

# THE SAVINGS AND LOAN CRISIS: A SYSTEM DYNAMICS PERSPECTIVE

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## ABSTRACT

The savings and loan industry has been the primary source of home mortgages for American families since 1932. Since 1984, however, 25 percent of the savings and loans, approximately 700 out of 2800, have failed. Although the total costs associated with these failed savings and loans have yet to be determined, estimates range from \$300 billion to \$1 trillion. This paper discusses a system dynamics model of the effects of interest rate risk and default risk focusing on the savings and loan industry. Using the model to test the effects of policy initiatives specific to the prime interest rate and the default risk on loans, the authors demonstrate that the savings and loan crisis might have been lessened or even avoided if the regulators had a better understanding of the system's structure and the effect of that structure on system behavior.

## INTRODUCTION

The savings and loan industry has been the primary source of home mortgages for American families since 1932. Although the industry continues to be the largest originator of home mortgages today, its financial health has declined over the past decade. Since 1984, 25 percent of the savings and loans, approximately 700 out of 2800, have failed. Even today, in 1993, the magnitude of the bailout and the final costs have yet to be determined. Estimates range from \$300 billion to a possible high of \$1 trillion.

Until the late 1970s, the savings and loan industry was strictly regulated and profitable. However, high inflation in the late 1970s together with the development of money market mutual funds caused a crisis within the industry: disintermediation - a silent run on deposits. The crisis resulted from depositors withdrawing their funds from the savings and loan associations and investing them in financial instruments that offered higher rates of return.

To address this problem, the federal government enacted legislation in 1980 that increased the deposit insurance coverage from \$40,000 per account to \$100,000, extended the federal override of state interest rate ceilings on various loans, and extended the authorization of NOW accounts. Additional federal legislation in 1982 mandated the complete phase-out of interest rate floors and ceilings, expanded lending and investment authority, and removed mortgage loan-to-value ratio limits. These two pieces of legislation sought to enhance the savings and loan industry's ability to compete with other financial institutions.

Although these measures initially appeared to have a positive impact on the industry, a second, more ominous, crisis occurred in the mid-1980s: a dramatic escalation in the number of savings and loans becoming insolvent. In response to this crisis, federal legislation specific to insolvent savings and loans was enacted in 1989. This legislation was designed to facilitate the takeover of

insolvent savings and loan associations, payoff the insured deposits, and liquidate their assets.

Although the number of insolvent savings and loans has declined in the past few years, the problem remains. A review of the literature indicates that there is no consensus on its root cause. Although there is a tendency, especially on the part of the media, to "blame" the crisis on corrupt savings and loan executives and the politicians who have intervened with regulators on behalf of the insolvent thrifts, this paper presents an alternative explanation. The authors hypothesize that the crisis within the savings and loan industry resulted from the interaction between the structure of the savings and loan industry and the regulations imposed on the system in the early 1980s.

The authors propose that the primary problem within the savings and loan industry stems from government regulations pertaining to the interest rate risk and the default risk on loans. The interest rate risk is defined as the gap between what savings and loan associations pay depositors and what they charge borrowers, while the default risk on loans is the probability that a particular type of loan will not be repaid in full. To explore the importance and influence of these two factors on the savings and loan industry, a system dynamics model was developed.

## **A MODEL OF THE SAVINGS AND LOAN INDUSTRY**

This paper presents a preliminary system dynamics model of the savings and loan industry in the United States. Designed to demonstrate the feasibility of examining the savings and loan industry from the system dynamics perspective, the model captures the stock and flow of money through the system. It also captures the historical trends and the effects of the 1980 and 1982 legislation on system behavior. The model is used to test the effects of policy initiatives specific to the prime interest rate and the default risk on loans.

