

RECOGNIZING MACROECONOMIC FLUCTUATIONS IN VALUE BASED MANAGEMENT

by Lars Oxelheim,
Lund University, and
Clas Wihlborg,
Copenhagen Business School*

Value Based Management (VBM) has become a key instrument for evaluating corporate strategies, projects, and overall performance. Although VBM can be used together with standard discounted cash flow in the planning stages, its principal use has been in developing performance measures like economic value added (EVA) and cash flow return on investment (CFROI) that can be used to evaluate ongoing corporate projects and company-wide performance—that is, after the corporate investment decisions have been made and the capital committed.¹ Perhaps even more important, VBM performance measures often provide the basis for bonus systems that aim to align managerial incentives with those of shareholders.

The primary advantage of VBM frameworks is their ability to overcome the deficiencies of accounting-based performance measures like earnings per

share, in part by focusing on corporate cash flow. One limitation of most VBM frameworks, however, is their failure to distinguish between changes in cash flows that reflect changes in a firm's competitive position, and cash flow changes that derive mainly from fluctuations in the macroeconomic environment that show up in variables like exchange rates and interest rates. Our aim in this paper is to develop a framework that enables management to isolate the effect of such variables on performance, while taking into account the interdependence and correlation of the variables in responding to broader changes in the macro environment.²

Changes in macroeconomic variables are, of course, beyond management's control. To the extent that changes in interest rates and exchange rates affect corporate cash flows and value, such effects can also weaken the link between managerial pay and performance.³ For this reason, "cleansing" per-

*The authors want to thank Don Chew for valuable comments on contents and composition. Lars Oxelheim is grateful for financial support from the Savings Bank Foundation in Skåne, Sweden.

1. There are a number of VBM frameworks. The two best known are Shareholder Value Analysis (SVA) (see A. Rappaport, *Creating Shareholder Value: The New Standard for Business Performance*, Free Press, London (1986)) and Economic Value Analysis (EVA) (see B. Stewart, *The Quest for Value: The EVA-TM Management Guide*, Harper Business, New York (1990)). However, there are a number of challengers, including Cash Value Added (CVA) (see E. Ottosson and F. Weissenrieder, "Cash Value Added (CVA)—A New Method for Measuring Financial Performance," *Gothenburg Studies in Financial Economics*, 1996:1, Department of Economics, Gothenburg University) and Cash Flow Return on Investment (CFROI) (see Madden, B.J., *A Total System Approach to Valuing the Firm*, Butterworth-Heinemann (1999)).

2. There are methods of adjusting performance for macroeconomic variables, including the exchange rate's deviation from purchasing power parity (see B. Stewart, "Normalizing Exchange Rates for Purchasing Power Parity," *Midland Corporate Finance Journal*, Vol. 1, No. 2 (Summer, 1983)) and changes in oil prices (see J. McCormack and I.D. Gow, "EVA in E&P Industries: The Case of Nuevo Industries," *Journal of Applied Corporate Finance*, Vol. 13, No. 4 (2001)). However, no VBM framework takes into account the fact that macroeconomic variables often respond simultaneously to changes in macroeconomic conditions.

3. It is well established in the incentive contract literature that if risk-averse managers' remuneration is linked to noise factors beyond their control without strong linkage to shareholder value, then their incentive to exert effort on behalf of shareholders may be weakened. See, for example, R. Milgrom and J. Roberts, *Economics, Organization and Management*, Prentice-Hall, New York. (1992), Chapter 7.

formance measures of macro effects may strengthen managers' incentives to add value by doing what they do best—allocating capital effectively and increasing operating efficiencies.

