Using econometric models to predict recessions
Contents

Lenders and environmental policies .......................................................... 2
Eleanor H. Erdevig

Lenders face new risks and costs as a result of environmental policies.

Call for conference papers ........................................................................ 13

Using econometric models to predict recessions ..................................... 14
Mark W. Watson

The explanation of why a model failed to predict the most recent recession suggests that this recession was unique.

Index for 1991 ..................................................................................... 26
Lenders and environmental policies

Eleanor H. Erdevig

One of the major issues influencing economic development in the nineties is the possible impact of environmental laws and regulations. Many analysts expect the effect to be significant as companies seek to comply with environmental requirements.

Among those increasingly affected by environmental policies are lenders who generally provide the funds to borrowers for business operations and expansion. Lenders have found themselves at risk for environmental compliance both indirectly, when a borrower is faced with the added costs of complying with environmental laws, and directly, when a borrower defaults on a loan.

This article examines the liability of lenders and the nature of the risk exposure for financial institutions as a result of environmental laws and regulations. It reviews the recent court record relating to financial institution lending associated with contaminated properties. It discusses proposed measures to reduce the uncertainty for lenders under current environmental policies. And, given the long history of industrial activity within Seventh District states—Illinois, Indiana, Iowa, Michigan, and Wisconsin—it considers whether this area may be more affected by environmental policies than elsewhere in the United States.

Environmental legislation

On January 1, 1970, President Nixon signed into law the National Environmental Policy Act of 1969 (NEPA) which established environmental protection and preservation of our natural resources as a national policy. The act provided for an Environmental Protection Agency (EPA), the President’s Council on Environmental Quality, and an environmental impact review program. With the founding of the EPA in December 1970, the environmental movement entered a new phase.

Other major environmental legislation followed. Most of this legislation was directed primarily toward monitoring and regulating the ongoing activities of individuals and corporations that might contribute to a deterioration in our environment. Among the legislation either enacted or amended was the Clean Air Act, the Solid Waste Disposal Act, amended by the Resource Conservation and Recovery Act (RCRA) of 1976, the Toxic Substances Control Act (TSCA), and the Safe Drinking Water Act.

In 1978, the conditions in the Love Canal community, which had been built over an abandoned hazardous waste dump in upstate New York, prompted Congress to investigate the problems associated with toxic waste sites. The resulting legislation, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), commonly known as the Superfund act, was enacted, according to its preamble, “to provide for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive

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hazardous waste disposal sites.” The law was subsequently amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA)1.

The passage of CERCLA ended the disinterested party status of financial institutions. Previously, for the most part, financial institutions were bystanders and not directly affected by environmental legislation. Many were of the opinion that the environmental law developments were a concern only for those enterprises that produced some form of environmental externalities, such as smoke, solid waste, and water discharges.

The intent of CERCLA was to assign the cost of cleanup of contaminated sites to the responsible parties. In addition to the parties responsible for placing the contamination in the ground, the act assigned responsibility to successors in the chain of title, for example, the present property owner. The third parties responsible for the cleanup costs are those “associated” with the title to the contaminated property, for example, a mortgagee. It is in this third grouping that financial institutions have found themselves at risk. This risk exposure has led to and may continue to lead to significant financial losses associated with lending to enterprises responsible for contaminated properties.

CERCLA identifies four broad classes of responsible parties that are liable for the costs of cleaning up hazardous substances when the federal government, state government, or a private party brings suit. The first two classes include any person owning or operating a vessel or an onshore or offshore facility, that is, owners or operators. If the title or control to a facility is conveyed to a unit of state or local government due to bankruptcy, foreclosure, or tax delinquency, the person who owned, operated, or otherwise controlled activities at such a facility immediately before the transfer remains the responsible owner or operator. The third class includes persons who arranged for disposal, treatment, or transportation of hazardous substances. The fourth class includes those who transported any hazardous substances to selected sites.

Persons included in the four classes may be exempt from liability if they can establish that they acquired the contaminated property after the disposal or placement of the hazardous substance at the facility and if they are able to claim the “innocent landowner’s” defense. To do so, they must establish that they exercised what is called “environmental due diligence,” that is, at the time they acquired the facility, they did not know and had no reason to know that any hazardous substance was disposed of at the facility. To establish that they had no reason to know, the law provides that they must have undertaken, at the time of the acquisition, all appropriate inquiry into the previous ownership and use of the property consistent with good commercial or customary practice.

The definition of “owners or operators” of facilities as potentially liable parties under CERCLA includes an exemption for persons who hold a “security interest” in a facility. According to the law, the owner or operator definition does not include “a person, who, without participating in the management of a vessel or facility, holds indicia [a form] of ownership primarily to protect his security interest in the vessel or facility.”

Interpretation of this “security interest” exemption under CERCLA has generated uncertainty within the financial and lending communities, particularly with regard to the extent to which a secured creditor may undertake activities to oversee the affairs of a borrower or debtor, for the purposes of protecting the security interest, without incurring CERCLA liability. Specifically, there is concern over whether certain actions commonly taken by the holder of a security interest—such as monitoring facility operations, requiring compliance activities, refinancing or undertaking loan workouts, providing financial advice, and similar actions that may affect the financial, management, and operational aspects of a business—are properly considered to be evidence that the security holder is “participating in the management of a facility.” There is also concern regarding the effect of foreclosure on the security interest exemption of the lender.

Recent major court cases

Court cases have gradually been addressing the issues of lender responsibilities and liabilities. Two types of cases are of particular interest to lenders; those involving the “innocent landowner’s” defense and those involving the security interest exemption. Cases involving the innocent landowner’s defense are of interest to lenders because of the impact of compliance
with environmental law on the borrowers’ ability to repay the loan, the consequent default risk, and the risk assumed by the lender if foreclosure is necessary. Cases involving the security interest exemption are of interest because of the uncertainty surrounding the type of activities which might be engaged in by the lender to monitor the loan and the extent of the risk exposure.

In an early 1985 bankruptcy case, *In re T. P. Long Chemical, Inc.*, the EPA applied for reimbursement by the bankruptcy estate for costs incurred in removing drums of hazardous substances discovered on the property of the debtor, a rubber recycling company. Some of the funds in the estate represented the proceeds from an auction by the trustee of personal property in which a bank held a security interest. The court relied on the security interest exemption to find that the bank as a secured creditor was not liable for costs incurred by the EPA under CERCLA. The court stated that if collateral becomes worthless or poses a risk to the public, the secured creditor is under no obligation to assume possession of the collateral or to insure against the risk. Furthermore, if the bank had repossessed its collateral, it would not be an “owner or operator” as defined under CERCLA because its only “indicia of ownership” was primarily to protect its security interest and it had not participated in the management of the facility.

Subsequently in 1985 a seminal case addressed the protection provided to lenders by the security interest exemption from the liability imposed on owners and operators. In *United States v. Mirabile*, a bank, one of the secured creditors, foreclosed on its mortgage and successfully bid at a sheriff’s sale for the property of a defunct business that had created a hazardous waste. Four months later the bank assigned its bid to the Mirabiles. When the EPA sued the Mirabiles to recover its cleanup costs, the Mirabiles joined the bank as third-party defendants. The court held that a lender may be liable as an “owner or operator” of contaminated property if it participates in the day-to-day “operational, production, or waste disposal activities” of its borrower’s business on the property. However, facility monitoring, involvement in financial decisions, restrictions on financial decisions contained in loan documents, and general financial advice were permissible. In addition, the court stated that the mere financial ability to control waste disposal practices was not sufficient for the imposition of liability. The court found that the bank was not liable because it had not participated in the management of the business, and its actions after foreclosure were undertaken merely to protect its security interest in the property. Foreclosure and repurchase were considered to be a natural consequence of protecting a security interest.