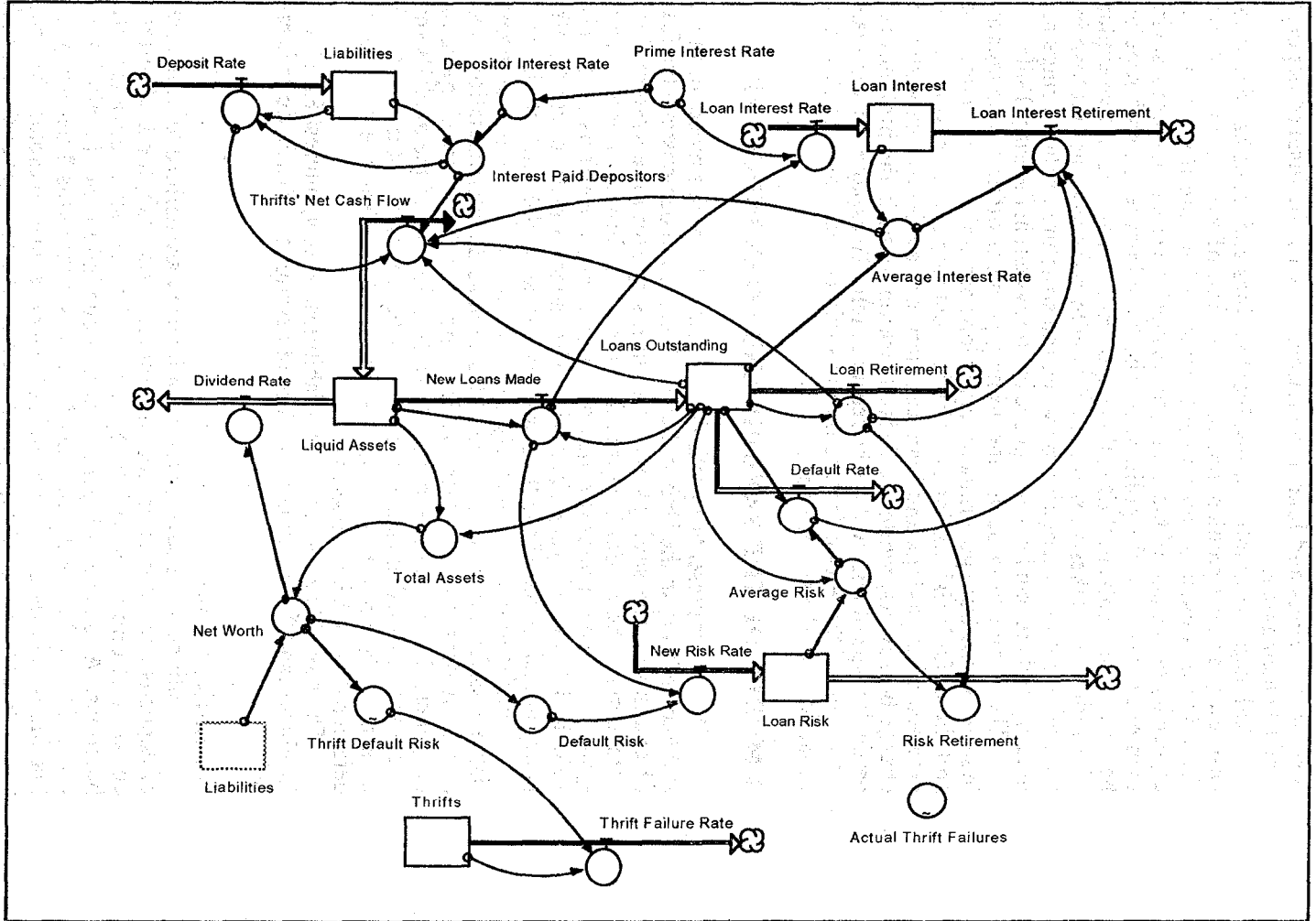
In order to focus exclusively on the problems and effects of interest rate risk and default risk, system variables such as disintermediation, operating costs, payments to the Federal Savings and Loan Insurance Corporation, and the general health of the economy have been left out of the model's structure. These variables will be incorporated into a future version of the model. For the present study, only those variables that directly affect interest rate risk and default risk have been modeled.

The model has four sectors: Liabilities, Assets, Interest Rate/Loan Risk Co-Flows, and Policy Initiatives. A brief description of each sector is provided below.

