Measuring Value Creation and Its Distribution Among Stakeholders of the Firm*

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Abstract

We present a general methodology that uses publicly available data to estimate the magnitude of economic value creation and its distribution among a firm's stakeholders. Based on productivity literature in economics, the methodology goes beyond the conventional focus on shareholders and allows the examination of value appropriation by other stakeholders of the firm including employees, customers and government. We illustrate the methodology using historical data on General Motors and Toyota.

Keywords: RBV, Value Creation, Appropriation, Stakeholders, Productivity

1. INTRODUCTION

This paper focuses on two fundamental questions in strategic management:

1. How much economic value does the firm create?
2. Who captures that value?

Many scholars have addressed these questions conceptually (e.g., Brandenberger and Stuart, 1996; Bowman and Ambrosini, 2000; Amit and Zott, 2001; Coff, 2005), but surprisingly few empirical studies have been carried out, particularly on the second question. In this paper we draw from the economics literature on productivity measurement (Harberger, 1998, 1999) to show how the magnitude of value creation and value capture can be estimated for a given firm, using data from standard financial accounting statements and other public sources. The methods presented in this paper can be applied fairly widely, albeit with some limitations.

While our main emphasis is empirical, the methodology may also be helpful from a conceptual standpoint, as it is based on equations that allow the creation and distribution of economic value to be explicitly represented. In the strategic management literature, there is much debate and arguably some confusion about the concept of value creation. Strategic management researchers have often taken an overly narrow view, equating value creation with returns to shareholders. Efforts to expand the scope of analysis to other stakeholders have been ad hoc, addressing returns potentially captured by employees, suppliers or customers, but in a manner that has not been comprehensive or complete.

This narrow conception of value creation has been promoted by standard

concepts and practices. Corporate accounting systems emphasize the measurement of profit, which constitutes the "bottom line" of the firm's income statement. 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 or rent. Such measures are readily available, but they omit important components of corporate value creation.

The standard focus on shareholders stems from the notion of the profit-maximizing firm and from the difficulties of obtaining data on other stakeholders. Although not directly visible in the firm's accounting statements, the returns to other stakeholders are clearly important -- in many industries, the economic value captured by consumers is many times greater than the producer surplus. If firms compete aggressively in an environment where technology is improving, economic value will be created in each period, but most of it will flow to customers.

Another disadvantage of focusing solely on profits is the inability to distinguish between value creation (or destruction) and value transfers. For instance, shareholders of General Motors (GM) have not fared very well since the late 1970s. From 1978 to 1998, nominal returns to GM's stockholders, including dividends and capital gains, were about 10% per annum. By comparison, the S&P Index grew at the rate of about 14% per year during the same period.[1] This information alone is not sufficient to determine if GM's shareholders lost because the firm destroyed economic value (e.g. due to poor operational practices) or because shareholders

were forced to give up to other stakeholders much of the value that was created by GM (e.g., to workers in the form of higher wages and benefits, or to customers in the form of lower product prices). These possible explanations have very different implications for managers and policy makers.

Strategic management researchers operating within the "resource-based view of the firm" have recognized that internal stakeholders such as top management may be in a position to appropriate rents associated with resource-based competitive advantage. The distribution of bargaining power among the various stakeholders has been shown to be crucial in determining the allocation of rents (Bowman & Ambrosini, 2000; Castanias & Helfat, 1991; Coff, 1999; Lippman and Rumelt, 2003b). However, the resource based view does not provide much guidance on the distribution of bargaining power and hence the allocation of any rents earned by the firm. Given that rents may flow to various stakeholders, Coff (2005) argues that a firm's competitive advantage is "at best…loosely coupled to firm performance" and that "the bulk of a firm's competitive advantage is not observable in the traditional measures of firm performance" such as financial returns.

Our methodology addresses some of these problems by introducing a framework for assessing value creation and capture. We show how research on stakeholders and rent appropriation can be made more quantitative by applying basic concepts from the productivity literature. The lynchpin of our approach is that, when appropriately defined and measured, value creation by a firm is quantitatively equivalent to improvements in the firm's efficiency of resource use. This allows us to

[1] Data from http://finance.yahoo.com/.

exploit a simple accounting identity that equates the revenues of a firm to the sum of all payments made to its stakeholders. Our approach is flexible and reasonably comprehensive in terms of tracking the flow of value among stakeholders. It allows us to include or exclude stakeholders depending on data constraints. Moreover, our methodology not only helps to understand the distribution of new value created by the firm but also any transfers of existing value among the stakeholders.

We illustrate our methodology with examples drawn from the global auto industry, where the range of corporate performance has attracted much attention. Among the automotive producers, it is well known that Toyota has created enormous economic value in recent decades. By comparison, General Motors' value creation has been meager despite the firm's large size. Our approach allows us to quantify and compare the value created by Toyota and GM, and to examine its distribution among stakeholders of each firm.

The paper is organized as follows. Section 2 defines the concepts of value creation and value capture as used in this paper. Section 3 shows that value creation, as defined in this paper, is equivalent to improvements in efficiency of resource use by the firm. In Section 4 our methodology and the data requirements for our approach are discussed. Section 5 applies the methodology to data on Toyota, General Motors and Nissan. Finally, we discuss limitations of our methodology, propose extensions, and draw conclusions.

2. VALUE CREATION AND VALUE CAPTURE

Value Creation

A firm creates value by producing and delivering goods/services at a cost that is lower than what the consumer is willing to pay for that good/service. In the neoclassical economic view of the firm, this value creation can be divided into two components: “producer surplus” (profits) and “consumer surplus.” The firm is owned by its shareholders, who capture any residual rents or profits ("producer surplus”) that remain after the shareholders have paid for all the other resources used for producing the good/service. Typically, the residual rents or profits are generated by the firm's superiority relative to competitors. In addition, the firm creates value that flows to consumers in the form of "consumer surplus." Consumers enjoy this surplus to the extent that the price they pay for the firm's product is less than their maximum willingness to pay. The total economic value created by the firm at any point in time is equal to the sum of the producer and consumer surplus. This can be represented graphically as the shaded area between the demand and cost curves (Figure 1).

The value created by the firm changes over time, mostly due to innovations and improvements implemented by the firm.[2] Specifically, value creation increases when these innovations increase the consumer’s willingness to pay (for instance, when the quality of the product improves) or reduce the cost of supply (e.g. as a result of adoption of alternative distribution channels such as the Internet). Suppose

[2] Value created by a firm may also change not as a result of innovations but due to a change in the size of the firm; i.e., the firm simply changes the quantity of resources

the firm depicted in Figure 1 reduces its cost in period 2 while keeping output and the market demand curve constant; the incremental value creation will be the darkly shaded area in Figure 1. Note that price does not enter the picture since it does not affect value creation – it only decides how value is divided between producers and consumers.

The preceding discussion suggests that we might measure value creation in two ways: (a) statically, as the value created at any point in time, or (b) dynamically, as the change in total economic value. The empirical methodology in this paper adopts a dynamic approach and measures the increment in economic value created by the firm from one period to the next. We discuss the advantages of this approach later in this section.

