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A System Dynamics Model of Bank Geographic Diversification

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After seventy years of placing restrictions on banks that wished to operate in more than one state, in 1994 the federal government enacted the Riegle-Neal Interstate Banking and Branching Efficiency Act, which went into effect in 1997. With this one move, the government opened up the arena for banks wishing to operate across state lines. This was supposed to help banks in at least two ways. First, allowing bank holding companies to convert other-state subsidiaries into branches would allow for the elimination of duplicated overhead, increasing bank efficiency (Carow and Heron, 1997; Berger and DeYoung, 2001). Second, since different regions of the country have different economic profiles, banks would more easily be able to diversify their assets and liabilities, reducing risk (Hughes, Lang, Mester, & Moon, 1996; McLaughlin, 1995; Spiegel & Gart, 1996). The hoped-for policy effect of this change was a system of stronger banks better able to compete against domestic non-bank financial institutions and foreign banks in the U.S., and foreign banks in their home countries (Matasar & Heiney, 2000).

Rather than focus on the policy aspects of this change, the present paper will examine its effects on the cognitive map of one large regional bank holding company. It will examine how the change was incorporated into this bank's cognitive map, but will be even more concerned with the implications of the bank's mental model, testing some of those implications with output from a system dynamics model.

COLLECTIVE MENTAL MODELS AND SYSTEMS THINKING

Weick (1979) suggested that, through a process of enactment, selection and retention, an organization's members create a cognitive schema, or map, of the most important aspects of their collective experience. This schema channels future action, leading to further refinements of the

map, leading to future action, and so on. Senge (1990) describes the phenomenon of cognitive maps through the term "mental models," which can apply to either individuals, groups or organizations. The present paper will use the terms "cognitive map," "cognitive schema," and "mental model" interchangeably.

RESEARCH OBJECTIVES

The present paper examines the geographical expansion of one bank, Aquilo Bank (a pseudonym). More precisely, it examines the implications of the cognitive map of the geographical expansion strategy articulated by Aquilo's upper management. The paper examines these implications by using a system dynamics model of Aquilo's cognitive map.

DESCRIPTION OF SETTING

In the early 1990s Aquilo Bank, on the verge of bankruptcy, was placed into receivership by a federal court. It had its major operations (including about 20 branches) in one relatively small state, a small number of branches in an adjacent state, and about $2 billion in assets. At that point, Aquilo's management set two targets: one million customers and $10 billion in assets. Today, Aquilo is a $21.1 billion banking and financial services company with over two million customers and banking divisions in six states. Aquilo is the third largest banking company in its region and is one of the 100 largest commercial banking companies in the United States. It operates over 300 branches and 400 ATMs throughout its region. Aquilo Bank is a good example of a banking organization that availed itself of a geographical expansion strategy. The question is, what mental model lay behind this remarkable performance? And what are the implications of this mental model?

METHOD

The method chosen to address this phenomenon was system dynamics (Forrester, 1961; Richardson & Pugh, 1981). System dynamics is a quantitative simulation method that attempts to assist decision makers in thinking systemically about problems they confront. System dynamics projects are roughly divided into two phases–qualitative and quantitative. The qualitative phase develops the mental model that depicts the decision makers' understanding of what is creating the phenomenon. The quantitative phase attempts to create a model whereby assumptions and relationships in the mental model can be tested and "played with."

Given the time constraints on Aquilo Bank management, the present study used a data gathering approach more streamlined than is typical for system dynamics. The CEO of the bank was interviewed for approximately one and one-half hours. Three other executives from the bank (two in strategic planning and one from retail operations) were also interviewed for approximately the same amount of time. From these interviews, the researchers were able (with feedback from Aquilo's managers) to create a causal loop diagram of the cognitive map of the geographical diversification strategy of Aquilo Bank's top management, as shown in Figure 1. (See the figure's caption for a brief explanation of links and loops.)

The present paper will discuss both the loops in Aquilo's mental model and the implications of the quantitative model that has been developed from the data, turning to an examination of the results of test runs done using the system dynamics model that was developed from Aquilo's mental model.

CAUSAL LOOP RESULTS

Causal loops

Causal loop diagrams are composed of system elements whose causal linkages are symbolized by arrows. Arrows indicate the direction of causality. Signs indicate the polarity of relationships. A "+" sign means that, all else equal, if the cause increases (decreases), the effect increases above (decreases below) what it would otherwise have been. A "-" sign means that, all else equal, if the cause increases (decreases), the effect decreases below (increases above) what it would otherwise have been. Loops are designated "R" for "reinforcing" or "B" for "balancing." Reinforcing loops signify that increases or decreases in the value of any variable in a series of connected variables are ultimately amplified ("reinforced") as their effects are traced through that connected series. In balancing loops, increases in the value of any variable in a series of connected variables are ultimately decreased (and decreases are ultimately increased) in a way that "balances" or dampens these changes. Causal structures dominated by reinforcing feedback loops generate behavior that moves component values progressively away from initial or equilibrium values. In contrast, structures dominated by balancing feedback loops generate behavior that resists continued change in a given direction and that directs system behavior toward a goal or equilibrium condition (Goodman, 1974). Balancing feedback loops and reinforcing feedback loops combine to produce much of the behavioral change observed over time in organizations (Forrester, 1961; Senge, 1990).