### **Liabilities Sector**

Liabilities in the savings and loan industry are defined to be the sum total of deposits and interest earned on deposits. As such, the Liabilities sector consists of one level which represents the system's aggregate stock of liabilities. As shown in Figure 1, there is one inflow into Liabilities, Deposit Rate. This inflow is the Interest Paid Depositors plus 3 percent growth in Liabilities. The model's structure has been developed to capture the concept of a double entry accounting system used by the savings and loan industry. Double entry requires that liabilities also be counted as assets, so the model includes the Deposit Rate as part of Thrifts' Net Cash Flow, an inflow into Liquid Assets.

Figure 1 Overview of Model Structure



## **Assets Sector**

Since the goal of the industry is to ensure that assets exceed liabilities, savings and loans must balance their liabilities, which are short-term financial instruments, with their assets, which are long-term financial instruments. Traditionally, this balance has been achieved by managing interest rate risk and default risk.

The Assets sector consists of two levels: Liquid Assets and Loans Outstanding. Assets in this model are defined as the sum of these two levels. As shown in Figure 1, the inflow into Liquid Assets is the Thrifts' Net Cash Flow. The Thrifts' Net Cash Flow represents the amount of money coming into the system from deposits, loans that are repaid, and the interest paid on outstanding loans minus the amount that must be paid to depositors in the form of interest on deposits.

There are two outflows from Liquid Assets. The first is Dividend Rate. This flow represents the money that is paid to those who have invested in the system. The rate of this flow is Net Worth multiplied by 10%, which is designed to capture the dividends paid to investors and the thrift industry's operating costs. Net Worth is determined by subtracting Liabilities from Total Assets.

The second outflow from Liquid Assets, New Loans Made, is the single inflow into Loans Outstanding, a level that represents the cash that is available to make new loans. As such, New Loans Made is formulated by multiplying the sum of Liquid Assets and Loans Outstanding by 6%; this amount is then subtracted from Liquid Assets. This formulation captures the fact that Federal Reserve regulations require that 6% of a thrift's assets be kept liquid to cover depositors' demands for cash.

There are two outflows from the Loans Outstanding level: Loan Retirement and Default Rate. Loan Retirement is formulated by dividing Loans Outstanding by 12, based on the assumption that a thrift's mix of loans are paid in full after an average of 12 years. The Default Rate is formulated by multiplying Loans Outstanding by Average Risk. Because this outflow represents the decline in assets attributable to loans that are defaulted on, it reflects the extent to which the system is affected by the types of loans made. Furthermore, the amount of risk on a particular loan depends on the type of loan and the savings and loan industry's experience in making and servicing that particular type of loan.

There is also an accounting outflow between Loans Outstanding and the Thrifts' Net Cash Flow. This accounting flow captures the interest paid by borrowers on outstanding loans and is formulated by multiplying the Average Interest Rate by Loans Outstanding and adding the product to the Thrifts' Net Cash Flow. This structure captures the fact that the interest earned on loans changes gradually.

## **Interest Rate/Loan Risk Co-Flows Sector**

A co-flow process is generally used to track an average attribute associated with a material quantity (Richmond, 1990). The inputs to the co-flow process are the primary flow and a conversion coefficient. This model has two such co-flow structures. One co-flow captures the average interest rate earned on loans made. The primary flow for the co-flow is New Loans Made and the coefficient is the prime interest rate plus 1.5%. This markup is a fee for the risk

that is assumed when making a loan and is common in the financial industry. The inflow into the Loan Interest co-flow is formulated by multiplying the Prime Interest Rate plus 1.5% by the New Loans Made rate. The outflow is formulated by multiplying the Average Interest Rate by the sum of Loan Retirement and Default Rate. The Average Interest Rate is determined by dividing Loan Interest by Loans Outstanding. The primary reason for modeling the co-flow structure is that when interest rates change, the interest rate on "old" loans will continue at the old rate, while the new interest rate will be levied against new loans. Thus, the overall interest earned on Loans Outstanding will change over time.

The second co-flow in the model captures the average default risk on loans. Its primary flow is New Loans Made and the conversion coefficient is Default Risk. This formulation is similar to that described above with the primary difference being the conversion coefficient. The Default Risk conversion coefficient is part of the model's structure and is determined by Net Worth.