Value Capture

Under the neoclassical view, there are only two stakeholders who can capture the value created by the firm: consumers and producers. Consumer surplus increases if the price of the product falls or if product quality improves without being offset by an equivalent increase in price. As owners of the firm, shareholders capture a greater increment of economic rent if the firm is able to reduce its cost relative to competitors or improve product quality in a way that allows the firm to sell its product at a higher price relative to cost.[3]

The neoclassical view does not envisage broader stakeholders of the firm,

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used without changing the efficiency of resource use. Our methodology does not consider this as value creation. For a fuller discussion, see Section 3.

such as employees, capturing any part of the surplus or economic value created. Employees, including managers and the CEO, are merely "factors of production" that are subject to the forces of the labor market and are paid a market wage. Similarly, the firm is assumed to buy its inputs from suppliers at a market price; hence, suppliers do not capture any surplus. Under the assumption that these factor markets are competitive, employees and suppliers have no power to extract any of the rents potentially generated by the firm.[4]

The "resource-based view of the firm" (RBV), relaxes these assumptions about perfection of the firm's factor and product markets (Barney, 1986). Castanias and Helfat (1991) were the first to describe how managers and employees may be able to capture many of the quasi-rents attributable to their individual and collective skills. Small numbers bargaining and the creation of firm-specific human capital gives employees (and other stakeholders) the ability to tap into the firm's value creation beyond what they would enjoy under fully-competitive market forces (Lippman and Rumelt, 2003a and 2003b). Indeed, the returns captured by top management have increased dramatically in recent years, a trend that has been widely discussed in the scholarly and business literature (Bebchuk and Grinstein, 2005; Murphy, 1997). The RBV provides a framework for understanding how employees and other resource owners may be able to capture some of the rents attributable to the resources that they control.

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[3] These two ways of value creation correspond to Porter's notions of cost and differentiation advantage.

[4] Wages and salaries may nevertheless rise over time, reflecting the increasing skills of the workforce.

In this study, we provide a framework for measuring the economic value created by the firm, as well as the distribution of this value among various stakeholders. We take a dynamic approach, focusing on the change in value creation from one period to the next. Specifically, we focus on value created by the firm as it improves its efficiency of resource use. We adopt such an approach for two reasons. First, it allows us to draw from established methods for assessing productivity change that have been developed in the economics literature. We show in the next section that the change in value created by the firm is exactly equivalent to the firm's change in total factor productivity (correctly measured), which is a measure of the improvement in efficiency of resource use. A second reason for a dynamic approach relates to the difficulty of measuring "consumer surplus." To estimate the total consumer surplus at any point in time requires complete information on the shape of the demand curve for the firm's product (or alternatively, the maximum "willingness to pay" of each consumer). By focusing on changes over time we are largely able to sidestep this problem and estimate the magnitude of consumer gains from changes in product price.

Equivalence between Value Creation and Productivity Growth

The basic intuition behind our approach for measuring value creation is straightforward. From one period to the next, a firm creates value if it produces additional output (greater quantity or higher quality, as reflected by customer willingness to pay) using the same amount of resource input.

Consider an auto producer such as Toyota, whose performance has been improving over time. Like all firms, Toyota transforms resource inputs, including

labor, capital and materials, into useful outputs. From one period to the next, the economic value created by Toyota increases if the company produces the same output with less input (or equivalently, more output with the same level of input). For example, assume that Toyota produces one million cars in a given year; then in a later year, Toyota produces the same number cars of identical quality but requires 10% less capital, labor and materials. In this case, Toyota's resource efficiency ("Total Factor Productivity") has grown by 10%. While Toyota's output has not changed, the firm has freed up resource inputs that can be used elsewhere in the economy.

Alternately, assume that Toyota produces one million cars in the first year, and one million cars of higher quality in the second year, using the same amount of labor, capital and materials input in both years. Consumers are willing to pay 10% more for Toyota's cars in the second year because of their enhanced quality. In this case, as in the previous example, Toyota has created 10% more economic value. If prices are recorded and interpreted correctly, in both cases Toyota will also be found to have achieved a 10% gain in the efficiency of resource-use. These examples show that incremental value creation by the firm is equivalent to gains in total factor productivity. Both are achieved through resource savings, quality improvements, or some combination.

3. METHOD

We draw from the productivity literature (Harberger, 1999) to formalize these ideas. Our unit of analysis is a firm whose employees (L) utilize the firm's capital (K) to transform materials and other purchased inputs (M) into useful output (Y).

A payment identity holds at any point in time: the firm's total revenues must be equal to the sum of payments to "stakeholders" who provide necessary factors of production to the firm. Defining Y as the firm's real output and assuming only three stakeholders (labor, capital and materials providers), we can write this identity as

$$pY \equiv wL+rK+mM \qquad (1)$$

Where:

p is the price of the firm's product,

Y is the firm's total output (measured in *real* or price-adjusted terms),

L is the quantity of labor (total number of employees),

K is the amount of capital employed by the firm,

M is the quantity of materials and other purchased inputs,

w is the wage rate,

r is the rate of return on capital, and

m is the price of purchased materials.

This equation denotes that the firm's revenues must equal its factor payments. Note that an equivalent change in all prices (e.g., a doubling of p, w, r and m) leaves the essential relations unchanged.

Now consider the next period when these variables change to, say, $p+\Delta p$,

$Y+\Delta Y$ and so on. Assuming that the changes are small relative to the initial values, for the subsequent period, we can write[5]:

$$p\Delta Y+Y\Delta p = w\Delta L+L\Delta w+r\Delta K+K\Delta r+m\Delta M+M\Delta m \quad (2)$$

Dividing by pY, noting that the shares of labor, capital and material in the revenues are $s_L=(wL/pY)$, $s_k=(rK/pY)$ and $s_M=(mM/pY)$ and re-arranging Equation 2, we can write:

$$(\Delta Y/Y)-s_L(\Delta L/L)-s_K(\Delta K/K)-s_M(\Delta M/M) = s_L(\Delta w/w) + s_k(\Delta r/r) + s_m(\Delta m/m) – (\Delta p/p) \quad (3)$$

This formula represents the fact that the incremental value created by the firm in each period must equal the incremental value distributed.

Consider the left hand side of Equation 3 and define R such that:

$$R = (\Delta Y/Y) - s_L(\Delta L/L) - s_K(\Delta K/K) - s_M(\Delta M/M) \quad (4)$$

In this formulation, the firm's revenue is assumed to be paid out to those who provide the firm with labor, capital and materials; hence the factor shares sum to unity ($s_L + s_K + s_M = 1$). In the economics literature on productivity, Equation (4) is the Total Factor Productivity (TFP) residual (Hulten, 2000). It represents the increase (decrease) in output that is not attributable to increases (decreases) in the quantities of inputs used and hence, captures the *percentage change* in the efficiency of resource use by the firm. This is also precisely the increment in economic value

[5] This is equivalent to taking a total differential of the payment identity for the initial period.

created by the firm as a percentage of the firm's initial revenues. For instance, in the previous example, if Toyota produces 10% more cars with the same inputs (or produces cars for which consumers are willing to pay 10% more), then ($\Delta Y/Y$) = 10% and all other terms are 0. Hence, the incremental value created is R = 10%, which is also the increase in resource efficiency (or TFP) of Toyota.

Now we consider how the economic value created by the firm is distributed among the firm's stakeholders. Equations 1, 2 and 3 allow for the identification of value flowing to the following stakeholder groups: shareholders, employees (including management), suppliers and customers. We assume that the firm's customers are the final consumers of the good or service produced by the firm.

