



6

Agent-based computer modelling can advance our inquiry. Our 'Brightline' model represents, among other factors, the dynamics of externalisation in interactions among four key agents in the large publicly held corporations: customers, corporations, government, and shareholders. Companies compete for customers by reducing their liabilities through externalisation; an aggressive management that is compelled by its shareholders to function within government-determined limits on externalisation will generate superior values over the long term.





6

Modelling Corporate Accountability

And the music master praised the bird very highly – yes, even assured them that it was better than the real nightingale ... But the poor fisherman, who had heard the real nightingale, said: ‘It sounds pretty enough and it is similar too. But something is missing. I don’t know what it is.’¹

The previous chapters have led us to an important question: How can corporations achieve greater accountability? In Chapter 1, presenting a synopsis of ‘The Nightingale’ by Hans Christian Andersen, we faced the eternal question of ordered predictability versus dynamic change. In Chapters 2 through 5, we saw this tension at work in the modern corporation, which has two distinct aspects: on the one hand, it relentlessly pursues the goals of unlimited life, size, power, and license; on the other hand, it continues to evolve as a complex adaptive system (CAS) that is capable of evolving beyond its original, simple ‘programming’. And we said that the best hope for greater accountability lies in independent, informed, motivated, and empowered shareholders.

In the present chapter, we seek to explore this last idea more fully via agent-based computer modelling – a relatively new technology that can reveal the interactions present within complex systems. We are fortunate to have worked on this project with a programmer from the ‘SWARM’² team at the Santa Fe Institute, who created specifically for this book a useful and effective tool for modelling the interactions of shareholders and corporations



based on our views of corporate accountability. We call this modelling project 'Brightline'.³

MODELLING COMPLEX ADAPTIVE SYSTEMS

Thinking about the corporation as a complex system operating *within* a complex system can quickly become intricate – so much so that it qualifies as an 'intrinsically difficult problem', one that requires for its full solution a 'computer as large as the universe running for at least as long as the age of the universe'.⁴

Can the dynamics of corporate complexity be accurately modelled? Even the great John Holland of the Santa Fe Institute admits the limitations of his peers and forbears in this regard. 'After more than a century of intensive effort, we still cannot model many basic capabilities of the central nervous system.'⁵ Ecosystems likewise defy easy analysis: 'Matter, energy, and information are shunted around in complex cycles ... Even when we have a catalogue of the activities of most of the participating species, we are far from understanding the effect of changes in the ecosystem.'⁶

Similar challenges awaited us, we knew, in modelling corporate complexity. To quote John Holland again, the quest of the complexity scientists is to identify 'coherence under change', which is the 'central enigma' to each complex adaptive system. I would like to pause here at the word 'enigma' because I think it says a tremendous amount about the challenge of modelling.

An enigma is a puzzle. A puzzle is something that appears disordered but that has a hidden order subject to decoding. In this book, we have wanted to 'decode' certain aspects of corporate structure to find the potential for dynamic life within it. At the same time, we have wanted to see the economy in the same light, focusing on the corporation's role in the 'living' economy.

MODEL DESCRIPTION

Ultimately we decided to focus our efforts very narrowly on the externalising practices of *large publicly held corporations*, specifically those corporations where a substantial proportion of stock is held by institutional investors. The ability of these firms to access capital at attractive rates is directly dependent on their stock performance, which in turn is dependent on their

ability to draw and maintain customers. We also decided to focus on the manner in which these corporations persistently externalise costs, one of the key concerns of the long-term owner, as described more fully below. We then built our model specifically around these mechanisms and the impact that active shareholders might have in responding.

We also designed the model to allow multiple runs using a wide range of variable settings, and will eventually include the capability of then showing and comparing the results of multiple runs against one another. The result is a basic modelling program for exploring these fundamental issues of corporate accountability from a number of different perspectives. In particular we wanted to show how *active shareholder involvement*, by imposing new standards of accountability, might ultimately affect the long-term value of these large corporations. Previous studies have shown or suggested a link between shareholder activism and improved long-term corporate performance.⁷ In creating our model we sought to reveal at least one of the mechanisms involved.

