Keywords: value creation, value distribution, value appropriation, stakeholders, economic gain

INTRODUCTION

The notion that firms create and distribute economic value is central to the field of strategic management. Several streams of research—in particular, the resource-based view of the firm (RBV), the stakeholder theory of the firm, and more recently, value-based strategy (VBS)—explicitly focus on questions of value creation and capture.[1] Despite this centrality of 'value creation' within the field, there has been a lack of clarity on the precise meaning of the concept. Without clear definitions and suitable empirical tools, researchers have rarely attempted to measure the total economic value created by a firm or its distribution among key stakeholders.

A major source of confusion is that value creation can be reasonably defined in two different ways: first, as the total economic value created by a firm within a specific interval of time (sum of consumer and producer surplus); and second, as the change in this value over longer periods. We call the first definition 'static value creation', and the second, 'dynamic value creation' or 'economic gain'. While both are useful concepts, the dynamic notion has been largely ignored in strategic management and is comparatively undeveloped. This is surprising given that the common view of value creation by a CEO is explicitly dynamic: shareholders want the CEO to *increase* the firm's profit and stock price over time.

Drawing together concepts from economics and strategic management, we show that economic gain has two components, which we call 'innovation' and 'replication'. A firm may improve through cost reductions or through quality improvements that increase customers' willingness to pay (WTP). We refer to these broadly as 'innovation', recognizing that they may arise

[1]In the RBV (e.g., Wernerfelt, 1984; Barney, 1991) the economic value created by a firm arises from the scarcity of valuable resources and competitors' difficulty in imitating or substituting them. The stakeholder theory views the firm as 'a constellation of cooperative and competitive interests possessing intrinsic value' (Donaldson and Preston, 1995, p. 66) and focuses on value capture by these stakeholders. Similarly, VBS uses game theory to model coalitions of agents who cooperate to create value and then compete to capture it (Brandenburger and Stuart, 1996; MacDonald and Ryall, 2004; Makadok, 2011; Chatain and Zemsky, 2011).

from various sources internal and external to the firm. In addition, a firm that is superior to its rivals can create value by expanding at the expense of competitors, thereby serving more customers who may benefit from the firm's higher quality or lower cost. We refer to this second type of value creation as 'replication'.[2] While the two components are related—replication creates value only if the firm has previously been innovative relative to rivals—it is useful to distinguish them in assessing the process of value creation. Given our focus on specific firms, we ignore value creation that may come from exogenous growth in industry demand.

We adapt methods from the literature on productivity measurement to estimate these components of dynamic value creation, as well as the distribution of value among the firm's stakeholders. In some contexts it is possible to derive the estimates from standard corporate accounting data. Although we cannot directly overcome the problem of measuring consumer surplus, which hinders most empirical efforts to estimate the total economic value created by a firm, we show that under some assumptions this problem can be reasonably addressed in a dynamic context. To make our concepts and measures more concrete, we provide an illustration of dynamic value creation for Southwest Airlines (SWA) and American Airlines (AA) over the interval from 1980 to 2010.

Our theoretical exposition of economic gain and the associated measurement framework make several contributions to the strategic management literature. (A related empirical study, Lieberman, Garcia-Castro and Balasubramanian (2016), analyzes a larger sample of airline and automotive companies, thereby providing more comprehensive evidence on inter-firm and inter-stakeholder variation as well as guidance on data implementation.) At the broadest level we clarify that value creation by a firm can be viewed and potentially quantified in the alternative ways that we

[2] Although quantity changes are not alien to VBS (e.g., Bennett, 2013; Stuart, 2007) they have not been extensively studied. Our discussion brings to the surface the fact that innovation gains and quantity changes are both fundamental in how firms create and capture value.

call ‘static’ and ‘dynamic’. The ‘static’ notion (total surplus) is widely recognized, but the dynamic notion (change in surplus) is often more relevant and measurable.

The ability to estimate economic gain and its distribution among the firm’s stakeholders has the potential to facilitate conversations among theoretical strands of the strategic management literature—especially the RBV, the stakeholder view, and the VBS. Furthermore, economic gain links with the concept of competitive advantage, which is often defined as a firm’s ability to create greater economic value than competitors. Achieving economic gain is a necessary condition to increasing competitive advantage. Like economic gain, competitive advantage is now regarded as relating to all stakeholders (Peteraf and Barney, 2003; Coff, 1999, 2010), whereas most studies of firm performance have been limited to measuring shareholder value. Thus, compared with prior empirical work in strategic management, our measurement framework offers a more comprehensive assessment of a firm’s value creation and distribution.

ALTERNATIVE CONCEPTS AND MEASURES OF VALUE CREATION

Confusion about value creation arises from at least two sources. As described above, one source of confusion relates to whether the concept is ‘static’ or ‘dynamic.’ A second source relates to the corporate stakeholders under consideration: only shareholders, or a more inclusive set. Table 1 classifies common concepts and measures of corporate value creation along these dimensions.

--Insert Table 1 about here--

Shareholder value versus total value creation

The most commonly considered stakeholders are the firm’s shareholders. Shareholder value creation and associated measures (profits, market capitalization, etc.) are standard concepts. Using simple ratios such as return on assets or equity, the firm’s profit rate can easily be compared over time or relative to competitors. More sophisticated measures such as ‘economic value added’ subtract out the firm’s cost of capital in order to estimate true economic profit. Countless studies draw upon such measures, which can be readily computed from available data.

Such a focus on shareholder value has two main limitations. First, by considering only a single, albeit important, stakeholder, it offers a limited perspective, ignoring most of the economic value typically created and distributed by a firm. Second, it provides only a partial insight into *how* firms create value: managers can create value for shareholders by enlarging the total value created by the firm or simply by redistributing rents. Actions that expand the total pie are fundamentally different from those that merely carve a larger slice for shareholders, with distinct implications for stakeholders and society.

Going beyond shareholders, the concept of *total* economic value is usually defined as the gap between the customer's WTP and the supplier's opportunity cost. This approach can be formulated within the context of supply and demand curves (e.g., Besanko, Dranove, Shanley, and Schaefer, 2012) or in a bargaining framework (e.g., Brandenburger and Stuart, 1996). Although broader than shareholder value, this concept of economic value (total surplus) usually limits its attention to two stakeholders: shareholders and consumers.[3]

Empirical applications of the concept of total value creation are constrained by difficulties in measuring WTP and opportunity costs. To overcome these challenges, a growing number of studies in industrial organization economics develop models of competition that incorporate structural estimates of costs and demand, thereby providing assessments of producer and consumer surplus. (See Ackerberg et al., 2007, for a review of this literature.) These studies typically examine a single industry, modeling specific features of the industry context to obtain moment conditions that allow supply and demand to be identified.[4]

While the structural estimation approach has been used primarily to answer policy questions

[3] Brandenburger and Stuart (1996) include three stakeholders: suppliers, the firm, and customers.
[4] A recent example in the strategy literature is Grennan (2014), which develops such a model to measure the importance of bargaining ability in determining the division of value between coronary stent producers and their customers (hospitals).

in economics, it offers promise for addressing questions in strategic management. A major strength of the structural approach is the ability to incorporate idiosyncratic firm or industry data to identify determinants of the economic surplus and its division among parties. Although studies in this vein have focused almost exclusively on characterizing effects at the industry level, the approach can be applied to questions at the level of individual firms.

Static versus dynamic value creation

Within the two notions of value creation described above—shareholder value and total economic value—a second dimension relates to timeframe. Measures such as accounting profits, economic value added (EVA), residual income, and the economic value created (e.g., Brandenburger and Stuart, 1996; Davis and Kay, 1990) are *static* in that they focus on value created in a single time period. In contrast, the business press and much of the scholarly literature describe (shareholder) value creation as *dynamic*: an increase in the firm's stock market value. The common notion of a value-creating CEO is not one who presides over a firm with large profits or stock market capitalization, but rather a CEO who is able to raise the firm's profit and stock price over time. Shareholders want the CEO not simply to maintain the firm but to grow it in a profitable way; it is rare that a CEO is judged based on the level of shareholder wealth and not on the changes.[5]

Furthermore, a dynamic framework emphasizes the need to consider stakeholders beyond shareholders in order to fully understand the flow of economic value. Firms that create new value may distribute it in different ways depending upon competition, legal rights, bargaining power, and so on. For example, a firm that introduces an innovation with strong patent protection is likely to be in a position to appropriate much of the innovation's value for its shareholders or employees. By comparison, in an environment where technology is improving but difficult to protect from imitation, most if not all of the new economic value will flow downstream to consumers. The

[5] Moreover, arguments from behavioral economics suggest that human utility adjusts to a reference point and is thus more sensitive to changes than to absolute levels (Kahneman, 2011).

computer industry is perhaps the best example: prices of computers and profits of computer manufacturers have fallen over the past three decades even though innovations have exponentially improved the quality of computers used by customers.

To summarize, the conceptualization of value creation differs greatly across the quadrants in Table 1. Concepts of *shareholder* value creation—both static and dynamic—are well established, and good empirical measures are in wide use. With regard to *total* value creation, static concepts are well developed, but the difficulty of measuring consumer surplus limits their empirical application. Dynamic concepts and measures of total value creation have gone almost completely unrecognized in strategic management, and tools for assessing value capture by multiple stakeholders remain rudimentary and ad hoc. This suggests the need for concepts and methods to characterize growth in total economic value and the distribution of that value among stakeholders of the firm. The remainder of this paper develops such a concept: 'economic gain'.[6]

ECONOMIC GAIN: A DYNAMIC NOTION OF TOTAL VALUE CREATION

Concept

We define *economic gain* as the change in economic value (total surplus) created by a firm from one period to the next. We begin by illustrating the notion of economic gain arising from an innovation. Consider Firm A facing a single competitor Firm B in some industry. Suppose in period 0, the two firms are identical, and the economic value created by each is v_0Y_0, where v is the average economic value created per unit (i.e., the average difference between WTP and cost), Y is the number of units of output, and the subscript refers to the period. Now, suppose Firm A develops a single innovation in period 1, and that innovation has two types of effects that last over two periods. First, the innovation increases the average value created in each period by Δv_1 to v_1. Second, this innovation allows the firm to grow by taking away some of its competitors' customers. In particular, suppose

[6] We thank Arnold Harberger for suggesting this term.

