Classifying Financial Risk

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Abstract. This paper explores two concerns: risk and classification theory. The structure of the paper is that we will introduce a little more of each subject in turn, forming a structure that may be envisioned as a kind of double helix: for each turn of the spiral for risk related topics, we will add more detail, which will feed across into the next turn of the spiral in the topic of applying classification theory.

Keywords: Risk, classification theory, risk ontology

1 Overview

This paper explores two concerns: risk and classification theory. The structure of the paper is that we will introduce a little more of each subject in turn, forming a structure that may be envisioned as a kind of double helix: for each turn of the spiral for risk related topics, we will add more detail, which will feed across into the next turn of the spiral in the topic of applying classification theory.

2 Identify Concepts of Risk

The concept of risk in business is essentially teleological: there must be a defined system with a defined goal or goals. Risks are then defined as events which can affect the system’s ability to meet its goals. Sometimes only negative events which affect goal attainment negatively are considered but sometimes both negative and positive events are part of the risk assessment. Events which can positively affect goal attainment are often called opportunities and are fed into the goal setting subsystem of the system. Only the negative risks are considered in this paper. Once a risk is identified then its likelihood and impact (loss) are assessed. Impact is often measured in terms of the local currency. The risk can be managed in four ways. First, it can be avoided. This method involves changing the goal or the system so that the risk is no longer present. The second method of managing risk is to share it. The most common example would be insurance. If there is a risk of fire damage to a system or organization, the organization can buy insurance. In the case of the risk being materialized, the insurance company will help cover the loss. The third method of managing risk is to control the risk. In this method an investment is made in a control system which operates such as to reduce the risk. Investing in a sprinkler system which would activate in case of a fire is an example of a control. A cost-benefit analysis is usually performed to ensure that the cost of the control is outweighed by the risk reduction the control achieves, often referred to as risk mitigation. The last method of managing risk is to accept it. In this method the risk is acknowledged and monitored only.

Risk is identified through an assessment process. This process involves having the people responsible for attaining the goals assess what events may prevent the goals from being achieved. The assessment usually includes assigning likelihood and impact values onto the risks. What results is a large set of potential risks which are then managed by applying one of the four methods mentioned above to each of them. The organization managing its risks will have finite resources to expend on risk management. Because of that, a concept of a risk
portfolio is used to manage the risks. The portfolio is the collection of risks which are either being insured against, controlled or accepted. That is, they have not been avoided. This portfolio is conceived as having a mean risk and risk variance associated with it. That is to say that the risks that the organization is accepting or controlling each have their own "riskiness." The collection of the riskiness of the parts is the riskiness of the portfolio. Upper management of the organization sets the overall shape of the risks in the portfolio. The mean of the portfolio is called the risk appetite and the variance is called the risk tolerance.