Further, by comparing runs we can compare the results attained both with and without the presence of active shareholder involvement, what might be called the ‘governance gap’. From an active shareholder’s perspective, the ideal corporation should either be fully internalising or fully disclosing – indeed ‘transparent’ – in its accounting for the real costs of doing business. We believe that only the fully transparent corporation will maximise shareholder value over the long term, and that this is the central goal towards which all such reforms must be directed.

Where existing corporations externalise costs and even seek to influence the regulating mechanisms of government (i.e. taxation and penalties for illegal activities), the ideal corporation must accept full accountability for *all* of the costs of doing business – and active shareholders will seek to ensure this. Thus we chose to model corporate agents that seek to externalise costs in order to maximise short-term market gains and profitability. We also sought to show how the countering influence of active shareholders might impact this behaviour in the interest of longer term and persistent value. (For more about the Brightline model, see the Appendix to Chapter 6.)

ON EXTERNALISATION

In the age of instant information, diminishing tariff barriers, free movement of currency, interchangeable domiciles for optimum production, and the



universal availability (at least in theory) of management talent, much of the traditional 'competitive advantage' that one company enjoyed in competition with others has disappeared. Given these difficult competitive conditions, how can one company undersell another?

To paraphrase a political button in a past US presidential election, 'It's the externalisation, stupid!' Around the globe, with the national interest turning from war to commerce, large corporations are now able as never before to *pass on the costs of their operations to society as a whole* – all the while convincing elected officials that the corporate interests are congruent with the public good.

And so the values that government has traditionally given to business – patent protection, enforcement of 'property rights', and all manner of patents and franchises – now have an important new supplement. Business has become more competitive in the short term by externalising its costs. The specific manifestations of this cost transfer vary from country to country. In one nation, we might see high unemployment, in another, high medical costs, and in yet another inadequate pension reserves. As the corporate cause of these social costs becomes more obvious, shareholders begin to see profits for the shell game they are, and adjust the value of stocks (see box, 'Tobacco Road: A Sermon', in Chapter 10).

In sum, short-term competitiveness, purchased at a high social cost, cannot last. As we hope to show in the Brightline model, extreme externalisation eventually causes a corporation to cease being competitive, a condition that can only be corrected by active shareholder involvement.

THE AGENTS

After carefully considering the minimum number of agents needed to effectively model our intended range of behaviours, we implemented the following interactive agents:

- customers
- corporations
- government
- shareholders.

The customer agents

The customer agents represent the purchasers of the products and services offered by the corporations. The corporations are assigned a variable number of customer agents at the beginning of each run, reflecting real-world variations in age and size. Customer agents may then choose to continue to 'buy' the goods or services of their original assigned corporation, or to jump ship to another as the run progresses. (See Fig. 6.1.)

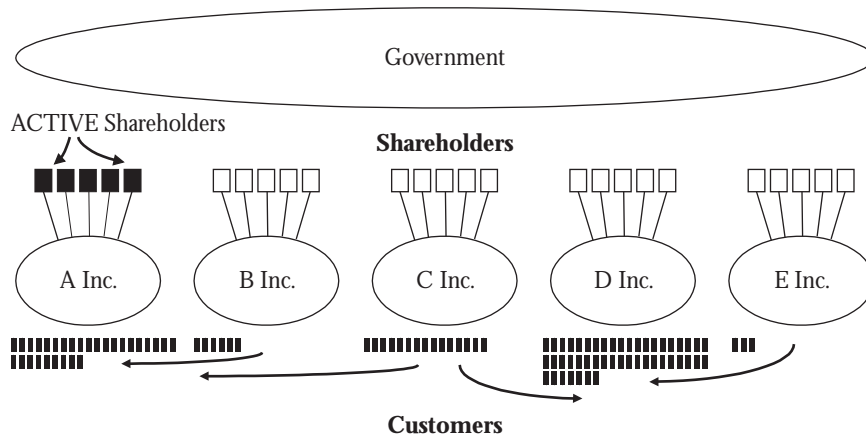


Fig. 6.1 Brightline model sample run showing movement of agents.