Firm A grows to $Y_1=Y_0+\Delta Y_1$ in period 1 and to $Y_2=Y_1+\Delta Y_2$ in period 2.[7] For simplicity, we make the following assumptions: (a) Firm A grows by taking customers away from Firm B[8]; (b) Firm A does not innovate in period 2; (c) Firm B does not innovate in periods 1 and 2.[9] Then, the economic value created by Firm A in period 1 is given by:

$$\nu_1 Y_{1=} (\nu_0 + \Delta\nu_1)(Y_0+\Delta Y_1) \qquad (1)$$

However, some of this value is created by Firm A simply replacing Firm B. In particular, if Firm B had not contracted, then it would have created $\nu_0\Delta Y_1$ of economic value that is now by created by Firm A (by assumption, the average value created by Firm B does not change and stays at ν_0). Excluding this inter-firm transfer and subtracting the economic value created by Firm A in period 0 from Equation (1) gives the economic gain for Firm A in period 1:

$$\Gamma_1 = Y_0\Delta\nu_1 + \Delta\nu_1\Delta Y_1 \qquad (2)$$

Turning to period 2, Firm A's economic value created equals:

$$\nu_1 Y_{2=} (\nu_0 + \Delta\nu_1)(Y_0+\Delta Y_1+\Delta Y_2) \qquad (3)$$

Note that we use ν_1 as the average value created, since by assumption, Firm A does not innovate in period 2. As before, a part of this economic value created ($\nu_0\Delta Y_2$) is purely an inter-firm transfer from Firm B to Firm A. Excluding this inter-firm transfer and subtracting the economic value created by Firm A in period 1 from Equation (3), gives the economic gain for Firm A in period 2:

$$\Gamma_2 = (\nu_1 - \nu_0)\Delta Y_2 \qquad (4)$$

Thus, the total economic gain for Firm A from its innovation in period 1 is given by:[10]

[7] If there were no costs to expanding the firm, the firm could expand and occupy the whole industry instantly. However, that is unlikely, and hence, a firm will spread out its growth over multiple periods.
[8] More broadly, firm A may grow at the expense of several firms, including firms outside the industry. This discussion can be generalized to those situations.
[9] In general, firm B may also innovate and increase its average value created over time. We discuss this later in the text as well as in Online Appendix B and C.
[10] We use $(\nu_1 - \nu_0)$ in the last term of Equation (5) rather than $\Delta\nu_1$ to make it more apparent that the comparison for replication gain is with an outside firm or industry average (see Equation (6)).

$$\Gamma = \Gamma_1 + \Gamma_2 = \underbrace{\left\{ Y_0\Delta\nu_1 + \Delta\nu_1\Delta Y_1 \right\}}_{\text{'innovation gain in Period 1'}} + \underbrace{(\nu_1 - \nu_0)\Delta Y_2}_{\text{'replication gain in Period 2'}} \tag{5}$$

Hence, a firm can achieve economic gain in two broad ways. First, and corresponding to the first two terms of Equation (5), value is created through innovations within firms that increase the average economic value created per unit over its current output ($Y_0\Delta\nu_1$) and allow the firm to expand by immediately displacing some competitors ($\Delta\nu_1\Delta Y_1$). We term this as 'innovation gain'. Broadly, innovations increase the customer's WTP for the product (without proportionately increasing the opportunity costs), or decrease the opportunity costs (without proportionately decreasing the customer's WTP).[11] The second way of achieving economic gain, 'replication gain', corresponding to the third term of Equation (5), is when the superior firm, based on its past innovations, grows relative to its competitors.[12]

--Insert Figure 1 about here--

We illustrate this graphically in Figure 1 for a cost-reducing innovation.[13] In Period 0, Firm A is identical to its competitors, with a unit cost of C_0 and an output, Y_0. The price is $p_0=C_0$. All the economic value created, equal to the area between the demand and supply curves, is appropriated by the customers. The firm and its stakeholders receive their opportunity costs.

In Period 1, Firm A innovates and reduces its unit costs to C_1. Thus, the firm has created additional value ($\Delta\nu_1 = \nu_1 - \nu_0 = C_0 - C_1$) by freeing up resources that can be used elsewhere. Now,

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[11] We include in the category of gains from innovation a range of enhancements that are under the firm's control, such as unit cost reductions from economies of scale. Note that WTP and opportunity costs may also change due to factors outside the control of the firm. However, given our focus on economic value that arises through the actions of a firm, we exclude these possibilities from the concept of economic gain.

[12] The covariance term ($\Delta\nu_1\Delta Y_1$) could potentially be assigned to replication gain. However, this requires an unrealistic assumption of no firm growth in period 1 and is inconsistent with our measurement framework for innovation gain. (See below and proofs of Propositions 1 and 2 in the Online Appendix.)

[13] Online Appendix A provides additional graphical illustrations including on the static notions of value creation. That appendix also lays out the assumptions underlying these graphical illustrations.

Firm A expands output to Y_1 in this period by taking customers away from its competitors. Firm A's economic gain in period 1 is the sum of the two hatched rectangles (corresponding to the two terms in Equation (2) or the two terms corresponding to 'innovation gain in Equation (5)). The hatched rectangle to the left of Y_0 corresponds to the gain from having a lower cost in existing markets/customers ($Y_0\Delta\nu_1$). The hatched rectangle between Y_0 and Y_1 is the gain from immediately displacing some of its less-efficient competitors, and expanding output ($\Delta\nu_1\Delta Y_1$).

In the next period, Period 2, Firm A does not innovate further, but leverages its innovation from period 1 and expands output to Y_2 by further displacing its competitors. Then, Firm A's economic gain in Period 2 is solely due to *replication* of its competitive advantage in Period 1. This corresponds to Equation (4) (or the last term in Equation (5)), $(\nu_1 - \nu_0)\Delta Y_2$, and is equal to the area of the dotted rectangle between Y_1 and Y_2 in Figure 1.[14] There are several real-life examples of such economic gain. Many successful firms such as McDonald's, Starbucks, and Walmart started with an innovation that provided them an initial advantage over their competitors, and then expanded over time by leveraging that innovation. Later in this article, we discuss the example of Southwest Airlines, and show that it appears to have followed a similar path. Such replication is a common type of strategy, particularly when productive units are specific to a geographic area (Winter and Szulanski, 2001, Bowman and Ambrosini, 2003; Jonsson and Foss, 2011).

While the above illustration focuses on a cost reduction, economic gain from innovations that increase WTP is conceptually similar. Firms that are able to increase their customers' WTP, say by improving product quality, will increase the per-unit value created, and eventually grow by

[14] Note that the same total economic gain would be achieved if Firm B had immediately copied and fully implemented Firm A's innovation, thereby preventing Firm A's displacement of Firm B. In the next section, we will include such imitation as a form of innovation gain. The concept of replication gain is needed in our framework to capture economic gains associated with changes in market share. (If market shares remain stable in an industry with constant demand, all economic gain will be innovation gain.)

displacing their competitors. Thus, to summarize, economic gain arises when a firm reduces its cost or increases the customers' WTP through innovation, or when a superior firm grows at the expense of its competitors.

Now, we briefly discuss two sources of value creation ignored here. The preceding discussion assumes that the focal firm's competitors do not innovate, and that industry output stays constant (at $Y_{IND(0,1,2)}$) in Figure 1. However, firms may imitate innovations from their competitors or adopt innovations from outside the industry. Then, the per-unit value created by competitors will also increase over time, and in the extreme case, competitors are eventually able to match the focal firm's cost (or WTP). This causes industry output to increase (to $Y_{IND(N)}$ in Figure 1). Further, this brings new 'extra-marginal' customers into the industry, as firms lower their prices (or improve their products). The economic value created for these additional customers is depicted in Figure 1 as the solid triangle towards the right of the figure. This is the familiar 'Harberger triangle' (Harberger, 1954, 1964; Hines, 1998), which is often small compared to the gains from innovation. We briefly discuss this aspect later in the paper.

We also ignore an additional way in which economic value may be created within an industry: exogenous growth in demand. Changes in consumer tastes, growth in population or income, or increases in the prices of substitute products may shift the industry demand curve in a manner that increases the consumer surplus generated by the industry. We exclude this type of value creation from the concept of economic gain, as it is independent of the actions of firms in the industry. Accordingly, our definition of economic gain through replication refers to expansion of a superior firm that increases its market share. Given this focus, we also exclude any value creation that may arise when a firm diversifies into a new industry.

Turning to measurement, the notion of economic gain has a major advantage: at least a part of it can be reasonably and generally estimated using publicly available data on inputs, outputs, costs, and prices (including potential adjustments for quality). Because it considers only period-to-period changes, under some assumptions, it circumvents the problem of estimating WTP and opportunity costs. This allows us to estimate innovation gains in many situations, and replication gains in some situations. Such a general approach to measuring a firm's economic gain from innovation is discussed in the next section.

