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Economists have long been involved in the search for a few key indicators that predict the behavior of market economies. For Canada, it has been shown that the yield curve reliably tilts down and that real M1 growth declines before economic contraction, but this has been demonstrated almost exclusively in the context of single estimation equations or atheoretical VARs. This paper offers an alternative approach to the study of economic turning points. To qualify as a business-cycle indicator, a variable must behave differently when an economy is approaching or in recession than it does during economic expansions. That simple logic admits a variety of parametric and nonparametric tests of a variable's usefulness, in forecasting. We examine the behavior around recessions of sixteen Canadian and U.S. time series. In the end we find that only the slopes of the Canadian and the U.S. term structure meet the prespecified criteria; the change in the nominal MCI and in real M1 follow behind.

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I. Introduction

Economists have long been involved in the search for a few key indicators that summarize and predict the behavior of market economies. That pursuit took its most organized form in the National Bureau of Economic Research's early research program, culminating in the work of Burns and Mitchell (1946) and Friedman and Schwartz (1963). Such work, however, fell out of favor for a while, as economists first relied on large structural models and then on mostly atheoretical time-series techniques.[2] Of late, researchers are again focussing on the forecasting performance of single indicators, in part because the track records of the alternatives have been uninspiring.

The macroeconomic time series for the United States have been sifted by many researchers, notably including Stock and Watson (1989), who employed modern time series techniques to investigate the predictive ability of 280 macroeconomic variables. Other researchers have successfully championed individual indicators. For example, Laurent (1988) identified the systematic flattening, and even inversion, of the term structure of interest rates in the United States in advance of economic downturns, and Estrella and Hardouvelis (1991) demonstrated the indicator properties of the yield curve more formally with a battery of econometric tests. Both Bernanke and Blinder (1992) and Friedman and Kuttner (1992), extending the insight of Stock and Watson (1989), considered in some detail the predictive ability of the spread of the commercial paper rate over a comparable Treasury bill rate.

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[2] The turning point for the study of cyclical indicators was Koopmans's (1947) famous review, "Measurement without Theory" of Burns and Mitchell (1946). Koopmans argued that when considering the business cycle, " . . . even for the purpose of systematic and large scale observation of such a many-sided phenomenon, theoretical preconceptions about its nature cannot be dispensed with, and the authors do so only to the detriment of the analysis." (p. 163). Similarly, large-structural macro models came under attack with Lucas's (1976) "Econometric Policy Evaluation: A Critique" which extended that same logic to argue that " . . . given that the structure of an econometric model consists of optimal decision rules of economic agents, and that optimal decision rules vary systematically with changes in the structure of series relevant to the decision market, it follows that any change in policy will systematically alter the structure of econometric models." (p. 126).

Similar work has progressed in other industrial countries as well, the results of some of which with regard to Canada are summarized in Table 1. For Canada, Cozier and Tzacks (1994) and Clinton (1994-95) have shown that the yield curve for government securities reliably tilts down in advance of economic contraction. Both Hostland, Poloz, and Storer (1988), Milton (1988), and Muller (1990), in contrast, study the changing fortunes of monetary and credit aggregates in signaling economic activity in Canada, reaching the conclusion that M1 appears to be most reliably related to future spending growth while the growth of M2 is the better predictor of inflation. Hu (1993) also finds that the term structure is useful in forecasting activity in the major countries and that its link to economic activity has strengthened since the 1970s, particularly for the United States and Canada; Estrella and Mishkin (1995) provide evidence that the yield curve helps to predict economic activity and long-run inflation trends in four European countries.

There have been important contributions to the technique of forecasting business-cycle turning points, including Neftci (1982), who used the statistical literature on optimal stopping time to calculate probabilities of turning points, and Diebold and Rudebusch (1989), who introduced a variety of ways to evaluate probability forecasts. Still, most of the judgments on potential indicators have come from regression exercises where success is judged by high explanatory power in predicting some measure of output growth. However, this emphasis on standard regression technique can be problematic. To the extent that behavior changes over time or business-cycle dynamics are inherently nonlinear, point estimates of a variable's significance may be unreliable. Moreover, the uncertain nature of the underlying time-series properties of both sides of those equation makes it difficult to be confident about the distributions of any specific estimator.