Besides strengthening managerial incentives, another argument for filtering out macro influences on corporate performance measures is that it may replicate a process that, at least to some extent, is actually performed by investors when setting stock prices. For example, a company with abnormally high profits that result from a depreciating currency is likely to trade at a lower P/E ratio than if the same profits were generated solely from normal operations. By compensating managers for a *currency-adjusted* contribution to value added in this case, managers' bonuses may be a more accurate reflection of the market value added (or MVA) built into a company's stock price.⁴

In earlier research, we have argued that corporate managers can measure the exposure of their firm's cash flows to macro conditions by estimating their exposure to a set of macro price variables such as inflation, exchange rates, and interest rates.⁵ More specifically, we have recommended the use of *exposure coefficients* (measured within a multivariate regression framework) to quantify the effect of unexpected changes in macro price variables on corporate cash flows (or, alternatively, on the value of the assets generating the cash flows). In this paper, we show how similar exposure coefficients can be used in a VBM context to remove the effects of macro variables on a firm's cash flows (or value) during a specific time period and so arrive at a measure of a company's "intrinsic" cash flows and value. The basic framework for decomposing changes in cash flows using exposure coefficients is laid out in the next section. In the remaining sections, we use the case of Electrolux to illustrate the decomposition procedure and the potential size of the macro influences we are seeking to remove, and then comment briefly on when and how the procedure should be applied for purposes of management compensation.

VBM AND MACRO FLUCTUATIONS

The framework of Value Based Management rests on the premise that the value of the firm is equal to the discounted net present value of its expected cash flows, or its DCF value. Expressed as an equation,

$$V_{A,t} = \sum_{j=0}^J \beta^j E[X_j] + PVRO \quad (1)$$

where V_A is the value of corporate assets, X is the cash flow in a given period (j), β^j is the discount factor for the j periods, and $PVRO$ represents the present value of real options that cannot be captured in conventional present value analysis. In most of the article that follows, we ignore real options and focus just on current cash flows as the basis for performance evaluation, since in most VBM frameworks bonus systems are based on current cash flows adjusted for a capital charge.

Changes in cash flows in any period can be decomposed into two components. One component represents changes assuming that macroeconomic conditions remain unchanged from the previous period. To the extent such conditions remain the same, changes in the cash flow for any individual firm are assumed to be attributable entirely to changes in the firm's competitiveness in the market place and the growth in demand for the firm's output. Moreover, given a firm's technology, employee and managerial competence, and product demand, there is at any time a level of cash flows that can be identified as the *intrinsic* level of cash flows for the period. We denote changes in this intrinsic level x_L .⁶

The other component of cash flow changes during a period depends on changes in macroeconomic conditions, as reflected in changes in variables such as exchange rates, interest rates, and price levels. We denote these changes x_M . And this in turn means that total changes in cash flow can be expressed as the sum of the two components:

$$x_{t+j} = x_{L,t+j} + x_{M,t+j} \quad (2)$$

4. It thus also represents a possible explanation for large observed differences between market values and economic values as measured by EVA. See S. O'Byrne, "EVA and Shareholder Return," *Conference paper*, Financial Management Association Annual Conference, Honolulu (1997).

5. See our book, *Managing in the Turbulent World Economy—Corporate Performance and Risk Exposure* (John Wiley and Sons, Chichester and New York, 1997), in which we develop a "macroeconomic uncertainty strategy" (MUST) analysis.

6. The intrinsic level cannot usually be observed, and it is not constant. It is independent of influences of macroeconomic events, however, and reflects the ability of management to employ resources productively. The fact that the intrinsic level is not directly observable does not mean that it lacks practical significance. On the contrary, we argue that management should estimate it and use it as a keyinput in major business decisions.

Under most circumstances, a regression equation of the following general form can be used to estimate the effects of changing macro variables on firm performance:

$$x_{M,t} = a_e e + a_i i + a_p p + a_r r \quad (3)$$

where e , i , and p represent percentage changes in sets of exchange rates, interest rates, and price levels in period t .⁷ The variable r , by contrast, is used to capture changes in firm- and industry-specific conditions that may be significantly correlated with macro events. The partial derivatives with respect to e , i , and p (a_e , a_i , and a_p) represent sensitivity coefficients (in multivariate regression analysis) that are meant to reflect the exposure of firm cash flows to changes in macroeconomic price variables.⁸

The coefficients in equation (3) reflect more than just the direct impact of each variable on cash flows. Each coefficient also captures the effect of correlations among the variables in question, and among other macro variables that do not show up in the equation. Moreover, for every company there is likely to be a specific set of variables that best captures cash flow effects from macro events. For example, as we show in the next section, our regression analysis suggests that the effect of changes in macro conditions on the cash flows of the Swedish company Electrolux is best reflected by changes in four variables: the sterling/krona exchange rate, the short-term Swedish and British interest rates, and the long-term German interest rate (while the rate of Swedish inflation appears to provide no additional information).