Measuring dynamic value creation and appropriation

Equation (5) above traces the economic gain from a particular innovation and represents the theoretical ideal where one firm is engaged in one innovation in one period. In practice though, many firms may have several innovations lasting over multiple periods. Hence, in general, it is not possible to measure the economic gain from a specific innovation. Instead, we focus on a decomposition of economic gain that is broadly analogous to Equation (5) but abstracts away from specific innovations. In particular, we use the following:

$$\Gamma_t = \underbrace{\left\{ Y_{t-1}\Delta\nu_t + \Delta\nu_t \Delta Y_t \right\}}_{\text{'innovation gain'}} + \underbrace{\Delta Y_t \, max\left\{ 0, (\nu_{t-1} - \nu_{t-1}^{*}) \right\}}_{\text{'replication gain'}} \qquad (6)$$

where Γ_t is economic gain in period *t*, Y_{t-1} is the quality-adjusted (discussed later) output of firm A in period *t-1*, Y_t (= $Y_{t-1} + \Delta Y_t$) is the output of firm A in period *t*, ν_{t-1} is the average economic value per unit of firm A in period *t-1*, ν_t (= $\nu_{t-1} + \Delta\nu_t$) is the average economic value per unit of firm A in period *t*, and ν_{t-1}^{*} is the average economic value per unit of firm A's competitor (or the industry average). The above decomposition is similar to Equation (5) and corresponds to the two broad ways of creating economic gain. A key difference is that we do not now ascribe causality to specific innovations. Further, it is limited to firm-level averages, and does not consider within-firm heterogeneity (such as across business units, products or services). The decomposition can be disaggregated to a finer level if such data are available.

As before, the first two terms in Equation (6) refer to gains from increases in the unit economic value created in a given period. However, in Equation (6), these gains may arise due to innovations in the same period or due to lagged effects of prior-period innovations. The last term is the gain in period *t* arising from firm A growing at the expense of a competitor who was at a competitive disadvantage in period *t-1*. Hence, it can be broadly considered as economic value created through the growth of the superior firm. We restrict replication gains to firms with $\nu_{t-1} > \nu_{t-1}^*$ in order to avoid double counting of such gains and to be able to assign them to identifiable stakeholders of the superior firm.

In developing the measurement framework, we assume that the WTP per unit of output and the input opportunity costs per unit (of input) are unobservable while the quantities and prices of inputs and outputs are observable. For interested readers, the Appendix explicitly states the underlying assumptions and a series of formal propositions that develop our approach in a more technical fashion. These propositions are proved and elaborated in the Online Appendix. Readers not interested in the derivation of the framework can go directly to Equation (13).

Measuring innovation gain

To develop our approach for measuring economic gain from innovation, we formally draw from the productivity literature in economics (Harberger, 1997; Harberger, 1998; Hulten, 2001). Consider a firm with three stakeholders (labor, capital and materials providers). Suppose, it has cost-reducing innovations that reduce the quantity of inputs required to produce one unit of *real* output (broadly defined as output adjusted for quality changes; see Appendix for details). Specifically, the inputs of labor (L), capital (K) and materials (M), required to produce one unit of output, Y, change by ΔL, ΔK and ΔM. Then, the innovation gain in Equation (6) is given by

$$\Gamma = -Y\Delta c - \Delta c \Delta Y \tag{7}$$

where c is the average opportunity cost per unit of output, which is given by c = (wL+rK+mM)/Y.

Here, w is the rate of labor compensation or wages, r is the rate of return on capital, and m is the price of purchased materials. Also, since the firm's revenues, pY, must equal its factor payments, the following payment identity holds:

$$pY \equiv wL + rK + mM \tag{8}$$

where p is the real price of the firm's product. We assume that on average, factors are paid their opportunity costs in the first period (and hence p=c, and $(c+\Delta c) = [w(L+\Delta L) + r(K+\Delta K) + m(M+\Delta M)]/(Y+\Delta Y)$). Using this to expand and simplify Equation (7), we get:

$$\Gamma = - [w(L+\Delta L) + r(K+\Delta K) + m(M+\Delta M)] \tag{9}$$

Dividing by pY, substituting the shares of labor, capital, and material as $s_L=(wL/pY)$, $s_k=(rK/pY)$, and $s_M=(mM/pY)$, and using Equation (8), Equation (9) simplifies to:

$$G = (\Delta Y/Y) - s_L(\Delta L/L) - s_K(\Delta K/K) - s_M(\Delta M/M) \tag{10}$$

Equation (10) provides the economic gain from innovation. The Appendix (Proposition 1) lists the specific assumptions underlying the above calculations and shows that with additional assumptions (Proposition 2), Equation (10) also holds for WTP-increasing innovations. Broadly, *G* represents the increase (decrease) in output that is not attributable to increases (decreases) in the quantities of inputs used. For example, suppose Toyota produces a certain number of cars in a given period. In the next period, if Toyota produces 10% more cars with the same inputs or produces higher quality cars for which consumers are willing to pay 10% more, then $(\Delta Y/Y) = 10\%$, and all other terms are 0. Then, the economic gain is G = 10% (of previous period's revenues), which is available for distribution to Toyota's stakeholders.

Turning to the distribution of economic gain, revenues must equal factor payments in the second period as well. Hence,

$$(p+\Delta p)(Y+\Delta Y) = (w+\Delta w)(L+\Delta L) + (r+\Delta r)(K+\Delta K) + (m+\Delta m)(M+\Delta M) \tag{11}$$

Expanding, using Equation (8) and simplifying, we get:

$$p\Delta Y - w\Delta L - r\Delta K - m\Delta M = -\Delta p(Y+\Delta Y) + \Delta w(L+\Delta L) + \Delta r(K+\Delta K) + \Delta m(M+\Delta M) \qquad (12)$$

Note that the right hand side of Equation (12) is simply the additional payments flowing to each stakeholder in the second period compared to the first period. To proceed, we make the assumption that the changes are small enough that the cross-product terms $\Delta p\Delta Y$, $\Delta w\Delta L$, etc. can be ignored. (See Proposition 3 in the Appendix, which relaxes this assumption.) Dividing Equation (12) by pY and substituting for the factor shares, we get:

$$(\Delta Y/Y) - s_L(\Delta L/L) - s_K(\Delta K/K) - s_M(\Delta M/M) = s_L(\Delta w/w) + s_k(\Delta r/r) + s_m(\Delta m/m) - (\Delta p/p) \quad (13)$$

Note that the left hand side of Equation (13) is equal to the economic gain created (Equation 10). Consider the right hand side, which reflects the distribution of economic gain:

$$G= s_L(\Delta w/w) + s_k(\Delta r/r) + s_m(\Delta m/m) - (\Delta p/p) \qquad (14)$$

The first term represents the economic gain appropriated by labor (reflected as an increase in their wages), the second term represents the part of economic gain going to capital providers, the third term represents the economic gain captured by suppliers and the last term is the benefits to customers (in the form of lower prices). Consider our hypothetical example of Toyota, in which the firm is able to produce 10% more cars (or higher quality cars) with no change in input. In this case G = 10%. How might that gain be distributed? One possibility is that the gain flows entirely to customers as a 10% reduction in the price of Toyota cars. In other words, $\Delta P/P$ equals –0.10, which corresponds to a 10% price reduction for cars of unchanging quality, or equivalently, better cars, for which consumers would be uniformly willing to pay 10% more, at an unchanging nominal price. This pass-through of the economic gain to consumers might arise if all producers in the auto industry implement similar innovations and compete aggressively. Another possibility is that the economic gain flows partially to consumers and partially to other stakeholders. For example, if

Toyota's rivals do not achieve the same level of economic gain as Toyota—say, because they did not implement the innovations as successfully—it is likely that only some of Toyota's gains from innovations will be competed away to consumers; the remainder may be captured by Toyota's employees, suppliers, or shareholders. The extent to which these groups capture Toyota's overall gain depends upon their bargaining power, the degree of competition in the industry, and Toyota's performance relative to rivals.

Note that the distribution of gains represented by Equation (14) applies even in the absence of any economic gain by the firm (i.e., when G is zero or even negative). So, some stakeholders could gain (e.g., consumers) at the expense of other stakeholders (e.g., shareholders), even if the total economic gain is zero or negative.

In the remainder of this paper, we refer to the formulation represented by Equation (13) [or its component parts, 'value creation' in Equation (10) and 'value distribution' in Equation (14)] as the 'VCA model' (for Value Creation and Appropriation). If the production technology is constant returns to scale, Equation (10) is equivalent to the well-known Solow (1957) decomposition for total factor productivity (TFP), whereas Equation (14) (the 'dual') has been much less frequently used.[15]

Measuring replication gain

The approach outlined above for measuring economic gain from innovation can be modified to measure the economic gain from replication. In this case, we first estimate the gain corresponding to $\nu_{t-1} - \nu_{t-1}^*$ in Equation (6), i.e., the gain from shifting a single unit of output from the less efficient competitor (or industry average) to the focal firm. Then we can multiply this estimate by ΔY_t, the number of units over which the focal firm displaces the competitor.