Our methodology hinges on the fact that the firm's "productivity residual" can be computed in two different ways. Consider the right hand side of Equation 3, which represents the distribution of productivity gains among the various stakeholders. We can write:

$$R = s_L(\Delta w/w) + s_k(\Delta r/r) + s_m(\Delta m/m) - (\Delta p/p) \quad (5)$$

The first term on the right hand side of Equation (5) represents the gains appropriated by labor; the second term represents the gains to capital; the third term represents the gains captured by suppliers; and the last term indicates the benefits to customers.

Consider our hypothetical example of Toyota, in which the firm generated a

10% increase in economic value, equivalent to the gain in total factor productivity between the first and second periods. In this case R = 10%. How might that gain in economic value be distributed? One possibility is that the gain flows entirely to customers in the form of a 10% reduction in product price (i.e., $\Delta P/P$ equals -0.10). This might arise if all producers in the auto industry achieved a similar 10% productivity gain, and the firms compete aggressively enough that the entire gain flows to consumers.

Another possibility is that the productivity gain flows partially to consumers and partially to other stakeholders. For example, if the productivity gains of Toyota's rivals are smaller than Toyota's, it is likely that only some of Toyota's gain 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 returns represented by Equation (5) applies even in the absence of any productivity gain by the firm (i.e., when R is zero or even negative). Consider the example of Wal-Mart, the discount retailer, which has been criticized for squeezing its American suppliers and moving much of its supply base offshore in recent years. For Wal-Mart, as for any retailer, outside purchases represent a large share of total revenue, and hence reductions in the price of purchased materials are critically important in reducing the firm's cost structure. If Wal-Mart abandons its US-based suppliers in favor of cheaper offshore purchases,

the original suppliers suffer a loss that is offset by potential gains to other Wal-Mart stakeholders. To make the example more specific, assume that in the case of Wal-Mart, the share of purchased materials as a fraction of total revenues, s_m , equals 60%. If Wal-Mart achieves a 30% reduction in the cost of all purchased inputs by switching to offshore suppliers, Wal-Mart's other stakeholders obtain a benefit equal to 18% (= .60 x .30) of Wal-Mart revenues.

These stakeholders gain even in the *absence* of any productivity improvement by Wal-Mart. (In this case, value is transferred, but there is no value creation.) Wal-Mart might choose to pass the entire cost savings forward to customers in the form of an 18% price reduction. However, it is likely that some of the cost savings would go to shareholders, and some, perhaps, to management and other employees.[6]

4. DATA REQUIREMENTS AND ESTIMATION

Various data are required to estimate equations (4) and (5): company data on the quantity of output (Y), inputs (L, K and M), and factor shares (s_L , s_k , and s_m); and "price" data on wages (w), the rate of return the capital (r), the price of purchased materials (m) and the price of the firm's output (p). These data requirements may seem overwhelming, but most of the required information is readily available from company financial statements and other public sources. One exception, however, is

[6] In this example, bargaining between the Wal-Mart and its initial suppliers ends with a large transfer of value away from the suppliers. In other industry value chains, though, suppliers have captured much of the economic rent. For instance, in the personal computer industry, Microsoft and Intel exploited their bargaining power to obtain a substantial portion of the value created by the industry as a whole (Gadiesh and Gilbert, 1998).

information relating to the price and quantity of the firm's purchased inputs (m and M). Given that these data are seldom available to outsiders, we ignore inputs from raw materials suppliers and reformulate the empirical model in terms of the firm's "value added."

Value added is equivalent to revenue minus the cost of purchased inputs. Value added can be computed from firm's accounting statements by summing up the following "factor payments": total labor compensation, depreciation and amortization, rental payments, net income after taxes, and all tax payments.[7] In the reformulated model that we estimate, output (Y) is replaced by value added. (Henceforth we use V to represent value-added).

The input factor shares are computed by taking the firm's payments to each factor and dividing by the total value added. Payments to labor are not a required item for reporting by US firms, and therefore it is not possible to estimate the model for all American companies. However, a large number of US firms do report sufficient information on labor compensation[8], and such payments are a required item in accounting systems used in Japan and much of Europe (which use a value added approach). Likewise, data on the total number of employees (L) are not universally reported, but they are typically reported by firms that provide information on labor compensation.

[7] Lieberman and Chacar (1997) describe the computation of value added from company financial statements.

[8] For the period 1980-2003, Compustat has complete labor data for about 18,000 firm-year observations of about 87,000.

The equations presented in the previous section do not recognize any tax payments made by the firm to national and local governments. Taxes can be incorporated in the model in various ways. We take government as an entity that taxes the shareholder returns. Hence we replace rK, the pre-tax return to capital, with r*K + τrK, where r* is the after-tax rate of return, and τ is the tax rate.[9] One might view government as a stakeholder that provides a flow of useful services to the firm (infrastructure, legal protection, basic security, etc.) and receives tax payments in return.

Reflecting the reformulation of our model in terms of value added, and the inclusion of tax payments, the estimated model consists of the following two equations:

$$R = (\Delta V/V) - s_L(\Delta L/L) - s_K(\Delta K/K) \quad (6)$$

$$= s_L(\Delta w/w) + s_K\Delta r/r - (\Delta p/p) = s_L(\Delta w/w) + s_{K^*}\Delta r^*/r^* + s_T\Delta r/r + s_T\Delta\tau/\tau - (\Delta p/p) \quad (7)$$

Where

τ represents the tax rate, as described above,

Δr is the change in before-tax return to capital,

Δr* is the change in after-tax return to capital,

s_L and s_K are the labor and pre-tax capital shares of value added (s_L+s_K =1),

s_{K^*} is the after-tax capital share of value added, and

[9] We compute the tax rate as a proportion of the gross returns to capital, i.e., value added minus wages and benefits. The results of the model are slightly changed if labor input is taxed, or if government services are taken as a fixed factor of production, or as a factor proportional to output.

s_T is the tax share of value added (such that $s_K=s_{K^*}+s_T$).

These two payment identities represent the fact that the economic value created by the firm (Equation 6) must equal the value distributed by the firm (Equation 7). This reformulation now enables us to assess value creation and its subsequent distribution among consumers, labor, capital and government. The data required to estimate Equations (6) and (7) are readily available for many companies. In the next section, we illustrate how these equations can be used to study value creation and value capture by applying them to data on global automotive companies.

5. APPLICATION OF OUR APPROACH

We applied the methodology represented by Equations (6) and (7) to historical data on Japanese and US auto companies. The methodology involves first estimating the productivity gains (or change in the flow of economic value), and then estimating the distribution of those productivity gains to consumers, labor, capital and government.

We begin by using Equation (6) to estimate the increment in economic value created by the firm from one period to the next. In order to do so, we use the following data items:

- V and L, the firm's real value added and employment, are taken from the firm's accounting statements as discussed above
- Capital (K) is taken as the sum of net plant, property & equipment and raw material and work-in-process inventories in the case of General Motors. For the Japanese companies, capital is taken as the sum of

tangible fixed assets and raw material and work-in-process inventories

- Labor's share (s_L) is computed by dividing total labor compensation (including benefits, managerial bonuses, and other fringes, but not stock options) by value added
- Capital's share is computed as a residual, 1- s_L. This follows from the assumption that the firm's value added is paid out to labor and capital (where the latter payments include all taxes), and hence the factor shares sum to unity ($s_L + s_K = 1$).