The loss of customers translates directly into a decline in cash flow, a measure of short-term performance; this is the first of two standards we will use to 'value' each corporation. The second is the accumulated total number of customers held over time, a measure of the corporation's persistent value. We want to see what relative changes in valuation will occur between the beginning and end of the run, and to then gauge the impact of ACTIVE shareholder agents on these valuations.

While we acknowledge that real-world customers often can and do play an activist role in affecting corporate behaviour, we felt that any effort attempting to model this role was beyond the scope of the present effort. We note, however, that real-world customers and shareholders, particularly the beneficiaries of the institutional shareholders of these large publicly held corporations, are increasingly one and the same.



The corporation agents

The corporation agents begin each run having been assigned an equal share of the available customer agents, whose movements from corporation to corporation then provide the basic measure of each corporation agent's performance over the course of each business cycle. (See Fig. 6.2.)

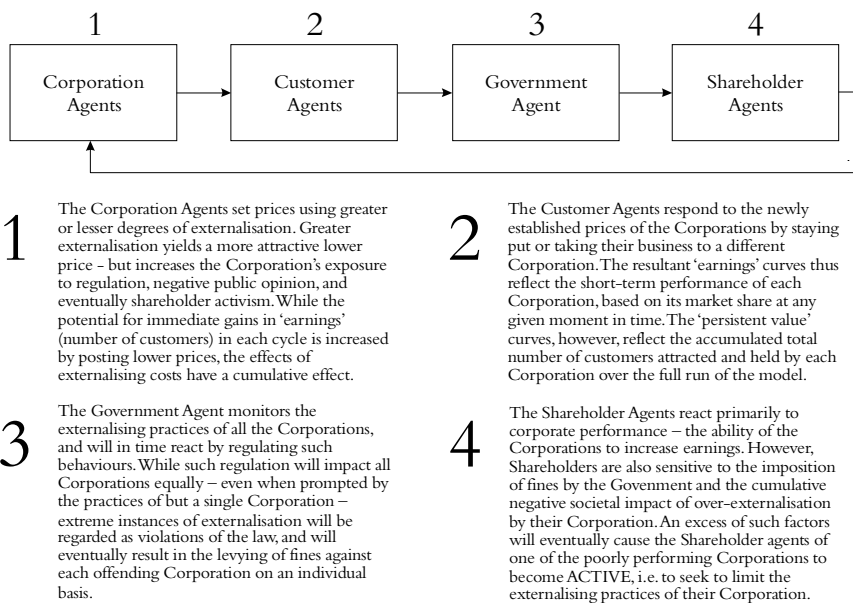


Fig. 6.2 The business cycle.

To improve its performance, a corporation must attract new customers. It does this by 'posting' a more attractive 'price' for its 'products', but in this instance it may do so only by externalising more of its 'costs'. The greater the degree of externalisation, the lower the price; the lower the price, the more attractive the corporation becomes to potential customers. But while the customer agents react to such price changes on a per cycle basis, there are other effects of externalisation that are cumulative and are monitored by both the government and shareholder agents. *Thus while a corporation may improve its 'performance' in a given cycle by externalising more of its costs, the long-term effects of such behaviour will have a cumulative negative impact on performance.* The corporation must always weigh the benefits of any short-term gains against this long-term cost to its value.



In a given business cycle each corporation agent must consider its current market share, existing price position, and the current impact of past externalising practices in order to set a new price for attracting new customers. Ideally, this new price will be low enough to attract new customers without increasing the externalisation of costs – because (as we shall see) externalisation lowers the long-term value of the company.

The government agent

The government agent responds to the effects of such externalisation, either all at once or cumulatively over time, by imposing taxes and legal constraints upon the corporation agents. While one or more of the corporations may be responsible for such behaviours, it is important to note that as long as such behaviours fall within the law, the resultant governmental constraints generally apply equally to all the corporations.