Suppose the firm faces a competitor with the same WTP as the focal firm, and which pays

[15] An exception is Harberger (1997, 1998) and related studies, which apply the TFP formula and the dual to assess economic growth at the industry level.

its input owners their opportunity costs. We can then replace the first (baseline) period in the above discussion with this competitor's output and inputs scaled in a way that the scaled output matches the output of the focal firm. Formally, suppose in some period, Y_c, L_c, K_c and M_c are the competitor's output and input quantities, p_c, w_c, r_c and m_c are the output and input prices, and ρ is a scaling factor such that $Y_c=\rho Y_1$, where Y_1 is the output of the focal firm in the first period. Then, repeating the same calculations as above, we can write:

$$-\left\{s_{Lc}(\Delta L_c/L_c) + s_{Kc}(\Delta K_c/Kc) + s_{Mc}(\Delta M_c/M_c)\right\} =$$

$$s_{Lc}(\Delta w_c/w_c) + s_{kc}(\Delta r_c/r_c) + s_{Mc}(\Delta m_c/m_c) - (\Delta p_c/p_c) \qquad (15)$$

Where $\Delta L_c=(\rho L_1- L_c)$, $\Delta K_c=(\rho K_1- K_c)$, $\Delta M_c=(\rho M_1- M_c)$, $\Delta w_c=(w_1- w_c)$, $\Delta r_c=(r_1- r_c)$, $\Delta m_c=(m_1- m_c)$, $s_{Lc} = (w_cL_c/p_cY_c)$, $s_{Kc} = (r_cK_c/p_cY_c)$, and $s_{Mc} = (m_cM_c/p_cY_c)$. Note that $\Delta Y_c=(\rho Y_1- Y_c)=0$, since we are scaling the competitor to the firm's size. Broadly, the left hand side indicates how much more economic value the firm is creating, per unit of output, relative to the competitor in that period. To compute replication gains (in dollars) from this period to the next, we multiply throughout by $(1/\rho)p_cY_c$ times the extent of growth, $(Y_2- Y_1)/Y_1$ (Proposition 4 in the Appendix shows this formally). The right hand side indicates the difference between the two firms in how that economic value is distributed. In particular, it denotes the additional economic gain (as a percentage of the scaled competitor's revenues) to the stakeholders of the superior firm relative to what they would have received if they were part of the competitor firm in the first period.

AN ILLUSTRATIVE EXAMPLE: SOUTHWEST AIRLINES, 1980-2010

Overview

To illustrate these concepts and methods, we focus on the U.S. airline industry to estimate the economic gain created by Southwest Airlines (SWA) and American Airlines (AA) over the interval from 1980 to 2010. We first compare SWA and AA using operational indicators to give an overview of how value is created in this industry. We then apply the VCA model to develop estimates of economic gain. Our calculations are intended as a quantitative sketch of the creation and distribution of economic gain by these firms, not as a causal test of any hypotheses.

The airline industry offers several attractive features for applying the VCA model. First, the requisite data are publicly available for many airline companies over a long period of time. Second, the industry is likely to meet many of the assumptions required for a reasonable application of the model. A vast majority of value creation in this industry is through cost-reducing innovations, particularly with regard to labor and fuel use. Innovation gains through increases in service quality (higher WTP for a better experience delivered) have been marginal, if any. SWA's growth has largely come from a decline in its competitors' market shares rather than through industry growth. While there have been improvements in the quality of planes, the quality of other inputs such as fuel and pilots have not changed significantly. Finally, the industry has been very competitive, which means the factors are likely to be earning returns close to their opportunity costs.

--*Insert Tables 2A and 2B about here*--

Tables 2A and 2B summarize the data and our calculations for SWA and AMR over decade intervals between 1980 and 2010. The US airline industry was deregulated in 1978, when price and entry restrictions on interstate flights were eliminated. SWA began providing scheduled service in 1971 but remained a small carrier flying only within Texas until late 1979. Thus, our data from 1980 to 2010 capture SWA's expansion across the United States. In its formative years SWA developed a distinctive business model (Gittell, 2005), which SWA refined and replicated during the subsequent period of expansion. By comparison, AA has long been one of the world's largest airlines; we take AA as representative of the established carriers in the United States. Moreover, AA and SWA have always been direct competitors, with SWA headquartered in Dallas, and AA in nearby Fort Worth.

The most common measure of output in the airline industry is 'revenue passenger miles' (RPM), the total number of miles flown by paying passengers during a calendar year. We adopt RPM as the standard to compare between the airlines and over time, recognizing that some quality differences exist.[16]

SWA is an outlier in the airline industry, having grown to become one of the major carriers in the United States while remaining consistently profitable. Table 2 shows that in 1980, SWA produced 7% of AA's output, based on total RPMs flown. By 2010, SWA had reached almost 60% of AA's size and offered service between virtually all of the major cities of the United States. In 1980, SWA's net income was 13.4% of revenue; by 2010, this ratio had fallen to 3.8%, albeit on a much larger revenue base. By comparison, AA suffered losses in both years.

The major source of SWA's advantage has been its labor efficiency. In 1980, SWA had 909 employees per million RPM flown; by 2010, SWA had cut this figure by more than half to 447. In comparison, AA had 1,526 employees per million RPM in 1980 and 583 in 2010. SWA also enjoyed an input cost advantage in its early years, given that it paid comparatively low wages and salaries. In 1980, average wages and benefits were just over $26,000 per employee at SWA, as compared with almost $34,000 at AA. By 2010, however, SWA was paying the highest compensation in the US airline industry, averaging $106,000 per employee at SWA versus $87,500 at AA. Thus, SWA's advantage in labor efficiency was increasingly offset by a higher unit labor cost. In effect, employees at SWA were capturing a larger share of the value created by the company, as compared with employees at AA and other legacy carriers.

SWA has enjoyed lesser efficiency advantages in other areas. In 1980, SWA consumed 37

[16] Airlines differ across various dimensions of quality. For example, AA offers a mix of coach, business and first class service, whereas SWA provides only coach class. Thus, AA has arguably provided RPMs of higher average quality. On the other hand, SWA's flights have shorter average length-of-haul, which requires greater resources per RPM (given the time devoted to takeoff and landing). All airlines have adopted tighter packing of passenger seating in recent years, which has reduced the average quality of customer experience, offset to some degree by improvements in other areas such as aircraft entertainment systems. Viewed over a thirty-year perspective, however, such quality-of-service differences are relatively minor, particularly by comparison with many other industries. Thus, RPM provides a reasonably consistent benchmark for assessing value creation across airline companies and over time.

gallons of jet fuel per thousand RPM, as compared with 43 gallons at AA. Between 1980 and 2010, SWA nearly doubled its fuel efficiency while AA improved by an even larger margin; the two carriers achieved almost identical fuel efficiency in 2010. (These gains stemmed primarily from improvements made by the aircraft and engine manufacturers.) In most years, SWA appears less efficient than AA in capital input per RPM, although this could be an accounting issue. In 1980 SWA maintained a significantly higher load factor (RPM divided by Available Seat Miles, or ASM) than AA; in later years AA achieved marginally higher values than SWA. In general, load factors have been rising since the 1990s, as airlines have made greater efforts to avoid empty seats. Airlines have also adopted higher density seating—a fact well known to coach passengers. This tighter packing of passengers raises efficiency in the use of fuel, capital, materials and labor, although service quality suffers to a degree.

Estimation of gains to innovation

Table 2a summarizes our estimates of economic gains from innovation at SWA and AA. Applying Equation (10) to the airline data (after extending the formula to incorporate multiple inputs including labor, capital, fuel and materials, as described in Authors (2016)), yields the estimated 'total gain from innovation' shown in the bottom portion of the table. In general, innovation gains have been substantial in the airline industry. Over 1980 to 2010, AA's percentage gain of 66% exceeded that of SWA (50%). For both carriers, about half of this total gain arose between 2000 and 2010, a period of industry restructuring when airlines responded to major pressures, including a deep recession and a steep rise in oil prices.

Applying Equation (14) to the airline data gives the distribution of the innovation gains among each firm's customers, employees, suppliers and shareholders.[17] For both airlines, the

[17] The analysis can be performed at a more detailed level, e.g., distinguishing management and employee groups within the airlines. Here we focus on average effects by stakeholder category at the expense of a more fine-grained discussion.

estimates show a consistent flow of gains to customers, as well as a sharp increase in the value flowing to fuel suppliers between 2000 and 2010. Employees also captured some of the innovation gains, although the pattern differs between SWA and AA.

Over the 1980-2010 period, nearly all of AA's innovation gains were distributed to its customers in the form of price reductions. This extreme flow of value from AA to customers reflects the strong competitive pressure in the US airline industry. Only a small proportion (5%) of AA's innovation gain went to the company's employees. Virtually none of the gain went to shareholders, given that AA experienced losses of about 2% of revenues in both 1980 and 2010.

SWA also distributed the majority of its innovation gains to customers. Relative to AA, however, SWA's gains increasingly went to employees. Table 2a shows an employee gain of almost 19% at SWA between 1980 and 2010, more than three times the comparable figure for AA. Conceivably, this shift of gains to employees at SWA may reflect an effort by the company to provide incentives and maintain morale needed to sustain rapid growth.

Table 2a reveals shifts of value out of and then returning into the supply chain for fuel, as fuel prices fell between 1980 and 2000 but then increased more than threefold. Over the period from 2000 to 2010, the majority of all innovation gains made by SWA and AA flowed to fuel suppliers, most likely ending up as rents collected by oil producers.

Perhaps surprisingly, Table 2a shows negative gains to capital for SWA. Although seemingly at odds with SWA's consistent profitability and rising stock price, the negative values indicate a decline in the *rate* of profit, rather than *total* profit. SWA's total profit has been increasing, as the company's growth more than offset the declining profit rate. Over the 30-year period of our sample, SWA's profit rate fell from 13.4% to 3.8% of revenue while the company's total net income grew more than sixteen-fold.

Gains from replication

The calculations summarized at the bottom of Table 2a estimate the gains from innovation *within* SWA and AA as they improved their operations from 1980 to 2010. Complementing this analysis, Table 2b gives similar calculations that compare *between* SWA and AA at four points in time: 1980, 1990, 2000 and 2010. These calculations estimate the gains that would have been achieved by immediately transforming AA into a firm with SWA's efficiency level. We perform these calculations by scaling up the data for SWA to match AA's output (RPM) in each year, and applying Equation 14. Below, we apply these estimates to assess the gains from SWA's replication and growth.

Table 2b reveals that SWA maintained a significant efficiency advantage over AA in each of the years examined. However, the magnitude of SWA's advantage diminished over time. This is consistent with the higher rates of innovation gain for AA in Table 2a. Based on our calculations, shifting a unit of output from AA to SWA in 1980 would have produced an economic gain of 27.9%.[18] A similar transformation in 2010 yields a gain of only 6.0%. Thus, the efficiency of the two airlines has been converging over time. One possible explanation is that AA was able to adopt innovations pioneered by SWA and others at a faster rate than SWA was able to achieve new innovations to improve its business model.

