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# Measuring & Tracking Industry Risk

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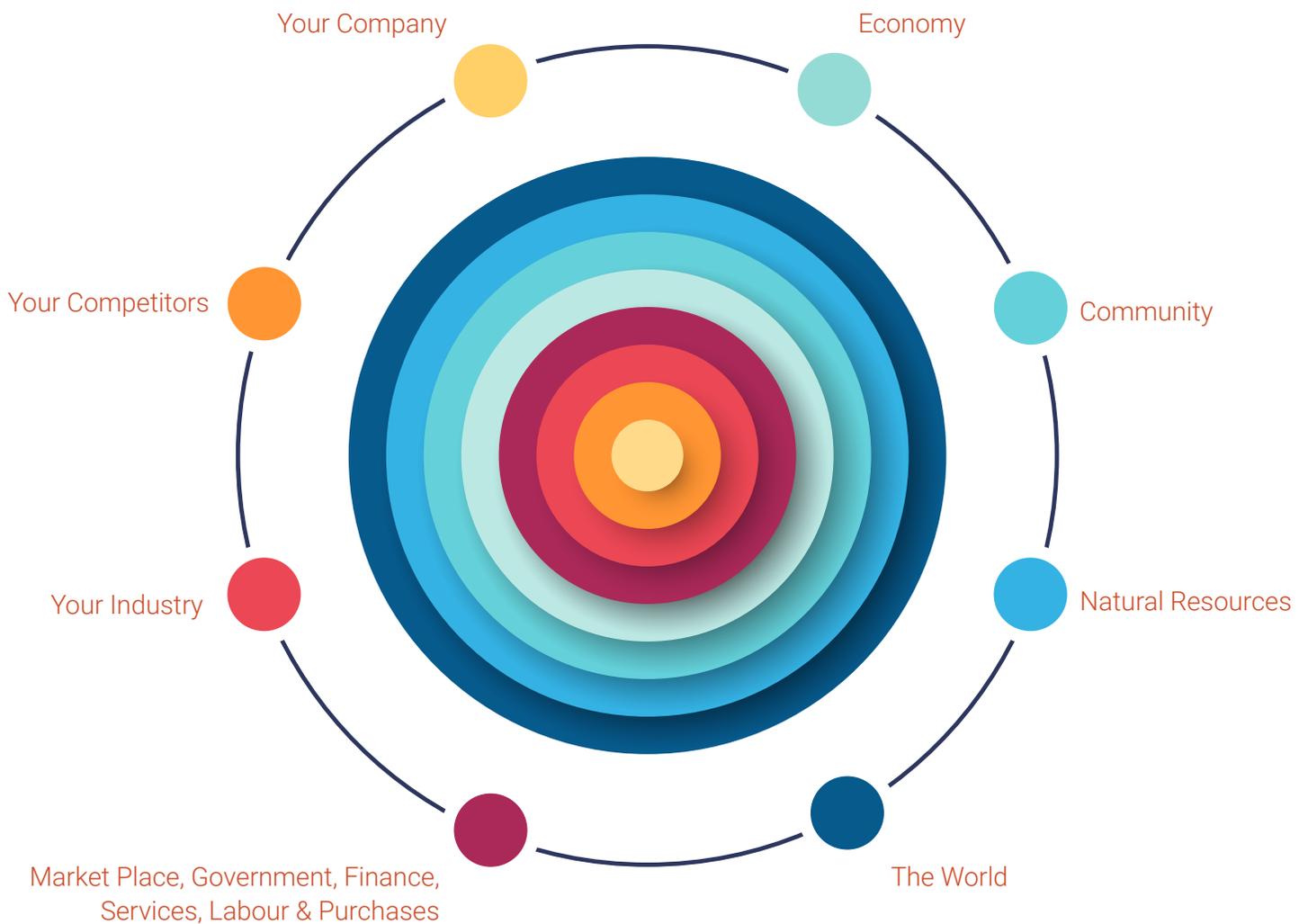
**IBIS**World

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# Contents

# 1. Introduction

No industry operates in isolation – it is part of a chain of suppliers and customers each with different operating conditions, threats and opportunities. Contextualising these disparate factors is vital in understanding an industry's likely risk and thereby providing an indication of its future performance.



Your Company

Economy

Your Competitors

Community

Your Industry

Natural Resources

Market Place, Government, Finance, Services, Labour & Purchases

The World

# 1. Introduction

IBISWorld's Risk Rating Model is a trusted tool for measuring and tracking operational risk at the industry level. While the model does not seek to determine the expected default probability of an individual operator in a given industry – such an evaluation is not possible without company- or operator-specific information – IBISWorld Risk Scores are an extension or addition to any exiting operator specific analysis, and may be used to identify and help mitigate risks before they appear. Such risk models are most useful when properly understood and interpreted. The following White Paper provides a discussion of how we at IBISWorld generate industry Risk Rating Scores and validates the model used to assess risk at the industry level.

# 2. Components of Risk

To calculate the overall IBISWorld Risk Rating Score for a given industry, we assess the risks pertaining to industry structure (i.e. structural risk), expected future performance (i.e. growth risk) and economic forces (i.e. sensitivity risk). These three components of risk are scored separately, using the IBISWorld Risk Rating Model, and subsequently weighted and combined to derive an overall industry-specific score. The three components of risk are dissected and explained as follows.

