# A test of a company's business model

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## 1. Project overview

It is well known that financial performance measures, such as net income and return on assets, are backward looking and short-term oriented. Consequently, most companies measure and monitor multiple indicators of performance, some of which are non-financial leading indicators of financial performance. These leading indicators are sometimes called 'performance drivers'. They are important because they provide more timely indications of success or failure.

Arguably, more advanced companies use combinations of leading and lagging measures in formal business models, such as Balanced Scorecards, to guide and monitor performance. These business models are said to be superior to multi-factor key performance indicator (KPI) or 'dashboard' approaches to performance measurement. This is because they contain more than just lists of potentially relevant variables – they are built around a hypothesised causal structure.

However, many academics and practitioners have argued that, valuable as these business models might be, their hypothesised causal structures need to be subjected to empirical tests. If the models are based on erroneous premises, they can actually mislead managers, causing them to pursue the wrong goals and make flawed decisions.

Previous studies have tested companies' business models in firms that implemented the same business model across multiple units (e.g. retailer stores or bank branches). Although, these studies suggest that tests of companies' business models have the potential to produce useful information in multi-unit organisations, most firms have a single operating unit.

The goal of this study was to conduct formal, empirical longitudinal tests of the assumed cause-and-effect relationships in the business model of a single-unit organisation. The research site seemed to offer the ability to conduct a 'clean' set of tests from a business model.

The research site is a medium size United States based medical test equipment manufacturer. It is engaged in a single line of business – the production and sale of equipment used for performing medical diagnostic tests. The company's devices are 'closed-systems', meaning that they work only with the company's own reagent kits and cannot perform other manufacturers' tests.

The entire set of data obtained was monitored on a quarterly basis by the company's board of directors and top management over an eight and a half year period, from the first quarter of 1998 through to the second quarter of 2006. This data time-series is relatively long and is also relatively 'clean'. The company is a 'pure play', which means that it operates only in a single line of business with just one business model. In this way, the overall corporate performance measures are not distorted by shifts in a cross-business sales mix.

In addition, the company's top management team, its strategy, and therefore its business model, were constant for the entire period of time. The company's stock was publicly traded on the New York Stock Exchange throughout the period, so it could be established whether the individual and collective elements of the business model were leading indicators of both financial performance and shareholder value creation.

During formal empirical testing, the research team wanted to see if the performance metrics, monitored on a regular basis by the company's management and directors, provided reliable leading indicators of the firm's profits and shareholder returns. They also wanted to find out if they could suggest ways to improve the business model, for example, by adding or subtracting variables, or by weighting them differently.

## 2. Objectives

- **Contribute to research literature**

Many previous studies have called for more empirical testing of company business models, but examples are rare because of limitations in gaining access to internal company data. The researchers believed that this study could illustrate useful templates for conducting such tests.

- **Improve practice**

This study was designed specifically with 'interventionist' goals in mind. The intention was to develop findings that would be useful both to the managers of this research site and, more generally, to the managers of all single business unit companies. In this particular setting, one simple possibility of findings would have been to validate the model that managers were using to guide the company. A more important possibility would have been to refine the model. This would have involved quantifying the importance (and relative importance) of the key indicator variables, by clarifying the length of the lead-lag relationships involved. It would also have meant suggesting other variables that would have significant value in predicting future financial or market performance.

While this business model is tailored to this company's situation, we expected that our tests of this model could provide methodological insights that would be useful to managers of other companies who wished to conduct similar tests.

## 3. Identifying the model to test

Like most companies, managers at the research site have beliefs and assumptions about their business model. They base many important business decisions on those beliefs and assumptions, but they have never tested them empirically.

The researchers began their study by learning to understand the company and its business model. In field interviews, managers explained that the company follows what is commonly referred to as a 'razor/razor blade' strategy. Here it sells the test equipment at a small mark-up, or even at cost price. It then maximises its profits, selling the reagent kits needed to perform the tests. Its customers are mostly hospitals and independent laboratories located in over 100 countries around the world. In various geographical regions, the company sells either directly to customers through its own sales force or through distributors.

The interviews with top management and board members led to the development of the pictorial representation of the company's business model, seen in Figure 1. This model shows research and development, instrument placements, the number of reagents approved by the government for sale, and the changes in gross margins that are key performance drivers leading to higher income (and greater shareholder value).

Figure 1 depicts three paths to value creation and specifies managerial assumptions about the lengths of the lags between changes in drivers and performance effects.

In the first path, R&D leads to performance via instrument placements. This path takes approximately 15 quarters, because R&D investments lead instrument placements by approximately nine to 12 quarters[1]. Once installed, instruments take approximately three quarters to start operating at capacity, achieving their full potential to generate reagent sales, and therefore operating income.