Reinforcing loops

Aquilo Bank's cognitive map contains five reinforcing loops and nine balancing loops. Reinforcing Loop R1, "Revenue Drives Acquisition," (see Figure 2) is straightforward. Aquilo makes an acquisition, which leads to more customers, more revenue, and more profit. The

higher profit raises the confidence level of Aquilo's management, which, to close the loop, leads to even more acquisition. Loop R2, "Confidence Drives Acquisition," (Figure 2) says simply that as the amount of acquisition rises, so does the management team's confidence, which further drives up acquisition.

Loop R3, "Pressure to Expand Geographically," (Figure 3) comes from Aquilo's beginning position in a smallish state. To reach the asset and customer targets mentioned earlier, it felt the need to acquire, which necessitated geographical expansion (because it could not reach those targets from in-state operations only). This reduced the bank's traditional preference for operating in contiguous states, which in turn increased the number of regions available, leading to more acquisition opportunities and, ultimately, even more pressure to acquire. Loop R4, "Culture-Based Expansion," (also in Figure 3) depicts how geographical expansion increased the opportunities to acquire banks with similar culture, something that was important to Aquilo's management.

In Loop R5, "Attractiveness From Convenience," (shown in Figure 4) the bank begins by increasing its acquisitions. This leads to more banks and an increase in automatic teller machines (ATM). These in turn increase the convenience factor and the bank's attractiveness, leading to more customers. This increases revenue, profit, and earnings per share, which raises management's confidence level, leading to even more acquisition, closing the loop.

Balancing loops

Balancing Loop B1, "Cost Brake on Acquisition," (Figure 5) shows one of the systemic negative feedback processes in this cognitive map. As acquisition increases, so does the number of banks owned by the corporation. This leads to higher costs and lower profits and earnings per

share (the primary profit target monitored by management). Lower EPS reduces management's confidence, leading to less acquisition, closing the balancing loop.

Loop B2, "Get More Assets," (also shown in Figure 5) is technically a balancing loop, but it also depicts a major engine of growth for Aquilo Bank. Another term often used in system dynamics for balancing loop is "goal seeking loop," and Loop B2 is a classic example. In this instance, the goal it is seeking is more assets. As desired assets increase, the asset shortfall increases, leading to pressure to acquire. The resulting acquisition increases the number of banks and assets, closing the asset shortfall. This reduces the pressure to acquire and shuts down this loop, but only after the bank has grown considerably larger than it was at the outset.

A similar dynamic can be seen in Loops B3, B4 and B5, shown in Figure 6. All three are seeking the goal of more customers, and each responds to the resulting customer shortfall with a different action. In Loop B3, "Community Bank Strategy," the bank responds to the customer shortfall with efforts to improve its community bank image, which increases its attractiveness and leads to more customers, closing the customer shortfall. Loop B4, "Customer Growth Through Selling," shows how the bank reacts to the customer shortfall by increasing its cross-selling, which leads to more customers (since a person with two accounts is considered two customers). Loop B5, "Customer Retention," builds off the cross selling by reducing the churn rate. Churn rate is the rate at which customers close out accounts and move their business to another bank. A customer with multiple accounts at Aquilo Bank is less likely to do this, so increased cross selling reduces churn, which increases customers, closing the customer shortfall.

It is interesting to note that two of the previously mentioned reinforcing loops, R1, "Revenue Drives Acquisition," and R5, "Attractiveness From Convenience," also close the customer shortfall by increasing the number of customers. In the case of R1, as banks are

acquired, they automatically bring new customers with them, closing the customer shortfall. In R5, newly acquired banks bring ATMs with them, increasing Aquilo's attractiveness and drawing new customers. This is an interesting example of balancing and reinforcing loops working in concert to drive corporate growth. Raising the goals in the balancing loops leads to actions within those loops that will close the resulting gaps, but also leads to the kicking in of growth-oriented reinforcing loops.

By contrast, the four remaining balancing loops, B6 through B8 (shown in Figure 7) and B9 (shown in Figure 4), are all examples of "brakes" on growth. In Loop B6, "Size Brake on Acquisition," as pressure to acquire increases, acquisitions increase, which lower the bank's ability to control its organization. This motivates a reduction in the number of regions to which the bank might expand, thereby reducing the opportunities for acquisition and the pressure to acquire, closing the balancing loop. In Loop B7, "Geographic Brake on Acquisition," acquisitions lead to an increase in regions served, which reduce the bank's ability to control its organization and its motivation for seeking new regions in which to acquire, which ultimately lowers the opportunities for acquisition and the pressure to acquire. The reduction in the number of regions served reduces, in Loop B8, "Brakes on Culture Based Expansion," the number of banks with cultures compatible with Aquilo's, which reduces the number of acquisition opportunities and therefore the pressure for acquisition. Lastly, in Loop B9, "Image Brake on Acquisition," we see the dark side of ATMs. While they provide convenience, they detract from Aquilo's community bank image, reducing its attractiveness and leading to a reduction in the growth rate of new customers, revenue, profit, acquisition, and, ultimately, in ATMs, thereby closing this balancing loop.