Performance evaluations can also be based on changes in the *value* of corporate assets rather than on changes in cash flows. In this case, equation (3) can be applied directly using the actual (or estimated) changes in value as the independent vari-

able. But if the firm's equity is not traded, or the performance of a corporate division is being evaluated, then equation (1) can be used to derive value effects that are based on the estimated cash flow effects of macro variables.⁹ This is the method we use in the example that follows.

CASH FLOW DECOMPOSITION AND VALUATION: THE CASE OF ELECTROLUX

Electrolux AB is one of the world's largest manufacturers of white goods equipment. Thanks mainly to acquisitions, the company has become a truly global player. Electrolux is headquartered in Sweden and, in spite of widespread international as well as Swedish ownership, the company is controlled by the so-called Wallenberg group through its holding company called Investor.

Using statements of quarterly real operating cash flows for the Electrolux group from 1986 through 1994 that we obtained from the firm, we decomposed changes in these flows into the components described in the previous section. In an initial fundamental analysis,¹⁰ we identified a number of key variables with potential economic explanatory power after getting answers to the following questions: Where does Electrolux produce; where does it buy its inputs; where are these inputs produced; what are the major markets for its products; and what are the major currencies and interest rates that affect the value of Electrolux's financial liabilities? After this initial part of the analysis, the company's major competitors were identified and the same questions were asked for them. This analysis generated a set of 11 macro price variables with potentially significant effects on Electrolux's cash flows during the period in question. The changes in real operating cash flows¹¹ were then regressed on changes in the variables from the fundamental analysis consisting of exchange rates between the Swedish krona

7. See Oxelheim and Wihlborg (1997), op. cit. This article is not premised on any specific macroeconomic model. In most macroeconomic models, different shocks affect particular price variables in different combinations. The price variables are essentially signals of macroeconomic conditions. Economic models differ about the magnitude and duration of change in the price variables in response to different macroeconomic shocks but most open-economy models have in common the mentioned price variables.

8. This formulation assumes a linear relationship for percentage changes, which is appropriate if the impact on cash flows of a macro event is expected to vary proportionally with the change in the particular variable. But to the extent that managers can take measures to protect firm cash flow in response to large percentage changes in macro variables—for example, by exercising real options—then this assumption can be modified, as discussed near the end of this article.

9. Nevertheless, it should be kept in mind that are three limitations with this

application. First, the coefficients in equation (3) refer to *single-period* cash flow effects, while changes in value reflect changes in expected *future* cash flows as well as current performance. Second, the discount factor in equation (1) incorporates all risk factors and may therefore not be applicable to the two separate components of cash flow. In other words, the appropriate discount factor for intrinsic cash flows may differ from the appropriate discount factor for cash flows caused by macroeconomic events. Third, changes in the value of real options (PVRO in equation (1)) from macroeconomic events must be estimated separately.

10. The fundamental analysis in a risk management context is discussed and illustrated in our article, "Measuring Macroeconomic Exposure – the Case of Volvo Cars," *European Financial Management*, Vol. 1, No. 3, 241-263 (1995).

11. Deflated by producer prices in manufacturing, and measured as the revenues from goods sold minus costs of goods sold.

TABLE 1
SENSITIVITY COEFFICIENTS
OF SEASONALLY ADJUSTED
REAL OPERATING CASH
FLOW TO
MACROECONOMIC
VARIABLES, ELECTROLUX
GROUP.

	1986-92	1986-93
SEK/GBP	.55*	.92*
Long DEM interest rate	.47*	.43*
Short GBP interest rate	.24*	.33*
Short Swedish interest rate	-.28*	-.29*
R ² (adjusted)	.46	.51
D.W.	2.1	2.3

*Significant at a 5% level. All variables are measured in percent rate of change.

and a few major currencies, interest rates, and rates of inflation.¹²

Table 1 summarizes the results of our analysis.¹³ The macro price variables listed in the table explain about 50% of the fluctuations in (seasonally adjusted) changes in quarterly real operating cash flows. Moreover, our analysis suggests that a one percent depreciation of Swedish kronor vis-à-vis British pounds, holding the other variables constant, is expected to lead to an 0.55% increase in Electrolux's operating cash flow. Because the Swedish krona is the company's home currency and the firm derives significant net revenues from operations based outside Sweden, the company's stockholders benefit from any transaction in which a net positive foreign position is converted into that currency. The company also benefits from the stronger competitive position in Sweden that results from a weaker krona.