The following year, in the case of *United States v. Maryland Bank & Trust Company*, a district court adopted a narrower interpretation of a lender’s liability after foreclosure. In the *Maryland Bank* case, the EPA sued the bank under CERCLA for reimbursement of the costs of cleanup of a hazardous waste dump after the bank had foreclosed on the property. Maryland Bank, although clearly the owner, claimed that it held title to the property “primarily to protect its security interest in the property,” and was, therefore, not an owner as contemplated by the statute. However, the court found that Maryland Bank had “purchased the property at the foreclosure sale not to protect its security interest, but to protect its investment.” Only during the life of the mortgage did the Bank “hold indicia of ownership primarily to protect its security interest in the land.” Further, the court noted that Maryland Bank had held title for nearly four years after foreclosure and for a full year before the EPA cleanup and that the Mirabile decision “pertained to a situation in which the mortgagee-turned-owner promptly assigned the property [after four months].” Consequently, according to the court, current ownership after foreclosure in this case was sufficient to impose liability on the bank, even if the bank was not operating the contaminated facility. As a result, Maryland Bank had to pay more than half a million dollars in cleanup and court costs and was unable to recover its costs or original investment on resale.

Although the court in the *Maryland Bank* case did not address the issue, there is the possibility that a lender, otherwise liable, can take advantage of the “innocent landowner’s” defense to liability normally available to a purchaser. For this defense, the purchaser must have “undertaken, at the time of the acquisition,
all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice”—the so-called “environmental due diligence.” On the assumption that the lender may be an owner after foreclosure, he or she may also need to prove that appropriate inquiry was made when the loan was approved and prior to foreclosure.

In U.S. v. Nicolet, Inc., the court also considered the application of the security exemption exclusion to mortgagees. In Nicolet, a parent corporation, T&N plc, owned all of the stock of a subsidiary, Keasbey & Mattison Company, the previous owner of Nicolet’s contaminated site, and held a mortgage on Keasbey’s property. The court denied a motion by T&N plc to dismiss the government’s complaint that T&N plc was directly liable because it held a mortgage on the site and actively participated in the management of the facility. Without reaching a final decision on liability, the court stated that “existing case law suggests that a mortgagee can be held liable under CERCLA only if the mortgagee participated in the managerial and operational aspects of the facility in question.” In a consent decree, T&N plc subsequently agreed to implement the remedy called for by the EPA.

A subsequent case in 1989, Guidice v. BFG Electroplating and Manufacturing Co., Inc., also addressed bank liability prior to and after foreclosure on contaminated property on which it held a mortgage. In this case, the court relied on the standards stated in Mirabile and Nicolet in reviewing the bank’s activities and concluded that the key question was “whether the bank had passed the point of protecting its security interest and was participating in the management or control” of its borrower. Finding that there was “no evidence suggesting that the bank controlled operational, production, or waste disposal activities” at the facility prior to foreclosure, the court ruled that the bank fell within the security interest exemption for this period. After the foreclosure and the bank’s purchase of the property at the sheriff’s sale (which it sold after eight months), the court relied on the Maryland Bank & Trust decision and the failure of the 1986 CERCLA amendments to specifically exempt mortgagees-turned-landowners to hold the bank liable “to the same extent as any other bidder at the (foreclosure) sale would have been.” The court indicated that it viewed lenders as serving an environmental policing function by paying close attention to environmental compliance to protect their financial stake.

A recent decision in the U.S. Court of Appeals for the Eleventh Circuit, United States v. Fleet Factors Corp., however, has introduced additional uncertainty into the meaning of the security interest exemption and the extent of lender liability under CERCLA. In this case, Fleet Factors, a commercial factoring firm, advanced funds to a cloth printing company on the company’s accounts receivable, with its facility and its equipment, inventory, and fixtures as collateral. After the textile firm was adjudged bankrupt, Fleet Factors foreclosed on its security interest in inventory and equipment and arranged for its sale and removal, but did not foreclose on its mortgage on the facility. The EPA subsequently found hazardous waste on the property and sued to recover its costs of cleanup. The district court adopted the interpretation of the security interest exemption previously accepted by other courts, stating that the exclusion permits secured creditors to “provide financial assistance and general, and even isolated instances of specific, management advice to its debtors without risking CERCLA liability if the secured creditor does not participate in the day-to-day management of the business or facility either before or after the business ceases operation.” The court denied Fleet Factors’ motion to dismiss the government’s complaint, but granted Fleet Factors the right to appeal. On appeal, the Eleventh Circuit disagreed with the district court’s interpretation of the CERCLA security interest exemption and remanded the case for further analysis consistent with its interpretation. The Eleventh Circuit stated that a secured creditor may be liable under CERCLA “by participating in the financial management of a facility to a degree indicating a capacity to influence (emphasis supplied) the corporation’s treatment of hazardous wastes. It is not necessary for the secured creditor actually to involve itself in the day-to-day operations of the facility in order to be liable—although such conduct will certainly lead to the loss of the protection of the statutory exemption. Nor is it necessary for the secured creditor to participate in management decisions related
to hazardous waste. Rather, a secured creditor will be liable if its involvement with the management of the facility is sufficiently broad to support the inference that it could affect hazardous waste disposal decisions if it so chose. In contrast to previous cases, which permit lenders to exercise general financial controls over a troubled borrower, the appellate court stated that the lender's capacity to influence a debtor facility's treatment of hazardous wastes may be inferred from the extent of its involvement in the financial management of the facility. Thus, according to the court, Fleet Factors could be held liable as the "owner" of the facility because Fleet Factors' mortgage on the property constituted an "indicia of ownership," and its involvement in either the financial management or the operational management of the facility could cause it to lose its security interest exemption.

In support of its interpretation, the Eleventh Circuit reasoned that the lower the threshold of control employed to determine whether the benefit of the exemption had been lost, the greater the incentive would be for lenders to play the role of environmental policeman to keep borrowers in compliance. The court reasoned that its ruling would encourage lenders to investigate the potential borrower's environmental practices and to factor the discovered risks of CERCLA liability into the terms of the loan agreement. The lower threshold would also encourage lenders to monitor borrowers' waste management practices and "insist upon compliance with acceptable treatment standards as a prerequisite to continued and future financial support."

A subsequent decision by the Ninth Circuit Court of Appeals, In re Bergsoe Metal Corp., however, stated that the mere capacity or unexercised right to control facility operations is insufficient to void the security exemption, and stated that "there must be some actual management of the facility before a secured creditor will fall outside the exception." In its discussion of what constitutes management, the court held that "a secured creditor will always have some input at the planning stages of any large-scale project and, by the extension of financing, will perform encourage those projects it feels will be successful. If this were 'management,' no secured creditor would ever be protected." In addition, the court held that certain rights that a secured creditor reserves to protect its investment, such as the right to inspect the premises and to reenter and take possession upon foreclosure, does not put it in a position of management. According to the court's decision, "what is critical is not what rights the Port (the creditor) had, but what it did. The CERCLA security interest exception uses the active 'participating in management.' Regardless of what rights the Port may have had, it cannot have participated in management if it never exercised them."

The recent Fleet Factors and Bergsoe decisions have introduced additional uncertainty into the question of the liability of lenders for hazardous wastes produced by the operations of borrowers. Of particular concern are the extent to which lenders may oversee the activities of debtors, particularly troubled borrowers, without being considered to be participating in management, and the effect of foreclosure and subsequent purchase of the collateral by the creditor. The resulting new risks in lending are discussed below.

**Traditional risks in lending**

Prior to the passage of environmental legislation, particularly CERCLA, during the last two decades, a financial institution's risk associated with lending was generally considered to consist of two elements: default risk and market or interest rate risk. Default risk is related to the probability that the debtor will be unable to perform all of the legal requirements set forth in the loan contract. Most frequently, default is triggered when the borrower fails to meet principal and interest payments in accordance with the terms of the contract. To minimize their exposure to default risk, financial institutions frequently secure loans with collateral. Thus, if the borrower defaults on the loan, the financial institution is able, in theory, to sell the collateral and recover all or a portion of the loan. The maximum possible loss to the financial institution arising from default risk should be no greater than the size of the loan outstanding, plus any legal and administrative costs.

