A MULTI-FACTOR FRAMEWORK FOR FIRM EVALUATION

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1. Introduction

Over the years, many different approaches to the issue of firm evaluation have been presented in the literature. Various forms of ratio analysis (including ratio pyramids), index systems, credit scoring models and multiple discriminant models are among the best-known methods. Generally, these approaches emerged in response to the extensive need for practical instruments to support credit decisions. However, since these approaches lack a unifying theoretical framework, they often produce incompatible or even contradictory results, which, of course, limits their applicability (see Van Der Wijst [1985] for some examples).

In this paper we describe a framework for firm evaluation which is based on two important developments in financial theory:

a. multi-factor valuation models

b. the revival of the concept of flexibility and its valuation.

At the same time, the framework has, in our opinion, a good potential to be understood and used in practice. The substance of this paper consists of an outline of the proposed framework, presented in the next section. In section 3 we discuss some aspects of its operationalization. The use of the framework is illustrated in section 4. Finally, our conclusions are summarized in section 5.

2. Theoretical background

To provide the proper setting for the understanding of the proposed framework, we will first briefly discuss the multi-factor portfolio model, which was recently presented by Hallerbach en Spronk [1986]. In their model, they intendedly deviate from the well-known

mean-variance model as presented by Markowitz [1952, 1959] among other reasons because the use of variance as a uni-dimensional measure of risk is rejected. Instead, Hallerbach and Spronk (op cit.) base their approach on multi-factor models. A security is viewed as a claim on a series of uncertain future cash flows. In this view, a stock represents a residual claim on a part of the cash flows generated by the firm. The results of the firm will partly reflect the firm's policy but they will also depend on the external forces and influences from the firm's dynamic environment. An investor buying a stock will have his expectations with respect to the firm's results but at the same time he is exposed to the influences from the environmental factors on the firm's results. The shareholder's claim can thus be characterized as an expected return plus a vector of sensitivities for unexpected changes in the firm's environment (in an efficient market, the influence of expected changes in the environment are included in the expected return).

In this view, the return on a stock can be written as:

return = expected return +
(sensitivity for unexpected changes in environmental factor 1 x unexpected change of factor 1) +
(sensitivity for unexpected changes in environmental factor 2 x unexpected change of factor 2) +
.
.
.
(sensitivity for unexpected changes in environmental factor m x unexpected change of factor m) +
disturbance term (specific risk)

In the literature several multi-factor models have been proposed. Each of these models aims to find a set of factors which can be generally used. In some cases, factors have been proposed which have no clear *causal* relation with the cash flows generated by the firm (see for a critical survey Hallerbach [1986]). Hallerbach en Spronk (op cit.) take the position that (a) one should only accept factors which have a clear causal relation with the firm's results and (b) the possibility,

that stock A might be sensitive to a somewhat different set of factors than stock B, should be left open.

The first task of an investor who accepts the multidimensional risk concept as described above is to determine the relevant factors for each potential security in the portfolio and to estimate the associated sensitivities. Given the individual securities' sensitivities, the portfolio's sensitivities for the unexpected changes in the specified factors can be expressed as a weighted average of the sensitivities of the individual securities. The weighting factors are thus defined as the fractions of the portfolio invested in the respective securities. If then these fractions are treated as instrumental variables, the portfolio problem can be defined as a multiple objective programming problem, in which the portfolio's expected return and its various sensitivities are treated as separate and generally conflicting goal variables. Hallerbach and Spronk (op cit.) attack this problem by using IMGP, an interactive approach by means of which the investor has the possibility to adapt his portfolio interactively on basis of the returns and sensitivities which can be obtained (cf Spronk, [1981]).