We offer a different perspective in this paper by noting that a key inference problem in the study of business cycles is gauging the probability of recession in any given period. An indicator is useful in that process if an estimate of the conditional probability of recession, given the recent behavior of the indicator, is more precise than an estimate of the unconditional probability of recession. In order for a difference to

exist between those unconditional and conditional forecasts, a variable must behave differently when an economy is approaching or in recession than it does during economic expansions. That logic allows simple tests of a variable's usefulness, some of which do not impose specific parametric forms and, therefore, are more likely to be robust across a variety of possible distributions of the underlying data. Because the tests are so straightforward, it is also possible to assess their robustness in a variety of manners.

Specifically, we present summary data on the monthly behavior of sixteen major Canadian time series over the post-World-War II period, splitting the sample into three subsets, corresponding to those periods twelve months before economic downturns, the recession themselves, and all other months. Intuitively, a leading indicator should behave differently in the twelve months before economic contractions than it does during expansions; a coincident indicator should behave differently in economic contractions than it does during expansions. From that perspective, the leading indicator properties of a variable should be obvious when comparing the empirical probability distributions of these three subsets, which we estimate by a kernel-smoothing algorithm. More formally, a variety of parametric and nonparametric tests are then performed to establish which variables move differently around and in recession than elsewhere. Some popular macro variables--including the growth, in real terms, of stock prices, M2, and domestic credit--do not appear to move sufficiently differently across the three subsets of the data to be useful as leading indicators.

Of course, macroeconomic time series are characterized by differing degrees of sluggishness. Some, particularly financial market prices, can move quickly and by large amounts, while others, particularly aggregate measures of goods prices and spending, tend to move more slowly through time. To control for these differences, we estimated autoregressive relationships for each variable and then subjected the errors from those relationships--the impulses driving their movement--to a battery of parametric and nonparametric tests. This logic--that the level of a variable could contain both news about the business cycle and lagged effects of its own earlier movements--can be made more general. An indicator might be

useful in forecasting because it contains information about the business cycle or because it summarizes information contained in *other* variables. In particular, it is possible that an indicator might win a forecasting race because it better summarized the stance of monetary policy, with obvious implications for economic activity, than other variables.[3] To assess this possibility, we generalized our first-stage regressions. We first added lagged values of the Canadian short-term rate to extract the systematic effect of domestic monetary policy and, then, the current and lagged values of U.S. short-term rates to control for foreign influences on the Canadian economy. The residuals from those regressions were treated as the news in the indicators and were tested for systematic differences across stage of the business cycle. Judging an indicator solely by its idiosyncratic component resulted in a significant winnowing of the list of potential leading and coincident indicators.

Only two of the original sixteen time series call at least one-half of the recessions and send at least as many signals as noise and appear to have unique explanatory power, in that they contain information over and beyond that seen in their own histories or domestic or foreign interest rates. Two readings on the yield curve--the slope of the Canadian term structure and the slope of the U.S. term structure--perform best.

The next section presents the sixteen macro time series that will be put under scrutiny, which can be sorted into four categories: Financial (including rates of return, prices, and quantities), international, composite (the level and the change of the Bank of Canada's monetary conditions index), and real-side. We examine the behavior of these variables in and around the nine postwar recessions in our data set. We also track the ex post forecasting record of each time series by recording their success in signaling before recession. As a prelude to our basic tests, we also examine the distribution of each variable before, during, and outside economic contractions. In Section III, those statements are made more formally in terms of conditional probabilities, and we present the results of the parametric and nonparametric tests. In Section IV, we extend the coverage of those first stage regressions to gain some insight on the sources of cyclical movements. We first extract the systematic nature of domestic monetary policy and then test the intrinsic ability of each variable to predict cyclical turning points. Then, we extract the information contained in

[3] For example, Sprinkel (1964) argued that the stock market led U.S. turning points because it responded to monetary policy actions sooner than did aggregate spending. For Canada, Macklem (1995) held that the term structure slope is a useful indicator because it measures the stance of monetary policy.

U.S. monetary policy and determine the forecast ability of intrinsic domestic factors. This battery of tests is summarized in Section V, while Section VI offers concluding comments.