3 Finance Risk Concept Formation

If we take the earlier discussion of the components of financial risk, then they are asset-backed risk, credit risk, foreign investment risk, liquidity risk, market risk (including equity, interest rate, currency and commodity risks), operational risk, reputational risk, legal risk and information technology risk. What principles of classification can help us to analyze these risks and their relation to one another? If we try to consider the goals of corporate finance in order to define risk, we quickly realize that financial goals in an organization are integrally tied to the goals of the organization itself. So we might instead consider the ways that an organization uses corporate finance to help it to meet its goals and then consider the major risks that come from such uses. Finance is basically concerned with raising capital and applying capital as needed to further an organization’s goals. What does an organization need to do in order to manage the process of raising and applying capital? First it must be able to access markets. Capital is usually raised from other organizations outside the firm. The firm can also self finance to the extent that it achieves and retains profits. We can then break capital down into four activities: raising capital, using capital, maintaining capital and distributing capital. These activities can be tested to see if they provide a good facet for classifying financial risk. Recall that a facet requires the application of a principle or principles in classifying concepts. The principle here is that the financial risks occur in one of the four activities. Each financial risk can be evaluated in turn. Asset-backed risk refers to the risk that capital held in an asset will lose value. This would be classified into the maintaining capital activity. Credit risk is the risk that capital lent to another organization will not be paid back. This can be classified as part of the using capital activity. Foreign investment risk is obviously part of using capital as well. Liquidity risk is the risk that the organization will not have enough liquid capital (cash) to pay its obligations. This can be classified as part of the capital maintenance activity. For market risks, first equity risk is the risk that capital held in the equities (stocks) of other organizations will lose value. This again is part of the maintenance of capital activity. Interest rate risk is the risk that capital raised or used will be done using an inappropriate interest rate. This would be part of both the raising capital and using capital activities and so would violate the independence of the partitions requirement of the facet. Currency risk is the risk that assets held in other currencies will lose value and can be classified as a capital maintenance risk. The final market risk is commodity risk which is the risk of value loss when holding commodities. This again can be classified as a capital maintenance risk. Operational risk is the risk of capital loss while using capital in production settings and so is again a capital maintenance risk. Reputational risk is the risk of the loss of firm reputation in the marketplace and so could be applied to any of the activities. Again we see a lack of independence of the facet for this risk. Legal risk and information technology risk can also be seen to apply to all four activities and so also violate independence. If we analyze the partition violations then we see that the first, for interest rates, is driven by the fact that interest rates are used as a parameter in risk calculations. For the last three, reputational, legal and information technology risk, they are all about the organization itself. These results point to the possibility that there are different facets we may want to consider.

One alternative facet might be the risk assessment itself. If we apply the risk assessment process as a facet to financial risks then we see that asset-backed risk, foreign investment risk, equity risk and commodity risk all involve the loss associated with what gets impacted by the
risk, that is, where the loss may be. Credit risk, liquidity risk, interest rate risk and currency risk are associated with the likelihood of events occurring. An example is the likelihood of fluctuations in currency exchange rates. Operational risk and reputational risk are classified under involving the responsible parties to analyze risks. Legal risk and information technology risk are both classifiable under the risk portfolio concept since they are managed across the population of risks that the organization has identified.

4 Classification Considerations

Taxonomies are “any system of representation that is used to group, arrange, and describe items according to meaningful principles and which provides users with an overview of the set of items as a whole (Lambe, 2007).” Theoretically, ontologies are a type of taxonomies. In practice, taxonomies are usually hierarchical structures, while ontologies use triples. Hierarchical structures can be best thought of as environments in which transitive, one-to-many relationships are likely to occur. The transitive relationship need not be the generic is-a relationship. In fact, the relationship type need not be consistent across the hierarchy (though consistency is often useful). Certain types of structures support certain types of inferences. For example, there is nothing inherently wrong with polyhierarchical structures. However, in practice these structures often mix together different types of transitive relationships, which make it difficult to infer the nature of a class based on its position in the hierarchy. Theoretically, the generic relationship implies that all subordinates are members of the superordinate. However, in practice, sometime this only applies to “most” members of subordinate. Example: furniture / chairs / ski lift chairs.

5 When Does Taxonomy End and Attributes Begin?

The principle might be in a previous section: the properties of things may be used to divide and subdivide things in a hierarchy. Properties are the intension behind the hierarchical structure. The question becomes: when to continue to subdivide the taxonomy - do you use properties that haven’t been used yet? Also what is the atomicity of your thought space or world (problem domain). Once you get to a single individual object is that an instance? Actually you can have an intensional definition, whose extension happens to be only one individual - that simply tells you that the category is not very useful as a category. Then there is the idea of classifying things based on statuses over time - for example Gorge Washington as a child or loans in different phases. We originally modeled these in FIBO as if phase was another part of the classification, but this did not feel neat in the absence of some formal representation of the facet. Also maybe we need some clarity on the temporal classification facets. As for instances, all properties can be used to create sub-classes of a thing. All things can be looked at in terms of a broad set with the properties, and / or a narrower set of sub class each differing by one or another property. In principle a sub-class can be defined by one property but realistically we tend to define classes with a number of properties.