By contrast, an increase in Swedish short-term interest rates has a significant adverse impact on Electrolux's real operating cash flows, largely because the demand for capital goods falls with an increase in interest rates. The other two interest rate components, British short rates and German long rates, are both positively correlated with the company's cash flows. The most plausible explanations of these correlations is the association of higher rates in both these countries with improving macroeconomic conditions and increases in aggregate demand.

Table 2 illustrates the decomposition of changes in total cash flows into intrinsic and macroeconomic

components for the (out-of-sample) periods 1993 and 1994.¹⁴ Column (1) shows actual quarterly cash flow changes in 1993 and 1994. Columns (2), (5), (6) and (7) list the changes in the price variables, which are multiplied by the coefficients in Table 1 to obtain the changes in cash flows caused by changes in all the macro variables (x_M) in column (8). Changes in intrinsic cash flows (x_I) are registered in column (9).

Although we have not yet addressed this point, some portion of changes in macro variables like exchange rates and interest rates can be anticipated using futures rates (or, in the case of exchange rates, differences between two countries' interest or inflation rates). And in some cases, it may make sense to distinguish between expected and unanticipated changes, and to insulate managers' performance only from the changes they cannot anticipate and protect against.

To that end, Table 2 shows also how changes in cash flows caused by *unanticipated* macroeconomic events can be estimated under the assumption that the coefficients in Table 1 apply to both expected and unanticipated macro fluctuations. The difference between Swedish and U.K. interest rates in the previous quarter is used as a proxy for the anticipated exchange rate changes in column (3). Unanticipated exchange rate changes follow in column (4). It is assumed that all changes in interest rates are unanticipated in columns (5), (6), and (7). After multiplying unanticipated changes with the coefficients in Table 1, unanticipated cash flow

12. Total European housing starts were included to control for changes in the industry's conditions. Dummy variables were used to adjust cash flows for seasonality. Regressions were run for the whole period 1986-94, as well as for the periods 1986-92 and 1986-93. The latter regressions are reported below because they make it possible to conduct out-of-sample analysis.

13. The set of significant coefficients shown in Table 1 was obtained from a backward stepwise regression using contemporaneous dependent and independent variables. Lagged variables were introduced but without substantial changes in results.

14. The coefficients reported in Table 1 are "out-of-sample" in the sense that the 1986-92 coefficients were used to estimate the impact of macroeconomic events in 1993, and the 1986-93 coefficients were used to estimate the impact in 1994.

TABLE 2

DECOMPOSING ELECTROLUX' CASH FLOWS OUT OF SAMPLE INTO "INTRINSIC" CASH FLOWS AND CASH FLOWS CAUSED BY ANTICIPATED AND UNANTICIPATED MACROECONOMIC EVENTS (IN PERCENT RATE OF CHANGE)

Year/Q	(1) Real Group Operating Cash Flow % Change from Previous Quarter (x)	(2) Actual SEK/GBP % Change	(3) Anticipated SEK/GBP % Change (InterestRate Differential)	(4) Unanticipated SEK/GBP % Change	(5) 10 Year German Interest Rate % Change	(6) Three Month Great Britain Interest Rate % Change	(7) Three Month Swedish Interest Rate % Change
1993/1	27.18	11.47	0.79	10.68	-7.78	-14.02	-22.94
1993/2	5.39	1.96	0.71	1.25	-2.09	-6.59	-7.82
1993/3	9.36	5.92	0.56	5.37	-5.07	-1.01	-7.84
1993/4	9.74	1.89	0.40	1.49	-8.55	-6.33	-12.55
1994/1	0.03	-4.27	0.42	-4.69	5.72	-4.83	-2.62
1994/2	2.78	-0.48	0.47	-0.96	13.54	-2.73	1.10
1994/3	1.42	1.06	0.50	0.56	5.64	8.80	8.40
1994/4	18.74	-0.88	0.47	-1.35	3.92	11.56	6.61
Mean	9.33						
Std.de	9.37						
Mean/ Std.de	99.56						

changes caused by macro events (x_M^U) are registered in column (10). Finally, column (11) shows intrinsic cash flow changes plus cash flow changes caused by expected macro events ($x_L + x_M^A$).