## 2.1 Growth Risk

The first component of risk in IBISWorld Risk Rating Model is growth risk, that associated with a given industry's revenue performance. Generally, a high rate of revenue growth in a given industry is associated with a lower overall difficulty of operation in said industry. In such a case, success can come relatively easily in a quickly growing market. Conversely, a contracting market tests management's skill to a much greater level, as each pound earned requires more effort for the average company.

The growth risk score is a cardinal function of the expected rates of growth of industries over the forecast period. Recent and forecast growth rates for all covered industries are analysed. The recent growth rate for an industry is calculated over two years according to the standard compound annual growth formula:

$$R_r = (Rev\ y/Rev\ y\text{-}2)^{0.5} - 1$$

Where "Rev y" is industry revenue in year y and "Rev y-2" is industry revenue two years prior.

The forecast growth rate for an industry is calculated over a single year as follows:

$$R_f = Rev\ y\text{+}1/Rev\ y\text{-}1.$$

# 2. Components of Risk

A rating of 1.0 is assigned to a point two standard deviations[1] above the mean and a rating of 9.0 is assigned to a point two standard deviations below the mean. Observations above and below these points are truncated to these limits.

Risk ratings for observations are given by the formula:

*Rating = min(max(10-(((observation- (ave-2sd))/4sd)*8+1),1),9)*

Where "ave" is the average of the last 10 years of GDP growth as taken from the Business Environment Database, and "sd" is the standard deviation of revenue growth observations during the corresponding period.

The growth risk rating methodology generates an estimate of absolute risk for industry growth, as opposed to an estimate of the industry's risk relative to other industries. In other words, whilst a given industry may be less risky than others, it may still be considered to exhibit a high level of risk compared to its past performance.

The growth risk rating methodology is based on 10 years of GDP growth as, in general, revenue growth across UK industries has a direct correlation with UK GDP growth. (i.e. long-term GDP growth is a logical proxy for a normal industry's performance).

Therefore, this measure has been identified as an indicator of "normal" growth, rather than basing the model on a measure of normality tied to the current year of an industry's revenue growth. A 10-year timeframe captures a trend longer than a single business cycle, thereby encompassing both positive and negative results, and is also recent enough to accurately reflect current operational conditions.

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*[1] See glossary for technical definitions*

# 2. Components of Risk

The end result is the development of one recent and one forecast growth risk score for each industry. These scores are cardinal ratings – a real number ranging between 1.0 and 9.0. Recent and forecast growth scores are combined to form an overall growth risk score by adding 75% of the forecast growth scores to 25% of the recent growth score. Consequently, the model attempts to capture the increased risk associated with revenue forecasts that are revised down, and vice versa. The breakdown for growth risk score weightings is presented in Figure 1.

Figure 1: Growth Risk Score Breakdown

**25%** RECENT GROWTH

Compound annual rate for last 2 years

**75%** FORECAST GROWTH

Forecast one-year growth

**-** BENCHMARK

Minimum/maximum boundaries. Compare with LT ave.

GROWTH SCORE (25%) OF OVERALL SCORE

# 2. Components of Risk

## 2.2 Structural Risk

The second component of risk is associated with the structure of a given industry. To assess this, the IBISWorld Risk Rating Model considers and scores the qualitative internal factors of an industry that influence a business's operating environment.

> There is an element of risk in the fundamental characteristics common to all industries.

Essentially, the model used to examine structural risk gauges the fundamental characteristics common to all industries, and analyses them at the industry-specific level. The components that determine the structural risk score are as follows: Barriers to Entry; Industry Assistance; International Trade; Basis of Competition; Industry Life Cycle; and Revenue Volatility.

IBISWorld analysts make a subjective judgement as to the degree a given internal factor influences the industry's operating environment – for example, barriers to entry may be high, moderate or low – and whether the extent of these factors is changing. Contingent on the degree and trend of the structural dimension, it is given a cardinal risk rating - a real number ranging between 1.0 and 9.0. From this, the overall structural risk rating is derived by taking a weighting of the risk score of each structural dimension, and amalgamating said scores.

# 2. Components of Risk

## 2.2.1 Barriers to Entry

*How protected are firms from new entrants and what prevents prospective firms from entering a given industry?*

Barriers to entry consist of requirements that an aspiring operator must satisfy or problems that must be overcome prior to commencing operations in a given industry. Common barriers to entry may include insurmountable start-up costs, substantial capital requirements, intellectual property rights, a high level of market share concentration among incumbent operators, and the need for economies of scale in order to operate profitably.

The IBISWorld Risk Rating Model assumes that a high level of barriers to entry is associated with a lower risk, as such barriers afford protection to existing players, which will typically increase the probability of economic rent. Conversely, low barriers tend to invite more participants to the industry, typically leading to lower prices, by way of new competition, and consequently narrowing the potential for profit. The standardised risk scores for this structural dimension are presented in Table 1.