POLICY TESTING RESULTS

There are dozens of possible policy choices that can be simulated in the model. The present paper will discuss only a few, and will concentrate on the effects of particular policy choices on the bank's actual strategy. As Senge (1990) pointed out, the key to change and growth in systems like Aquilo's is to find the leverage points and exert pressure on them. Aquilo Bank's cognitive map suggests that if it wants to continue to grow, it should consider, among other things, these policies:

1. Implement systems that will improve control, even over longer distances or larger organizational size. Or, learn to live with less-than-perfect control.
2. Let go of the idea that its managers must be able to drive to contiguous states to perform their jobs.
3. Be willing to look at potential acquisitions where the cultural match is less than perfect.
4. Let go of the idea that it is a community bank and simply go for growth and size.
5. Expand outside of home area, where returns might be higher.

Each of these policies was tested in the model. The results of these tests on Net Income and Earnings per Share (EPS) are shown in Figures 8 and 9, respectively.

Improving control. Aquilo Bank's management very much wants to maintain control over its operations. It feels that it must contain its expansion for that to happen. But what if the bank were to improve its systems or in other ways boost its capacity to control its operations? The model shows that there would be only a negligible increase in net income (Figure 8), and actually a decrease in EPS (Figure 9), compared to its actual strategy. What happens is a "fix that fails." Increasing management's ability to control leads to a larger number of banks being

acquired, but this leads to lower ability to control, so the policy of increasing control proves to be self-defeating. This is probably not a high leverage policy for Aquilo Bank, although it probably needs to work on increasing the potency of its control systems merely as good practice and continuous improvement, and to enable it to control its ever-expanding empire.

Letting go of preference for contiguous-state operations. Aquilo Bank's management has a preference for expanding from state to contiguous state. This, in their judgment, allows for greater, and easier, control. It also appears to be a part of the company's somewhat cautious culture. Were Aquilo to relax this preference, the result would be an increase in net income (see Figure 8), but little effect on earnings per share (Figure 9). This is a "fix that succeeds a little bit." By relaxing this cultural preference, Aquilo Bank allows itself to expand to a greater number of regions, and acquires a greater number of banks. This yields more assets on which to earn a return. This is a bit more promising than the increasing-control policy.

Less-than-perfect cultural match. Aquilo Bank is very concerned that any bank it acquire be compatible with its culture. This obviously restricts the number of possible acquisition or merger candidates. What if the bank became less choosy about the culture of its prospective partners? Figures 8 and 9 show that the effects on profits and EPS are negligible. By being less "picky" about its targets, Aquilo Bank increases the number of banks it might acquire, but this has only a small effect on its goal for number of banks, and as a result very little changes. This is a very low leverage policy.

Abandon community bank image. Aquilo Bank, like many banks, wants it both ways—it wants to be large, but it wants customers to think of it as a friendly community bank. What if it abandoned this image-building stance by simply going for larger size? The model shows that this is a high leverage policy, showing a 33% increase in net income and a 19%

increase in the earnings per share. In essence, this is the strategy that Aquilo Bank chose in the first place, i.e., to grow. But there is an even higher leverage strategy available to the company.

Expand outside of home area. In a previous study (citation withheld for blind review purposes), it was shown that Aquilo Bank's home area was actually a low one for bank profits. Other areas, some far away from its base but others very much within striking distance, had the potential for much higher profits. When that is entered into the model, along with the desire to grow and a loosening of the contiguous-state preference (both prerequisites for this strategy), net income and earnings per share rise the most of all—49% for net income and 25% for earnings per share. Clearly this is the strategy that Aquilo Bank should pursue, but to do so it would have to let go of two of the most subtle aspects of its collective mental model—its preference for contiguous-state operations and its desire to remain a "community" bank.

CONCLUSION AND NEXT STEPS

Many other policy test could be conducted with this model. The effects of increased cross-selling effort, greater emphasis on customer service, and product attractiveness could all be tested. The model, if set at equilibrium, could assess the effects of single and combination policies on a small bank (i.e., Aquilo when they came out of receivership) to see which would have been the highest leverage. Lastly, by moving away from Aquilo Bank itself and trying to simulate a more "generic" bank, many loops could be added to the model. The model also needs to refine its profit loop to see those effects more clearly. Many other tests and changes are possible. Much could be done with, and learned from, this model. But all of these lessons would require a far longer manuscript than is currently possible. Suffice it to say here that the present exercise has illuminated a clear course of high-leverage action for Aquilo Bank. Whether it chooses to act on this learning is its decision.