Thus while ‘taxes’ effect all corporations and their shareholders more or less equally, governmental fines and legal settlements in response to extreme instances of externalisation (described together for purposes of our model as ‘fines’) impact corporations individually. Furthermore, these penalties will then increase the likelihood that the shareholder agents attached to that corporation will become active. In this way our model reflects the long-term ‘costs’ to society of such externalising behaviours, and the potential sensitivity of long-term shareholders to such mounting costs.

The shareholder agents

The shareholder agents have but a single variable attribute – they may become more or less ACTIVE in seeking to limit the externalising practices of their corporations. As all of our shareholder agents represent long-term, value-directed investors, with concise and consistent needs for the future, they remain fully invested in a single corporation throughout the run of the model. (See Fig. 6.1.) We did not make any attempt to model the market behaviours of shareholders, something far beyond the scope of this project.

Instead, we programmed several typical shareholder tendencies into the model. Passive shareholders are ‘satisfied’ with their corporation’s



performance – and thus remain passive – whenever such performance improves or at least holds steady. They become ‘unhappy’, i.e. more likely to turn ACTIVE in response to decreases in performance.

In each run, however, the shareholders of one corporation are given the capacity to become ACTIVE, in response to excessive externalisation by their corporations, particularly if such behaviour reaches illegal levels, providing a much needed balancing mechanism. Eventually such ACTIVE shareholders, acting in concert – to become effective at least three of the five shareholders must become ACTIVE at the same time – then limit subsequent externalisation by their corporation to insure that such practices will remain within the law, on the one hand limiting management’s ability to seek the highest possible levels of short-term performance, but on the other effectively shielding the corporation from future intervention and fining by government.

While we felt it was beyond the scope of these efforts to examine or even fully describe the role of employees in relation to our corporation agents, it is nevertheless worth noting once again that in many real-world instances the interests of shareholders and employees are identical. In fact, pension fund beneficiaries now in effect own as much as 26% of the outstanding stock in America’s publicly held corporations, plus another 8% through other mechanisms such as employee stock ownership plans.⁸

We similarly chose to ignore the existence of the various other classes of shareholders, such as market speculators. These short-term holders, while having their place in the overall economy, are simply not relevant to our discussion here.

RUNNING THE MODEL

Thus the model includes a total of five corporation agents, and seeks to describe the impact of no more than five shareholder agents for each of the corporation agents. There is just one government agent, and there are 100 customer agents. These numbers reflect a not-uncommon number of competitors in a single market, a sufficient number of sizeable shareholders needed to directly impact such corporations, and a large enough pool of customers to clearly show market share trends and patterns. We wanted to keep the model small enough to be run on commonly available desktop computers, yet sufficiently complex to do its intended work, in hopes of facilitating

further study.

At the beginning of each run a number of attribute variables (see Appendix to Chapter 6) are set by the run-time user. The typical run covers an elapsed time period of 300 cycles of activity. In the course of each cycle (see Fig. 6.2) the corporation agents post prices for their ‘products’ using greater or lesser degrees of externalisation of costs. While more externalisation may yield a more attractive lower price, it also increases the corporation’s exposure to government taxation, negative public opinion, and eventually fines against performance – which will in turn increase the likelihood of shareholder activism.

Following the posting of new prices, the customer agents then react by staying where they are or moving to a different corporation.

Next, the government agent examines the cumulative externalising practices of all the corporation agents and reacts accordingly. Too much accumulated externalisation will result in the application of more taxation, making further externalisation more difficult and ‘costly’ for the corporation agents. And genuinely excessive externalisation by any one corporation will result in the levying of penalties against that corporation, further inhibiting its ability to lower prices and compete more effectively.

Finally the shareholder agents react to this latest round of corporate ‘performance’, responding to changes in market share, the imposition of penalties against their corporation by the government, and the cumulative negative societal impact of over-externalisation. Any excess of such factors will eventually cause certain shareholder agents to become ACTIVE, and thereafter seek to limit further externalisation by their corporation.