The bottom portion of Table 2b allows us to draw some tentative inferences about the distribution of the replication gains made by SWA as it enlarged its market share at the expense of AA (and other legacy airlines). These calculations suggest that as output and corresponding resource inputs shifted from AA to SWA, much of the resulting economic gain was distributed to consumers and shareholders of SWA. This follows directly from the lower prices and higher profits of SWA relative to AA. However, one needs to be careful about such interpretations, as the calculations are based upon company averages; we do not know if such a reallocation of resources from AA to SWA

[18] Equivalently, AA could have produced its 1980 output with 21.8% (.279/1.279) less resource inputs, based on the factor prices paid by AA in 1980.

at the margin would have had the same distribution of returns or have led to the efficiency gains that we see in Table 2b.

Assessment of overall gains from innovation and replication

To have a complete picture of value creation by SWA, we now bring together the forms of economic gain discussed in this paper. These are illustrated in Figure 2, which provides a stylized representation of the US airline industry supply curve as it has shifted over time. To draw this curve, we assume that AA is representative of all airlines in the industry other than SWA, and that airlines have constant marginal cost up to capacity. These assumptions imply that the industry supply curve is made up of an initial flat portion over the output of SWA, followed by a similar portion at a higher level of resource input for AA and all other airlines. We also ignore any deviation between the prices of input factors and their opportunity costs, and changes in such over time. The resulting curve in Figure 2 resembles Figure 1 in the theoretical part of this article.

--Insert Figure 2 about here--

We draw such curves for 1980, 1990, 2000 and 2010 relative to the benchmark of AA's 1980 cost level (set at 100). The values represented come from SWA's output and the estimated total gains from innovation in Tables 2a and 2b. The initial flat portion of the curve is drawn at the level of SWA's resource input per RPM, extending horizontally to SWA's output in each year. The subsequent portion of the curve is drawn at AA's resource input per RPM in that year, relative to the comparable figure in 1980. Hence, in 1980, the portion of the curve corresponding to SWA is 21.8% lower (0.279/1.279, from Table 2b) than the AA part of the curve. These segments shift downward in each decade at the rates of gain from innovation estimated in Table 2a. The downward arrows on the left of Figure 2 correspond to the innovation gains of SWA, whereas the downward arrows on the right of the Figure correspond to the innovation gains of AA. For instance, from 1980 to 1990, SWA's innovation gain was 5.6% (Table 2a), which corresponds to the length of the topmost downward arrow on the left of Figure 2. The 'toe' of the curve expands in each decade, as SWA's output has grown.

From these curves in Figure 2 one can gauge magnitudes of 'static' and 'dynamic' value creation. In each year, the shaded portion of the curve is the static value creation due to the presence of SWA in the airline market. It represents SWA's 'added value' to the market, as discussed in the VBS literature, or equivalently, the loss of value that would arise if SWA did not exist (and its service was replaced by other, less efficient carriers, as represented by AA). It is clear from the figure that SWA's static value-added, given by the area of these rectangles, increased greatly from 1980 to 2000, as the decline in SWA's relative efficiency was more than offset by SWA's growth.[19]

Figure 2 also illustrates the dynamic economic gains achieved by SWA and AA, which. were substantial for both companies. The total gain between 1980 and 2010 is the area between the corresponding supply curves. It is the resource savings achieved through the improvements made by the two airlines and by the expansion of the more efficient company, SWA.

Limiting the analysis to gains made by SWA, over each decade the total economic gain is given by the sum of SWA's innovation gain (denoted by the appropriate downward arrow at the left of Figure 2 between the supply curves) and SWA's replication gain (denoted by the horizontal arrow).[20] It is clear that gains from replication have been a large component of SWA's total economic gain, given the company's large initial competitive advantage combined with its rapid growth. Indeed, if SWA had made innovation gains at its historic rate without expanding from its 1980 level of output, the company's total economic gain would have been meager—merely the small rectangle between the y-axis and the downward arrows shown for SWA.

[19] Under the assumptions, SWA's static value creation (or value added) in each year equals SWA's efficiency differential, as indicated in Table 2B, times the output of SWA in that year.
[20] If AA is also innovating, another reasonable estimate of SWA's replication gain would net out the economic gain associated with AA's innovation from SWA's replication gain. However, then AA's gains cannot be mapped to its stakeholders in that period (because the output and inputs associated with those gains is within SWA). The Online Appendix discusses this further.

DISCUSSION

We now consider some implications of the VCA Model, and the advantages and limitations of the measurement framework. We conclude with a brief discussion of areas for future research.

Implications of the VCA Model in Linking Value Creation and Distribution

Lack of correspondence between creation and capture of economic gain. The VCA Model requires that the economic gain must be equal to the sum of the gains appropriated by the various stakeholders, but it does not impose any restrictions on how much each individual stakeholder can appropriate. This lack of a value creation–appropriation correspondence is similar to that in the VBS literature (Brandenburger and Stuart, 1996; MacDonald and Ryall, 2004) where value appropriation is indeterminate, subject to bounds. Furthermore, recent advances in strategic management, including works on the dynamics of rent appropriation and stakeholder bargaining power (Coff, 1999; Castanias and Helfat, 2001; Lippman and Rumelt, 2003a,b; Asher, Mahoney, and Mahoney, 2005; Wang and Barney, 2006; Coff, 2010; Harrison, Bosse, and Phillips, 2010), are consistent with this intuition. These properties allow a simultaneous examination of value creation and appropriation in empirical studies. Such an exercise is not possible with shareholder value, which, by definition, equals the value appropriated by the shareholders.

Lack of correspondence between profit growth and economic gain. Profit growth is a key objective for managers and shareholders. However, profit growth does not correspond to economic gain if it comes at the expense of another stakeholder's returns. As can be seen from Equation (14), such cases represent value transfers from one stakeholder to another rather than value creation. Conversely, while an increase in competitive advantage leads to economic gain, such a gain does not necessarily translate into profit growth. Competition for resources and customers may result in all economic gain created by the firm being competed away to customers and resource owners. Hence, profit growth does not imply positive economic gain, and conversely, positive economic gain does not imply profit growth.

Innovation gain and the average unit stakeholder returns. Innovation is often considered critical to a firm's performance. Our framework highlights another important aspect of innovation: only innovation gain can increase the average unit stakeholder returns *for all stakeholders* of a given firm. To see this, set the left hand side of Equation (14) to zero. Then, if one stakeholder gains, at least one other stakeholder must lose.

By comparison, pure replication is simply scaling up the current level of value creation by proportionately expanding the firm's inputs and outputs. Hence, while the total level of value creation goes up, the value created per unit does not change, which in turn implies that the average return for all stakeholders cannot increase. This does not mean that the firm's stakeholders do not gain. Because the firm is expanding, it will have more employees, customers and suppliers, who in aggregate now receive more economic value than they did previously (e.g., when they were associated with the firm's competitors). Hence, some or all of these stakeholders clearly benefit from replication gain, even though the average return may not change.

Advantages and Limitations of the VCA model

A major advantage of the VCA model, besides its tight integration with theory, is that the data required for estimating Equation 13 (quantities and prices of inputs and outputs) are publicly available for many firms and industries. Furthermore, the model is based on a payment identity and thus does not require that markets be in some form of equilibrium. The method is therefore widely applicable.

Even so, the full set of required prices and quantities are not obtainable for many firms and industries. Data on inputs from suppliers are normally lacking. In such cases, an abbreviated form of the model can be estimated based on value-added, as we discuss in Lieberman et al. (2016). A related constraint is that most US companies do not provide data on employee wages and benefits, and some companies are diversified to an extent that makes it hard to untangle value creation within specific businesses without access to detailed business-unit data. Still, an exploratory analysis of the Compustat Global database (which covers 1996-2010 and about 115 countries) suggests that there are well over 87,000 firm-year observations with all the required data. The Online Appendix provides additional details, including data availability by country and by industry sector, and a flow chart that helps assess whether our model may be suitably applied.

Another advantage of the model is its relation to traditional measures of firm performance, such as return on assets. Ignoring taxes, our measure of the gains to capital (s_k $\Delta r/r$) represents the part of the economic gain that flows to shareholders. For instance, consider a firm with a capital (K) of 250 million dollars, and initial revenue (pY) of $200 million, of which $75 million went to workers as wages and benefits (wL), $25 million as profits to capital (rK), and $100 million as payments to suppliers. Then, its initial return on assets, *r*, would be 10%. If this firm creates an economic gain of 2%, then without any change in output prices, employment, wages, or capital stock, the measure, s_k $\Delta r/r$, would be 2%, since capital owners capture all the economic gain. The new return on assets can be obtained by adding the incremental $4 million (2% of $200 million) to profits, and dividing by the capital base to get 11.6%.[21] Hence, gains to capital in the model will be correlated with increased return on assets as measured traditionally. Nevertheless, as the SWA example demonstrates, one must be careful not to view a declining rate of return as necessarily indicative of a decline in the firm's economic profits. For growing firms whose returns exceed the cost of capital, economic profits can increase despite a diminishing rate of return.

While the VCA model has wide applicability, many limitations must be recognized. We now elaborate on these, referring the reader to Lieberman et al. (2016) for further details on some context-specific issues.

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[21] Part of this return represents depreciation; if the rate of economic depreciation is 10%, the return net of depreciation is initially zero, rising to 1.6% in the second period.