Applying these definitions to equation (6), we compute the productivity gains, R.

We use the R computed from equation (6) along with equation (7) to estimate the value distribution among the various stakeholders. In order to so, we use the following additional data items:

- Wages (w) are computed by dividing total labor compensation (including benefits, managerial bonuses, and other fringes but not stock options) by the number of employees.
- Tax payments (τrK) are computed by summing up all tax payments by the firm, including income, excise and payroll taxes.
- Output prices (p) are defined as index numbers and computed using publicly available data on Producer Price Indexes (PPI) for motor vehicles and GDP deflators in Japan and the United States. We set all price indexes at 1.00 for the starting year in our computations (1978). For subsequent years, we compute the output price index to be the

ratio of the PPI for motor vehicles to the GDP deflator. Hence, our approach assumes that general inflation in the economy follows the GDP deflator, but changes in the firm's (quality-adjusted) output prices follow the motor vehicle PPI. Accordingly, we convert wages, capital stock and tax payments from nominal to real values using the GDP deflator; we convert value added from nominal to real using the motor vehicle PPI. Later in the paper we discuss these assumptions in greater detail.

These data items give us all but four variables (r, r*, Δr and Δr^*) in Equation (7). Hence, we can compute the gains appropriated by labor (the first term on the right hand side of Equation 7), the gains captured by the government ($s_T \Delta r/r + s_T \Delta \tau/\tau$) and the benefits to consumers (the last term in Equation 7). To compute the after-tax gains to capital, we first compute the before-tax gains using Equation 7 (i.e., $s_K \Delta r/r = R - s_L(\Delta w/w) + (\Delta p/p)$) and subtract from it the gains captured by government.

Tables 1, 2 and 3 give our calculations pertaining to value creation and distribution for Toyota, General Motors, and Nissan, respectively, over two time periods: 1978-1988 and 1988-1998. We selected these periods because they span across decades from comparable points in the business cycle. Given the reporting of our financial data, all figures for Toyota and Nissan are limited to operations in Japan, whereas the data for General Motors pertain to worldwide operations. If the international operations of Toyota and Nissan were included in our calculations, the estimates of total value creation by these firms would likely be larger.

The calculations for Toyota are shown in Table 1. Panel A of the table provides nominal data collected from Toyota's financial statements and other public sources. We converted these figures to real quantities by deflating them (wages and capital by the GDP deflator; value added by the PPI for motor vehicles normalized to 1978). We used the resulting values to compute the variables in Equation (6) including the changes in input quantities and shares of labor, capital and taxes (bottom panel), and ultimately, to estimate the productivity gain R.

Over the two-decade period represented by the data in Table 1, Toyota grew rapidly and created substantial economic value. Toyota's total factor productivity increased dramatically from 1978 to 1988, growing by a multiple of 72% (Panel B). Toyota also created substantial value over the period from 1988 to 1998. In percentage terms, Toyota's gains in 1988-98 were smaller than those shown for the previous decade, but in absolute terms they were larger, reflecting the increased size of the company.

Having estimated the incremental value created by Toyota, we used Equation (7) to estimate how these productivity gains were distributed. Gains to employees were computed as the product of labor share and the percentage change in real wages (the first term on the right hand side of Equation 7). The value flowing to government was computed as discussed earlier. The percentage change in the output price index provides the benefits to consumers. Finally, the returns to capital were obtained by solving Equation 7 as described earlier in this section.

All of the stakeholders in our analysis (labor, shareholders, government and

consumers) benefited from these gains made by Toyota from 1978-88, and all but the government gained during 1988-98. Panel B of Table 1 shows how the gains were distributed. The relevant values are shown in two ways:

(1) as components of the productivity growth rate, taken as a percentage of Toyota's value added in each base year, and

(2) as a total absolute value, taken in millions of 1978 yen.

Interestingly, the largest benefits during 1978-88 went to government. Tax payments by Toyota in 1988 were nearly as large as total labor compensation. Thus, the Japanese government has been a major beneficiary of Toyota's remarkable success. Capital owners also fared well, capturing 17% of productivity gains in the first decade and 12% in the second. Finally, labor and consumers benefited from higher wages and lower car prices. On the whole, the productivity gain was split remarkably evenly among these stakeholders.

Table 2 presents comparable calculations for General Motors. The pattern of value creation and distribution at GM contrasts sharply with the pattern at Toyota. Our analysis shows a 6% decline in total factor productivity for GM over the first decade of our sample, and a very small -0.4% decline over the second decade. Hence, we find net value destruction by GM and a decrease in GM's efficiency of resource use since the late 1970s.[10] Shareholders were particularly hard hit; they gave up even more than GM's overall efficiency loss. After-tax gains to capital fell by

[10] Note that GM may have created economic value over this period, but our analysis demonstrates that the increment was negative, i.e., GM created less value in 1998 than in 1978.

8% in the first decade and 19% in the second. The gains captured by the government in the form of tax payments also declined.

Despite the overall destruction of value (or absence of value creation) by General Motors, some stakeholders gained over the period of our sample. One beneficiary was the consumer, who gained from the decline in the price of motor vehicles produced by GM. Another beneficiary group consisted of the employees of General Motors, who gained through higher wages and benefits. The positive values for these groups in both periods contrast with the sharply negative values shown for returns to capital. This implies that in the case of General Motors, value was transferred from shareholders to the firm's employees and customers.

The contrast between Toyota and GM, as shown in Tables 1 and 2, is dramatic. In general, the Japanese automotive industry has performed better than the US industry in recent decades, and hence the possibility exists that the differences in value creation and distribution shown in these tables stem primarily from differences between the US and Japan. To verify that this is not a suitable explanation, we present data on Nissan in Table 3.

Table 3 shows that Nissan's productivity performance was intermediate; better than GM but far below Toyota's outstanding benchmarks. Given our reliance on industry price indices to measure gains to consumers, the gains flowing from Nissan to consumers, viewed in percentage terms, are identical to those shown for Toyota. Reflecting the competition between Nissan and Toyota in the labor market, the benefits to labor, in percentages, are similar for both companies. Nissan failed,

however, to match Toyota's strong gains to capital; indeed, Nissan's incremental gains to capital are negative.[11] Nissan's tax payments, already smaller than Toyota's in 1978, declined over the decades of our sample as Nissan's profits fell.

Another possible explanation for the dramatic difference between Toyota and GM could be that our approach examines the *change* in value created but not the *level* of value creation. Hence, it is possible that in 1978, GM had a much higher productivity than Toyota, and that in 1998 the two firms had similar productivities. The patterns in Tables 1 and 2 could arise if Toyota was merely catching up to GM's productivity levels. Though our approach does not provide a rigorous test to compare the *levels*, we can attempt a crude comparison. In order to do so, we "expand" Toyota to GM's size by equating Toyota's value added to GM's in 1978 and multiplying Toyota's capital and labor by the ratio of GM's value added to Toyota's value added. This is done in Table 4 and Appendix 1. Although the alternative estimates in the appendix differ in magnitude, they all suggest that GM was slightly more efficient than Toyota in 1978. This differential, however, is small relative to the subsequent productivity growth shown for Toyota in Table 1. Hence, the large differences in value creation (between Toyota and GM) observed in Tables 1 and 2 cannot be linked to an initial difference in productivity levels.