TABLE 1: Scoring Barriers to Entry

## Barriers to Entry

| Levels | Increasing | Steady | Decreasing |
|--------|-----------|--------|-----------|
| High   | 1         | 3      | 9         |
| Medium | 2         | 5      | 8         |
| Low    | 4         | 7      | 7         |

# 2. Components of Risk

## 2.2.2 Industry Assistance

*Do industry operators receive any funding or non-financial support from the public sector or trade associations?*

Industry assistance is, predominantly, associated with government policy objectives (e.g. capital investment, trade tariffs, tax concession, grant funding) that are designed to improve industry performance and create outcomes that differ from expectations under perfectly competitive conditions. In some cases, assistance may also derive from other sources such as trade associations, equity investors and other industry stakeholders. IBISWorld analysts assess the level of assistance from public-sector sources or support networks and whether the degree of support is changing. Analysts also note if external assistance is non-existent.

The short- and long-term effects of industry assistance differ and have disparate risk outcomes. In the short term, new assistance can be assumed to have a beneficial effect. However, if this is continued into the long term, an expectation of ongoing assistance can become entrenched and result in sub-optimal economic outcomes (e.g. the presence of x-inefficiencies). As per the IBISWorld Risk Rating Model, the assumption is that existing assistance has been factored in by the industry, diluting its initial effects, but new assistance brings short-term additional benefits.

# 2. Components of Risk

Regardless of the level of assistance, an increasing trend of assistance over time will subdue risks in a given industry. Assuming the policy change has the desired effect and increases operational efficiency, this may lead to a lower risk of default. Conversely, when the level of assistance in a given industry is decreasing, operational risk rises; the assumption may be made that as an industry has assimilated the benefits of extant assistance, operators reliant on this continuing may become exposed to operational difficulties if the support network is reduced.

Finally, when the level of assistance in an industry is insignificant, the trend is not considered to affect risk. Structural dimension risk scores for industry assistance are presented in Table 2.

TABLE 2: Scoring Barriers to Entry

## Industry Assistance

| Levels | Increasing | Steady | Decreasing |
|--------|------------|--------|------------|
| High   | 1          | 3      | 9          |
| Medium | 2          | 5      | 8          |
| Low    | 4          | 7      | 7          |
| None   | 7          | 7      | 7          |

# 2. Components of Risk

## 2.2.3 International Trade

*Does a given industry engage in international trade and to what extent do cross-border operations or import inflows affect a domestic company's performance?*

### 2.2.3.1 Exports

The international market for a given industry's goods and or services represents growth opportunities for companies within said industry. However, there are increased risks associated with cross-border trade. Sources of risk that derive from exports may include: domestic firms' limited understanding of trade conditions in foreign markets (e.g. marketing strategies) and unfamiliarity with foreign regulations; exchange rate volatility; and sovereign risks.

The IBISWorld Risk Rating Model considers exports as a proportion of revenue, as opposed to exports in absolute terms, and categorises them as being high (greater than 20%), medium (greater than 5% and less than or equal to 20%), and low (less than or equal to 5%). Meanwhile, export trends, whether increasing, steady or decreasing, take into consideration whether exports, both as a proportion of revenue and in absolute value terms, is changing.

# 2. Components of Risk

Low exports indicate limited exposure to overseas market volatility and, therefore, lower risks associated with foreign dealings. In other words, while changes in the size of the foreign sector of a market may have risk implications, the risk sensitivity for companies in an industry with a focus on the domestic market would be mitigated due to the foreign sector being smaller than a business with a higher export exposure.

Meanwhile, decreasing exports typically represent a shrinking market, which is considered to be a higher overall risk. Conversely, increasing exports indicate increased dealings with foreign systems. Although inherent risks remain when operating cross border, this can signal expanding market opportunities. Structural dimension risk scores for exports are presented in Table 3.

TABLE 3: Scoring Exports

## Exports

| Levels | Increasing | Steady | Decreasing |
|---|---|---|---|
| High (>20%) | 4 | 5 | 9 |
| Medium (>5% %<=20%) | 3 | 4 | 7 |
| Low (<=5%) | 2 | 1 | 2 |

# 2. Components of Risk

## 2.2.3.2 Imports

Risk associated with the existence of competing imports is not simply the opposite of those associated with exports, albeit overall market size implications are similar: Generally, an increasing level of competing imports shrinks the market available for domestic producers, and vice versa. The predominant risk associated with imports is related to competition concerns. For instance, if the share of imports as a proportion of domestic demand is low, the industry in question has a lower exposure to competing sales in the domestic market deriving from foreign entities. Meanwhile, decreasing imports signals that foreign entities have less presence in the domestic market, lowering competition for domestic operators. Structural dimension risk scores for imports are presented in Table 4.

TABLE 4: Scoring Imports

### Imports

| Levels | Increasing | Steady | Decreasing |
|---|---|---|---|
| High (>35%) | 9 | 8 | 8 |
| Medium (>5% %<=35%) | 7 | 5 | 4 |
| Low (<=5%) | 3 | 2 | 1 |

# 2. Components of Risk

## 2.2.4 Basis of Competition

*What is the level of competition from industry counterparts or external entities and how difficult is it to gain market share?*

In the IBISWorld model, competition is the degree to which a company is influenced by another company that produces an identical or substitute product, either within the industry or externally, and how this affects efforts to maximise their long-term returns. IBISWorld analysts make an informed judgement regarding the level of competition for industry operators and whether the degree of competition is changing.