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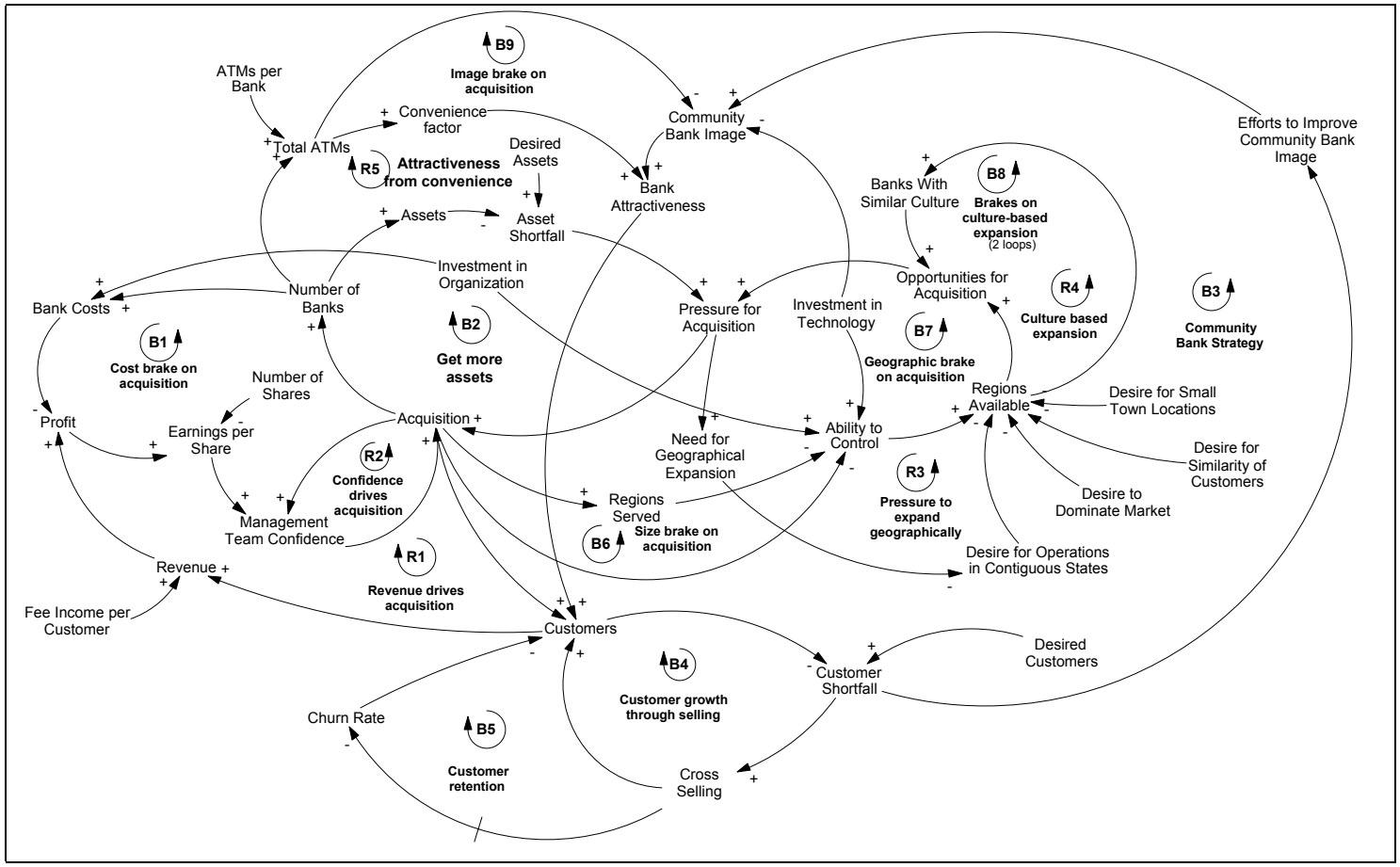

Figure 1Aquilo Bank Geographical Diversification Cognitive Map

Note: Arrows indicate the direction of causality. Signs indicate the polarity of relationships, a "+" sign meaning that, all else equal, if the cause increases (decreases), the effect increases above (decreases below) what it would otherwise have been. Loops are labelled "R" for "reinforcing," signifying that increases or decreases in the value of any variable in a series of connected variables are ultimately amplified ("reinforced") as their effects are traced through that connected series.