The second type of traditional risk in lending is called market or interest rate risk. For example, as long term interest rates fall, mortgages tend to be refinanced or paid off. The financial institution is then in a position of having to reinvest those funds at the lower
market interest rate. Alternatively, as rates rise, the financial institution may be caught holding assets that are yielding a return less than the current market rate.

**New risks in lending**

Environmental laws and regulations have introduced additional uncertainty and a new dimension to risk for financial institutions in lending. Compliance with environmental legislation in general represents an indirect risk to the lender because of the requirements imposed on the borrower. In reviewing the default risk, the lender must also now consider the borrower's current and potential costs of compliance with environmental laws and regulations. If the compliance imposes an additional financial burden on the borrower, he or she may be less able to pay the interest and principal of a loan. Thus the lender must be assured that the borrower has exercised "due diligence" and is protected by the "innocent landowner's" defense in the acquisition of property which may or may not be used as collateral for the loan. The lender must also be reasonably certain that the borrower is aware of any environmental laws and regulations which might be expected to affect the operation of his or her business.

The new dimension to the risks faced by a lender is that a financial institution may become liable for the costs of cleanup of contaminated property owned by a borrower. The "security interest exemption" was intended to limit the exposure of lenders to such liability, but it requires that lenders not participate in the management of the borrower's business. As discussed in the previous section, recent court decisions have introduced additional uncertainty into what activities are permitted by the lender without losing the security interest exemption. If the security interest exemption is lost and the lender is adjudged to have acted as an owner or operator, the lender may incur environmental cleanup costs which exceed the total amount of the loan.

Much of the uncertainty revolves around whether there should be a low or high threshold for "participation in management" and therefore for lender liability for cleanup. A low threshold means that lenders would be considered to be participating in management even though there was very little oversight of their borrowers' operations. Some advocates of a low threshold believe that lenders would thus be more likely to monitor borrowers' compliance with environmental laws and regulations, rather than risk liability for the costs of cleanup. Lenders would, in effect, serve as environmental auditors. According to the decision in *Fleet Factors*, the ruling was expected to "encourage potential creditors to investigate thoroughly the waste treatment systems and policies of potential debtors. If the treatment systems seem inadequate, the risk of CERCLA liability will be weighed into the terms of the loan agreement. Creditors, therefore, will incur no greater risk than they bargained for and debtors, aware that inadequate hazardous waste treatment will have a significant adverse impact on their loan terms, will have powerful incentives to improve their handling of hazardous wastes.

"Similarly, creditors' awareness that they are potentially liable under CERCLA will encourage them to monitor the hazardous waste treatment systems and policies of their debtors and insist upon compliance with acceptable treatment standards as a prerequisite to continued and future financial support. Once a secured creditor's involvement with a facility becomes sufficiently broad that it can anticipate losing its exemption from CERCLA liability, it will have a strong incentive to address hazardous waste problems at the facility rather than studiously avoiding the investigation and amelioration of the hazard."

Those opposed to a low threshold believe that this would represent additional risks for lenders for which they may not be compensated. Limiting the oversight activities of borrowers' operations to avoid being considered to be "participating in management" would increase the risks to lenders because they would have less information about the operations of borrowers. Lenders are reluctant to make loans where there are additional risks which may be highly uncertain and unquantifiable. In the *Guidice* ruling discussed above, the court stated that "a low liability standard would encourage a lender to terminate its association with a financially troubled debtor and expedite loan payments in an effort to recover the debts."

A high threshold means that a lender would be able to engage in more monitoring of and advising about a borrower's activities without
being considered to be "participating in management." In this case, it would be in the interests of the lender to be sure that the borrower is complying with environmental laws and regulations, because failure of the borrower to do so increases his or her liability for cleanup costs and the risk of defaulting on the loan. The decision in the Guidice case states, "A goal of CERCLA is safe handling and disposal of hazardous waste. To encourage banks to monitor a debtor's use of security property, a high liability threshold will enhance the dual purposes of protection of the banks' investments and promoting CERCLA's policy goals."

It is important that the appropriate level of threshold for participation in management by lenders be resolved. Although a low threshold may encourage lenders to more carefully assess the risks involved prior to lending with contaminated property as collateral, the inability to carefully monitor the borrower's operations after the loan is made without incurring CERCLA liability will generally restrict the availability of credit for such loans. A high threshold, on the other hand, will enable the lender to more closely monitor a borrower's operations to prevent default and assure compliance with environmental laws and regulations without incurring CERCLA liability.

In either case, lending with possibly contaminated property as collateral involves extra costs for environmental inspections and appraisals. Monitoring the activities of borrowers to ensure compliance with environmental laws and regulations increases the costs of servicing the loan for lenders. Although the terms of the loan can include the recovery of some costs, the extent of the risk assumed by the lender may be difficult to quantify. Consequently, some risk may be uncompensated.

If the borrower defaults on the loan, foreclosure on property serving as collateral presents additional risk and uncertainty. If the lender acquires the property upon foreclosure, he or she may be considered as the owner liable for cleanup of contaminated properties. In addition, the property may not be saleable because it is contaminated.

**Proposed clarifications of lender liability**

As discussed above, recent court decisions on lender liability under environmental law have increased uncertainty among banks and other lenders and may affect the availability of credit. Currently, both the EPA and Congress are attempting to rectify the situation.

In August 1990, in response to concern regarding the possible effects of lender liability on the availability of credit, the EPA promised a House panel that the agency would issue a rule to clarify the bounds of the "safe harbor" provided by the CERCLA security interest exemption. After a number of reviews and revisions the EPA proposed rule was announced on June 5, 1991. The proposed rule is an interpretation of the existing "security interest exemption" to CERCLA liability of both privately owned financial institutions and governmental loan guarantors or lending entities.

The EPA rule recognizes that security holders that possess an ownership interest in a facility may need to undertake certain activities in the course of protecting their security interest to properly manage their loan portfolios. Such activities may include inspections or monitoring of the borrower's business and collateral, providing financial or other assistance, engaging in loan workout activities, and foreclosing on secured property. In recognition of the need for these activities, the EPA rule describes a range of permissible activities that may be undertaken by a private or governmental lending institution in the course of protecting its security interest in a facility, without being considered to be participating in the facility's management and thereby voiding the exemption. To clarify the Fleet Factors decision, it states that participation in management means "actual participation in the management or operational affairs by the holder of the security interest, and does not include the mere capacity, or ability to influence, or the unexercised right to control facility operations."

The EPA regulations also provide a safe harbor allowing the lender either to foreclose on the property or to take a deed in lieu of foreclosure. No time limit is specified for the sale of the property, but the lender is required within 12 months of foreclosure to list the property with a broker and to continue to advertise the property for sale, at least monthly thereafter. At any time more than six months after foreclosure, the lender may not reject or fail to act upon within 90 days a bona fide offer to
purchase the property for fair consideration. Fair consideration is defined as outstanding principal plus interest and costs of holding the property.

The EPA rule also encourages, but does not require, the common practice of holders of security interests to undertake or require environmental inspections to minimize the risk that their loans will be secured by contaminated property. Such inspections are considered to be consistent with the security interest exemption and the lender is not considered to be participating in the management of the facility.

Bills were introduced in March 1991 in both the House and in the Senate which were designed to clarify lenders’ liability under current environmental laws. The bill submitted by Representative John LaFalce (HR 1450) is a revised version of legislation which he introduced in earlier congressional sessions. Introducing the bill, Mr. LaFalce stated that “testimony [at Small Business Committee hearings during the 101st Congress] from Government agencies, business community representatives, environmentalists, and bankers made clear that banks and other lending institutions are increasingly refusing loans to creditworthy small businesses that either use hazardous materials or are located in areas of possible contamination because of fears regarding potential liability generated by court action.” For the most part the revision incorporates the provisions of the rule prepared by the EPA and would amend CERCLA of 1980 and RCRA of 1976. According to Mr. LaFalce, the House bill seeks to clarify the liability under those acts of lending institutions, fiduciaries, trustees, and others holding indicia of ownership primarily to protect a security interest in facilities subject to those environmental laws. At the same time he expects the revised legislation to address concerns of the environmental community by encouraging the conduct of environmental assessments, assuring that lenders and other parties who are directly responsible for environmental damage remain liable, encouraging lenders to take action to remedy environmental damage rather than walk away from their collateral, and requiring lenders foreclosing on property to move diligently to dispose of that property in order to remain within the bounds of the security exemption.