### **Policy Initiatives Sector**

The model was developed to test two policy initiatives, one related to interest rate risk and one related to the default risk on loans. To reiterate, interest rate risk refers to the gap between the interest rate that thrifts pay depositors and the rate that they charge borrowers. This gap determines the earnings of the bank. The risk involved stems from the fact that a thrift's liabilities are short-term, while its assets are long-term. Therefore, sudden changes in the interest rate can quickly narrow the gap, decreasing earnings (White, 1991).

The default risk on loans also has an impact on earnings. Default Risk refers to the probability that a particular type of loan will be paid off in full. Historically, mortgages have been one of the safest types of loans to make in terms of Default Risk, but the riskiest in terms of interest rate risk. Short-term commercial loans, loans to developers, loans for raw land, consumer loans, and investments in junk bonds are relatively short-term investments and thus reduce interest rate risk, but their default risk is greater than that for mortgages. Legislation in 1980 and 1982 intended to reduce interest rate risk by liberalizing the types of loans which thrifts could make, but, at the same time, these actions increased the Default Risk that thrifts faced.

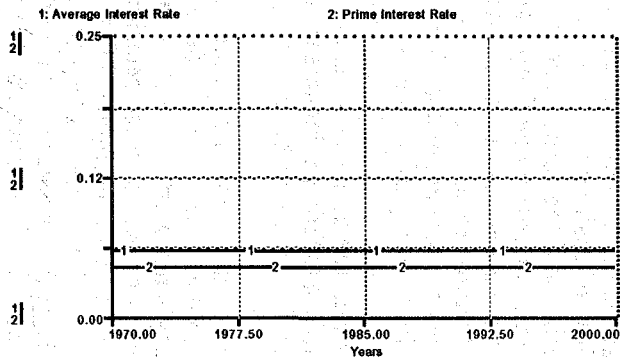
### **MODEL BEHAVIOR**

The simulation begins in 1970 and runs for thirty years. Figures 2A and 2B show simulations of the model under ideal conditions. Figure 2 reflects the system's behavior when the interest rate paid depositors is fixed at 3% and the interest rate paid by borrowers is fixed at 6%. These interest rates provide thrifts with sufficient earnings to cover operating costs and losses and to pay dividends. As shown in Figure 2B, under ideal conditions, where the interest rates remain fixed, Net Worth, Total Assets, and Liabilities all continue to grow.

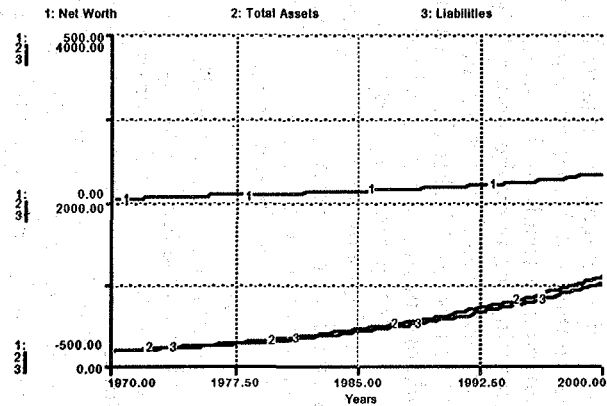
Figure 3A shows the effects of inflation on interest rates. Although the interest rate began increasing in 1978 and reached a peak of almost 19% in