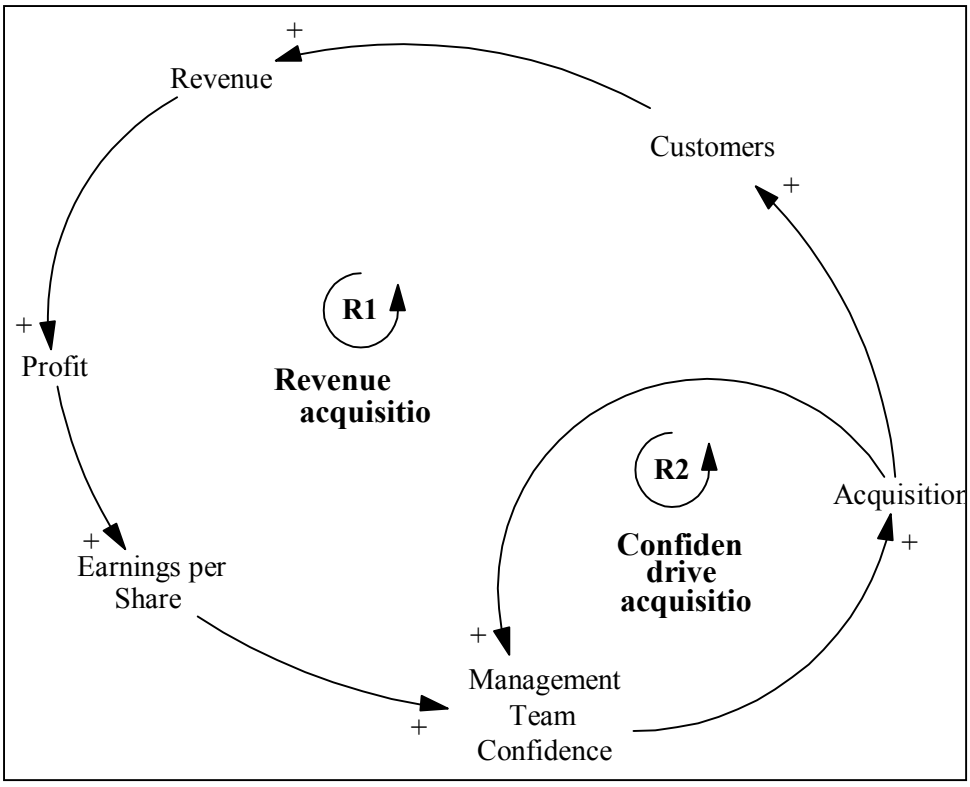

Figure 2 Reinforcing Loops 1 and 2

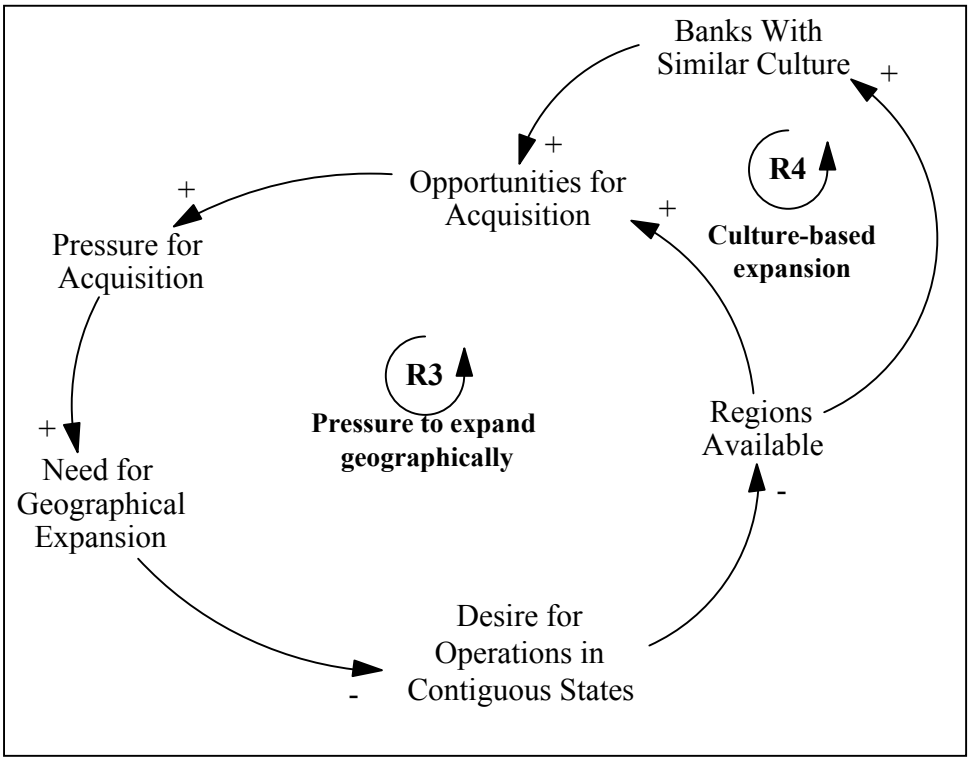

Figure 3 Reinforcing Loops 3 and 4

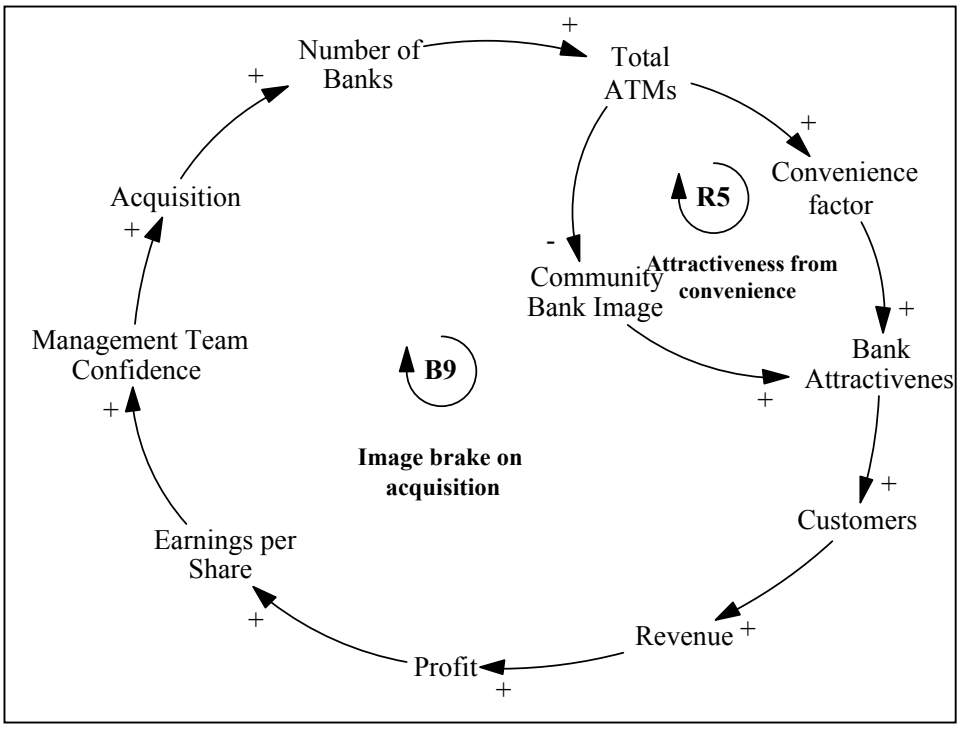