The Senate bill, sponsored by Senator Jake Garn (S 651), is known as the Federal Deposit Insurance Improvement Act of 1991, and is similar to legislation that he introduced a year earlier. It amends the Federal Deposit Insurance Act to cap the liability of insured depository institutions and other mortgage lenders under federal statutes that impose strict liability for the release of hazardous materials, provided that the institution or company involved did not cause or contribute to the contamination. For insured depository institutions, the limitation applies to property acquired through foreclosure, held in a fiduciary capacity, or held as a lessor pursuant to a lease that is the functional equivalent of a loan. If a cleanup is conducted, the liability of the institution is limited to the actual benefit it receives, up to the fair market value of the property. The limitation does not apply if any institution or company, after acquisition of property through foreclosure or the termination of a lease agreement, fails to take reasonable steps to prevent the continued release of a hazardous substance after such release is discovered. To clarify the uncertainty created by the decision in the Fleet Factors case, the Senate bill also provides that an insured depository institution or mortgage lender will not be liable under federal law because they have the unexercised capacity to influence operations at or on property in which the institution has a security interest. The Senate bill would also protect federal banking and lending agencies against liability under state and federal laws for contamination on property acquired in connection with receivership or conservatorship activities, in connection with the provisions of a loan, or as a result of a civil or criminal proceeding, as long as they did not cause or contribute to the release of hazardous substances. The Senate bill has been incorporated into the banking reform bill as Title X which is under consideration in the Senate for approval.

The rules and regulations proposed by the EPA have received mixed reviews. Bankers and other lenders have indicated that they still want the level of certainty that only legislation would bring. Lenders fear that courts will not use an EPA rule to block private lawsuits brought by other interested parties against lenders. Environmental groups, on the other hand, claim that the banking industry’s contention
that it is facing enormous potential liability from hazardous waste sites is exaggerated. They oppose new legislation and assert that the threat of lenders’ liability encourages lenders to investigate whether a company has a toxic-waste problem before agreeing to lend to it. Environmentalists expect this to make companies more vigilant about obeying environmental laws.

**Contaminated sites in the Seventh District**

Seventh District states have a long history of industrial activity and many of the cities in the region have grown into major manufacturing centers. With the activity and the growth have come the need to dispose of wastes that may be contaminated. It is such wastes that may result in liability for remedial action under CERCLA.

Banks in Seventh District states are very concerned with their potential liability under CERCLA. Overall, banks indicate a general unwillingness to lend to borrowers that are involved with hazardous materials. They cite the costs for both legal and investigative reviews which are now included in most commercial lending relationships where real property is taken as collateral. Due to the unsettled state of federal case law concerning the degree of participation in management that will subject a lender to liability for hazardous waste problems, banks are voluntarily absorbing costs for cleanup actions, releasing collateral coverage for existing loans, and not exercising rights as lien holders over real property to avoid claims by the EPA of more extensive liabilities. For existing credits, it is not unusual to have a small- to medium-sized company walk away from its debts, leaving the bank with possession and the problem of disposition of real property. In some cases the banks have refused to foreclose on properties so as to remove the potential determination of “owner or operator.” This decision is obviously influenced by the underlying value of properties and the bank’s assessment of the cost associated with claims by the EPA. This has not only affected lending relationships, but is increasingly posing problems for bank trust departments in instances where exercising fiduciary responsibilities may pull the institution into the “owner or operator” designation by the EPA.

The following are examples of the types of problems encountered by Seventh District banks.

A bank with a problem mortgage on a scrap yard recovered as much as possible from secondary collateral but walked away from their primary collateral and took a loss rather than take title to the scrap yard.

A 600 acre farm in trust was leased to a horsebreeder. Unfortunately, a relative of the breeder was a wastehauler. Two children found 3,700 barrels of toxic waste in the weeds on the property. At least $400,000 was spent in cleanup. Fortunately, the trust was large enough to cover the cost and no personal assets were attached.

A trust department holds a land contract which is currently in default. The trust officer suspects pollution on the site and is reluctant to take the property back. Likewise he is concerned about his fiduciary responsibility if he doesn’t move to make the property income producing.

Some indication of the exposure to environmental risks in the Seventh District is provided in CERCLIS, the CERCLA Information System. CERCLIS is the EPA’s comprehensive database and management system that contains the official inventory of CERCLA sites. It supports the EPA’s site planning and tracking functions with data from the pre-remedial, remedial, removal, and enforcement sections of the Superfund program. Inclusion of a specific site or area in the CERCLIS data base
FIGURE 2

NPL sites per 1,000 square miles

![Map showing NPL sites per 1,000 square miles across the United States. The map shows shades ranging from light gray to dark red to indicate the number of sites per area, with Michigan having the highest density and Iowa having the lowest.]

does not represent a determination of any party’s liability, nor does it represent a finding that any response action is necessary. About 50 percent of the CERCLIS sites are eliminated from further consideration at the first step of the evaluation process, the preliminary assessment. Sites that the EPA decides on the basis of available information do not warrant moving further in the site evaluation process are given a “No Further Response Action Planned” (NFRAP) designation in CERCLIS. Sites that the EPA believes pose environmental threats significant enough to warrant detailed evaluation for possible remedial action under Superfund are placed on the National Priorities List (NPL). The EPA uses a Hazard Ranking System (HRS) to identify sites for inclusion on the NPL. Between 2 and 7 percent of the CERCLIS sites evaluated are placed on the NPL.

Currently about 5,200 sites from Seventh District states are listed on CERCLIS. Of this number, 53 percent are designated as requiring no further action. Of the 2,473 remaining, 205 are on the National Priorities List (NPL). This represents 17 percent of the total 1,188 NPL sites in the United States. As shown in Figure 1, the number of NPL sites in the individual states ranges from 77 in Michigan to 20 in Iowa. The remaining 2,268 sites may require cleanup but are not considered serious enough to be currently eligible for the Superfund list.

As an indication of the extent of the risk of contaminated sites in individual states, the number of NPL sites per 1,000 square miles of land area is shown in Figure 2. Except for Michigan, the NPL ratio for each of the Seventh District states is moderately above the national average of 0.3. In Michigan there are 1.4 NPL sites per 1,000 square miles. The number of other sites on CERCLIS (not eligible for NPL) per 1,000 square miles is below the U.S. average of 4.4 in Wisconsin and Iowa and moderately above in Michigan, Illinois, and Indiana.

Conclusion

Environmental laws and regulations and recent court cases have introduced additional uncertainty and a new dimension to risk for financial institutions in lending. The apparent attempt to encourage lenders to require borrowers to comply with environmental laws and clean up industrial properties prior to granting a loan and during the life of the loan has introduced additional costs for the lender. In addition, lenders may find themselves liable for cleanup costs if they are adjudged to have par-
participated in the management of a business that has contributed to the contamination of property that serves as collateral for a loan.

The additional uncertainty and costs affect the availability of credit as lenders are reluctant to make loans where the risks are largely unquantifiable. As a result, less funds are available for businesses where the risks of contamination are present either for operations or cleanup.

It is important for both the financial and environmental communities that the uncertainties as to the environmental liabilities associated with lending be clarified. Otherwise there exists a possible reduction in the availability of credit to any industry, area, or borrower that appears to present a risk of liability for hazardous substance removal.

FOOTNOTES


245 B.R. 278 (Bkrtcy. 1985).

15 Environmental Law Reporter 20922 (E.D.Pa. 1985)


901 F.2d 1550 (11th Cir. 1990), cert. denied, 111 S.Ct. 752 (1991).

910 F.2d 668 (9th Cir. 1990). The Ninth Circuit claims to agree with the Eleventh Circuit decision in a footnote: “As did the Eleventh Circuit in Fleet Factors, we hold that a creditor must, as a threshold matter, exercise actual management authority before it can be held liable for action or inaction which results in the discharge of hazardous wastes. Merely having the power to get involved in management, but failing to exercise it, is not enough.”