In the second path, R&D leads to performance via the release of new reagents. This path takes about seven quarters. The firm takes approximately one year, that is, four quarters, to conduct research and to develop a new reagent. The Food and Drugs Administration (FDA) takes about two quarters to approve the new reagent[2], and the new FDA approved reagent takes about one further quarter to translate into higher reagent sales and higher operating income.

Finally, the third path suggests that changes in gross margins positively affect operating income over the following quarter. Managers and board members monitored gross margins quarter by quarter, as decreasing trends in gross margin percentages could lead to a decrease in future profitability.

This business model is intendedly incomplete. For example, it does not include some performance drivers, such as hiring successes and training efforts that might be included in the learning and growth section of a Balanced Scorecard. However, the model does capture the key performance metrics that were regularly monitored by the company's top executives and directors.
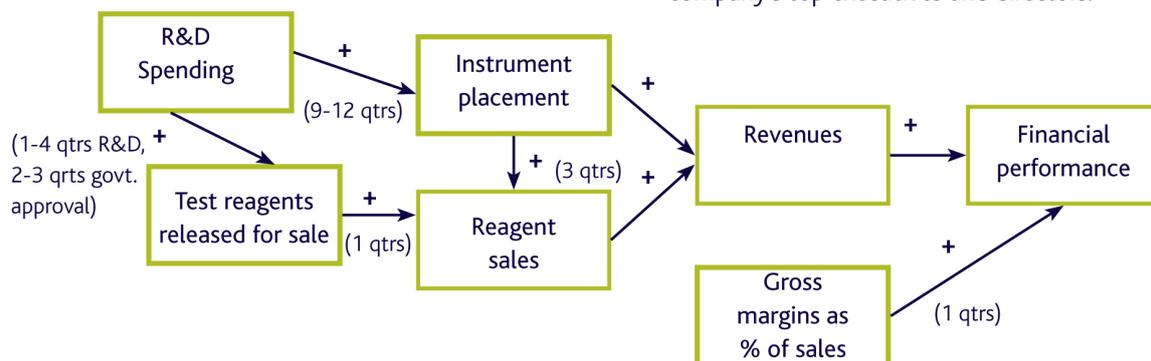


**Figure 1**

**Pictorial illustration of the major elements in the company's business model**

[1]According to the firm's executives, the firm invests to develop (and improve) new instruments over a period of five years (i.e. 1-20 quarters). However, most of the investment occurs during the third year of development (i.e. between the 9th and 12th quarter).

[2]Some of these lag-lengths can be longer for certain reagents. For example, R&D spending can take up to three years when complex reagents are developed, and the FDA approval can take as long as one year in some cases.  However, not every reagent requires FDA review and approval, since some reagents are directed exclusively to international markets.

## 4. Main empirical findings

The empirical tests of this model yielded four primary empirical results. First, while management believed that there are four important 'performance drivers' or leading performance indicators, the researchers found that only two of the four hypothesised drivers (R&D spending and instrument placements) are consistently associated with future financial performance. The other two drivers in the company's business model (test reagents released for sale and changes in gross margin percentages) provided little or no useful incremental information to predict future financial performance.

Secondly, the researchers examined the paths through which the different leading indicators in the company's business model are hypothesised to relate to each other in a time-dependent causal sense. Support was found for only one hypothesised path: R&D expenditure leads to instrument placements which lead to future operating income.

Thirdly, the researchers examined the incremental information contained in other performance measures which was included in the data set provided, but not in the incomplete business model. The results indicated that none of these additional measures were significantly associated with future operating income.

Finally, it was found that only two of the four measures in the company's business model provided useful information to predict movements in the company's stock returns.

## 5. Conversations with management

The research was designed as an 'interventionist' study, intended both to advance the research literature and to help management. Company managers confirmed that the researchers were testing the model that they had described earlier. But, interestingly, they were not surprised at the mixed findings. They had not expected the researchers to be able to validate every aspect of the model with their formal tests.

Our reflections on our empirical findings, as well as our conversations with management suggested that finding support for all the predicted relations would have been difficult for several reasons.

First, further analyses suggested that a dataset including 32 observations (corresponding to 32 quarters from a company with a single operation unit) was too small to detect small- and medium-sized effects of the leading indicators on output measures.

Second, managers explained many limitations in the highly aggregated data used by the researchers. They

noted, for example, that only about one in thirty reagents released for sale has a substantial impact on sales. The dashboard data provides only the aggregate data, with no indication as to whether that particular test is likely to have 'significant' effects.

Third, it is difficult to assess the precise periods in which leading indicators of performance are likely to impact both operating income and stock returns. For example, both instrument placements and the release of new reagents create annuities. They lead to an increase in revenues throughout an indefinite number of periods rather than just a single, precise period.