Figure 4 Reinforcing Loop 5 and Balancing Loop 9

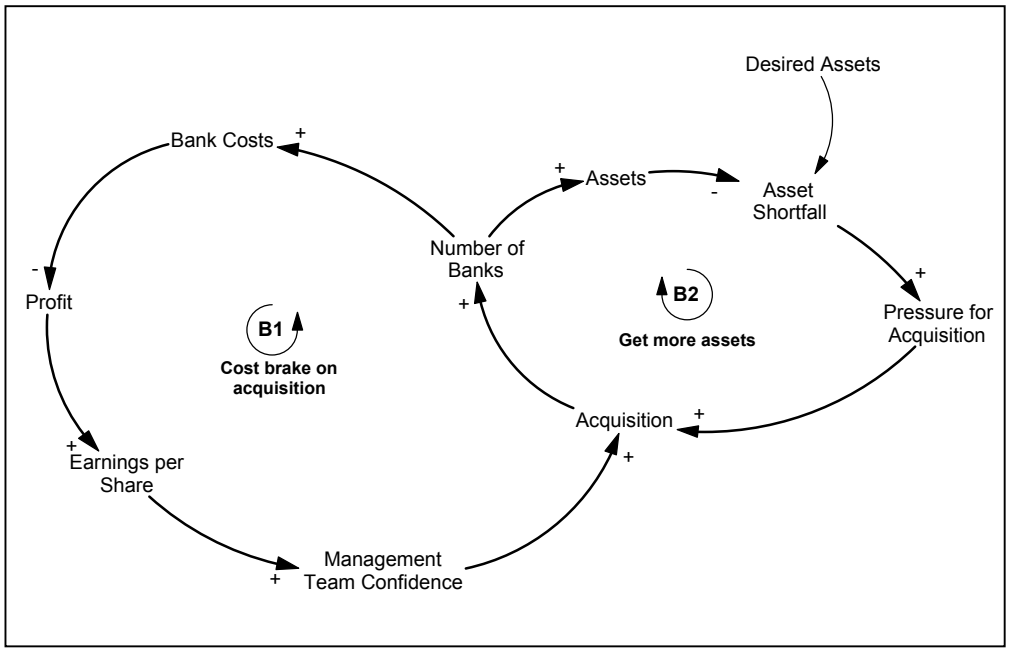

Figure 5 Balancing Loops 1 and 2

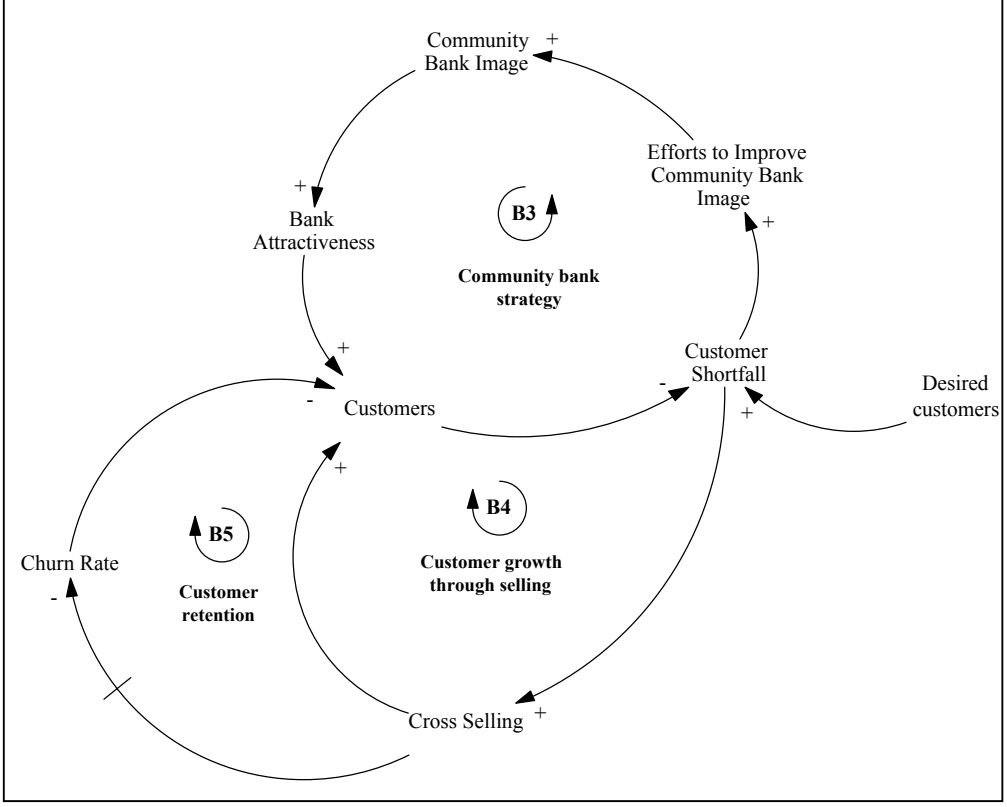