**Figure 2A**

**Behavior With Constant Interest Rates**

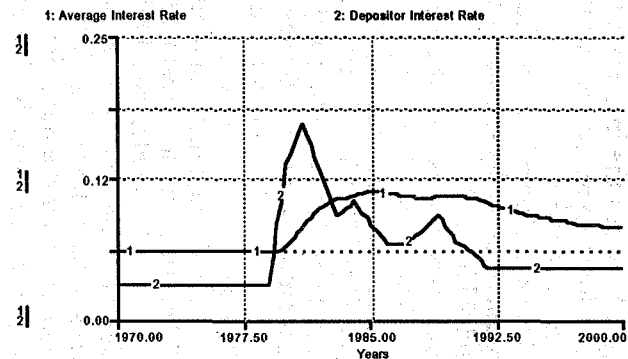


**Figure 2B**

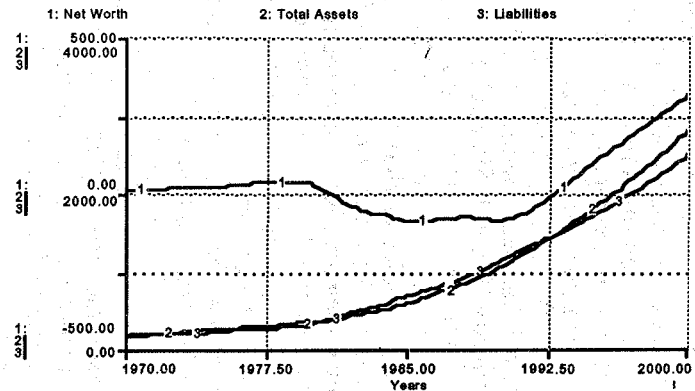


**Figure 3A**

**Behavior With Actual Interest Rates 1978-1989**



**Figure 3B**



1981, the model reflects interest rate changes only after 1980. Prior to that time the interest rates that could be paid and charged by thrifts were set by federal banking regulators. The 1980 legislation allowed the interest rate paid to depositors to increase, and it rapidly became greater than the average interest rate received on outstanding loans. The gap between the interest rate on deposits and the average interest rate received on loans represents losses that the savings and loan industry incurred due to interest rate risk (Kane, 1989; White, 1991; and Woerheide, 1984). This gap is reflected in Figure 3B. This interest rate shock has been identified as the primary cause of the losses sustained by the industry (Kane, 1989; Spellman, 1982; and White, 1991).

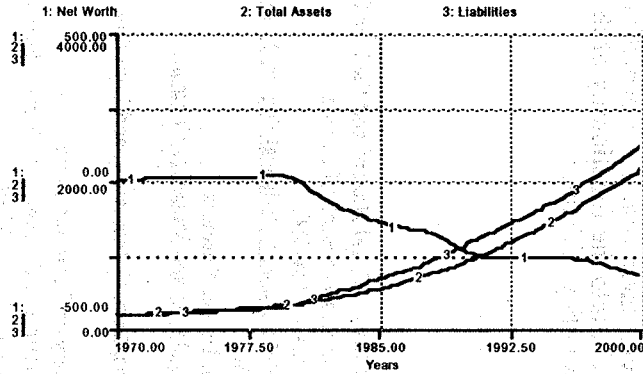
Figure 3B shows the impact of the interest rate increases on the model's behavior with respect to Net Worth, Total Assets, and Liabilities. This simulation indicates that the savings and loan industry was capable of recovering from the interest rate increases of 1978-1982. Historically, however, negative Net Worth requires that thrifts be closed or that additional assets be brought into the industry. To accomplish this the Depository Institutions Deregulation and Monetary Control Act of 1980 and the Garn-St. Germain Depository Institutions Act of 1982 changed the structure of the deposits that thrifts could hold and the types of loans that they could make. These factors, combined with the effect of deposit insurance, resulted in a willingness of the thrifts to take on diversified loans that contained additional risk. Thus, instead of adhering to past practice and riding out the interest rate increases, the thrifts opted to take on new types of loans that had an increased default risk associated with them. As documented by the behavior of the model, Figure 4A, this decision had a serious, long-term, negative impact on the industry.

The combined effects of the interest rate increases and the increased default risk on loans that resulted from loan diversification caused Net Worth to remain negative. Although the historical data indicate that the Net Worth of the industry did not remain negative for as long as the model indicates, this occurs because the model does not capture the inflow of cash into the system that occurred as a result of the liquidating of thrifts and the settlement of non-performing loans by the Federal Savings and Loan Insurance Corporation. This missing factor causes the model to differ from the actual data on net worth, total assets, and liabilities. An important factor in this process is that regulators, thrift managers, and auditors have wide discretion in deciding when a loan is non-performing. By not declaring loans non-performing, a thrift's assets, and thus its net worth, appear greater than it actually is. Therefore, as described in the literature, the model shows that the default risk is directly affected by net worth, that as net worth decreases, a thrift's willingness to make loans which contain additional risk increases (Kane, 1989; Scott, 1987; and Spellman, 1982).