[11] Note that the *returns* to Nissan's capital owners may have been positive during this period. The negative numbers shown here imply that capital owners did not capture any part of the productivity gains. In fact, competition in the labor and product markets forced Nissan's capital owners to transfer all the productivity gains (and then some more) to employees and consumers, thus lowering their own returns.

6. DISCUSSION

The approach to measurement of value creation and value capture described above is based on simple accounting identities, and thus it is quite general. In this section we elaborate on the key assumptions and potential limitations of the model. Many of these limitations relate to the difficulties of correctly measuring prices and quantities. We also consider ways that the model and measures can be elaborated.

The methodology itself is purely descriptive and focuses solely on measurement – it is agnostic about why the firm performs well or poorly, how value is created and why some stakeholders capture more value than others. Nevertheless, it provides an empirical tool to examine some of these questions, specifically by generating quantitative measures of value creation and distribution, which can then be analyzed. For instance, one could use the approach to estimate the value captured by consumers and investigate how the magnitude of consumer gains may be influenced by factors such as industry rivalry, buyer power, technological change, product characteristics, etc.

Another advantage of our method is its close relation to traditional measures of firm performance such as return on assets. Specifically, our measure of the gains to capital ($s_k \Delta r/r$ from Equation 5) represents the part of the additional value added, achieved through productivity gains, that flows to shareholders. (For simplicity, we ignore taxes.) This would also equal the incremental cash flow to shareholders. For instance, consider a firm with a capital (K) of 250 million dollars, and an initial value added (pY) of 100 million dollars, of which 75 million went to workers as wages and

benefits (wL), and 25 million as profits to capital (rK). Then, its initial return on assets would be 10%. If this firm increased its productivity by 2%, 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 productivity gains. The new return on assets can be obtained by adding the incremental 2 million (2% of 100 million) to profits, and dividing by the capital base to get 10.8%.[12] Hence, gains to capital in Equation (5) will be positively correlated with increased return on assets as measured traditionally.[13]

The methodology interprets a quantity that is essentially a "residual" (Equations 4 and 6) as being the result of productivity improvement efforts by the firm. In particular, all changes in a firm's output not explained by changes in input quantities are attributed to efficiency improvements and hence called "value creation." This interpretation, which largely follows the economics literature, is critical to our methodology and deserves some discussion. For a single-input case, where productivity can be intuitively defined as the ratio of output to input, the residual is equivalent to the increase in productivity.[14] Equations (4) and (6) are only extensions

[12] Given that our calculations for Toyota and GM take the capital stock, K, as a conventional accounting measure of the firm's assets, r can be interpreted as the gross return on assets. Part of this return represents depreciation; in the illustrative example presented, if the rate of economic depreciation was 10%, the return net of depreciation would initially be zero, rising to 0.8% at the end of the period.

[13] Our measures are directly linked to accounting measures of performance, but not to forward looking measures, such as the firm's stock price and market value. The latter are based upon anticipated returns; in this example, if the 2% productivity gain and its flow to shareholders were fully anticipated, there would be no change in the firm's market value.

[14] Let Y and L be the initial quantities of output and input. If these increase to $Y+\Delta Y$

to the case of multiple inputs. Hence, if all quantities are correctly measured and adjusted for quality variations, and if all inputs have been taken into account, the "residual" can be appropriately interpreted as a productivity gain.

Measurement issues arise because of two closely linked reasons: (a) real output quantities are not directly observed, and (b) we cannot completely adjust for quality changes in inputs and outputs. Because the firm's real output quantity is not directly observed, we have to infer it indirectly. Firm-specific prices solve this problem, but they are not normally available. Hence, we divide revenues (or "value added") by an industry price index to get a measure of output quantity. However, this brings to the fore all the difficulties in correctly computing the price index. First, price indexes are publicly available only at the industry level. If a firm's product portfolio is significantly different from the 'products basket' used for calculating the index, errors will creep into the computations of value creation and value distribution. Second, it is difficult to correctly adjust for improvements in the quality of the output. Ideally, the price index should reflect quality improvements - for instance, if the (real) dollar price of a 1 Gigabyte Memory for 2005 is the same as that of a 64 Kilobyte Memory in 1990, then the 2005 memory price index should be many times lower than the 1990 index. Though significant improvements have been made in index computations using hedonic pricing methods, it is unlikely that adjustment for all quality improvements can be made. Hence, for industries and firms that make substantial

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and $L+\Delta L$, "productivity" changes from $p_0=(Y/L)$ to $p_1=((Y+\Delta Y)/(L+\Delta L))$. Assuming the changes are small relative to initial values, it is easy to show that $(p_1-p_0)/\ p_0= (\Delta Y/Y)-(\Delta L/L)$. The term on the right hand side is simply the residual R in Equation (3) for a single-input case.

gains in output quality over time, our method is likely to understate the magnitude of value creation and its flow to consumers.

Our use of an industry-specific output price index assumes that the quality-adjusted prices of all domestic competitors are identical. Product market competition ensures that such equality is approximately met, but deviations may arise. For example, firms may undercut the prices of competitors in an effort to gain market share (or may lose share if they lag the price cuts of rivals). In this case, information on trends in market share, combined with assumptions about the elasticity linking market share and relative price, may allow the firm's price of output to be more correctly identified. For example, Toyota's market share gains in the United States in recent years suggest that the firm has set its quality-adjusted prices below those of rivals. Moreover, innovative firms may introduce new goods that are highly valued by consumers. To the extent that these goods are sold in the market at a price premium that reflects their superior quality and customer valuation, our method will appropriately capture their value as higher real output. Even so, the price of the product reflects the willingness-to-pay of the marginal customer; it is possible that infra-marginal buyers enjoy a large consumer surplus that is not captured by our method. One example is hybrid cars, where Toyota has been a pioneer. Some buyers may enjoy very high value from these cars, greatly exceeding their premium price. Such consumer surplus generated by new and innovative products is not captured by our model, although it could be estimated in supplementary calculations.

Further potential adjustments relate to the firm's international domain of operations. Our accounting data for Toyota and Nissan are limited to the operations

of these two firms within Japan. Hence, our use of Japanese price deflators is appropriate for these companies in our computations. Increasingly, though, Toyota and Nissan have become global producers. A full analysis of value creation must include their plants abroad, and particularly, their now-extensive manufacturing facilities in North America. But to do so adds greater complexity; for example, if data for different countries are combined, the price deflators should be taken as a blend of national indexes, adjusted for exchange rates. In the case of General Motors, we have simply assumed that US price indexes apply across the firm, even though the GM data include major operations outside the United States.

The inability to observe quality variations in inputs leads to a different type of error. Suppose GM is able to produce the same number of cars with 10% less labor only because it re-trained and augmented its workers' skills. When adjusted for the improvement in worker quality, there has been no change in the quantity of labor used and hence, no change in productivity. However, using the number of employees as the measure of labor input, we see a reduction in the quantity of labor and consequently, a spurious 10% productivity gain.

Following such worker training, wages may rise, reflecting the improvement in labor quality as well as the potential exercise of bargaining power. In this case GM has invested in "human capital" but may need to pay a premium to retain the more highly skilled employees. Labor unions may be able to influence the magnitude of this premium. Wages may also rise over time simply because of general labor market forces. These factors might be distinguished given data on worker training and shifts in relative wages observed for the firm, its industry, and the overall

economy. Even so, in our model it is likely that improvements in worker training and education will appear as gains in productivity, and such gains will be reflected, at least in part, in higher wages. Almost certainly, the gains captured by employees at Toyota, Nissan and GM, as shown in Tables 1, 2 and 3, are partly attributable to such increases in worker skill and quality.