Figure 6 Balancing Loops 3, 4 and 5

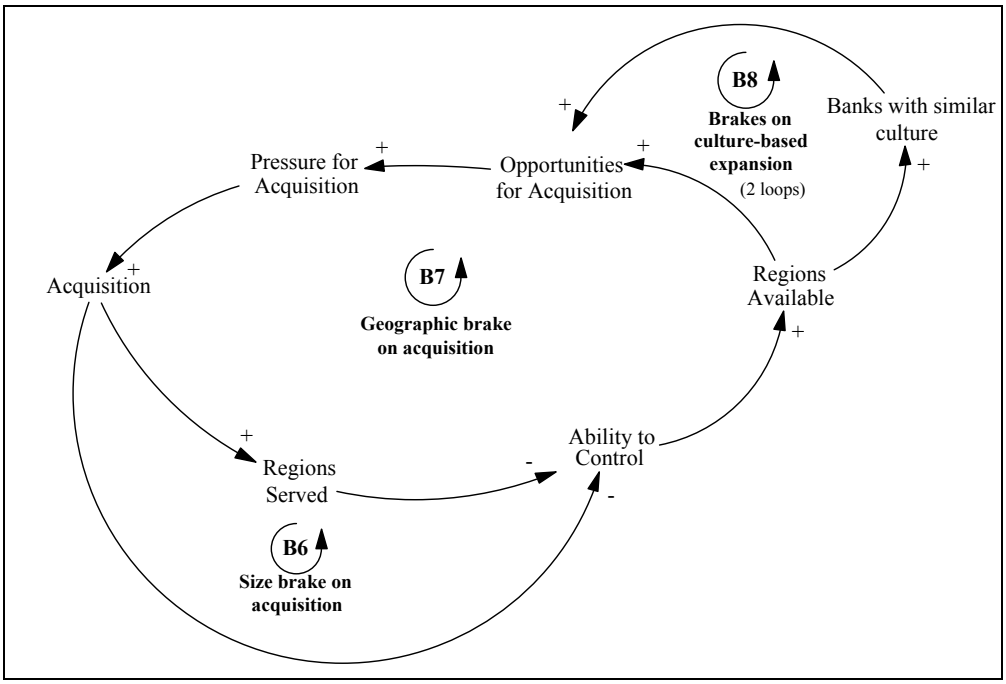

Figure 7 Balancing Loops 6, 7 and 8

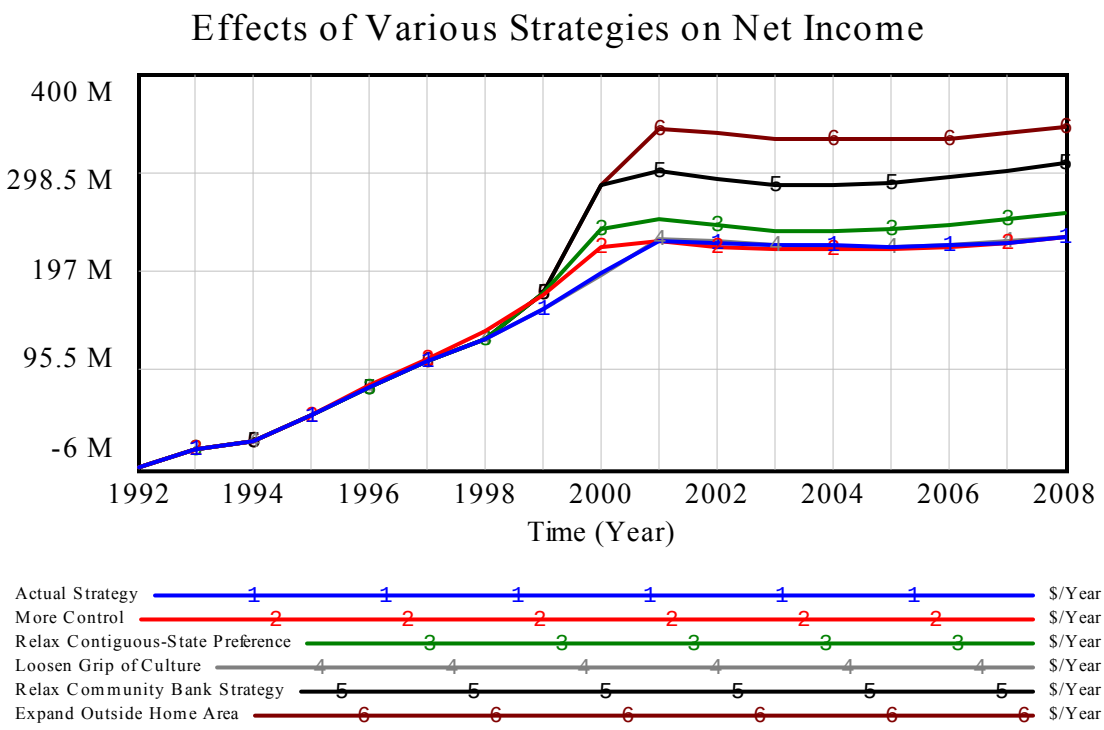