A SAMPLE RUN

We present here (in Fig. 6.3) a run of the Brightline program to show competition between five companies over a 300-cycle time span. In this run, the companies compete for customers by reducing their liabilities through externalisation. They externalise within the constraints of government intervention and fines, as well as shareholder intervention. What this particular run illustrates is that an aggressive management that is compelled by its shareholders to function within government-determined limits will generate maximum values over the long term. This provides initial evidence that directors and other fiduciaries can use to require management restraint



in various relationships with society. It is important to be able to project the long-term implications of particular patterns of corporate conduct. Corporate decisions can and should have a long-term beneficial impact – one that lasts after the retirement of most current officers and directors.

This sample run of the Brightline model illustrates both the advantages of corporate externalisation in maximising short-term performance and the longer-term advantages of a more controlled approach to externalisation, motivated in the Brightline model by the presence of ACTIVE shareholders in one of our corporate agents. It is interesting to note, however, that the presence of ACTIVE shareholders alone cannot possibly have this effect, as our ACTIVE shareholder agents can only insist that the corporation act within the legal limits established by the government agent. In the absence of government standards our model will either crash completely due to over-externalisation, or result in complete monopoly by the most aggressively externalising corporation. Similarly, in the absence of ACTIVE shareholders, the government agent alone will eventually prove ineffective, with the typical result being that the model will cycle endlessly between 'winning' corporations until eventually one gains monopolistic status.

One interesting twist on this variation, which need not be demonstrated using Brightline, is the kind of situation we now see in the tobacco industry, where government steps in ostensibly to address excessive externalisation, but is utterly ineffective in doing so, merely resetting its own standards to a lower level, and in effect encouraging the previously existent unregulated cycling between competitors to continue. In Chapter 10, we will explore this problem more fully (see box, 'Tobacco Road: A Sermon').

In this particular run we can see clear examples of most of the interactions possible in Brightline. It is important to note, however, that this particular run is but one of a very great many possibilities. While we have presented this example as a somewhat 'typical' Brightline run, readers should note that each and every run is different, given our beginning parameters, and it is only by comparing a great many such runs that the truly emergent patterns and possibilities presented by the model can be fully understood.

The run begins with all five corporations having an equal share of customer agents. Although it is too soon in the run to tell, C Inc. has been chosen as the potential focus company, but its shareholders remain passive at this point as its performance is still quite high. E Inc. is the first corporation to begin externalising aggressively, and assumes the earliest lead. By cycle 48, however, B Inc. has become even more aggressive, and has over-

taken E and assumed the lead. Not only have all five corporations begun externalising in an effort to attract customers, but all of them are now externalising at ‘illegal’ levels. At the same time, the government agent has noted the rise in overall externalisation and is preparing to begin fining the most aggressive companies.

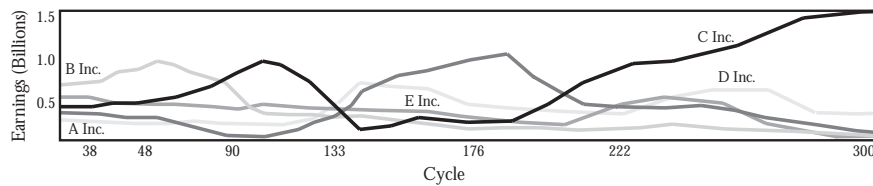


Fig. 6.3 Brightline sample run showing relative company performance.

Late in the run, company E is in the midst of value destruction caused by its externalising practices. The market will not value E at levels comparable to the earnings, cash flow, and assets multiples accorded other companies. As soon as sustained and effective shareholder involvement emerges (which is eventually possible), positive valuation will resume.

For companies that have risky products (asbestos, silicone, or tobacco) or that generate environmental hazards (nuclear energy, oil), sudden public awareness has triggered retaliation and consequent loss of values. In some instances, the companies have failed to disclose what they knew about the impact of their functioning in society. In others, the companies have egregiously subverted the election and other political processes – sometimes in violation of the law.