Factors that enable a company to differentiate itself from industry counterparts or external competitors are diverse, and firms may compete on price, product quality, product spectrum, service quality and so forth. Considering the diverse factors that indicate the level of competition, it is not always the case that an industry in which competition is supposedly increasing will display every aspect of signs of high competition. For instance, a low level of short-term profit in an industry may either be caused by a long-term high level of competition, or a short-term price war in an industry that normally has low levels of competition. Consequently, to account for the margin of error that this can lead to, the IBISWorld Risk Rating Model does not account for the competition trend, only considering the degree of competition.

# 2. Components of Risk

Typically, a higher level of competition is associated with higher levels of risk. This is because activities caused by high levels of competition not only tend to detract from profitability of companies, but also widen the range of business outcomes that management must consider. Structural dimension risk scores for competition are presented in Table 5.

TABLE 5: Scoring Basis of Competition

## Basis of Competition

| Levels | Score |
|---|---|
| High | 9 |
| Medium | 5 |
| Low | 1 |

## 2.2.5 Industry Life Cycle

*Is the industry in the growth, mature or decline phase of its life cycle?*

Industries have three broad phases of an operational life cycle, namely growth, maturity and decline. These phases are determined by factors within the industry such as market growth or saturation, product innovation, technological developments, and the degree of consolidation activity. By taking into account said factors, and considering the correlation between GDP growth and the industry's contribution to the wider economy, using industry value added (IVA) as a proxy, IBISWorld analysts assess the life cycle stage of a given industry.

# 2. Components of Risk

Typically, risks in an industry in the growth phase are lower than those for an industry in decline. In an industry that is in a growth phase, revenue and profit tend to be high and the requirement for labour and capital for both productive and research tasks is also high. This boosts an industry's IVA, its contribution to GDP, which is the major indicator of the growth phase. Structural dimension risk scores for volatility are presented in Table 6.

TABLE 6: Scoring Industry Life Cycle

## Industry Life Cycle

| Levels | Score |
| --- | --- |
| High | 9 |
| Medium | 5 |
| Low | 1 |

## 2.2.6 Revenue Volatility

*How extreme have revenue growth fluctuations been over a given five-year period?*

Volatility, in this context, is a measure of the magnitude of fluctuations in total industry revenue. Essentially, volatility is a proxy for shifts in overall industry operations and can stem from changes in the quantity of goods or services sold, or changes in the price charged. IBISWorld estimates volatility by calculating the difference between annual revenue growth rates for a five-year time period.

# 2. Components of Risk

The absolute values of these differences are subsequently determined (i.e. by converting each number to a positive figure by squaring all differences). The differences for all five years of a given focus period are summed and subsequently divided by the number of values. IBISWorld defines four levels of volatility: Very high, high, medium, and low, based on the average change over the five-year focus period.

A greater degree of revenue volatility implies higher risk for several reasons, predominantly due to the implication that an industry with high volatility has more unstable or uncertain operating conditions. For instance, when an entity is planning investment in a given industry, the problem of underused capacity or capacity constraints becomes critical for industry operators. If the time delay between identification of an investment and its commissioning is significant, then the operator may be unable to shift capacity when demand suddenly rises. Significant volatility can cause particular concerns for companies with considerable fixed costs, as in years where revenue falls, these must be spread over a much smaller cost base, to the detriment of profitability. Structural dimension risk scores for volatility are presented in Table 7.

TABLE 7: Scoring Revenue Volatility

## Revenue Volatility

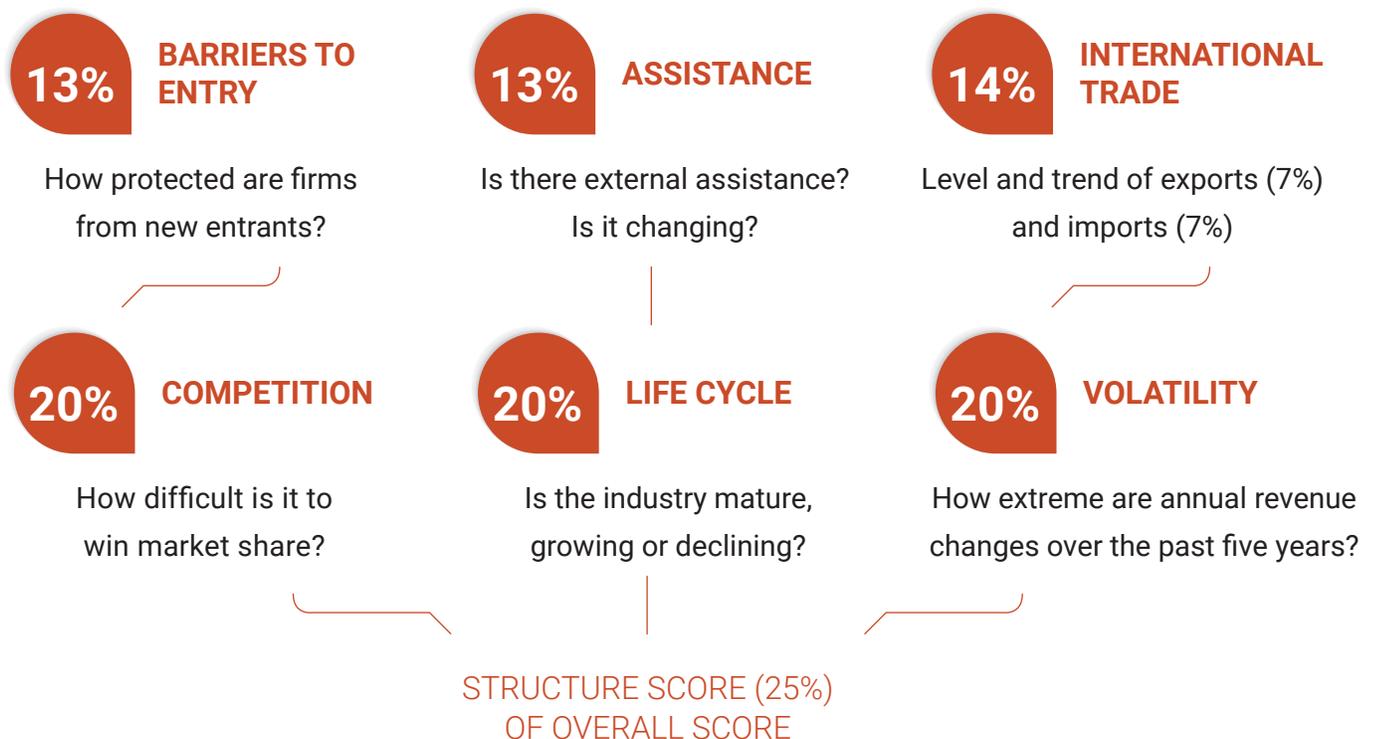| Levels | Score |
|---|---|
| Very High | 9 |
| High | 7 |
| Medium | 5 |
| Low | 1 |