II. Indicators and Economic Contractions

In this section, we describe the time-series variation in sixteen key macro indicators relative to turning points in the Canadian business cycle, which are listed in Table 2. There have been nine recessions in the post-World-War-II period, and, as reported in the memo item in the table, the Canadian economy has spent 17 percent of the months since 1958 in recession. This sample average can be thought of as an estimate of the unconditional probability that the economy was in a downturn in any given month. Our goal is to find an indicator, or indicators, that allows us to arrive at a more precise estimate of the probability of recession. We will select among the variables listed in Table 3. 1. Financial market yields, prices, and quantities

(1) Term Structure of Interest Rates in Canada. As measured by the yield on ten-year-and-over Government of Canada bonds less the three-month Treasury bill rate (Chart 1), the flattening of the Canadian yield curve since early 1994 has been substantial.[4] Nonetheless, the spread, presently around 200 basis points, is slightly above its average value over the past forty years (the dotted line in the upper panel) and is a good deal wider than is typical before an economic recession. In the average cyclical experience, the yield curve generally began to flatten as much as one year prior to the onset of recession, and the spread moved distinctly into negative territory before the economic peak (the middle left panel).

The behavior of the spread of the yield of the ten-year note over the three-month bill rate over the past forty years suggests a simple forecasting rule: Flat or inverted yield curves signal that the economy is

[4] We use the three-month Treasury bill rate to conform with other studies. As Macklem, Paquet, and Phaneuf (1995, p. 6) point out, prior to the mid-1970s, this rate was influenced by the eligibility of bills for secondary reserve requirements. The correlation of the bill rate with other short rates, however, is high.

about to enter or is currently in a recession. To allow systematic comparisons across indicators, we defined a signal of recession to be any reading on the indicator that was in the bottom twentieth percentile of its distribution. (This cutoff value is marked by the solid horizontal line in the chart just above zero.) The middle right panel of the chart holds that filter rule to a strict accounting. In the months from February 1958 to July 1995 that the yield curve was quite flat or inverted, 44 percent of those signals were recorded in the twelve months leading up to an economic downturn and 28 percent were posted in downturns.

In a probabilistic framework, the middle right panel provides estimates of conditional probabilities, or the probabilities, given a signal, that the economy is about to enter into a recession (44 percent), is in a recession (29 percent), or is in a continuing expansion (27 percent). This can be demonstrated by noting that, by the way the sample is split, the economy must be in one of three states: about to enter a recession (B), in recession (R), or in a continuing expansion (E). By sorting when the yield curve signals (an event denoted as I) by the stage of the cycle relative to the total number of signals, we have implicitly estimated the joint probabilities of a signal and a state.[5]

In most statistics texts, these joint probabilities are represented as $Pr[I \cap B]$,$Pr[I \cap R]$, and $Pr[I \cap E]$, which can be used to calculate conditional probabilities (as in Lindgren (1968)). For example, the

$$Pr[R \mid I] = \frac{Pr[I \cap R]}{Pr[I]}$$

probability of being in recession, given a signal equals

[5] In some sense, this division of the data by stage of the economic cycle follows Burns and Mitchell's (1948) notion of a reference cycle. Unlike Burns and Mitchell, we strictly use calendar time to make the division.

Simply, the conditional probability equals the share of the total number of signals observed in a particular state in the population; sample estimates of those probabilities are provided in the middle right panel of the table.

Notice that signals from the yield curve help sharpen inference about the stage of the cycle. As was already noted in the discussion of Table 2, the unconditional probability of recession in any given month, Pr[R], is about 15 percent. Knowing that the yield curve is flat or inverted raises the estimated probability of recession, Pr[R | I], to 29 percent. The leading indicator properties of the term structure are evident in such a comparison as well. As is presented in the memo item in Table 2, the Canadian economy has spent about 17 percent of the months since 1958 about to enter into recession (or Pr[B]=0.17). Observing a flat or inverted term structure raises that estimate considerably (Pr[B | I]=0.44).

Another measure of the yield curve's predictive success can be extracted by counting the number of recessions it called correctly. Of the six economic peaks over this time period, five were preceded within twelve months by an inverted yield curve. The one that got away was the recession beginning in 1974, although even then the term structure had flattened considerably.

While intuitive, imposing a cutoff value for what defines a signal is arbitrary, even if, in this particular case, watching for an inversion to the yield curve has an intuitive appeal. An alternative strategy is to examine the behavior of the term structure for the three subsets of the monthly readings of the term structure already discussed--in the year leading up to recession, in recession, and in all other months--to let the data show if the series behaves differently across the business cycle. Smoothed estimates of those three probability distribution functions are presented in the bottom left panel of Chart 1. By comparing these smoothed estimates of the probability distribution functions (which were fit by a kernel-smoothing algorithm), we obtain direct evidence of the yield-curve's predictive ability. In advance of economic contractions (the dotted line), the term structure is much more likely to be inverted than at other times, either when the economy is in recession (the solid line) or in expansion (the dashed line). These three

curves can be thought of as estimates of the distributions of conditional probabilities of the indicators given the stage of the business cycle.