The same kind of thinking can be used in firm evaluation, both internally (analysis of strengths and weaknesses) and externally (e.g. to support a credit decision). In either case, we believe it is appropriate to estimate the expected cash flows,to identify the factors which might influence these expectations and to measure the sensitivities of the cash flows for unexpected changes in these factors. Of course, there are some differences with the portfolio problem.For example, it is conceivable that, especially in internal evaluation, a firm is also evaluated in other terms than cash flows alone (e.g. employment level, labour relations, market power, etc.).Such a broadened evaluation can be done in a straightforward manner, be it that the amount of calculations increases and that one may want to investigate the interrelations between the evaluation criteria.

Many different factors may influence the future cash flows of the firm. Some of these factors will be well-identifiable and well-measurable. However, there will also be factors which are (a) well-

identifiable but less well measurable (e.g. because limitations in the data or because the factor concerned can not easily be operationalized). Finally, there will be factors (b) which are not well identifiable because of their too infrequent occurrence. The framework discussed here is primarily concerned with the sensitivity of the cash flows for unexpected changes in well-measurable factors. The factors ad (a) and ad (b) will together determine what we have called specific risk. Depending on the objective of the evaluation (is it an internal or an external evaluation, is it a routine evaluation or is it a one-time evaluation for a major credit decision, etc.), the evaluator will also have to pay attention to the less-well measurable factors hidden in the specific risk component. For instance, most suppliers of capital will take good account of the quality of management of a given firm. Within the proposed framework the influence of the quality of management will be partly reflected in the evaluators' expectations and partly, i.e. with respect to the unexpected influence, as a part of the specific risk component. A firm having a good and stable policy for recruitment and selection of personnel will produce less 'surprises' than a firm with a clumsy ad hoc policy. Of course, an evaluation backing an important credit decision will pay attention to such a factor, even if it is less well measurable. In the discussion of the portfolio model, risk was defined as the potential influence of 'environmental' factors plus the specific risk component. Following the example of quality of management,one might ask whether and, if so, in which cases non-environmental factors (factors from inside the firm causing unexpected changes in the cash flows) should,instead of being included in the specific risk component, be recognized as separate factors for which the associated sensitivities have to be estimated. Again, the answer to this question will depend on the position of the evaluator and on the factor concerned. For instance, internal evaluators will generally have a better insight in the potential influence of internal factors than external evaluators have. This means that the former often know what they can expect from these internal factors and, if there is uncertainty, that they, better than external evaluators, can identify the relevent factors and assess the firm's sensitivity for these factors. When an internal factor can be identified and be reasonably measured one may still ask whether this factor should be isolated from

the specific risk component. Below will become clear that we answer this question in an affirmative manner.

After the identification of the most important factors and the assessment of the firm's sensitivity for these factors, a number of questions remain. A first question is whether and, if so, how the firm is prepared for unexpected changes in the factors. Obviously, both the defensive and the offensive weapons of the firm should be considered. In both cases, the firm has two possibilities to armour itself. One possibility is to neutralize or to limit a risk beforehand by 'buying an insurance' with respect to this risk (where 'buying an insurance' should be understood in a broad sense). For instance, firms often insure themselves against the negative consequences of unexpected changes in the factors such as fire or exchange rate fluctuations (the latter can often be insured by buying valuta options). On the other hand, the firm can assure itself of the positive effects of unexpected changes in the factors (e.g. by acquiring the exclusive selling rights of a product in development). Another possibility to face risks, instead of buying an insurance, is to create sufficient elbow-room in the firm to be able to react adequately to an unexpected change in some factor if and at the moment it occurs. An example is not to insure against fire but instead to make a large enough reservation to be able to bear the negative consequences of fire. The importance of some elbow-room is illustrated by a comparison of the histories of PanAm and Braniff (example from Casey en Bartczal, [1985]). At a certain moment both firms generated a negative operational cash flow. Braniff went bankrupt in 1982 while PanAm could survive longer by selling two important assets (Intercontinental Hotel and PanAm building). An evaluation of PanAm based on a cash flow analysis alone -i.e. without taking account of its 'elbow-room'- would clearly have given a wrong answer.