Assuming that our task is to evaluate managers' performance in the out-of-sample period (again, 1993 and 1994), we came up with three different measures of changes in cash flows. As reported in column (1), the average quarterly change in total operating cash flows was 9.33%, while the average quarterly change in intrinsic cash flows net of all macro effects in column (9) was 7.63%. Adding cash flows caused by expected macro developments in column (11), the average change is 7.93%. It can also be seen that cash flows attributable to macro fluctuations add significantly to the standard deviation of changes on a quarterly basis. Columns (8) and (10), which measure changes caused by all macro changes and unanticipated macro changes, respectively, show large variations in quarterly changes in 1993 and 1994. Indeed, in the fourth quarter of 1993, macro effects dominated the changes in quarterly cash flows.

In sum, the data presented in Table 2 for Electrolux suggest that a very large proportion of the variability of operating cash flows is caused by macroeconomic fluctuations. Furthermore, most of the variability attributable to macro changes is caused

by *unanticipated* events (as can be seen by comparing columns 8 and 10). Thus, if Electrolux linked its managerial bonus payments to intrinsic cash flows, the variability of bonus payments would be significantly lower than in the case in which bonus payments are linked to total cash flows. But, as we discuss next, the choice of which cash flow variable to use for performance evaluation depends on the extent of management's flexibility to respond to changes in macro variables.

DECOMPOSITION IN PERFORMANCE ASSESSMENT

An important—and, arguably, the most important—task of VBM is to link managerial bonuses to changes in shareholder value. In what follows, we assume that a company's operating cash flows, adjusted for a capital charge for a given period, provide a reasonable basis for determining managerial remuneration for that period. The key issue here is whether components of operating cash flows that can be confidently attributed to fluctuations in macro conditions should be filtered out from the cash flows generating bonuses because these flows are beyond management's control.

Table 2 effectively provides three choices of the cash flows to be used as the basis for mana-

TABLE 2

DECOMPOSING ELECTROLUX' CASH FLOWS OUT OF SAMPLE INTO "INTRINSIC" CASH FLOWS AND CASH FLOWS CAUSED BY ANTICIPATED AND UNANTICIPATED MACROECONOMIC EVENTS (IN PERCENT RATE OF CHANGE) (CONT'D)

Year/Q	(8) Operating cash flow effect of all macro variables % Change (x_M)	(9) Operating cash flow net of all macro variable effects (Intrinsic cash flows) % Change (x_I)	(10) Operating cash flow effect of unanticipated changes in macro variables % Change (x_M^U)	(11) Cash flow change after hedging unanticipated changes in macro variables % Change ($x_I+x_M^A$)
1993/1	13.04	14.14	12.61	14.57
1993/2	2.68	2.71	2.30	3.09
1993/3	7.58	1.78	7.27	2.09
1993/4	7.08	2.66	6.87	2.87
1994/1	-5.43	5.46	-5.66	5.69
1994/2	-7.60	10.37	-7.85	10.63
1994/3	-2.35	3.78	-2.63	4.05
1994/4	-1.43	20.18	-1.69	20.43
Mean		7.63		7.93
Std.de		6.66		6.66
Mean/ Std.de		114.72		118.97

gerial rewards. They are the total (unadjusted) operating cash flows in column (1), the intrinsic cash flows in column (9), and the cash flows net of those caused by unanticipated macroeconomic events in column (11).