9FR 28797 (June 24, 1991).


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Using econometric models to predict recessions

Mark W. Watson

On April 25, 1991, the Business Cycle Dating Committee of the National Bureau of Economic Research (NBER) determined that the U.S. economy had reached a business cycle peak in July 1990 and had fallen into a recession. Could this recession have been predicted by econometric models? In this article I discuss how econometric models can be used to forecast recessions and provide a partial answer to this question by documenting the forecasting performance of one model, the NBER's Experimental Recession Index.

Econometric models describe statistical relationships between economic variables. By extrapolating these relationships into the future, econometric models can be used for prediction. Carefully constructed econometric forecasts can predict recurring patterns in the economy, but even the best econometric model can not anticipate unique events that have not left a statistical footprint in past data.

Recognizing these strengths and weaknesses, most economists base their forecasts on a combination of econometric analysis and judgment (or economic instinct). The relative weight given to judgment and econometric analysis depends on how unique the forecasting period is expected to be. For example, econometric models can be expected to work well for predicting the response of the economy to monetary expansions and contractions, since the statistical record contains many similar episodes. On the other hand, econometric models probably will perform poorly for predicting growth in economic activity in Eastern Europe over the next five years, since the statistical record contains few transformations of command to market economies.

Since the focus of this article is on how, and how well, econometric models forecast recessions, I begin by defining a recession. A statistical model requires a precise definition, and, as we will see, different definitions lead to different econometric approaches. After I describe these econometric methods, I evaluate the recent forecasting performance of one econometric method: the NBER's Experimental Recession Index, which I developed jointly with James Stock of Harvard University. It turns out that this index did not perform well over the current recession. Unraveling the reasons for its poor performance says much about the causes of the current recession.

What is a recession?

Contrary to popular wisdom, the official (NBER) definition of a recession is not "two or more quarters of consecutive decline in real GNP." The official definition is far less precise. Indeed, it is so imprecise that it is worth providing in detail. Burns and Mitchell (1946) give the official definition of a recession as one

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phase of a business cycle. A business cycle is defined as follows:

"Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitude approximating their own."

Using this definition, the NBER Business Cycle Dating Committee somehow determined that the U.S. economy reached a cyclical peak in July 1990. Actually, this is not as difficult as it appears. As lawmakers have claimed about obscenity, recessions may be difficult to define, but you know one when you see it.

Figure 1 presents an index of aggregate activity constructed using four monthly coincident indicators; the index of industrial production, total nonagricultural employment, manufacturing and trade sales, and real personal income. The precise details underlying the construction of the index are given in the Appendix. The shaded areas in the graph are the postwar recessions, as determined by the NBER. As is evident from the graph, recessions are periods of sustained and significant declines in the index.

It is interesting to compare the NBER official peak and trough dates to those that would be determined using the rule of two consecutive quarters of declining GNP. I do this in Table 1. The two sets of dates are more different than one might imagine. Recessions are often interrupted temporarily by one quarter of positive GNP growth; this causes the GNP rule to miss the peak or trough. This occurred during the recessions of 1949, 1973-1975, and 1981-1982. Moreover, two of the postwar recessions determined by the NBER—1960-61 and 1980—did not coincide with two quarterly declines in GNP. The NBER approach to dating recessions yields more reasonable results than the GNP method because it relies on a large number of monthly indicators rather than a single quarterly indicator.

The NBER's experimental indicators

There are two distinct econometric methods used for predicting recessions. The first is based on traditional macroeconometric models like the Wharton, DRI, or Michigan models.
TABLE 1
NBER business cycle reference dates and periods of GNP decline

<table>
<thead>
<tr>
<th>Peak</th>
<th>Trough</th>
<th>GNP decline periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/53</td>
<td>5/54</td>
<td>53:II—54:II</td>
</tr>
<tr>
<td>8/57</td>
<td>4/58</td>
<td>57:IV—58:1</td>
</tr>
<tr>
<td>4/60</td>
<td>2/61</td>
<td>None</td>
</tr>
<tr>
<td>12/69</td>
<td>11/70</td>
<td>69:IV—70:II</td>
</tr>
<tr>
<td>11/73</td>
<td>3/75</td>
<td>74:III—75:II</td>
</tr>
<tr>
<td>1/80</td>
<td>7/80</td>
<td>None</td>
</tr>
<tr>
<td>7/81</td>
<td>11/82</td>
<td>81:IV—82:1</td>
</tr>
<tr>
<td>7/90</td>
<td></td>
<td>90:IV—91:1</td>
</tr>
</tbody>
</table>

NOTE: The GNP decline periods indicate periods during which GNP was declining for two or more consecutive quarters.

The second is based on economic indicators like those originally developed by Burns and Mitchell at the NBER in the 1930s, the Commerce Department’s Composite Index of Leading Indicators, or the NBER experimental indicators that Stock and I developed. Traditional macroeconomic models were not developed to predict recessions, but they were developed to predict variables like real GNP. These models can be used to construct approximate recession predictions by using their forecasts to calculate the likelihood of two consecutive declines in real GNP. In contrast, the indicators approach, as implemented in my work with Stock, predicts recessions using the official NBER definition. The remainder of this article will focus on this approach. Readers interested in a discussion of traditional econometric models or a more technical description of the indicators approach should read the discussion in the Box.

At the request of the Secretary of the Treasury in 1937, a research team at the NBER led by Burns and Mitchell identified a set of leading, coincident, and lagging indicators of economic activity for the U.S. economy. These indicators were chosen to tell policymakers where the economy was going, where it was, and where it had been. In the early 1960s, the NBER ceded responsibility for the system of economic indicators to the Commerce Department. Since then, the Department of Commerce has maintained the indicators, periodically updating the set of variables to reflect changes in the economy and data availability. The Department of Commerce publishes the indicators monthly, and the composite index of leading indicators is regularly reported in the financial and popular press.

In 1987, James Stock and I started an NBER sponsored project to rethink the system of economic indicators. We developed three

Econometric methods for predicting recessions

Predicting recessions using traditional macroeconomic models

Traditional macroeconomic models describe the relationship between a set of "endogenous" variables, say $Y_t$, "exogenous" variables, $X_t$, and errors, $e_t$. The endogenous variables are the variables that the model is attempting to explain; in a typical model they include real GNP, investment, the rate of inflation, interest rates, and other variables. The exogenous variables are variables that the model takes as given and are important for explaining changes in the endogenous variables; in a typical model they include government purchases, tax rates, and the monetary base. The error terms capture changes in the endogenous variables not explained by the exogenous variables. They are modeled as random.

Symbolically, the model is represented as

$$Y_t = G(Y_{t-1}, Y_{t-2}, \ldots, Y_{t-p}, X_t) + e_t,$$

which shows the relationship between the endogenous variables and their past values, the exogenous variables, and the errors. Forecasts of the endogenous variables $j$ periods into the future constructed using information through time $t$ are denoted as $E[Y_{t+j}]$, that is, the conditional expectation of $Y_{t+j}$ given information available at time $t$. This forecast is the best guess of the endogenous variables at time $t+j$ given information available to the forecaster at time $t$. (The forecast is best in the sense that it minimizes the average squared forecast error.)

The forecast, $E[Y_{t+j}]$, is just one summary of the information at time $t$ relevant for predicting the
future. In principle, the macroeconometric model can be used to deduce the entire probability distribution of the future data conditional on information available at date \( t \), that is, \( F (Y_{t+1}, Y_{t+2}, \ldots, Y_{t+k}) \). The point forecasts are the mean of this distribution, but one could also calculate, for example, the conditional variance of \( Y_t \) or the 95 percent conditional confidence interval for \( Y_t \). Indeed, given \( F (Y_{t+1}, Y_{t+2}, \ldots, Y_{t+k}) \), one could calculate the probability of any event characterized by future values of \( Y_t \). In particular, if a future recession is defined in terms of future \( Y_t \)'s, then the probability of a future recession, conditional on information at date \( t \), can be deduced. Fair (1991) uses this observation, together with stochastic simulation techniques, to calculate recession forecasts from his model. This procedure is simple, yet quite general.