Another assumption of our calculations is that the GDP deflator corrects for inflation in the prices of all inputs. This limitation can be overcome by applying different price indexes to deflate wages, capital stock, etc. For international firms, though, the problem is less tractable. Some bias is introduced into Table 2 given our use of U.S. GDP deflators to adjust the wages of GM workers located abroad. Viewed in perspective, though, these errors are likely to be smaller than those arising from other sources.

In our empirical approach, gains to consumers are given by reductions in the firm's output price relative to the GDP deflator. This may appear to be a limitation, since it suggests that a firm whose output price merely follows the rate of inflation in the economy will fail to create any value for consumers. However, a broader perspective shows that a full analysis of gains to consumers must incorporate the gains they receive as recipients of higher wages and profits. Consider an economy where all firms achieve identical rates of productivity growth, and the changes in their output prices are also identical. In such an economy, all product prices move together, precisely tracking the GDP deflator. It is clear from Equations 4 and 5 that to accommodate the growth in TFP, wages and returns to capital must rise relative to output prices. Hence, consumers gain through their dual role as employees and

shareholders: they receive higher wages and returns to capital, relative to product prices. Returns to capital are unlikely to rise indefinitely, so over long periods of time the productivity gains in an economy flow primarily into higher wages. Indeed, in most economies the gains enjoyed by consumers come from the reduction in average prices *relative to wages*.

"Spillovers" are another reason why our approach will tend to understate the extent of value creation by innovative firms. Our approach measures only the value creation that goes to the firm's own stakeholders. However, a given firm's innovations can "spill over" to other firms and their stakeholders. For instance, many auto companies have now adopted key features of the "Toyota production system" and have greatly improved their efficiency and product quality as a result. Such gains from dissemination of the Toyota's basic methods have gone to stakeholders of Toyota's competitors, with customers likely being the major beneficiaries. These "spillovers", though fundamentally attributable to Toyota's efforts, are excluded from our estimates of Toyota's value creation because they are not reflected within Toyota's accounting statements.

Spillovers are one form of market "externality;" other externalities, which may be positive or negative, are excluded from our analysis. Thus, our analysis fails to capture the impact of negative externalities such as pollution resulting from the operation of the firm; if negative externalities are important, our approach will overstate the firm's true value creation.

Furthermore, our approach does not directly capture one particular mode of

value creation: a highly productive firm can create value simply by growing, even if it achieves no gain in productivity from one period to the next. In such a case, the firm is not improving its efficiency of resource use – it is simply "replicating" itself. If the firm grows by taking market share away from less productive rivals, then society benefits as a result of resources being re-allocated to a firm where they can be utilized more productively. In our approach, value creation in a given period occurs only when the firm's efficiency increases relative to its efficiency in the prior period. Hence, our approach shows positive value creation only if the firm makes improvements with regard to its resource-use efficiency. Over long periods of time, the errors induced by ignoring this simple replication type of value creation are probably small. Though it is possible that firms grow for short periods without any improvements in their productivity, it is unlikely that they can continue to grow over many years without productivity gains.

These considerations suggest that our calculations of value creation by Toyota are likely to be conservative on balance. Adjustments for Toyota's positive spillovers, infra-marginal consumer surplus, growing market share, and international scope would be expected to yield even larger estimates of value creation than those shown in Table 1. On the other hand, adjustment for rising labor quality would reduce Toyota's estimated productivity gain, but this adjustment is presumably small.

Notwithstanding these problems, the methodology's usefulness lies in its ability to offer *quantitative* insights into the distribution of value among the firm's stakeholders. It is particularly useful because none of the current methodologies used in the strategic management field offer such a possibility, which has constrained

a detailed quantitative investigation of questions related to value distribution. The limitations discussed above only serve as reminders to be careful when interpreting the quantitative results.

Another important advantage of this method is its flexibility to incorporate additional stakeholders, should data on them be available. One simple extension of this model is to decompose "labor" into various components, e.g., by separating out the CEO (and other top management) as a factor of production.

7. CONCLUSIONS

In this paper we have presented a methodology for estimating the magnitude of economic value creation and the distribution of value among a firm's stakeholders. Using public data on global automotive companies, we have demonstrated how the methodology can be applied. Our calculations provide quantitative evidence on the dramatic differences in value creation and distribution between Toyota and General Motors in recent decades.

In addition to an empirical method, our approach offers a conceptual framework for understanding value creation and distribution in a precise way. We have shown that the standard TFP formula, combined with its "dual", provides such a framework within the context of the firm's value chain. The TFP formula (Equation 4) gives the economic value created by the focal firm, whereas the dual (Equation 5) tracks the flow of this value among stakeholders. The latter include stakeholders "within" the firm (shareholders and employees), and those located upstream (suppliers) and downstream (customers) of the firm, along the value chain.

Our empirical approach takes into account the realities of tax payments and the fact that sufficient data on suppliers are seldom available. Thus, the applied version of our model drops the firm's suppliers as a potential recipient of value but adds government as a stakeholder in the success of the firm. While this approach has some limitations as an empirical tool, we have shown that it can be meaningfully applied for many companies.

The concept of value creation is central to the field of strategic management, and researchers have paid great attention to the capture of value by internal and external stakeholders. Yet there has been surprisingly little development of quantitative methods for broadly representing the creation and distribution of economic value at the firm level. We believe that our approach offers promise as a tool for applied research in strategic management. While essential features of our approach are drawn from the field of economics, economists have shown little interest in applying this type of analysis at the level of individual firms. The methods described in this paper have broad applicability for generating firm-level estimates and for supporting a range of analyses on the determinants of value creation and its distribution among stakeholders.

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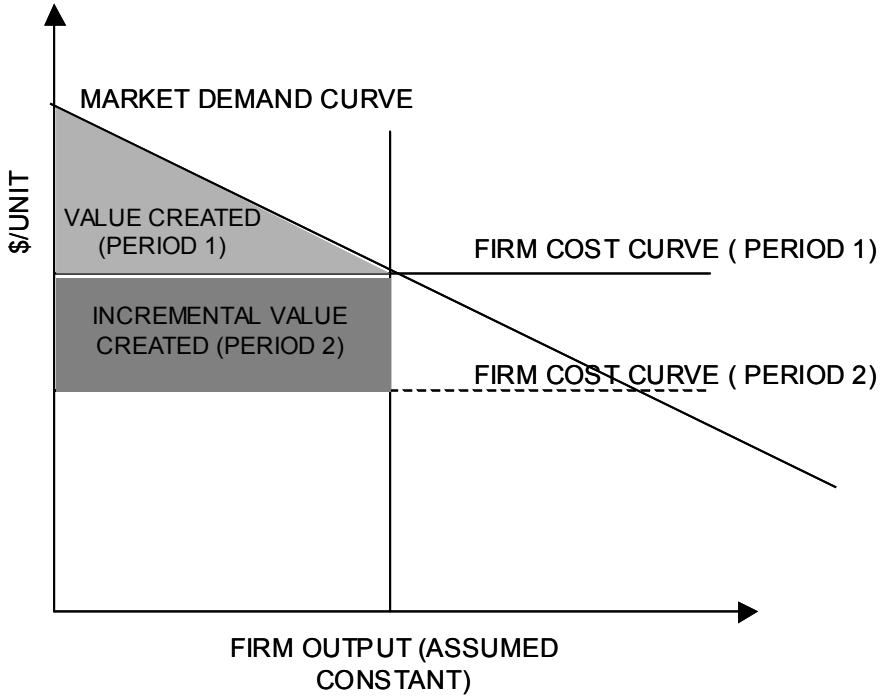