Consider an example from automobiles - number of doors, petrol (gasoline) versus diesel and so on. Yet there are many other properties we don’t use to classify them e.g. things about the interior, optional extras versus features installed as standard. Meanwhile we don’t classify green cars versus red cars and so on. So in the market, there are broader sets of cars that can be characterized by a range of features, to give us e.g. the GT versus XT version of a given make and model. So similarly with finance - some attributes are bundled in the categories we think about and so are not used to carve out those instruments into classes. Then there is a temporal side of this. In the auto example, during the model year; at the start of the model year, can make a case that you have to pay for the extras on this auto, but later in the year when the excitement of the new version has worn off, they may start to collect together some of the features, and either make them part of a standard model OR in some cases, marketing might consider that that feature was not really of interest – it is still there but no longer spoken of in the
marketing literature. Similarly in financial instruments - given these are a bundle of attributes, there are people out there looking for things with a given attribute.

Overall: as soon as there is something with a bundle of attributes, and people care about that bundle as a kind of thing (for example when they give it a name) then you have a class of thing in the domain of interest. Example: you might have a portfolio of various things you've purchased over the years, and you might have categorized th in one way or another when you bought them. A new regulation comes along which would cause to to divest of some category of thing, and now you have to classify the stuff in your portfolio according to the new classification in order to sell it.

6 Classifying Risk

This is not the same as classifying things. For example, take holdings and positions. These are distinct from the instruments themselves so we can talk about and classify holdings and positions and this is distinct from how we would talk about the instruments themselves or about the risk themselves. So when we talk about risk we want to talk not only about the instruments people hold but about the positions themselves - risk /reward ratio, appetite, purpose (protest capital versus net income and so on). But that is not just the position - one position may be positive for one goal and negative for another goal. The goal is very different, e.g., between hedge funds and asset managers. Goals of a trading organization are different to the goals of something else. So we need to categorize and classify the goals in order to classify the risks. If we take particular instruments or portfolios, and identify certain properties they might have (certain facets we might classify them by), this does not translate instantly into a particular risk position or a given risk concept. The more we can categorize the goals or strategies of an investment effort, the more we can classify the risks against that. We can classify risks by either of the two main facets of risk itself: the probability of a given event, and the impact of the event on the goals. Alternatively, we can classify the goals themselves and the strategies that are intended to meet those goals. Consider also the risk of insolvency. What are all the possible things that can happen? – The events. Risk is the probability of an event, so given an entire collection of activities in a bank or investment institution, you are summing up all the things that can happen.

In the FDIC (Federal Deposit Insurance Corporation) example, using the FDIC's model in terms of whether you are solvent or not is an example of regulatory risk. The goal is to appear solvent to the FDIC. Our own internal model for managing our business might not be reducible to the FDIC mode but is constrained by it. What is the FDIC about? Resolution when the institution seems to be technically insolvent. This is just an outcome - in risk terminology a definitional point of view, this is just one property of risk. Going bust is one kind of risk. Clearly the impact is higher than that of other risks. This is why we categorize separately the impact and the probability of the event. This is how we deal with our risk appetite. One of the things that happen is situations where we don’t actually know the probability. The impact - if we only have historic figures for the impact of a given kind of event, then these are necessarily out of date (with the exception of going bust, which is existential and therefore unchanging). or the number of times an event happens. Insight: the more an event happens, the more “liquid” our understanding of its impact. Where there is less or no data about the impact of an event, you need some kind of model (again, very like pricing in an illiquid market). For all this, consider that so far we are looking at the individual organization. Remember that systemic risk is not a summation of these. So we have to understand the overall impact in terms of economic activity. The connectedness of something will have a bearing on the system.

References
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