As indicated in Figure 4B, the decision to take on loans with increased default risk resulted in a steady upward trend in the number of loans defaulted on after 1982, further decreasing the industry's net worth. For illustrative purposes only, the number of thrifts that failed as a result of these decisions is reflected in Figure 5. While Figure 5 indicates that the model "fits" the historical data quite well, the reader should beware. The model's endogeneously-generated thrift failures "fit" the real world because the authors designed it that way. Since bank regulators, as noted previously, have broad latitude to close thrifts, many models could be "fit" to reflect the historical data

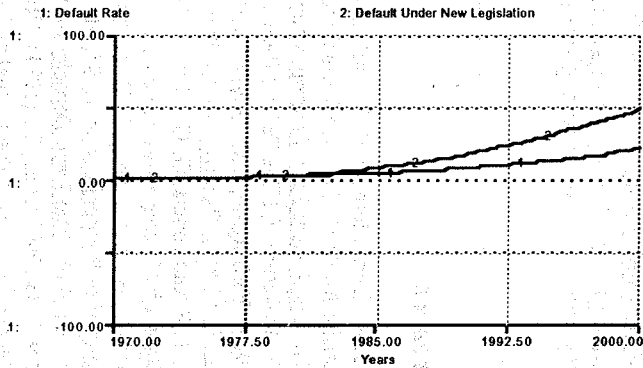
**Figure 4A**

**Behavior with New Loan Default Risk**



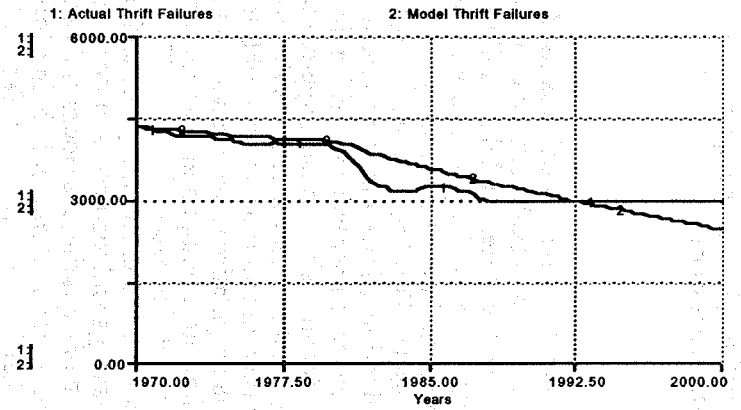
**Figure 4B**

**Loan Defaults**



**Figure 5**

**Actual Thrift Failures Versus Model Thrift Failures**





simply by adjusting the probability of closing based on net worth. As a measure of model fit and validity, it is more important and more difficult for the model to match the industry's net worth.

## SUMMARY

In this paper, a system dynamics model was used to demonstrate the effects that interest rate risk and default risk have on the savings and loan industry's net worth, assets, liabilities, and thrift failures. The regulations instituted in 1980 and 1982 to address the problems associated with interest rate risk sought to balance declining interest rate risk by diversifying and shorting the average loan life of assets. This "fix", however, had serious unintended consequences. Diversification allowed thrifts to make commercial loans, undeveloped land loans, and consumer loans for which they had no experience and which carried higher default risks. To date, approximately one-quarter of the thrifts have failed, costing the American taxpayers in excess of \$300 billion. By holding the default risk constant at its pre-1980 level, i.e., in effect, ignoring the 1980 and 1982 regulations, the behavior of the model developed by the authors shows that the savings and loan industry was capable of recovering from the interest rate increases of 1978-1982.

Although the model used is a preliminary one and, as such, focuses on only two aspects of the savings and loan crisis, it does suggest that a system dynamics model is capable of capturing the stocks and flow of money through the system. Hence, a more detailed model is being formulated to contain structural refinements that incorporate the effects of such variables as disintermediation, the deposit insurance fund, and the disaggregation of the types of loans made. The development of a more detailed model of the savings and loan system that reflects the dynamics of the total system should be of interest to public policy makers. It should provide them with a new analytical tool through which they can gain further insight into the functioning of the industry and enable them to explore and test new policy initiatives.

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