At the outset, note that we are using the terms 'innovation' and 'replication' to mean specific types of economic gain attributable to firm-level changes. We are agnostic, however, about the nature of underlying sources. Innovation gain could be due to the firm's own innovation or to imitation of rivals or some other form of spillovers. Similarly, replication gain is the additional economic value created in a given period because the firm expanded by displacing a competitor who was less efficient in the prior period. In our framework, the economic gain created by a firm through imitation of a competitor's innovation would be first reflected as an innovation gain for the imitating firm; subsequently, this firm might be able to grow and displace other competitors who failed to adopt the innovation, leading to what we call replication gain. Indeed, the biggest creator of value in an industry is often not the original innovator. If the objective is to separate economic gain into 'innovation' and 'replication' as defined in this article, then our framework will provide the correct breakdown, within the bounds of its assumptions. This also means that our framework is not a causal framework.

If market shares remain stable over time, all economic gains in an industry will take the form of innovation gain. However, as the example of SWA illustrates, in some cases a firm's total economic gain may be achieved largely through displacement of competitors. In such instances it is important to account for replication gain, even though the estimate of this gain is sensitive to assumptions with respect to the identity of the competitor(s) being displaced. In our airline example we took AA as a representative competitor, but alternatively, we could have taken an average of multiple airlines or have based our calculations on the actual changes in airline market shares observed in each period.

As shown in the Appendix and Online Appendix, the VCA framework exactly measures the innovation gains under certain assumptions. The Online Appendix provides propositions and a simulation analysis of the potential direction and magnitude of distortion if these assumptions are not met. More importantly, it helps develop a broad idea of contexts where our framework is likely to be reasonably accurate. We summarize findings from those analyses here.

In general, we find that the framework does well in measuring innovation gain if the firm grows by displacing competitors through cost-reducing innovations, and when input factors are not paid significantly more than their opportunity costs (Proposition 1 in the Appendix, Baseline Scenario and Scenario 2 in the Online Appendix). This is true even for large innovations that result in significant firm growth. Such conditions broadly match the assumptions of Solow's (1957) classic article and the literature on TFP (Hulten, 2001). Thus, established industries where cost-reducing innovations are the predominant form of innovation are likely to be particularly good contexts for applying the model. Airlines are one such example.

With WTP-increasing innovations, in theory, the model requires a constant-quality price index that reflects the underlying quality changes at the firm level. (See Proposition 2 in the Appendix.) While such firm-specific price indexes can be developed, a reasonable alternative is the use of industry-level constant-quality price indexes. Such indexes have been studied extensively (see for example, Diewert, 1995) and are readily available for many industries (see Online Appendix for a list). However, the use of such an industry-level price index requires the assumption that any observed price differences across firms in the same industry reflect quality differences (see Propositions 7—9 in the Online Appendix). This is more likely to be true for persistent long-term price differences than for short-term differences. It may be problematic for short-run analyses in very competitive industries with large inter-firm quality differences, where firms may pass through part or all of their quality advantage to consumers in the form of lower prices. Hence, a structural approach may be more appropriate to evaluate value creation and distribution in such contexts (e.g., Grennan, 2014). Similar measurement issues also arise if real input quantities are not directly observed or if we cannot completely adjust for input quality changes (see Proposition 6 in the Online Appendix).

Another source of measurement error is deviations of input prices from opportunity costs in the first period, which may arise if factor markets are not competitive. Though the framework allows for inter-supplier heterogeneity within a class of input providers, it assumes that on average, input providers are paid their opportunity costs in the first period. Sensitivity to this issue is discussed in the Online Appendix (Proposition 5 and Scenario 2 in the simulation analysis). In general, if a factor (such as labor) is paid more than its opportunity cost in the first period, the innovation gain arising from any savings of that factor per unit of output in the second period will be overestimated.

Significant industry innovation may result in the addition of new customers to the industry. This may overestimate true innovation gain for a specific firm. Broadly, output sold to these new customers has a lower economic value per unit than output sold to the industry's existing customers, which the VCA model is not able to discriminate.[22]

Another important limitation is that the method uses the marginal customer as a proxy for all customers. Thus, our approach ignores the fact that benefits to 'infra-marginal customers' (i.e., customers whose WTP is greater than the price) may differ from the marginal customer. This may be particularly problematic if a certain innovation increases the WTP for some customers but not for others. Further, any economic gain created through a unit-for-unit substitution of a costlier input (i.e., an input with higher opportunity costs) with a cheaper input (i.e., an input with lower opportunity costs) is not measured.

It is important to note that the choice of endpoints in performing the calculation can be critical; selection of endpoints that are at different stages of a business cycle can introduce serious

[22] However, as shown in the Online Appendix, the magnitude of such error is likely to be large only in industries where demand is highly elastic. In other industries with low to moderate price elasticity, the framework is likely to reasonably approximate actual innovation gains in industries.

distortion. Furthermore, Divisia indexes, such as Equation 13, are path dependent (Hulten, 1973). Hence an aggregation of sequential annual estimates will yield different values than when two distant endpoints are compared directly. Star and Hall (1976) suggest that such deviations tend to be small, but further work is needed to explore how these issues affect the robustness of estimates based on the VCA model.

Finally, the model relies heavily on accounting-based measures. Previous research has identified inherent limitations of accounting data to measure anything of economic relevance (Benston, 1985; Fisher & McGowan, 1983). Accounting measures generally ignore the time value of money and can be distorted by depreciation schedules, variations in investments periods, or differential growth rates, which may cause the accounting rate of return to deviate from the economic rate of return (Fisher & McGowan, 1983).[23]

Notwithstanding these limitations, Equation 13's usefulness lies in its ability to provide quantitative insights into the distribution of value among the firm's stakeholders. None of the current methodologies used in the strategic management field offer such a possibility, which has constrained quantitative investigations of questions related to value appropriation. The limitations discussed above only serve as reminders to be careful when interpreting the results.

Areas for future research

The VCA model offers many potential future research avenues, particularly for empirical studies. We suggest a few examples. Note that the model is agnostic about the underlying source of economic gain, and hence, is not by itself a causal framework. Even so, estimates from the framework can be used to study causal hypotheses, under the same condition required for any

[23] Although we cannot fully overcome these problems, our approach runs parallel to work in Productivity Accounting, a fruitful area of research which blends economics, statistics and business performance metrics (Davis, 1955; Grifell-Tatjé & Lovell, 2015). Recent studies in this research tradition have been able to obtain firm-level productivity estimates by using accounting data combined with supplementary information on input/output quantities and price indexes (e.g., Brea-Solís, Casadesus-Masanell, & Grifell-Tatjé, 2015).

empirical study in strategy: there is some exogenous variation in the data that permits causal identification.[24]

One issue that can be explored is whether shareholders are better positioned to capture gains from innovation or from replication. Replication gains do not usually require a firm to introduce changes in its business model. The firm simply grows by replacing less efficient competitors. Hence, there are no new knowledge asymmetries (in the sense of Coff, 2010) that stakeholders can exploit to capture more rents. Innovation gains typically require the efforts of skilled employees, who may capture a larger share of those gains. Hence, we conjecture that shareholders, as residual claimants, capture relatively more of replication gains (compared to innovation gains). This is consistent with the evidence for SWA (comparing Tables 2a and 2b).[25]

Similarly, the model can be used to examine if a more 'equitable' distribution of economic gain helps or hinders overall firm growth and the sustainability of a firm's competitive advantage. A number of literatures suggest that a broad sharing of economic gains is beneficial to the firm's stakeholders (including shareholders) over the long term (Harrison, Bosse, and Phillips, 2010; Weitzman, 1984). Similarly, Coff (1999) suggested that if shareholders do not appropriate value (or their appropriation is not evident in accounting performance), it might limit imitation attempts since the firm might not appear to be unusually profitable. More generally, the division of the economic

[24] We conjecture that assumptions regarding the time lag between the timing of an innovation and its impact on the average willingness to pay-cost gap and output growth (somewhat similar to assumptions in productivity estimation techniques such as Ackerberg-Caves-Frazer (2015) that assume a time lag between the firm's productivity changes and the change in input quantities, which allows them to causally estimate productivity) may be helpful. We leave this topic for future research.

[25] A related question relates to how the *rate* of growth may affect the ability of employees to capture economic gains. Compared with other factors utilized by the firm, skilled labor may be the more difficult to increase rapidly and effectively. If new workers cannot be hired and trained quickly, current employees may require incentives, e.g., to work overtime or to ensure their long-term retention within the firm. Moreover, employees may have power (through unions or other mechanisms) to impede the growth process. A firm that is growing rapidly may therefore choose to pay a premium to its workers. Conversely, a firm that is shrinking and laying off workers may have power to shift economic gains increasingly to shareholders.

pie can affect the future size of the pie. Potentially, these ideas can be empirically assessed in the VCA framework.

CONCLUSION

Understanding value creation and appropriation in firms has been one of the most fundamental concerns of the field of strategic management. Even so, the field has lacked clear definitions of value creation, and the extant approaches to measurement have important limitations. In this article we have attempted to provide greater clarity on the definitions by highlighting two main dimensions of misunderstanding—the breadth of stakeholder(s) being considered (shareholders vs. others) and the timeframe for analysis (static or within a single period, vs. dynamic across periods). We have focused on dynamic value creation and introduced the concept of economic gain: the increase in economic surplus generated by the firm between one time period and another. Furthermore, we have illustrated two main ways of creating economic gain—through innovations that reduce costs or increase WTP, and through the growth and replication of superior firms. Finally, we have presented a general, flexible, and computationally feasible method to estimate economic gain and its distribution among the firm's stakeholders. We hope these efforts bring greater precision to the definition of value creation and provide a useful foundation for measurement in future research.