# 2. Components of Risk

## 2.2.7 Overall Structural Risk Score

IBISWorld judges three structural components – volatility, competition, and life cycle – as most critical in assessing overall structural risk, and these are therefore each assigned a structural risk score weighting of 20%. Volatility has a significant impact on strategic business planning, investment and cash flow which, consequently, can have a considerable effect on a company's ability to operate. Meanwhile, competition can force businesses to adopt operating strategies they would not typically implement when market conditions are less turbulent. Life cycle is also assigned a 20% weighting, as it is an effective proxy for an industry's contribution to the wider economy, indicating an industry's future operating potential. The overall structural risk score is a non-integer number between 1.0 and 9.0. The breakdown for structural dimension risk score weightings is presented in Figure 2.

FIGURE 3: Internal Risk Scores Summary

**13%** BARRIERS TO ENTRY

How protected are firms from new entrants?

**13%** ASSISTANCE

Is there external assistance? Is it changing?

**14%** INTERNATIONAL TRADE

Level and trend of exports (7%) and imports (7%)

**20%** COMPETITION

How difficult is it to win market share?

**20%** LIFE CYCLE

Is the industry mature, growing or declining?

**20%** VOLATILITY

How extreme are annual revenue changes over the past five years?

STRUCTURE SCORE (25%) OF OVERALL SCORE

# 2. Components of Risk

## 2.3 Sensitivity Risk

Companies must deal with operators in upstream industries, which may provide raw materials, for example, and downstream industries, which provide markets for firms to offer goods and services. Consequently, industries are subject to external forces that influence operational performance, and contend with factors outside the scope of an industry operator's influence. These external factors are collectively known by IBISWorld as "sensitivities". Classification of these sensitivities is mainly an arbitrary exercise, as many have overlapping aspects. However, they fall into two broad groups: Macroeconomic sensitivities and not independently quantifiable sensitivities. Meanwhile, upstream and downstream demand conditions (i.e. the level of activity in other industries that affects the industry in question) are considered external sensitivities, whereby IBISWorld uses industry revenue as a quantifiable measure of risk. Together, these sensitivities are aggregated and forecast by dedicated IBISWorld analysts and are maintained as part of the IBISWorld Business Environment Database.

## 2.3.1 Business Environment Database

The Business Environment Database (BED) is an IBISWorld-maintained directory of key external drivers that affect a given industry's performance. These key drivers are then applied in the synthesis of an industry's sensitivity score. Not including external drivers related to the level of activity in upstream or downstream industries, the BED has in excess of 120 UK-related sensitivities in addition to more than 30 world titles. These key external drivers are categorised based on the type of sensitivity. The categories are: Resources, Community, Economy, Materials, Labour, Finance, Government, and Industry – and each driver is supported by forecast data and a detailed analysis of meaningful changes, as written by the analyst.

# 2. Components of Risk

IBISWorld's Business Environment Database includes hundreds of drivers that shape risk and performance

### 2.3.2 Calculating the Sensitivity Risk Score

The overall sensitivity risk score is comprised of two parts – the risk rating for selected sensitivities and the significance of the selected sensitivities to outcomes in the industry. The risk rating score of a given sensitivity is calculated using a historic and forecast series of the change in the sensitivity's behaviour. Over a relevant time period, the highest data observation (or growth rate) of a given sensitivity's dataset is assigned a risk score of 1.0. The lowest observation is assigned a risk score of 9.0. The remainder of this process is calculated as:

*9-8\*(obs-min)/(max-min))*

Not all factors affecting industries are quantifiable however. For example, non-quantifiable sensitivities may include consumer attitudes towards various products, technological development change over time and, to a certain extent, weather patterns. Whilst not strictly quantifiable, changes in such sensitivities may be part of an identifiable trend, and are able to be loosely classified or proxied elsewhere in the BED of broadly defined key external drivers.