Creating elbow-room can be viewed as buying and at the same time writing an(other) option. If an unexpected change of a factor materializes, the option holder has the right to use the elbow-room to react to this change. The possessor of the elbow-room is of course obliged to bear the consequences if the elbow-room is not sufficient. In this sense he is not only the holder of an option (with the right to use

the elbow-room) but at the same time he is the writer of an option (with the obligation to bear the consequences if the elbow-room is not sufficient). Elbow-room is often labeled as flexibility, where a distinction is made between operational and financial flexibility (cf. Kemna en Van Vliet [1984]). Examples of operational flexibility are the possibility to quickly adapt production (e.g. with respect to production volume or to product specification) according to the changing needs of the product's consumers. Already twenty years ago, the importance of financial flexibility was stressed by Donaldson [1969,1984] and in the Netherlands by Diepenhorst [1962] (the latter made the useful distinction between defensive and offensive flexibility). Examples of financial flexibility are unused reserves (cash surpluses, unused credit facilities), unused debt capacity, the capability to reduce expenditures and the earlier mentioned possibility to sell assets. Not surprisingly, the creation and maintenance of elbow-room is not without costs: flexibility has its price (cf. Kemna en Van Vliet,op cit.).

After the identification of the most important factors and the evaluation of the firm's armoury to react to unexpected changes of these factors, a supplier of credit will raise the question which insurances and which elbow-room he himself has in his relation with his client. In practice, the answer to this question is generally given in terms of collaterals and other guarantees and in terms of certain rights on information. In specifying these rights and guarantees, it may be useful to take account of the sensitivities of the firm concerned.