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Table 1: Static and Dynamic Measures of Value Creation by a Firm

	Shareholder Value	Total Economic Value
'Static' Measures (within a given time period)	*Current period shareholder returns* • Profit • EVA • Return Ratios • Residual Income *Current and (anticipated) future returns* • Stock price • Market capitalization • Tobin's *q*	*Current period returns to 'all' stakeholders* • Total Surplus = Profit + Consumer Surplus = WTP – Opportunity Cost *To individual stakeholders (other than shareholders)* • Quantitative stakeholder interests (e.g., Luffman et al., 1982) • Rents or quasi-rents to employees (e.g., Blair, 1998) • Division of rents through bargaining (e.g., Grennan, 2014)
'Dynamic' Measures (change between time periods)	• Change in profit, EVA, etc. • Change in stock price • Change in market capitalization	• **'Economic Gain'**

Note: This is not a comprehensive list of all notions of value creation used in the literature.

Table 2A. SWA vs AA Comparison by Decade, 1980 to 2010. (Innovation gains computed within each company over time.)

	SWA 1980	SWA 1990	SWA 2000	SWA 2010	AA 1980	AA 1990	AA 2000	AA 2010
Price indices								
GDP deflator (US)	1.00	1.47	1.79	2.21	1.00	1.47	1.79	2.21
Company data (nominal)								
Revenues (=pY)	213	1,187	5,649	12,104	3,820	11,720	19,703	22,170
COGS	152	1,025	4,310	10,488	3,673	10,908	17,120	17,681
Total output (RPM) (=Y)	2,024,097	9,958,940	42,215,162	78,046,967	28,178,057	76,877,841	120,325,000	134,298,000
Materials purchased (ASM) (=M)	2,969,448	16,411,115	59,909,965	98,437,000	46,633,745	124,117,286	167,286,000	165,420,000
Fuel consumed (=F)	74	282	1,013	1,437	1,222	2,390	3,037	2,480
Cost per gallon Fuel (=f)	0.84	0.78	0.79	2.4	0.9	0.77	0.72	2.24
Employment (=L)	1,839	8,620	29,274	34,901	43,000	102,809	111,100	78,250
Wages and benefits (=wL)	48	357	1,683	3,704	1,453	3,883	6,783	6,847
Capital employed (=K)	196	1,326	5,899	10,821	2,522	9,756	19,393	15,676
Taxes	1	28	392	286	-75	6	508	-35
Cost of purchased materials (no fuel)	42	448	1,826	3,336	1,120	5,184	8,151	8,008
Price of output ($/RPM) (=p)	105	119	134	155	136	152	164	165
Net Income	28	47	603	459	-76	-40	813	-471
Performance ratios								
Income/Revenue	13.4%	4.0%	10.7%	3.8%	-2.0%	-0.3%	4.1%	-2.1%
Employment/RPM	909	866	693	447	1526	1337	923	583
Wages/Employee	$26.10	$41.50	$57.50	$106.10	$33.80	$37.80	$61.10	$87.50
Fuel/RPM	36.6	28.3	24	18.4	43.4	31.1	25.2	18.5
Capital/RPM	97	133	140	139	90	127	161	117
Load factor (RPM/ASM)	68%	61%	70%	79%	60%	62%	72%	81%

	SWA 1980-1990	SWA 1990-2000	SWA 2000-2010	SWA 1980-2010*	AA 1980-1990	AA 1990-2000	AA 2000-2010	AA 1980-2010*
Total Gain from Innovation (TFP growth) *(a)*	**5.8%**	**17.5%**	**26.5%**	**49.9%**	**13.2%**	**21.3%**	**31.0%**	**65.5%**
Gains to employees *(b)*	2.5%	4.0%	12.1%	18.6%	-9.7%	9.6%	4.8%	4.7%
Gains to customers *(c)*	26.1%	8.1%	6.6%	40.5%	26.8%	12.5%	20.5%	59.6%
Gains to fuel suppliers *(d)*	-11.0%	-3.0%	19.2%	5.2%	-12.0%	-3.5%	16.7%	1.1%
Gains to suppliers *(e)*	7.9%	-3.0%	-3.2%	1.7%	6.2%	-1.8%	-8.5%	-4.1%
Gains to capital (Before-tax) *(f)*	-19.7%	11.4%	-8.0%	-16.3%	2.0%	4.6%	-2.4%	4.2%

*Sum of gains over decades, 1980 to 2010.

Table 2B. SWA vs AA Comparison by Decade, 1980 to 2010. (Gains computed between companies; SWA scaled to AA's output.)

	AA 1980	SWA 1980	AA 1990	SWA 1990	AA 2000	SWA 2000	AA 2010	SWA 2010
Scale factor (SWA expanded to AA's RPM in each year)	13.9		7.7		2.9		1.7	
Total output (RPM) (=Y)	28,178,057	28,178,057	76,877,841	76,877,841	120,325,000	120,325,000	134,298,000	134,298,000
Revenues (=pY)	3,820	2,965	11,720	9,161	19,703	16,101	22,170	20,828
COGS	3,673	2,116	10,908	7,916	17,120	12,285	17,681	18,047
Materials purchased (ASM) (=M)	46,633,745	41,338,570	124,117,286	126,685,279	167,286,000	170,760,130	165,420,000	169,383,805
Fuel consumed (=F)	1,222	1,030	2,390	2,179	3,037	2,888	2,480	2,472
Cost per gallon Fuel (=f)	1	1	1	1	1	1	2	2
Employment (=L)	43,000	25,601	102,809	66,542	111,100	83,439	78,250	60,055
Capital employed (=K)	2,522	2,729	9,756	10,236	19,393	16,814	15,676	18,620
Wages and benefits (=wL)	1,453	668	3,883	2,759	6,783	4,797	6,847	6,374
Taxes	-75	14	6	214	508	1,117	-35	492
Cost purchased materials (no fuel) (=mM)	1,120	582	5,184	3,460	8,151	5,206	8,008	5,740
Price of output (=p)	136	105	152	119	164	134	165	155
Total Gain* *(a)*		**27.9%**		**14.6%**		**11.4%**		**6.0%**
Gains to employees *(b)*		-9.8%		3.1%		-2.1%		6.0%
Gains to customers *(c)*		25.3%		24.6%		20.2%		6.2%
Gains to fuel suppliers *(d)*		-2.0%		0.2%		1.0%		1.7%
Gains to suppliers *(e)*		-15.6%		-18.8%		-19.4%		-12.9%
Gains to capital (Before-tax) *(f)*		30.0%		5.5%		11.7%		5.0%

*Gain if AA were replaced by SWA in each year

(a) $R=(\Delta Y/Y)-S_L(\Delta L/L)-S_K(\Delta K/K)-S_F(\Delta F/F)-S_M(\Delta M/M)$

(b) $S_L(\Delta w/w)$

(c) $-(\Delta p/p)$

(d) $S_F(\Delta f/f)$

(e) $S_M(\Delta m/m)$

(f) $S_K(\Delta r/r)=R-S_L(\Delta w/w)+(\Delta p/p)-S_F(\Delta f/f)-S_M(\Delta m/m)$

Figure 1. Economic Gain for a Superior Firm

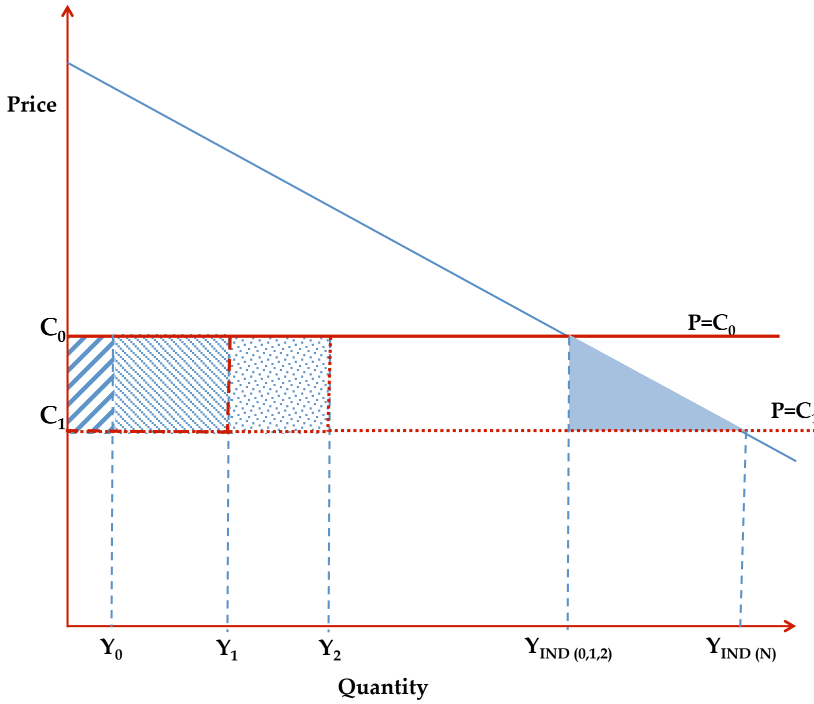
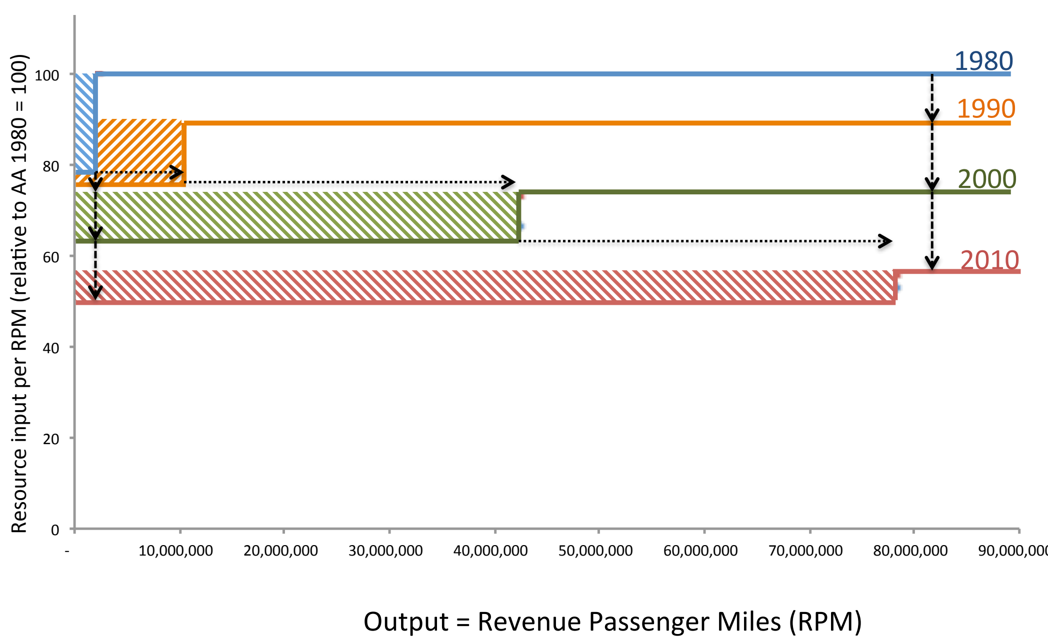