For each industry, the significance of sensitivities on performance is evaluated. IBISWorld analysts identify four to seven of the most significant key external factors that influence industry performance, and assign each sensitivity a weighting to represent how significant each sensitivity is to industry performance. As other less significant sensitivities affect industries, however, these weightings should not be considered mathematical inputs to a general equilibrium model for a given industry.

# 2. Components of Risk

The overall sensitivity risk score is itself made up of the risk ratings of the selected sensitivities identified for a given industry, weighted by the significance of these sensitives to a given industry's performance (See Figure 3). Where the effect of the sensitivity on the industry is contrary to that normally associated with the sensitivity, the risk rating of the sensitivity in question is reversed. That is, where a sensitivity with a risk rating of 7.5 is to be used in an industry that reacts in the opposite way to the majority of industries, a risk rating of 2.5 (i.e. 10.0-7.5) is used as the input to the sensitivity risk score generation process. Through this process, the overall sensitivity risk score for an industry is a real number between 1.0 and 9.0.

FIGURE 4: Example of Sensitivity Risk Score Breakdown [2]



| | | |
|---|---|---|
| Business confidence index (25% of sensitivity risk score) | Business capital expenditure (25%) | Number of residential property transactions (25%) |
| Sensitivity risk score (50% of overall industry risk score) | Official bank rate (10%) | Ratio of household debt to disposable income (15%) |
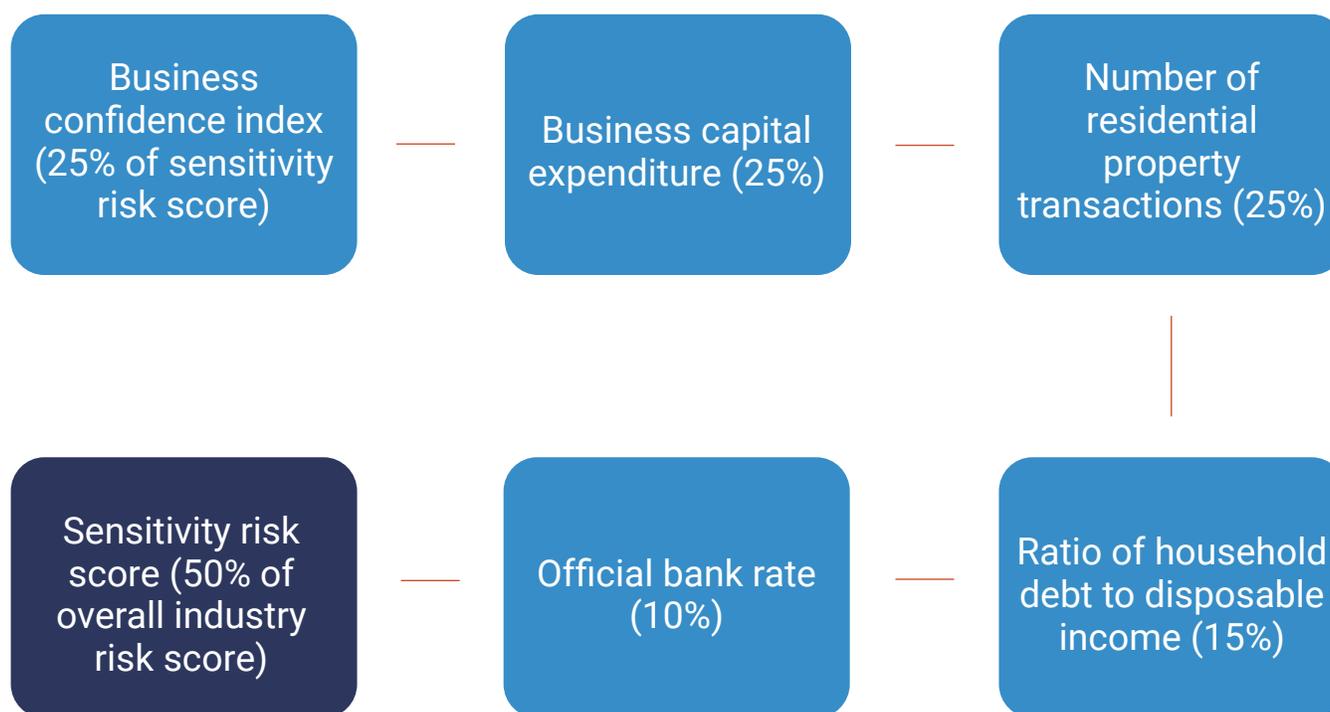
# 2. Components of Risk

## 2.4 Synthesis of Risk Components

As mentioned, the overall IBISWorld Risk Rating Score for a given industry is determined by assessing the risks pertaining to industry structure (i.e. structural risk), expected future performance (i.e. growth risk) and economic forces (i.e. sensitivity risk). These three components of risk are scored separately, using the IBISWorld Risk Rating Model to derive independent scores between 1.0 and 9.0, and subsequently weighted and summed to derive an overall industry-specific score. The weighing for each risk score component is presented in Table 8.