If management has little or no control over cash flows caused by macro events, an efficient compensation scheme should be linked mainly if not entirely to intrinsic cash flows. In this case, compensation based on the intrinsic cash flows in column (9) creates the strongest incentives for management to devote effort to enhancing the firm's long-run competitiveness. To the extent that a bonus system is linked to cash flows over which management has no control, managers are effectively rewarded (or penalized) for events beyond their control. This means that managers face greater risk (for which they must be compensated with a higher salary or more equity-based pay) and a weaker link between pay and performance.¹⁵

Some compensation experts argue that holding management accountable for cash flows caused by macro events not only puts them in the same shoes as their shareholders, but gives them incentives to

respond more effectively to changes in the macro environment. This argument assumes that operations can be adjusted in various ways to changes in expectations about macro events. But if that is so, then management *should* have incentives to make such adjustments, and the adjustment to total cash flows for purposes of management compensation should be limited to cash flows caused by *unanticipated* changes. In other words, the cash flows in column (11) of Table 2 would provide the relevant input for performance measurement under these circumstances.

The choice between adjusting cash flows for changes in all macro effects and adjusting for only unanticipated effects depends mainly on three considerations: how far in advance changes in macro conditions and variables can be forecast; how long the changes in the variables in question are expected to last; and how quickly operations can be adjusted to respond to such changes. For example, if it takes longer to adjust production volumes than an unanticipated exchange rate change is likely to remain in effect, then it clearly makes sense to base performance measures on

15. Incentive effects of the choice of exchange rate in budgeting decisions are discussed in D. Lessard and P. Lorange, "Currency Changes and Management Control: Resolving the Centralization/Decentralization Dilemma," *Accounting*

Review, July, 628-637 (1977). In their analysis the choice of exchange rate influences measures of performance and therefore incentives.

intrinsic cash flows. But, to use another example, if managers can quickly respond to an anticipated change in the exchange rate by shifting production among countries, then they should be held accountable, at least to some extent, for the effects of such currency changes on their operating results.

Companies can also invest in “real options” designed to enhance the flexibility of their operations in responding to future changes in macroeconomic conditions. Such flexibility may take the form of the ability to change suppliers in response to changing international prices of inputs, to increase production or change production location, or to adjust prices in different markets. By assuming a linear relationship between changes in macro variables and corporate cash flows, the process of filtering out macro effects described above does not take into account the “risk management effect” of such real options. The filtering system underestimates the positive cash flow effects of favorable macro events, and exaggerates the negative effects of adverse events. But despite these limitations, the performance evaluation system we are proposing has the virtue of preserving management’s incentive to invest in such sources of flexibility by including the beneficial effects of real options in the measure of managerial ability. That is, by investing today in real options designed to protect the firm against adverse changes in macro conditions and variables, our performance measurement system allows managers to benefit (along with the firm) when those changes materialize.

■ LARS OXELHEIM

is Professor of International Business and Finance at the Lund Institute of Economic Research at Lund University in Stockholm and an affiliate of the Research Institute of Industrial Economics.

CONCLUDING REMARKS

Value Based Management is a tool for designing performance evaluation and incentive compensation systems that aim to maximize shareholder value. In this article we argue that macroeconomic fluctuations cause cash flow and value changes that to a large extent cannot be controlled or influenced by management. Such changes should be filtered out of performance measures so that, to the greatest extent possible, the measures reflect mainly management’s ability and effort. For example, a multinational firm’s operating results in a given year may have as much to do with unexpected exchange rate and interest rate fluctuations as with managerial skill and decision-making; and managerial rewards, particularly at the operating level, should reflect mainly the latter.

In this article, we have argued that VBM performance measures should be fully (or partly) cleansed of macro influences such as (unanticipated) changes in exchange rates or interest rates in cases where management has limited ability to respond to the resulting exposures. A framework for filtering out macro influences on operating cash flows is developed using multivariate regressions to identify the impact of specific macro variables on changes in cash flows. In the case of Electrolux, a Swedish multinational, the framework reveals that changes in the krona/pound exchange rate and various interest rates contribute significantly to the variability of the firm’s cash flows; and that, for operating managers with little ability to anticipate or respond to such changes, the effects of changes in such performance measures should be removed from performance measures.

■ CLAS WIHLBORG

is Professor of Finance and Director of the Center for Law, Economics, and Financial Institutions (LEFIC) at the Copenhagen Business School in Denmark.