### Using stochastic simulation to predict recessions in Fair’s model

Fair’s model contains 30 stochastic equations and 98 identities for a total of 128 endogenous variables; it also includes 82 exogenous variables. Given initial conditions, \( (Y_t, Y_{t+1}, \ldots, Y_{t+k}) \), future exogenous variables, \( (X_t, X_{t+1}, \ldots, X_{t+k}) \), and future disturbances, \( (\epsilon_t, \epsilon_{t+1}, \ldots, \epsilon_{t+k}) \), the model can be dynamically solved forward to yield \( Y_{t+k} \). Taking the model as given, the only uncertainty about the future involves the values of the exogenous variables and the disturbances. Fair assumes that the \( \epsilon_t \)s are independent and identically normally distributed and that exogenous variables follow simple autoregressive models with normally distributed shocks. This makes it easy to simulate future values of the errors and the exogenous variables by drawing from a random number generator. These simulated \( X_t \)s and \( \epsilon_t \)s are used to solve the model to yield \( Y_{t+1}, Y_{t+2}, \ldots, Y_{t+k} \). This procedure is repeated many times and a histogram of the realizations \( (Y_{t+1}, Y_{t+2}, \ldots, Y_{t+k}) \) is an estimate of the conditional probability distribution \( F (Y_{t+1}, Y_{t+2}, \ldots, Y_{t+k}) \).

Fair uses this stochastic simulation method to predict recessions by defining a recession using the “two consecutive declines in real GNP” definition. That is, the economy is in a recession at time \( t+1 \), if time \( t+1 \) is in a sequence of two or more consecutive declines in real GNP. Since real GNP is an endogenous variable in Fair’s model, this probability can be calculated from \( F (Y_{t+1}, Y_{t+2}, \ldots, Y_{t+k}) \), the distribution of future values of the endogenous variables given information through time \( t \). Using the simulated data, the probability of a recession at time \( t+1 \) is approximated by the fraction of the simulations that were characterized by a recession at time \( t+1 \).

For example, to calculate the probability that the economy will be in recession in the first quarter of 1992 using data through the first quarter of 1991, Fair proceeds as follows. First, he generates values for the exogenous variables and disturbances in his model for 1990:2 through 1991:2. These values are chosen from a random number generator that mimics the variability in the future values of these variables. Next, using these values, he solves for the endogenous variables over 1991:2-1992:2. This process is repeated many times, and the values of the endogenous variables are recorded after each simulation. The probability of a recession is calculated as the fraction of the simulations in which the real GNP growth in the first quarter of 1991 was in a sequence of two consecutive declines; that is, the fraction of simulations in which real GNP declined in 1990:4 and 1991:1 or in 1991:1 and 1991:2.

The method can be generalized in many ways. First, the definition of the recession event can be changed; the important thing is that it must be a function of the future values of \( Y_t \). Second, in most circumstances the parameters of the econometric model are not known and are estimated from past data. This introduces additional uncertainty into the forecasts, since the forecasts depend on the model’s parameters. This uncertainty can be incorporated by drawing new model parameters from the appropriate distribution for each simulation. As should also be clear, there is no need to assume that the errors of the model are normally distributed, nor that the exogenous variables follow simple autoregressive processes. All that is required is that the realizations of the errors and the exogenous variables can be simulated. More detailed discussion can be found in Fair (1991).

### The indicators approach to predicting recessions

Stock and I developed an alternative approach to predicting recessions. Our approach uses the NBER’s definition of a recession rather than the declining GNP definition and is in the tradition of the system of economic indicators developed by Burns and Mitchell rather than large scale macroeconometric models. A description of our approach follows.

Recessions are discrete events: we are either in a recession or we are not. Discrete events can be quantified using 0-1 “indicator” variables. Let \( R_t \) denote a 0-1 indicator of a recession, so that \( R_t = 1 \) if there is a recession at date \( t \) and \( R_t = 0 \) otherwise. Let \( z_t \) denote a set of economic indicators that are useful for predicting future economic activity. Then the probability forecast of a recession at date \( t+1 \), given information at date \( t \), can be written as

\[
P(R_{t+1} = 1 | z_t, z_{t+1}, \ldots) = P_{t+1, t+1}^{R_{t+1} = 1}
\]
\[ P_{rj} \] is the probability that the economy will be in a recession at date \( t+j \), computed using information through time \( t \). The statistical question is what is the best way to parameterize this conditional probability, that is, what equation should be used to convert the information in the indicators into a recession probability.

In research utilizing cross section data, this is a well studied problem. Applied researchers often estimate "probit" or "logit" models relating an indicator variable, such as "union membership" or "completed college," to a set of explanatory variables. While the prediction problem considered here is conceptually similar, it differs in two important ways. First, the data are temporally dependent, which suggests that some degree of temporal smoothness should be incorporated in the functional form. Second, since lagged values of the indicators may be useful predictors, the number of explanatory variables is potentially very large.

The parameterization that Stock and I use borrows an important simplification from models designed to explain cross sectional data. Using the notation above, and abstracting from lags, the cross section model would parameterize the probability in Equation (2) as \( P_{rj} = f(c_j^2) \), where \( f(.) \) is a function that converts the "index" \( c_j^2 \) into a probability, that is, a number between 0 and 1. The single index, \( c_j^2 \), summarizes all the relevant information in the explanatory variables. Figure 1 suggests that the XCI might be a useful dynamic index, in the sense that it adequately summarizes the relevant information in the explanatory variables for predicting recessions. The problem is to convert this index into a recession forecast.

To see how this is accomplished, it is useful to proceed in three steps. In the first step, a probability model relating the XCI to observable variables is developed. This serves to define the XCI. Next, a forecasting model for future values of the XCI is developed. Finally, a model relating recessions to the XCI is specified.

As mentioned above, the XCI is an index of four monthly indicators of aggregate activity: the index of industrial production; aggregate employment; personal income; and trade sales. Precise definitions are given in Table 2. The XCI is an index of the common movement in these series. It is calculated from a dynamic factor analysis model using statistical methods originally developed for signal extraction. Thus, the XCI represents the common "business cycle signal" contained in the four coincident indicators. The precise mathematical formulation of the XCI model is given in the Appendix, where the common business cycle signal is denoted by \( c_j \). The XCI, plotted in Figure 1, is nothing more than an optimal estimate of \( c_j \) constructed from current and lagged values of the coincident indicators. Thus, the first problem—relating the XCI to observed variables—is solved.

To solve the next problem—forecasting future values of the XCI—leading indicators are added to the model. Prediction is carried out using a vector autoregressive model or VAR, a common model for multivariate time series; the details are shown in the Appendix. The XLI is the "best guess" of growth in XCI over the next six months. Using the notation introduced above, the XLI is \( E(c_{t+6}|c_t) \).

Recall that, using a standard macroeconometric model, we could go beyond "best guess" forecasts and obtain the entire probability distribution of future values of the endogenous variables. The same is true here: the model can be used to deduce the entire distribution of past, current and future values of \( c_t \), conditional on the observed indicators. For the purposes of predicting recessions this is important because the probability distribution of future \( c_t \)s summarizes all of the information in the model about future recessions.

Our formulation allows us to break up the construction of \( P_{rj} \) into two pieces. First, we construct the probability distribution of the \( c_t \)s given the observed leading and coincident indicators, as described above. Next we relate the \( c_t \)s to the probability of a recession. Figure 1 suggests that this is easy to do: your eye can naturally pick out recessionary patterns from a graph of \( c_t \). Recessions are the periods of sustained and significant declines in the index. The specification of the probability of recession given the \( c_t \)s that Stock and I use captures this simple notion. Unfortunately, carefully specifying a pattern recognition algorithm that mimics what your eye does naturally requires the introduction of much notation and many additional equations. This will not be done here, but the interested reader can see this detailed in Stock and Watson (1991b). It is sufficient to say that the specification assigns a high probability of a recession to periods of time in which \( c_t \) undergoes a sustained sequence of declines.