TABLE 8: Risk Scoring Synthesis

### Risk Scoring Synthesis

| Score | Importance | Weight |
|---|---|---|
| Sensitivity | Heavy | 50 |
| Structure | Medium | 25 |
| Growth | Medium | 25 |

# 2. Components of Risk

The IBISWorld Risk Rating Model assumes that external risks, sensitivities that are outside the scope of a given business, are often more severe than internal risks and ultimately less predictable. Consequently, the weighting for sensitivity risk is twice that of the structural and growth risk scores. The composite score for a given industry is a real number between 1.0 and 9.0. A score of 1.0 indicates the lowest risk within an industry. Conversely, the maximum risk is represented by a score of 9.0. The assigned level of risk for a given industry, relative to its overall risk score, is summarised in Table 9.

TABLE 9: Risk Scoring Scale

## Risk Scoring Scale

| Levels | Level of Risk |
|---|---|
| 1 to 3 | Very Low |
| > 3 to 4.1 | Low |
| > 4.1 to 4.7 | Medium-Low |
| > 4.7 to 5.3 | Medium |
| > 5.3 to 5.9 | Medium-High |
| > 5.9 to 7 | High |
| > 7 to 9 | Very High |

# 3. Validating the IBISWorld Risk Model

## 3.1 Introduction

A company may have robust historical performance, a healthy balance sheet and sound managerial controls, but it can be overwhelmed by factors in its operating environment, from changing consumer preferences to shifting macroeconomic headwinds. These factors may not appear anywhere on financial statements, but they directly affect the viability of a business and its operating potential. IBISWorld's risk rating model distils the impact of external factors to produce a single industry-specific score that signifies the difficulty of a firm's operating environment over the forthcoming 12 to 18 months.

Since the operating environment directly influences the performance of businesses, these industry-specific risk scores should forecast a company's ability to turn a profit with a high degree of accuracy. To test the efficacy of IBISWorld's risk rating model, industry risk scores were used to gauge the difficulty of the operating environment for each of the FTSE 100 companies between FY 2014-15 and FY 2017-18, assessing their ability to generate an operating profit. The results of a validation test show that the operating environment, as encapsulated by IBISWorld risk rating scores, plays a statistically significant[3] role in a company's ability to turn a profit.

Businesses that operate in higher risk industries have a greater likelihood of reporting poor half-year performance (i.e. recording an operating loss over a six-month period), and are assumed to be more likely to run in the red within a given financial year. IBISWorld's risk rating scores provide a leading indicator that can be used by creditors, investors, other stakeholders and anyone with an interest in a business's operating environment, to identify and help mitigate risks before they appear. Below, IBISWorld has run an independent validation test using public FTSE 100 data to apply real-world examples to the risk rating model.

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[3] *$H_0 1$ ANOVA P-Value of 0.0070; $H_0 2$ ANOVA P-Value of 3.871E-06*

# 3. Validating the IBISWorld Risk Model

## 3.2 IBISWorld Risk Rating Scores vs KPIs: FTSE 100 Operating Loss

A company's operating environment influences the financial performance of said company and its ability to turn a profit. Businesses that operate in a difficult or adverse operating environment, as identified by the industry's overall risk rating, will likely encounter greater functional difficulties and are assumed to incur losses more frequently that firms in industries with more favourable operating conditions. Consequently, we shall use the likelihood of an operating loss as the metric to test the IBISWorld Risk Rating Model's validity.

The FTSE 100 companies are used for the validation test, primarily because their respective financial information is publicly available, allowing our analysis to be replicated and our results confirmed. However, since only a small number of firms exist in this share index, we turn to half-year data to expand the sample size and minimise the implications of natural randomness. Lastly, operating profit and losses are used over net profit and losses to minimise the effects of accounting differences or exceptional items.

# 3. Validating the IBISWorld Risk Model

*1. Each company was correlated with an IBISWorld industry using the company's primary SIC code.*

| Company | Stock Index Code | SIC Code | IBISWorld Report Code | IBISWorld Report |
|---------|------------------|----------|-----------------------|------------------|
| Tesco plc | TSCO | 47110 | G47.110 | Supermarkets in the UK |

*2. Each company was linked to its IBISWorld overall industry risk score for each year of the focus period.*

| Company | IBISWorld Report Code | 2014-15 | 2015-16 | 2016-17 | 2017.18 |
|---------|-----------------------|---------|---------|---------|---------|
| Tesco plc | G47.110 | 4.91 | 4.69 | 4.85 | 4.8 |

*3. Each company-year combination was assigned to one of seven risk levels based on the overall industry risk score.*

| Industry Risk Score | Level of Risk |
|---------------------|---------------|
| 1 to 3 | Very Low |
| > 3 to 4.1 | Low |
| > 4.1 to 4.7 | Medium-Low |
| > 4.7 to 5.3 | Medium |
| > 5.3 to 5.9 | Medium-High |
| > 5.9 to 7 | High |
| > 7 to 9 | Very High |

# 3. Validating the IBISWorld Risk Model

Using this scale, the table from step two of the validation test becomes the following.

| Company | IBISWorld Report Code | 2014-15 | 2015-16 | 2016-17 | 2017.18 |
|---|---|---|---|---|---|
| Tesco plc | G47.110 | Medium | Medium-Low | Medium | Medium |