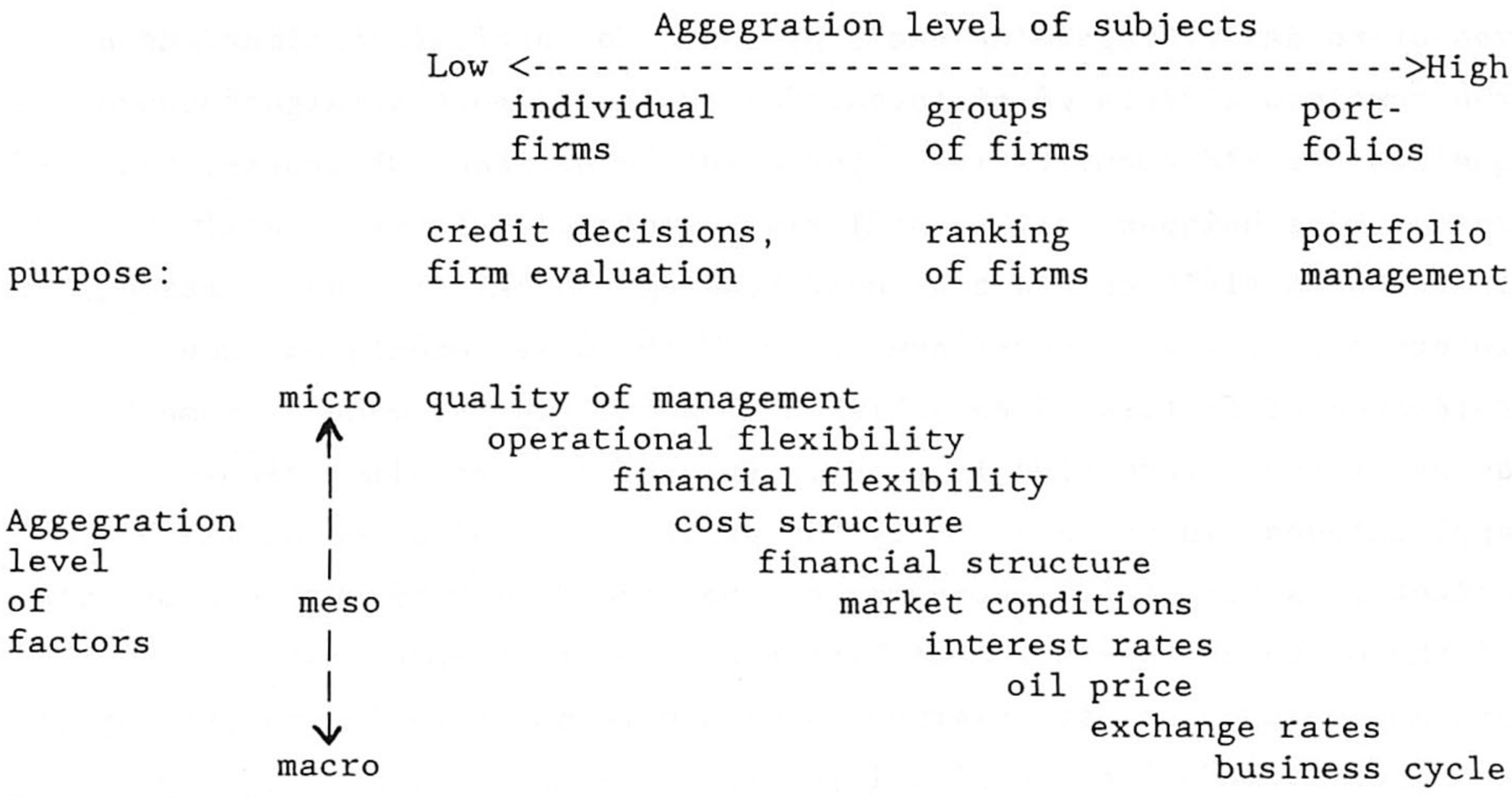
3. Operationalization

Since the multi-factor approach provides a framework rather than a set of techniques for financial analyses, it can be used to support a variety of different decisions and almost the entire financial analysts' toolbox may be used in its operationalization. To map this vast area, it may be useful to distinguish three aspects of the framework's operationalization, viz. the aggregation level of the subjects to be analysed, the aggregation level of the factors considered and the degree of detail of (or the nature of the results produced by) the analyses.

As regards the latter aspect, the degree of detail of the analyses may vary from an enumeration of the relevant factors on the one hand to complex statistical analyses on the other. Along this scale, the information obtained on the factors considered increases from a simple yes-or-no answer regarding their presence to intricate estimations of the combined effects of different factors, with more straightforward qualitative and quantitative information in between. Of course, the research techniques vary accordingly. Simple techniques to analyze factor-sensitivities are e.g. chartreading, checklists, qualitative interviews or even group-discussions. With these techniques, the relevance of factors is established in a qualitative manner. Some quantitative information is used in spreadsheet- or simulation-applications, in which not only the presence but also the estimated effect of a factor is incorporated. The effects may be obtained by rules of thumb, by extrapolation of historic data or by more complex estimation procedures. Information of a more quantitative nature may be obtained by modelling sensitivities for a group of firms, e.g. by modelling interfirm comparisons.

The aggregation level of the subjects to be analysed may range from the evaluation of an individual request for credit to the evaluation of credit portfolios as a whole (and even countries).For the factors considered, a corresponding sliding scale can be constructed, although most factors are likely to be relevant over a certain range of aggregation levels. Figure 1 depicts various aggregation levels and presents some factors of potential relevance for firm evaluation and portfolio management. The range of aggregation levels over which the relevance of a factor stretches may be limited for several reasons. For instance, most suppliers of capital will take good account of the quality of management of an individual firm, as was mentioned earlier, but for practical reasons it is hardly feasible to assess this factor in a consistent manner for portfolios. Also, within a homogeneous group all firms may be equally affected by changes in certain factors, e.g. a disruption of the supply of raw materials. Thus, such factors would not be relevant to discriminate between firms. However for portfolios the dependence on specific raw materials is an important factor. In spite of the limited aggregability of some factors, one may want to calculate

Figure 1. Aggregation levels of subjects and factors.