Footnote
These models are discussed in any good econometrics textbook. A detailed discussion can be found in Maddala (1983).
indexes designed to track and forecast the macroeconomy. The first is the NBER Experimental Coincident Index (the XCI). This is the series plotted in Figure 1; we saw that expansions and contractions in the series coincided with NBER business cycle reference dates. The second index is the NBER Experimental Leading Index (the XLI), which forecasts the growth in the XCI over the next six months. The final index is the NBER Experimental Recession Index (the XRI), which shows the probability that the economy will be in recession six months hence. The framework used to compute the XCI, XLI, and XRI is described in the Box, and a more technical description is offered in the Appendix.

The variables that are used to construct the XCI, XLI, and XRI are listed in Table 2. The coincident indicators are fairly standard; with one exception (total employee hours), they are the same variables used in the Department of Commerce's index of coincident indicators. Some of the leading indicators are standard (housing authorizations and manufacturers' unfilled orders); while others are not. For example, we use two interest rate spreads (a yield curve spread and a commercial paper/Treasury bill spread). The set of leading indicators was chosen from a systematic investigation of over 250 candidate series, which is documented in Stock and Watson (1989).

The XRI focuses on six month ahead prediction, but the statistical framework allows us to calculate recession probabilities over any horizon. Figures 2-4 show the recession probabilities computed for three different forecasting horizons from January 1962 through April 1991 computed from the model. Figure 2 shows the coincident recession indicator: the probability that the economy is in recession at time t constructed from data available at time t. Figure 3 shows the three month ahead recession indicator: the probability that the economy will be in a recession at time t+3 given information available at time t. Finally, Figure 4 shows the six month ahead recession predictor; this predictor is the NBER's Experimental Recession Index (XRI). The series are plotted so that date t corresponds to when the forecast was made.

For example, the six month ahead predictor

| TABLE 2
| Coincident and leading indicators |
|---|---|
| **Coincident indicators** | |
| 1. | Industrial production. |
| 4. | Total employee hours in nonagricultural establishments. |
| **Leading indicators** | |
| 1. | Housing authorizations (building permits): new private housing. |
| 3. | Trade-weighted index of nominal exchange rates between the U.S. and the U.K., West Germany, France, Italy, and Japan (smoothed). |
| 4. | Number of people working part-time in nonagricultural industries because of slack work (smoothed). |
| 5. | The yield on a constant maturity portfolio of 10 year U.S. Treasury bonds (smoothed). |
| 6. | The spread (difference) between the interest rate on 6 month commercial paper and the interest rate on 6 month U.S. Treasury bills. |
| 7. | The spread (difference) between the yield on a constant maturity portfolio of 10 year U.S. Treasury bonds and the yield on 1 year U.S. Treasury bonds. |
should tend to increase six months before the onset of each recession and decrease six months before the recession ends.

Looking first at Figure 2, the coincident recession indicator seems quite reliable. The major exceptions are the growth recession of 1967 and the beginning of the current recession. Keep in mind that coincident “prediction” is more difficult than it would appear; it was not until the end of April 1991 that the NBER determined that the economy had peaked in July 1990. Taken together, the Figures show that the ability to forecast a recession declines as the forecast horizon increases; the coincident recession predictor is more accurate than the three month ahead predictor, which in turn is more accurate than the six month ahead predictor. But, at least for the 1970, 1973-1975, 1980, and 1981-1982 recessions, predictions as far as six months ahead were reasonably accurate. The forecasting performance of the model for the current recession, particularly at the six month ahead horizon, was significantly worse than for the previous recessions.

There are several possible reasons for the failure of the model; each is carefully analyzed in Stock and Watson (1991b). In the next section I will mention them all and discuss the most interesting in detail. First, here is some background.

The NBER experimental leading indicator model was constructed using historical data from January 1959 through September 1988. All results after September 1988 are out-of-sample. Figure 1 shows that the XCI continued to be an accurate coincident indicator in the out-of-sample period: the XCI peaked in July 1990, precisely the peak chosen by the NBER’s Business Cycle Dating Committee, and fell nearly 4 percent from July 1990 through April 1991. Figures 5 and 6 show the forecasting performance of the leading indicators over the out-of-sample period. These Figures show how well the indicators predicted growth in the XCI three and six months ahead. The forecasts tracked the actual data reasonably well until the middle of 1990. The indicators correctly predicted the slowdown that occurred in 1989 and the subsequent rebound in early 1990. But, as data from the fall of 1990 became available, it was clear that the model was off track.
What went wrong?

Four possible reasons are analyzed in Stock and Watson (1991b). First, the statistical model may have been poorly determined, in the sense that the parameters were poorly estimated and the model “overfit.” That is, the model may have been fit to match patterns in the historical data that did not persist into the future. Second, the model may have been correct, but the data subject to large revisions. Third, the XCI may have become an unreliable coincident indicator. Finally, the set of leading indicators used in the model may have behaved differently than in past recessions. In Stock and Watson (1991b), we present a variety of evidence suggesting that the first three possible reasons were not important. However, the final reason—the unusual behavior of some of the indicators, relative to their behavior in past recessions—was important. Three of the seven leading variables were primarily responsible for the index’s optimism as the recession began: the spread between the yield on commercial paper and Treasury bills; the spread between the yield on 10 year government bonds and 1 year government bonds; and the exchange rate. The difference between the historical behavior of these variables and their behavior in the current recession is the key to understanding why the index failed and why the current recession is unique in the postwar historical record.

Table 3 documents the behavior of the interest rate spreads prior to the 1960 and subsequent recessions. During the 1959-1990 period, the spread between commercial paper and Treasury bills averaged 57 basis points and increased sharply prior to each of the 1960-1981 cyclical peaks. In contrast, coming into the current recession, the spread was essentially flat, averaging only 41 basis points during the first eight months of 1990.

The slope of the Treasury yield curve, measured as the yield spread between 10 year and 1 year government bonds, also behaved differently than in past recessions. Over the 1959-1990 period, the yield curve usually sloped upwards; the average yield curve spread was 54 basis points. But, before each recession in the sample, the yield curve inverted and this spread became negative. From January 1990 to July 1990 the yield curve spread remains essentially constant, averaging +38 basis points. This was a slightly negative reading by this indicator, but nowhere near
significant enough to suggest a recession. Just as important, in August and September of 1990, the yield curve steepened significantly; the spread increased to 97 basis points in August and to 113 basis points in September. Typically, such a steepening of the yield curve is associated with an increase in economic activity.

As the recession began, exchange rates also served as a positive indicator. In general, as the dollar weakens, U.S. goods fall in price relative to foreign goods, so that, controlling for the other indicators in the model, a depreciation in the dollar is a positive indicator. While the value of the dollar was essentially flat during the first seven months of 1990, it fell by 11 percent from July to November, suggesting an increase in future demand for domestically produced goods.

While the financial indicators behaved perversely during 1990, the real indicators used in the model behaved qualitatively as they had in earlier recessions. Building permits were weak. The number of workers involuntarily moving from full-time to part-time work increased. Manufacturers’ unfilled orders slowed. While these indicators provided negative signals, these signals were not large enough to forecast the recession.

**Could the recession have been predicted?**

The answer to this question is clearly yes: some analysts did accurately predict the recession. (An interesting question is how many of these forecasters also predicted recessions in 1987 and 1989.) Standard econometric models and the consensus business forecaster did not. For example, in May 1990 only 19 percent of the forecasters surveyed by the Blue Chip Economic Indicators expected the recession to begin in 1990. In mid-1990 the consensus forecast called for 2.3 percent growth in real GNP over the 1990-1991 period. Variables that are typically used to predict economic activity did not point to a recession. This raises the question of what variables could have been used to help forecast this recession.