Corporate contumacy predictably invites public retaliation in the form of fines, new restrictions, or even a trend toward socialisation. The time frame in which this occurs is likely to be beyond the tenure of a single CEO, management team, or board of directors. Therefore, it is most likely to be addressed – if at all – by long-term owners.

By cycle 90, C Inc. has been able to assume the lead because both B and D have been fined by the government for their earlier high levels of externalisation. C’s shareholders remain passive, in light of C’s performance, but C will now be next in line for government action.

The shareholders of our focus company, C Inc., do not in fact become ACTIVE until cycle 176, by which time C has already been fined and A has been able to take over the lead in current earnings. It is interesting to note



that at this point all five corporations can claim roughly the same amount of accumulated earnings, our measure of long-term performance.

By cycle 222, however, the model has begun to stabilise, with C Inc.'s ACTIVE shareholders effectively limiting C's externalisation to the legal limit. While all four of the other corporations now continue their cycles of over-externalisation and consequent government action, C now has the advantage of complete freedom from government intervention, and its current earnings consistently surpass its competitors, even though total accumulated earnings continue to be fairly evenly balanced.

At the end of the run at cycle 300, moreover, not only has C retained its current cycle advantage, to dramatic effect, but can now claim the highest level of total earnings as well, by a factor of nearly 2:1. In this particular run, at least, the actions of ACTIVE shareholders have provided a clear competitive advantage.

Of course, not every run is so clear cut. In each run the interactions are different, with government intervention coming sometimes much earlier in the run, and sometimes much later, depending on the relative aggressiveness of the corporate agents. If the designated focus company is able to assume a large enough lead early on in the run its shareholders may become ACTIVE too late in the run have any real impact. Conversely, absent at least some degree of aggressive management in externalising to gain greater customer share the focus company may never be able to gain enough advantage to 'win' by run's end. Over numerous multiple runs, however, some variation of this sample scenario emerges as the one most likely to occur, with the ACTIVE shareholder corporation turning in not only the best current performance but the best total performance as well.

Clearly then, at least in our Brightline model, it is a combination of factors that makes for the highest performance:

- a corporation agent with an aggressive management style
- an effective government agent with clear standards for externalisation
- ACTIVE shareholders able to hold their corporation to these standards.

SUMMARY AND CONCLUSION

We know that the real economic environment within which corporate entities operate is itself a complex, adaptive, self-organising system. Thus the



overall trends and behaviours of the economy are aggregations of individually directed behaviours, exhibiting non-linear dynamic relationships. Real-world economic trends and behaviours are based on the interaction between individual corporations, boards, shareholders, customers, the government, and other stakeholders. These trends and behaviours change over time as each individual entity seeks to gain a more advantageous position.

We have sought to model some of these interactions to explore the impact of responsible shareholder activism on the long-term performance of corporations. We have also sought to more fully explore the mechanisms whereby it is possible for one relatively small change in agent attributes within such a complex system – the shift of the shareholder role from passive owner to active participant – to impact the overall patterns and trends of the larger system.

Our sample run illustrates how existing, typical corporations, lacking in active shareholder involvement, cannot effectively be regulated by government alone. The unreformed corporation seeks to maximise short-term profitability by externalising as much of the true costs of doing business as possible, as we have seen both in our models and in the current case of the tobacco industry. But long-term shareholders, the actual owners of our public corporations, whose tenure over the generations will far exceed that of any given management/director term, can take action in their own interest and in the interests of long-term value. We are not talking here about ‘social investing’, but rather best business practices – the maximisation of long-term value.

Fiduciary shareholders and other participants in corporate life need structure and language with which to evaluate the relationship of current functioning and long-term value optimisation. The Brightline model can help owners and boards understand and communicate the impact of externalising behaviour on corporate competitiveness. Preliminary results from model runs indicate that a high level and/or rate of externalisation will bring – within a decade – substantial loss of competitive position. Owners, directors, and managers will want to consider these findings as they make decisions for the near and long term.

A great deal remains to be learned about the relatively new economic phenomenon of active shareholders. We offer here one useful tool for improving our understanding of their emerging role – explored more fully in the following chapters.