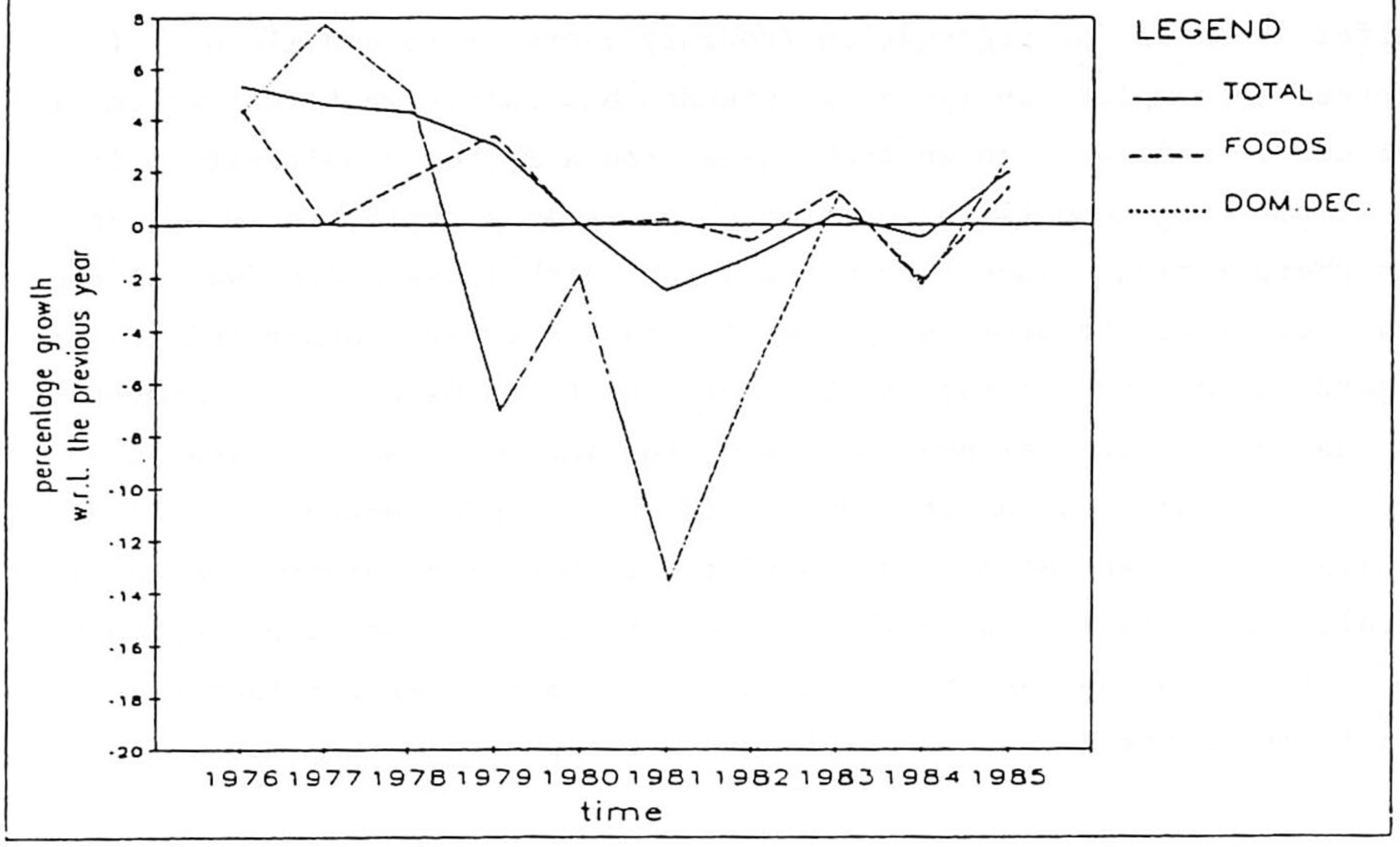
a portfolio's average sensitivities for other factors which have been identified at the level of individual firms. Such an analysis might for instance produce the result that earlier credit decisions have lead to a portfolio which is skewly distributed towards one or more factors or, in other words, that the portfolio is 'oversensitive' for certain factors. This result may be obtained in qualitative or in quantitative terms. On basis of such a conclusion, one could adapt the future credit policy. The interactive portfolio model described above might well be appicable here. Altenatively, one could classify the firms requesting credit in credibility classes, defined in terms of sensitivity values. This would lead to a partial order of the firms. The supplier of credit is then able to select the best classes of clients until a class is reached which contains doubtful prospects. For that class a more refined classification, again in terms of sensitivities, can be made.