It is always easy in hindsight to find a single variable that would have predicted a specific event. To be useful for forecasting, a variable must not only have predicted this recession, but also predict future recessions. Statistical procedures search for such variables by asking whether they have consistently predicted past recessions. In Stock and Watson (1991b), a careful statistical search for such variables is documented. We found that the most important variables omitted from our original model appear to be stock prices, help-wanted advertising, average weekly hours in manufacturing employment, and consumer sentiment. Interestingly, if the variables are added to our original list of indicators and the model is re-estimated, only marginal improvements are realized. The interest rate spreads predict the previous recessions so well that they get much of the weight in the statistical fit; the new variables receive little weight. The new variables lead to improved prediction only if the spreads are dropped from the model; in this case the new variables receive enough weight to be useful in the most recent recession. While this modified model performs better during the current recession, the original model performs better during previous recessions. The challenge is to construct a new model, including the entire list of indicators, and perhaps more, that will perform well during the next recession.
What does this tell us about the current recession?

These results suggest tentative conclusions about the nature of the current downturn. First and foremost is that it differs from the recessions of the 1960s, 1970s, and 1980s. This difference has been documented by other researchers, notably Strongin (1990) and Strongin and Eugeni (1991). In the present context, the most obvious symptom of this difference is the unusual behavior of the interest rate spreads relative to their behavior in past recessions. To understand what this difference suggests about the nature of this recession, it is important to understand why the interest rate spreads have traditionally been reliable indicators. This question has motivated much recent research [see Cook and Lawler (1983), Friedman and Kuttner (1990 and 1991b), Bernanke (1990), and Kashyap, Stein, and Wilcox (1991)], and a variety of explanations have been offered. The most reasonable seems to go as follows.

It is widely (although not universally) accepted that a tightening of monetary policy leads, in the short run, to a slowdown in aggregate economic activity. A tightening of monetary policy is accompanied by a rise in short term interest rates and a tightening in bank lending. The increase in short term interest rates relative to long term rates leads to an inverted yield curve. The tightening in bank lending leads some firms to raise capital by issuing new commercial paper. This increases the stock of commercial paper, which raises the commercial paper rate relative to the rate on Treasury bills.

This explanation suggests that monetary policy, important for the recessions of the 1960s, 1970s, and 1980s, was less important during the current recession.

An alternative explanation is that monetary policy played a major role in the current recession but that structural changes in financial markets changed the relation between monetary policy and the interest rate spreads. This explanation is not convincing: the commercial paper/Treasury bill spread did widen significantly before this recession, and the yield curve did invert. But this occurred in early 1989 when worries of inflation led the Fed to tighten policy. By the middle of 1990 the interest rate spreads had returned to normal levels, consistent with a more neutral monetary policy.

In the introduction, I noted that econometric methods are well suited for prediction over forecast periods with characteristics similar to those found in the sample. Many characteristics of the current recession are unique; the most obvious is the sudden outbreak of hostilities in the Middle East and coincident increase in uncertainty and fall in consumer sentiment. These could not have been predicted by any reasonable model. Thus, one can argue that this was a recession that should not have been predicted by an econometric model and that XRI passed this specification test. While there are elements of both truth and “cop out” here, I am not too concerned by the XRI’s failure to predict the recession. What is of more concern is the XRI’s failure to reflect the increased pessimism in the fall of 1990, by which time it was clear that the model was off track. Future research will focus on making the model more adaptive to changing circumstances.
APPENDIX

The probability model underlying the XCI is a dynamic factor model of the form:

1. \[ \Delta x_t = \beta + \gamma(L)\Delta c_t + u_t, \]
2. \[ D(L)u_t = \epsilon_t, \]
3. \[ \phi(L)\Delta c_t = \delta + \eta_t, \]

where \( x_t \) is a 4 x 1 vector of coincident indicators, \( c_t \) is the scalar unobserved "state of the business cycle," \( u_t \) and \( \epsilon_t \) are unobserved shocks, and \( \gamma(L), D(L), \) and \( \phi(L) \) are polynomials in the lag operator \( L; \) so, for example, \( \gamma(L)\Delta c_t \) represents a distributed lag of \( \Delta c_t \) with weights \( \gamma_i. \) The coincident indicators in \( x_t \) include industrial production, real personal income, total employment (hours), and manufacturing and trade sales. They are precisely defined in Table 2. It is assumed that the matrix polynomial \( D(L) \) is diagonal, so that \( D(L) = \text{diag}[d_i(L)] \), and \( \epsilon_t^1, \epsilon_t^2, \epsilon_t^3, \epsilon_t^4 \) and \( \eta_t \) are mutually uncorrelated Gaussian white noises. These assumptions imply that \( c_t \) explains all of the co-movement between the indicators, but that each indicator may move independently from the other because of innovations in its "uniqueness" \( u_t. \) Thus, \( c_t \) is a natural index of co-movement or covariation in the coincident variables and provides an index of aggregate cyclical activity. For three of the variables, \( \gamma(L) = \gamma_i \) and this fixes the timing of \( c_t \); movements in \( c_t \) are coincident with industrial production, personal income, and manufacturing and trade sales. Since employment is slightly lagging, lagged values of \( c_t \) enter its equation. The XCI, plotted in Figure 1, is the minimum mean square error estimate of \( c_t \), constructed from current and lagged values of \( x_t. \)

Leading indicators are added to the model to help predict future values of \( c_t \). The complete model, including leading indicators, is (1) and (2) together with the vector autoregression:

4. \[ \Delta c_t = \mu_t + \lambda_{c1}(L)\Delta c_{t-1} + \lambda_{c2}(L)y_t, \]
5. \[ \Delta y_t = \mu_t + \lambda_{y1}(L)\Delta c_{t-1} + \lambda_{y2}(L)y_{t-1} + \nu_{y1}, \]

where \( y_t \) is a vector of leading indicators and \( u_t \) is NIID\((0, \Sigma_t) \) and independent of \( \epsilon_t. \)

The definition of the leading indicators used in our analysis is given in Table 2; Stock and Watson (1989) provides a detailed discussion of the selection of variables, the estimated model and diagnostic tests.

Equations (1)-(2) and (4)-(5) provide a complete probability model for the index \( c_t \) and its relation to the coincident and leading indicators. Forecasts of \( c_t \) can be constructed in a straightforward way. The NBER's experimental index of leading indicators (XLI) are the forecasts of \( c_t \) over the next six months, that is, \( E_t(c_{t+6}|c_{t-1}). \)

The model can be used to construct the probability distribution of past, current, and future values of the index, conditional on the observed data, that is, \( P(c_{t+6}, c_{t+6}, ..., c_{t+6}, z_t, z_{t+1}, ..., z_{t+j}) = P(c_{t+6} | c_{t-1}, z_t, z_{t+1}, ..., z_{t+j}) \) for all \( t \) and \( j. \)

Thus, \( z_t \) provides no information about a recession at time \( t+j \) that is not included in \( \{c_t\}. \)

Interpreting \( z_t \) as the leading and coincident indicators in the model implies:

6. \[ P(R_{t+j} = 1 | \{c_t\}, z_t, z_{t+1}, ..., z_{t+j}) \]

so that the probability of a recession at time \( t+j \), given information through time \( t \), can be calculated in two steps. In the first step, the probability of a recession at date \( t \) is calculated, given the entire history of the index \( \{c_t\}, \) that is, \( P(R_{t+j} = 1 | \{c_t\}) \) is formed. In the next step, these probabilities are averaged using the probability distribution of the index \( \{c_t\}, \) conditioned on the observed data, that is, the integration is performed. This simplification is utilized to calculate \( P_{t+j} \) which is the NBER's Experimental Recession Index or XRI.
FOOTNOTES

1 This is an ongoing project, and our progress to date is summarized in three papers: Stock and Watson (1989), (1991a), and (1991b).

2 The most thorough documentation of the relation between aggregate activity and the supply of money is Friedman and Schwartz (1963).

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