The considerable spread of these distributions suggests that there were many false signals. As shown in the lower right panel, the median term structure is about flat in the year before recessions, indicating that one-half the time it will have a positive slope. The means and medians across the three subperiods presented in that panel also provide a rough sense of the cyclical properties of the yield curve and will allow

$$Pr[R \mid I] = \frac{Pr[I \cap R]}{Pr[I]}$$

more formal tests in the next section.

(2) The Commercial Paper Spread. The predictive power of the yield curve can be put in some perspective by examining the track record of another popular financial market indicator of the business cycle, the spread of the six-month commercial paper rate over the six-month Treasury bill rate. This risk spread gained considerable attention in the United States when Stock and Watson (1989) identified it as a key component of their experimental index of leading indicators. As shown in the upper panel of Chart 2, this spread does widen entering economic downturns in Canada. On average, the commercial paper rate gains about 60 basis points more than the bill rate in advance of recession (the middle left panel). If signals are arbitrarily recorded when the spread is in the upper twentieth percentile of its range from February 1958 to July 1994, then the spread caught five of six recessions but were misleading quite often, in that 63 percent of the time that a high spread was recorded the economy was not in or about to enter into recession. However, the record since the mid-1980s has been less kind: The spread has tended to be quite narrow and missed the 1990-91 recession.

(3) Real Equity Prices. This same technique can be applied to other financial variables, including what many analysts would take to be the grandfather of all leading indicators, the value of equity prices. The top panel of Chart 3 plots the twelve-month growth rate in the Toronto Stock Exchange (TSE) index deflated by the consumer price index over the past 37 years. Consistent with the long-held view that the stock market helps to signal turning points, there is a pronounced cyclicality to equity prices. On average, real equity prices swing from expanding at a 20 percent rate one year before a recession to contracting at near a 15 percent rate four months into the recession.

However, this erratic series sent too many warnings: About 47 percent of the months since 1958 had negative twelve-month changes in real equity prices. Placing the cutoff at the bottom twentieth percentile, only 7 percent of those signals come in the period just before an economic recession. To put this in starker terms, an analyst would be better off using the simple historical average of the share of months before a recession--the unconditional probability which equals about 17 percent--than respond to the signal from the stock market to calculate a conditional probability. The vast majority of the correct signals, 46 percent, occurred when the economy was actually contracting, suggesting that equity prices do better as a coincident, rather than as a leading, indicator. Declines in real equity prices preceded half of the economic downturns since 1958. The erratic nature of the signals from the equity market can also be seen in the bottom panel of the chart, where we present smoothed distributions for the monthly change (at an annual arithmetic rate) in real equity prices. The range of variations is quite wide, and there is substantial overlap of the outcomes across the stage of the business cycle.

(4) Real M1, (5) real M2, and (6) real credit growth. M1 was the monetary aggregate at center stage of the Bank of Canada's implementation of monetary policy between 1975 and 1982 (as described in Freedman (1994)) before financial innovation introduced considerable instability in the demand for money. Much of the appeal of M1 as an intermediate target had to do with its role as a useful leading indicator of economic activity. As Muller (1992) pointed out, M1 was better at predicting turning points than the

broader monetary or credit aggregates. As shown in Chart 4, real M1 growth has usually fallen below its twentieth percentile in the period leading up to or during a recession, and on average, begins to decline 12 months prior to the beginning of the recession. In "normal" periods, it has only crossed that benchmark 13 percent of the time. However, M1 is not without its faults and calls to mind Samuelson's observation of the indicator properties of the U.S. stock market--real M1 growth has forecast ten of the last six recessions in Canada. There are noticeable shifts in the distributions of monthly growth rates of real M1 across stage of the business cycle. In the median experience, real M1 contracts at annual rates of 2-1/2 percent and 1-1/4 percent in advance and during recession, respectively, as opposed to increasing at a 3-3/4 percent rate at other times.