Figure 8 Leverage-Testing Results for Net Income

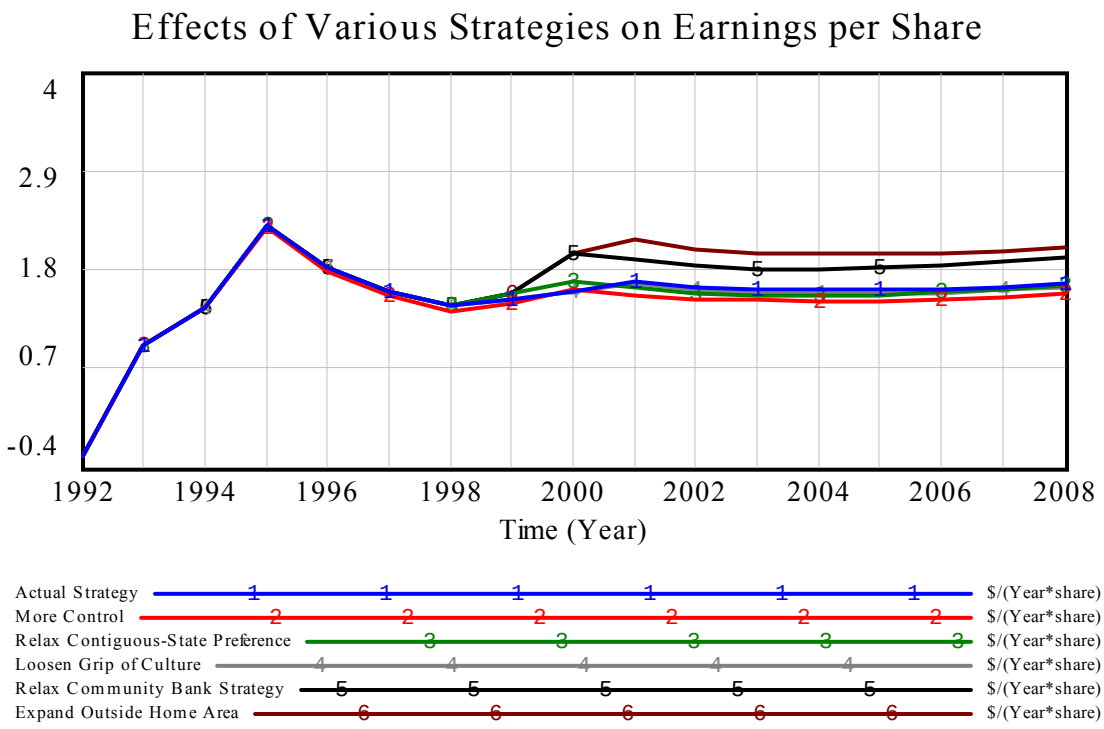

Figure 9 Leverage-Testing Results for Earnings per Share

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