FIGURE 1: VALUE CREATION

TABLE 1: VALUE CREATION APPROPRIATION ANALYSIS (TOYOTA)

PANEL A: BASIC DATA

	1978	1988	1998	Comments
Japanese Price Indices (*Source: Economic Planning Agency, Bank of Japan)*				
GDP Deflator (1990=100)	76.90	96.00	105.12	
PPI for motor vehicles (1990=100)	0.963	0.996	0.817	
GDP Deflator (Normalized to 1978)	1.00	1.25	1.37	
PPI for motor vehicles (Normalized to 1978)	1.00	1.03	0.85	
Company Data (Nominal) *Source: Annual Reports (Yuka Shoken Hokokusho)*				
Value Added (Yen million)	430,046	1,115,451	1,514,853	*Refer text for definition*
Wages and Benefits (Yen million)	173,880	431,614	678,894	
Capital Employed (Yen million)	404,669	1,019,697	1,457,920	*Tangible Fixed Assets + RM & WIP Inventories*
Employment (Number of Employees)	46,477	67,389	67,912	
Taxes (Yen million)	117,293	360,684	311,043	

PANEL B: VALUE CREATION ANALYSIS

	1978-88	1988-98	Comments (Refer Eq 6 & 7)
Productivity Growth (Decrease)	72%	47%	$R = (\Delta V/V) - s_L(\Delta L/L) - s_K(\Delta K/K)$
Gains to Labor	15%	16%	$s_L(\Delta w/w)$
Gains to Consumers	17%	25%	$-(\Delta p/p)$
Gains to Capital (Before-Tax)	40%	5%	$s_k(\Delta r/r) = R - s_L(\Delta w/w) + (\Delta p/p)$
Gains to Capital (After-Tax)	17%	12%	$s_k(\Delta r/r) - s_T(\Delta t/t) - s_T(\Delta r/r)$
Gains to Government (Tax)	22%	-7%	$s_T(\Delta t/t) + s_T(\Delta r/r)$
Value Creation (Destruction)	*Million Yen (1978 Yen)*		
Gains to Labor	64,571	177,537	
Gains to Consumers	73,795	270,605	
Gains to Capital	171,059	53,597	
Gains to Capital (After-Tax)	74,915	128,061	
Gains to Government (Tax)	96,144	(74,464)	
Total Value Creation (Destruction)	309,425	501,739	

PANEL C: COMPUTATIONS

				1978-1988		1988-1998		
	1978	1988	1998	DIFFERENCE	DIFFERENCE/ INITIAL	DIFFERENCE	DIFFERENCE/ INITIAL	Symbols in Eq (6) & (7)
Real Value Added	430,046	1,078,610	1,785,736	648,564	1.51	707,126	0.66	$(\Delta V/V)$
Employment	46,477	67,389	67,912	20,912	0.45	523	0.01	$(\Delta L/L)$
Real Capital	404,669	816,820	1,066,526	412,151	1.02	249,706	0.31	$(\Delta K/K)$
Taxes to Net Revenues Ratio	0.46	0.53	0.37	0.07	0.15	(0.16)	(0.29)	$(\Delta T/T)$
Average Real Wage	3.74	5.13	7.31	1.39	0.37	2.18	0.43	$(\Delta w/w)$
Relative Price of End Product	1.00	0.83	0.62	(0.17)	(0.17)	(0.21)	(0.25)	$(\Delta p/p)$
Labor Share of Real Value Added	0.40	0.39	0.45					s_L
Capital Share (Pre-Tax) of Real Value Added	0.60	0.61	0.55					s_k
Capital Share (After-Tax)	0.32	0.29	0.35					s_{k^*}
Tax Share	0.27	0.32	0.21					s_T

TABLE 2: VALUE CREATION APPROPRIATION ANALYSIS (GM)

PANEL A: BASIC DATA

	1978	1988	1998	Comments
US Price Indices (*Sources: BLS and BEA Websites)*				
GDP Deflator (Normalized to 1978)	1.00	1.65	2.11	
PPI for motor vehicles (Normalized to 1978)	1.00	1.49	1.74	
Company Data (Nominal) *Source: Compustat*				
Value Added ($ million)	30,605	47,180	33,948	*Refer text for definition*
Wages and Benefits ($ million)	20,580	33,249	26,500	
Capital Employed ($ million)	14,372	35,047	37,336	*Net Plant, Propery & Equipment+ RM & WIP Inventories*
Employment (Number of Employees)	839,000	765,700	406,000	
Taxes ($ million)	3,088	1,493	845	

PANEL B: VALUE CREATION ANALYSIS

	1978-88	1988-98	Comments (Refer Eq 6 & 7)
Productivity Growth (Decrease)	-6.2%	-0.4%	$R = (\Delta V/V) - s_L(\Delta L/L) - s_K(\Delta K/K)$
Gains to Labor	5%	13%	$s_L(\Delta w/w)$
Gains to Consumers	10%	8%	$-(\Delta p/p)$
Gains to Capital (Before-Tax)	-21%	-21%	$s_k(\Delta r/r) = R - s_L(\Delta w/w) + (\Delta p/p)$
Gains to Capital (After-Tax)	-8%	-19%	$s_k(\Delta r/r) - s_T(\Delta t/t) - s_T(\Delta r/r)$
Gains to Government (Tax)	-13%	-2%	$s_T(\Delta t/t) + s_T(\Delta r/r)$
Value Creation (Destruction)	*$ million (1978 dollars)*		
Gains to Labor	1,443	4,003	
Gains to Consumers	3,037	2,679	
Gains to Capital	(6,379)	(6,800)	
Gains to Capital (After-Tax)	(2,399)	(6,131)	
Gains to Government (Tax)	(3,979)	(669)	
Total Value Creation (Destruction)	(1,898)	(118)	

PANEL C: COMPUTATIONS

				1978-1988		1988-1998		
	1978	1988	1998	DIFFERENCE	DIFFERENCE/ INITIAL	DIFFERENCE	DIFFERENCE/ INITIAL	Symbols in Eq (6) & (7)
Real Value Added	30,605	31,662	19,528	1,057	0.03	(12,135)	(0.38)	$(\Delta V/V)$
Employment	839,000	765,700	406,000	(73,300)	(0.09)	(359,700)	(0.47)	$(\Delta L/L)$
Real Capital	14,372	21,186	17,708	6,814	0.47	(3,478)	(0.16)	$(\Delta K/K)$
Taxes to Net Revenues Ratio	0.31	0.11	0.11	(0.20)	(0.65)	0.01	0.06	$(\Delta T/T)$
Average Real Wage	0.02	0.03	0.03	0.00	0.07	0.00	0.18	$(\Delta w/w)$
Relative Price of End Product	1.00	0.90	0.82	(0.10)	(0.10)	(0.08)	(0.08)	$(\Delta p/p)$
Labor Share of Real Value Added	0.67	0.70	0.78					s_L
Capital Share (Pre-Tax) of Real Value Added	0.33	0.30	0.22					s_k
Capital Share (After-Tax)	0.23	0.26	0.19					s_{k^*}
Tax Share	0.10	0.03	0.02					s_T