Figure 2. Value Created by SWA Through Innovation and Replication, 1980 to 2010



APPENDIX

Proposition 1: Consider a firm with cost-reducing innovations which do not affect the WTP. Under Assumptions M.1-M.4, the left hand side of Equation (13) is equal to the economic gain from innovation in Equation (6) measured as a percentage of initial revenues.

Assumption M.1: The firm grows by displacing competitors whose average WTP and average opportunity costs per unit of output are the same as the firm's in the first period. Assumption M.2: On average, input providers are paid their opportunity cost in the first period. Assumption M.3: The opportunity cost per unit of inputs is constant over the two periods. Assumption M.4: The quality of inputs is constant over the two periods.

Proof Outline: Economic value created in the 1st period is $\varepsilon_1 = \nu_1.Y_1 + \nu_1.(Y_2\text{-}Y_1) = (\omega\text{-}o)Y_1 + (\omega\text{-}o)(Y_2\text{-}Y_1)$ where ω is *average* WTP, and o is average opportunity costs. Substituting $o = (o_L.L_1+ o_K.K_1+ o_M.M_1)/Y_1$ and simplifying, $\varepsilon_1 = (\omega - (o_L.L_1+ o_K.K_1+ o_M.M_1)/Y_1)Y_2$. By Assumption M.1, and writing $\omega=p + \sigma$, $\varepsilon_1 = pY_2\text{-} (wL_1+ rK_1+ mM_1)(Y_2/Y_1) + \sigma Y_2$. Now, $\varepsilon_2 = \omega.Y_2\text{-} (o_L.L_2+ o_K.K_2+ o_M.M_2)$, which by Assumptions M.3 and M.1 reduces to $\varepsilon_2 = \omega.Y_2\text{-} (wL_2+ rK_2+ mM_2)$. Noting WTP stays constant, and simplifying, the economic gain is $wL_1(\Delta Y/Y_1\text{-} \Delta L/L_1) + rK_1(\Delta Y/Y_1\text{-} \Delta K/K_1) + mM_1(\Delta Y/Y_1\text{-} \Delta M/M_1)$. Substituting $(wL_1+ rK_1+ mM_1) = pY_1$, dividing by pY_1, and substituting $s_L=(wL_1/pY_1)$, $s_k=(rK_1/pY_1)$, and $s_M=(mM_1/pY_1)$, we get $(\Delta Y/Y_1) – s_L(\Delta L/L_1) – s_K(\Delta K/K_1) – s_M(\Delta M/M_1)$.

Proposition 2: Consider a firm with innovations which may affect both unit costs and WTP. Then under Axiom 1 and Assumptions M.1-M.6, the left hand side of Equation (13) is exactly equal to the economic gain from innovation in Equation (6) measured as a percentage of the firm's initial revenues.

Axiom 1: WTP equals price for the marginal customer in the first period. Assumption M.5: There exists a constant-quality price index φ with the following property: $\varphi_2/\varphi_1 = \omega'''_2/\omega'''_1$, where ω'''_1 and ω'''_2 are, respectively, the first-period and second-period WTP for the first-period marginal customer. Assumption M.6: The WTP for every *inframarginal customer, ω^i follows $\omega^i_1 = \omega^m_1 + \sigma$ and $\omega^i_2 = \omega^m_2 + \sigma$.*

Proof Outline: The proof largely follows Proposition 1. A key difference is the treatment of output changes. So, define 'real output', Y^r, such that $Y_1^r=Y_1$; $Y_2^r=Y_2(\varphi_2/\varphi_1)$ and the corresponding change in real output as $\Delta Y^r= Y_2^r-Y_1$. The 2nd period economic gain is: $\Gamma= (\omega_2- \omega_1)Y_2 - (o_2-o_1)Y_2$. Using Axiom 1, Assumptions M5-M6, and substituting $Y_2^r = Y_2(\varphi_2/\varphi_1)$, we get $(\omega_2- \omega_1)Y_2 = p(Y_2^r - Y_2)$. Substituting for o_1 and o_2, and simplifying, $-(o_2-o_1)Y_2 = pY_1(\Delta Y/Y_1) - wL_1(\Delta L/L_1) - rK_1(\Delta K/K_1) - mM_1(\Delta M/M_1)$. Hence, true economic gain is $p\Delta Y^r - wL_1(\Delta L/L_1) - rK_1(\Delta K/K_1) - mM_1(\Delta M/M_1)$. Dividing by pY_1, and substituting for the input shares, we get $(\Delta Y^r/Y_1) - s_L(\Delta L/L_1) - s_K(\Delta K/K_1) - s_M(\Delta M/M_1)$.

Proposition 3a: Consider the economic gain captured by the input providers. If Axiom 1 and Assumptions M.1-M.6 hold, then the economic gain from innovation (measured as percentage of the initial period revenues) captured by customers, providers of labor, capital and materials are, respectively, $-g_Y^r(\Delta p^r/p)$, $g_L s_L(\Delta w/w)$, $g_k s_k(\Delta r/r)$ and $g_m s_m(\Delta m/m)$, where Δp^r is the change in real price and equals $(p_2^r-p_1)$, $\Delta w=w_2-w_1$, $\Delta r=r_2-r_1$ and $\Delta m=m_2-m_1$, g_Y^r, g_L, g_K, and g_M are the growth in real output, labor, capital and materials respectively.

Proposition 3b: Consider the increase in unit returns to the input providers. If Axiom 1 and Assumptions M.1-M.7 hold, then the increase in unit returns associated with the economic gain from innovation (measured as percentage of the initial period revenues) are given by the right hand side of Equation (13). Specifically, the increase in unit returns for customers, providers of labor, capital and materials are, respectively, $-(\Delta p^r/p)$, $s_L(\Delta w/w)$, $s_k(\Delta r/r)$ and $s_m(\Delta m/m)$.

Assumption M.7: The changes Δp^r, $\Delta Y, \ldots \Delta M$ are small relative to their corresponding initial values so that the cross products $\Delta p \Delta Y$, $\Delta w \Delta L$ etc. can be ignored.

Proof Outline: Second period real price is $p_2^r = p_2(\varphi_1/\varphi_2)$. The change in consumer surplus is $(\omega_2- p_2)Y_1 + (\omega_2- p_2)(Y_2-Y_1) - (\omega_1- p_1)Y_1 - (\omega_1- p_1)(Y_2-Y_1)$, which by Axiom 1, Assumptions M.5, and M.6 simplifies to $(\omega^m{}_2- p_2)Y_2^r(\omega^m{}_2/p_1)$. Dividing by p_1Y_1, noting that $p_2^r = p_2(\varphi_1/\varphi_2)$ and simplifying we get– $g_Y^r(\Delta p^r/p_1)$ where $\Delta p^r = (p_2^r - p_1)$ and $g_Y^r = (Y_2^r/Y_1)$. For labor, note that the change in total wages are $(w_2 - w_1)L_1 + (w_2 - w_1)(L_2 - L_1)$, which simplifies to $g_L s_L(\Delta w/w_1)$ where $s_L = w_1L_1/ p_1Y_1$. To prove Proposition 3b, replace g_Y^r, g_L, g_K, and g_M with 1 in the above expressions.

Proposition 4: Suppose there exists a competitor that pays its input owners their opportunity costs and with the same WTP as the focal firm. Let Y_c, L_c, K_c and M_c be the competitor's quantities, p_c, w_c, r_c and m_c be the prices, and ρ a scaling factor such that $Y_c = \rho Y_1$, where Y is the output of the focal firm. Let $G_M = -s_{Lc}(\Delta L_c/L_c) + s_{Kc}(\Delta K_c/Kc) + s_{Mc}(\Delta M_c/M_c)$ where $\Delta Z_c = (\rho Z_1 - Z_c)$, $Z = \{L, K, M\}$, and $s_{Lc} = (w_cL_c/p_cY_c)$, $s_{Kc} = (r_cK_c/p_cY_c)$, and $s_{Mc} = (m_cM_c/p_cY_c)$. Then, $(1/\rho)p_cY_cG_M(Y_2-Y_1)/Y_1$ is equal to replication gain as defined in Equation (6).

Proof Outline: G_M multiplied by $(1/\rho)p_cY_c$ is $(-w_cL_1 - r_cK_1 - m_cM_1) + (1/\rho)(w_cL_c + r_cK_c + m_cM_c)$, which simplifies to $p_cY_1 - w_cL_1 - r_cK_1 - m_cM_1$, the true economic value created by the focal firm in the first period. Dividing by Y_1 gives the additional economic value created per unit in the first period by the firm, and multiplying by (Y_2-Y_1) gives the replication gain.