Fourth, managers explained that some measures are not useful as predictive tools. This is because the managers intervene to ensure that there is not much variation from historical norms, at least on the downside. For example, one management goal was 'to keep gross margins stable'. This could be done by cutting costs, by pulling low-margin reagents off the market, and/or by lowering instrument placements with inherently low margins. Every time gross margin percentages dropped, or if it was sensed that they would drop, management immediately took action so that publicly disclosed information would not show lower operating income due to lower margins.

The management let the gross margin numbers convey a sense of what was happening, and it 'managed' those numbers so that the time series was relatively stable. In practice, management actively took steps to ensure that declines in gross margin percentages would not lead to a future decrease in operating income. This system 'endogeneity' limits the value of that measure for predictive purposes. Similarly, management limited the amount of R&D spent every year to 10-12% of sales, an amount based on estimates of how fast they wanted the company to grow and how much investment they could afford. However, with only a small variance in the amount of R&D spending, the predictive power of the variable is limited.

Finally, managers were not surprised by the lack of association between the leading indicators included in the business model and the company's stock returns. They explained their belief that the market takes a long time to recognise value creation, at least in a market with a relatively small stock float. They provided multiple examples of periods in which the company's stock price did not respond on a timely basis to new and publicly disclosed developments in the company.

## 6. Conclusions

Researchers attempted to test a business model in a single-unit company in conditions that were favourable to conduct such tests. However, the empirical findings were quite weak. Such negative findings do not indicate that the company's business model is invalid. To the contrary, the company's considerable success over an extended period of time suggests strongly that it is valid. Nonetheless, it is believed that this study makes some important research contributions. It also raises some important questions for practitioners to consider.

The findings suggest that testing multi-factor 'business models' in a single firm is very challenging, even when conditions seem ideal. But were they ideal? It turns out that testing causal relationships in this setting was relatively difficult because of the relatively long investment/payoff lags. Tests seem to be easier in multi-unit industries, such as retailing, restaurants, banking or in services with shorter business cycles. Most of these firms may be able to test their business models using large samples of comparable business units, for example, stores. Here the business model could be tested using only one business unit – the corporation – over time.

This study provides insights that explain why, in practice, the vast majority of firms do not validate their business models empirically. Although managers in single-unit firms have access to data that is not usually available to outsiders, their data sets are limited in some important ways. For example, the data might not be adequately disaggregated or organised in ways that are informative. Managers might be unable to control fully changing market conditions in their time-series of data. They do not know the precise periods in which the leading indicators of performance are likely to impact both operating income and stock returns. In addition, system endogeneity limits the variables' predictive abilities, as managers take steps to ensure that reported profits do not vary much, at least on the downside.

In retrospect, it was not surprising to find that management's belief in their business model was not shaken, despite learning that it had weak predictive ability. This was perhaps to be expected, given that the company had followed the same business model for many years with considerable success. Perhaps more interesting are the questions raised by the research findings. Despite the mixed results of our tests, management was not interested in recommendations aimed at sharpening their business model and performance measurement system so that attention could be focused on those more specific indicators that might have a demonstrable impact on performance. It is clear that if the external environment or operating performance changed, management could use either their instincts or use the more disaggregated information which exist internally to diagnose problems or to detect new opportunities. So why not sharpen the model and run the firm 'more scientifically' based on hard numerical analyses?

Managers of firms that face changes in the environment or firms that have changed strategies relatively recently might be more interested in business model validation studies. Yet testing business models with a short time-series is challenging. What is needed are studies focused on how managers actually 'test' their business models under these circumstances. Some managers may use less formal, more intuitive and more subjective approaches. Others might look for ways to overcome the types of problems identified in this study, to improve their ability to conduct meaningful statistical analyses. For example, to deal with small samples of data, managers in some companies might choose to collect more disaggregated data (e.g. our company could have collected data at an instrument - or customer level). Managers may consider re-defining some of the performance measures in the model in ways that would make them more homogeneous and lead to less volatile performance effects (e.g. company managers could distinguish across different types of reagents). To remove noise occurring over time, managers could conduct some 'natural experiments', such as by setting up some control groups (e.g. by implementing new operating strategies to serve some but not all customers). Finally, to address endogeneity concerns, managers could examine dynamic models that would capture performance effects from both leading indicators and management reactions to those leading indicators. Understanding how managers use different types of data and research methods to test their business models in cost-effective ways may be a promising venue for future research.

**Additional outputs providing more detail:**

Merchant, K.A. and T. Sandino. A test of a company's business model. Unpublished working paper, January 2009

**References and further reading**

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