*4. This process was repeated for the remaining companies for all four years of the focus period, resulting in the following distribution[4]:*

| IBISWorld Risk Designation | Firms | At Least One Negative Half Year | Half Years | Total Negative Half Years | Severity |
|---|---|---|---|---|---|
| Very High | 2 | 2 (100%) | 4 | 3 (75%) | 1.50 |
| High | 58 | 9 (15.5%) | 116 | 10 (8.6%) | 1.11 |
| Medium-High | 59 | 11 (18.6%) | 118 | 11 (9.3%) | 1.00 |
| Medium | 115 | 19 (16.5%) | 230 | 26 (11.3%) | 1.37 |
| Medium-Low | 89 | 8 (9%) | 178 | 8 (4.5%) | 1.00 |
| Low | 76 | 6 (7.9%) | 152 | 6 (3.9%) | 1.00 |
| Very Low | 1 | 0 (0%) | 2 | 0 (0%) | - |

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[4] *Due to the small sample dataset, IBISWorld recognises the potential for skewed results which do not account for margin of error or anomalies.*

# 3. Validating the IBISWorld Risk Model

The two hypotheses to conduct the validation test are:

$H_0$1: The likelihood that at least one half year of operating loss in a given financial year is equal regardless of the level of risk designated by IBISWorld for the industry in which a company operates.

$H_0$2: The overall likelihood of a half year operating loss is equal regardless of the level of risk designated by IBISWorld for the industry in which a company operates.

From our sample of the FTSE 100 companies across four financial years, there were two company-year pairings that were part of an industry designated with a "Very high" risk, and both pairings had at least one negative half year recorded. Furthermore, both of these company-year pairings contained four half years, three of which were operating losses. The proxy for severity is calculated by dividing the total number of negative half years by the number of company-year pairings that showed at least one negative half year.

# 3. Validating the IBISWorld Risk Model

## 3.3 Results

To test the statistical significance of our results[5], we perform a single factor analysis of variance for each of the two hypotheses stated.

$H_0$1: The likelihood that at least one half year of operating loss in a given financial year is equal regardless of the level of risk designated by IBISWorld for the industry in which a company operates.

| Groups | Count | Sum | Average | Variance |
|---|---|---|---|---|
| Very High | 2 | 2 | 1 | 0 |
| High | 58 | 9 | 0.1552 | 0.1334 |
| Medium-High | 59 | 11 | 0.1864 | 0.1543 |
| Medium | 115 | 19 | 0.1652 | 0.1391 |
| Medium-Low | 89 | 8 | 0.0899 | 0.0827 |
| Low | 76 | 6 | 0.0921 | 0.0847 |
| Very Low | 1 | 0 | 0 | 0 |

ANOVA: Single Factor: Probability of at Least One Negative Half Year

## ANOVA

| Source of Variation | SS | df | MS | F | P-value | F-crit |
|---|---|---|---|---|---|---|
| Between Groups | 2.1104 | 6 | 0.3517 | 3.0017 | 0.0070 | 2.1217 |
| Within Groups | 46.0496 | 393 | 0.1172 | | | |
| | | | | | | |
| Total | 48.1600 | 399 | | | | |

[5] *Null hypothesis rejected at the 1% (P-value of 0.01) significance level.*

# 3. Validating the IBISWorld Risk Model

We reject the null hypothesis in favour of the alternative that there is a statistically significant relationship between a company's likelihood of recording at least one half year of operating loss in a given financial year and the level of risk designated by IBISWorld for the industry in which a company operates.

$H_0 2$: The overall likelihood of a half year operating loss is equal regardless of the level of risk designated by IBISWorld for the industry in which a company operates.

ANOVA: Single Factor: Probability of Negative Half Year

| Groups | Count | Sum | Average | Variance |
|---|---|---|---|---|
| Very High | 4 | 3 | 0.7500 | 0.2500 |
| High | 116 | 10 | 0.0862 | 0.0795 |
| Medium-High | 118 | 11 | 0.0932 | 0.0853 |
| Medium | 230 | 26 | 0.1130 | 0.1007 |
| Medium-Low | 178 | 8 | 0.0449 | 0.0432 |
| Low | 152 | 6 | 0.0395 | 0.0382 |
| Very Low | 2 | 0 | 0 | 0 |

## ANOVA

| Source of Variation | SS | df | MS | F | P-value | F-crit |
|---|---|---|---|---|---|---|
| Between Groups | 2.5530 | 6 | 0.4255 | 5.9904 | 3.871E-06 | 2.1100 |
| Within Groups | 56.3270 | 793 | 0.0710 | | | |
| | | | | | | |
| Total | 58.8800 | 799 | | | | |

# 3. Validating the IBISWorld Risk Model

Once again, we reject the null hypothesis in favour of the alternative – that there is a statistically significant relationship between a company's likelihood of a half year loss and the level of risk designated by IBISWorld for the industry in which a company operates.

# 4. Glossary

**Standard Deviation:** *A statistic that measures the dispersion of a dataset relative to its mean.*

**Industry Value Added:** *The contribution of an industry to overall gross domestic product.*

**X-inefficiencies:** *The divergence of a firm's observed behaviour in practice from efficient behaviour assumed or implied by economic theory.*

**Economic Rent:** *An amount of money earned that exceeds that which is economically or socially necessary.*

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