TABLE 3: VALUE CREATION APPROPRIATION ANALYSIS (NISSAN)

PANEL A: BASIC DATA

	1978	1988	1998	Comments
Japanese Price Indices (*Source: Economic Planning Agency, Bank of Japan)*				
GDP Deflator (1990=100)	76.90	96.00	105.12	
PPI for motor vehicles (1990=100)	0.963	0.996	0.817	
GDP Deflator (Normalized to 1978)	1.00	1.25	1.37	
PPI for motor vehicles (Normalized to 1978)	1.00	1.03	0.85	
Company Data (Nominal) *Source: Annual Reports (Yuka Shoken Hokokusho)*				
Value Added (Yen million)	412,912	560,552	459,614	*Refer text for definition*
Wages and Benefits (Yen million)	220,238	335,204	331,617	
Capital Employed (Yen million)	440,544	633,259	795,435	*Tangible Fixed Assets + RM & WIP Inventories*
Employment (Number of Employees)	56,068	52,808	39,467	
Taxes (Yen million)	78,485	79,556	5,796	

PANEL B: VALUE CREATION ANALYSIS

	1978-88	1988-98	Comments (Refer Eq 6 & 7)
Productivity Growth (Decrease)	27%	9%	$R = (\Delta V/V) - s_L(\Delta L/L) - s_K(\Delta K/K)$
Gains to Labor	16%	12%	$s_L(\Delta w/w)$
Gains to Consumers	17%	25%	$-(\Delta p/p)$
Gains to Capital (Before-Tax)	-6%	-28%	$s_k(\Delta r/r) = R - s_L(\Delta w/w) + (\Delta p/p)$
Gains to Capital (After-Tax)	-1%	-6%	$s_k(\Delta r/r) - s_T(\Delta t/t) - s_T(\Delta r/r)$
Gains to Government (Tax)	-5%	-22%	$s_T(\Delta t/t) + s_T(\Delta r/r)$
Value Creation (Destruction)	*Million Yen (1978 Yen)*		
Gains to Labor	64,850	67,698	
Gains to Consumers	70,855	135,988	
Gains to Capital	(22,955)	(154,093)	
Gains to Capital (After-Tax)	(3,140)	(32,632)	
Gains to Government (Tax)	(19,815)	(121,462)	
Total Value Creation (Destruction)	112,750	49,593	

PANEL C: COMPUTATIONS

				1978-1988		1988-1998		
	1978	1988	1998	DIFFERENCE	DIFFERENCE/ INITIAL	DIFFERENCE	DIFFERENCE/ INITIAL	Symbols in Eq (6) & (7)
Real Value Added	412,912	542,038	541,801	129,126	0.31	(237)	(0.00)	$(\Delta V/V)$
Employment	56,068	52,808	39,467	(3,260)	(0.06)	(13,341)	(0.25)	$(\Delta L/L)$
Real Capital	440,544	507,267	581,892	66,723	0.15	74,625	0.15	$(\Delta K/K)$
Taxes to Net Revenues Ratio	0.41	0.35	0.05	(0.05)	(0.13)	(0.31)	(0.87)	$(\Delta T/T)$
Average Real Wage	3.93	5.08	6.15	1.16	0.29	1.06	0.21	$(\Delta w/w)$
Relative Price of End Product	1.00	0.83	0.62	(0.17)	(0.17)	(0.21)	(0.25)	$(\Delta p/p)$
Labor Share of Real Value Added	0.53	0.60	0.72					s_L
Capital Share (Pre-Tax) of Real Value Added	0.47	0.40	0.28					s_k
Capital Share (After-Tax)	0.28	0.26	0.27					s_{k^*}
Tax Share	0.19	0.14	0.01					s_T

TABLE 4: COMPARISON OF TOYOTA AND GM (1978)

	Toyota	GM	Toyota (Expanded)
Exchange Rate			
Yen to US $	210.46		
Company Data (Real=Nominal in 1978 prices)			
Value Added ($ million)	2,043	30,605	30,605
Wages and Benefits ($ million)	826	20,580	12,375
Capital Employed ($ million)	1,923	14,372	28,799
Employment (Number of Employees)	46,477	839,000	696,128
Taxes ($ million)	557	3,088	8,347

METHOD 1 (EQUATING RATE OF RETURN ON CAPITAL)

Assign GM's RoR to Toyota		
Toyota's actual RoR	0.34	
Toyota's assigned RoR	0.48	
Toyota's return to capital at actual RoR	9,883	
Toyota's return to captial assigned RoR	13,901	
Additional value to be created by Toyota	4,017	
% difference	13%	*GM's productivity is 13% higher than Toyota's*
Assign Toyota's RoR to GM		
GM's actual RoR	0.48	
GM's assigned RoR	0.34	
GM's return to capital at actual RoR	6,937	
GM's return to captial assigned RoR	4,932	
Additional value to be created by GM	(2,005)	
% difference	-7%	*Toyota's productivity is 7% lower than GM's*

METHOD 2 (USING EQUATIONS 6 AND 7)

Toyota numbers subtracted from GM numbers		
Change in Real Value Added	-	
Change in Employment	0.17	
Change in Real Capital Employed	(1.00)	
Average Labor Share	0.54	
Average Capital Share	0.46	
% Productivity Difference	37%	*GM's productivity is 37% higher than Toyota's*
GM numbers subtracted from Toyota numbers		
Change in Real Value Added	-	
Change in Employment	(0.21)	
Change in Real Capital Employed	0.50	
Average Labor Share	0.54	
Average Capital Share	0.46	
% Productivity Difference	-12%	*Toyota's productivity is -12% lower than GM's*

Appendix 1: Comparison of GM and Toyota in 1978

To compare GM's and Toyota's productivity *levels*, we can use one of two approaches, both of them only offering approximate answers. The first approach would be to simply assign the same rate of return on capital (say, defined as value added less wages less taxes divided by capital employed) for both Toyota and GM and compute the excess (or shortfall in) value created. Hence, we could assign a 48% rate of return (which is GM's rate of return on capital) to Toyota. This would imply Toyota would have to pay $ 13,901 million on its capital, which would mean its current value added is short by $4,017 million, or about 13% of its "expanded" value added (Table 4). Hence, in some sense, GM's productivity in 1978 is about 13% higher than Toyota's productivity then. Alternatively, we could assign Toyota's rate of return (34%) to GM and compute the excess value added by GM. This turns out to be about 7% of GM's value added. Based on this, Toyota's productivity is about 7% lower than GM's productivity.

An alternate approach is to "expand" Toyota to GM and use Equation (3) with the changes taken across GM and Toyota rather than over time for a single firm. We use this approach along with the average input shares to compute the productivities. Once again, we can have two comparisons, by subtracting GM from Toyota (i.e. "convert GM to Toyota") or subtracting Toyota from GM (i.e. convert Toyota to GM). Based on this approach, GM's productivity in 1978 turns out to be 37% more productive than Toyota if Toyota is used as the starting point or Toyota's about 12% lower than GM, if we use GM as the initial point. Though imprecise, both approaches suggest that GM was using resources only a bit more efficiently than Toyota in 1978.