4. Illustration

To illustrate the application of the justly described framework in practice, an analysis of the retail trade is performed on three different levels of aggregation (roughly macro, meso and micro). Of course, no complete analysis is intended but rather an illustration of the use of some well-known techniques from a factor-sensitivity point of view. Using domestic decoration shops as an example, we investigate how their market volume fluctuates with the business cycle (macro) and how they relate to other shoptypes (meso) and to each other (micro) as regards cash flow generation. The position taken here can be thought of as that of an external evaluator who, for instance, must decide on an important loan to a domestic decoration shop. Unfortunately, the available data are scant and restricted to historic information, as is usually the case in empirical analyses. Hence, the investigation must be confined to the sensitivity of historic cash flows for factors available in the data, but for illustration purposes this may suffice.

Starting the analyses on a high level of aggregation, fluctuations in the business cycle, represented by the national total of consumption expenditures, are depicted in Figure 2, along with the consumption expenditures on two product groups (foods and domestic decoration). Figure 2 shows the downswing of the business cycle over the period 1976 through 1981 and the subsequent upswing. The total market for foods (i.e. consumption expenditure on foods) stays close to the national total and remains within an interval of +5% to -5%. The domestic decoration market, on the other hand, shows a much larger variation, reaching a negative growth of almost 15% in 1981. Such a drastic decrease in total market volume is unlikely to leave most individual firms undamaged, although some firms may be more strongly affected than others. Thus, shoptypes selling mainly foods (such as supermarkets) may be concluded from Figure 2 to be much less sensitive for fluctuations in the business cycle than shoptypes selling primarily domestic decoration. This sensitivity , although it is on high level of aggregation, is likely to influence an external evaluator's decision wether or not to grant a loan to a domestic decoration shop.

Figure 2: GROWTH IN CONSUMPTION EXPENDITURES
(NAT. TOTAL, FOODS, DOMESTIC DECORATION)
source: CPB
EIM



In the above example, a simple technique producing qualitative results (chart reading) is used, as is commonly done in practice. The same phenomena could be analysed by using more complex techniques, e.g. by specifying and estimating a model for the effect of fluctuations of the business cycle on different markets. For lack of available data, this is not done here. Instead, we investigate, on a lower level of aggregation, how domestic decoration shops relate to other shoptypes and to each other as regards cash flow generation. This is done by developing a model for cash flow changes in two successive years. Basically, the model describes how cash flow is generated from three obvious sources, viz. changes in respectively sales, costs (as a percentage of sales) and gross margin. The degree in which cash flow is generated from these sources, or, in other words, the sensitivity for changes in these sources, is expected to depend on the firm's resp. the shoptype's characteristics with respect to finance, costs, assets and activities. As indicators of these characteristics the following variables are used:

- financial structure (debt-to-total assets),
- cost structure (fixed costs-to-total costs),
- inventory turnover (sales-to-inventories),
- business activities (dummy-variable)

High debt ratios and large fixed costs components are expected to be associated with comparatively low cash flows, while for high inventory turnovers the opposite effect is expected. By modelling the sensitivity of the cash flows for these characteristics we can determine their relevance on different levels of aggregation and, subsequently, use the results to assess the cash flow performance of shoptypes or individual shops. The following specification is used:

$$\text{(1)}\quad \Delta CFL = B_1 + (B_2.\Delta S + B_3.\Delta CPS + B_4.\Delta GMA).pdf^{B_5}.pfc^{B_6}.ito^{B_7}.exp^{B_8.DACT}$$

in which:

ΔCFL= change in cash flow (in guilders)
ΔS = change in sales (in guilders)
ΔCPS= change in costs as a percentage of sales
ΔGMA= change in gross margin
pdf = debt/total assets
pfc = fixed costs/total costs) divided by the sample average value
ito = inventory turnover
DACT= dummy for activities; for individual domestic decoration shops DACT=1 if the shop is specialized in soft furnishings, zero otherwise; for shoptypes, DACT=1 for shoptypes selling primarily durables and zero otherwise.
B.. = coefficients to be estimated.

Equation (1) is estimated for a sample of 185 individual domestic decoration shops and a sample of 39 shoptypes (using shoptype-average data), both referring to the years 1984-1985. All data were collected by the Research Institute for Small and Medium-sized Business in Zoetermeer. The estimation results are presented in Table 1.

Table 1. Estimated coefficients of (1).

		Individual dom.dec.firms		Shoptype averages	
		coefficient	t-value	coefficient	t-value
B_1	intercept	3558.	1.7*	347.	.4*
B_2	ΔS	.119	8.5	.141	18.1
B_3	ΔCPS	-7986.	-13.4	-6058.	-8.5
B_4	ΔGMA	8856.	9.5	6938.	7.6
B_5	pdf	-.120	-2.3	-.573	-2.2
B_6	pfc	-.167	-2.1	-	
B_7	ito	.271	3.9	-	
B_8	DACT	-.444	-4.2	-.220	-2.4
ρ^2		.770		.958	

Notes table 1:- the estimation results are produced by a nonlinear least-squares fit using Marquardt's algorithm (see Marquardt [1963])
- the square of the correlation coefficient between ΔCFL and its estimation (ρ) is taken as a measure of goodness of fit
- * means not significantly different from zero at a 5% level of significance
- for shoptype averages the model was re-estimated without B_6 and B_7 as these coefficients appeared to be insignificant.

Table 1 shows that the three sources contribute significantly to changes in cash flow, as could be expected, and that the sensitivity for changes in these sources depends indeed on four (individual firms) resp. two (shoptype averages) of the four characteristics. For shoptype averages, cost structure and inventory turnover appear to have no significant influence on cash flow generation. These results can be used in two ways. First, having identified relevant factors for cash flow generation (i.e. the variables with a significant influence in (1)), firms and shoptypes can be evaluated with respect to these factors. For instance, we can assess wether or not a firm has created elbow-room by e.g. maintaining a below average debt percentage (i.e. reserve borrowing power) or an above average inventory turnover. Second, we can calculate the effect of this elbow-room on the cash flow developement and take this factor into account in the evaluation of the cash flow. For instance, in domestic decoration shops a 20% above average inventory turnover is associated with on the average 1.2*.27=1.05 i.e. a 5% above average cash flow generation from the three sources mentioned earlier.

In this way, equation (1) produces an estimation of the cash flow generation based on a number of relevant characteristics. By using this estimation as a measure, the analyses facilitate a sharper evaluation of the cash flow performance of shoptypes relative to the retail trade as a whole and of individual shops relative to the shoptype. Although space forbids further elaboration, the above may suffice to illustrate the application of some common techniques within the framework of the multi-factor approach.

5. Conclusions

The multi-factor framework for firm evaluation presented in this paper can be used to support a variety of different decisions and it can be operationalized using existing research techniques. As a framework, it provides goals for the application of research techniques and a point of view from which the results can be interpreted rather than the techniques as such. So, not surprisingly, a number of elements from the framework have been operationalized and can be used in practice. However, many problems of both theoretical and practical nature still remain to be solved, particularly with regard to the estimation of factor-sensitivities, the possible instability of these sensitivities and the question how a manager can report his expectations regarding changes in certain factors in a consistent manner.

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