By contrast, the behavior of real M2 growth (Chart 5) indicates that, at best, it is a coincident indicator; by the time the contraction is evident the recession is well underway. Indeed, real M2 growth has not caught any of the last five turning points, and its probability distributions appear indistinguishable inside or outside recessions. Of course, the poor track record of M2 in predicting the business cycle need not imply that it has not significance for policy makers. Hostland, Poloz, and Storer (1988) and Muller (1990) have pointed out that M2 is more useful as an indicator of future inflation than of economic activity. Real domestic credit (Chart 6) does somewhat better it calling downturns in the business cycle, catching one half of the last six recessions. However, more than one half the time (70 percent), it sends misleading signals, making it a very noisy indicator.

2. International prices and quantities

Canada is a very open economy by almost any standard. For instance, the sum of export and imports averaged about 60 percent of GDP during 1990-95, well above the 20 percent registered for the United States. More recently, that ratio has been even higher. Hence, exchange rate developments can, at least in principle, exert an important influence on economic activity (see Duguay (1994)). In this subsection we

examine whether external variables, most of which capture developments in the United States, provide useful information in determining business cycle turning points.

(7) The G-10 exchange rate changes and (8) changes in the bilateral U.S. exchange rate. An exchange rate depreciation can be expected to, other things equal, stimulate exports and provide an external boost to the economy. This partial-equilibrium reasoning would imply that pre-recession periods may be characterized by an appreciating exchange rate and an erosion in international competitiveness, which would ultimately lead to a contraction in the export sector and in economic activity. In reality, however, a change in the exchange rate cannot be considered in isolation from the factors influencing the exchange rate. For instance, an exchange rate depreciation may result from heightened political uncertainty or concerns about underlying fundamentals, such as fiscal policy and debt. By undermining confidence, these factors could lead to *reduced* consumer spending and investment, which could trigger recession. Such a line of reasoning would then offer the opposite prediction, a depreciation in the exchange rate could be signaling the onset of recession.

Charts 7 and 8 suggest that the partial equilibrium approach may be a reasonable explanation of the data. The multilateral exchange rate (G-10) in Chart 7 and the bilateral exchange rate vis-a-vis the U.S. dollar are defined so that an increase represents an appreciation of the Canadian dollar. As is evident in the top and middle left panels of both charts, the exchange rate typically begins to appreciate about five months before the onset of recession. However, the range of variation for these cyclical averages is quite narrow relative to the overall movement in exchange rates, suggesting that signals from the foreign exchange market well may be swamped by noise. Indeed, more than half of the large appreciation in the Canadian dollar, whether measured against the U.S. dollar or a multilateral basket, come outside the twelve months before recession and recession themselves. As to their track record in calling recessions, both exchange rates called one-half of the turning points in their respective samples.

(9) The three-month and (10) ten-year treasury Canada-United States interest rate spreads. One might argue that, as the business cycle matures and risks of a downturn increase, the premia on Canadian debt demanded by the markets should increase, widening the spread with comparable U.S. instruments. An alternative, but complementary, proposition is that as the late stages of an economic expansion bring the economy above its potential, the Bank of Canada acts countercyclically, tightening monetary policy. The result is higher interest rates and wider spreads. Charts 9 and 10 trace the evolution of short- and long-term spreads during the course of the business cycle. Several features stand out. First, spreads widen prior to the onset of recession for both maturities, but more so for the three-month treasury bill. The bill spread starts to widen earlier (9 months prior to the peak), while the bond spread widens 6 months prior to the peak. Taken together these suggest the Canadian yield curve flattens relative to the U.S., suggesting that the tightening of monetary policy argument may be the more relevant in explaining the cyclical behavior of spreads.

As to the indicator properties, neither spread stands out as a particularly reliable indicator. The t-bill spread records an almost equal number of hits and misses and, as with the stock market and exchange rates, it provides false signals the majority of the time. The ten-year bond spread does better, capturing five of the last six turning points. However, it also sends false signals 70 percent of the time. It would appear that Canadian-U.S. interest rate spreads are importantly driven by other factors, most likely including political issues or policy developments that are not systematically linked to the Canadian business cycle.

(11) Term Structure of Interest Rates in the United States. Given the importance of the U.S. business cycle for the Canadian economy and the yield curve's comparatively high ability to predict that cycle (see, for instance, Laurent (1988), Estrella and Hardouvelis (1991), and Hu (1993)), we now examine how well the yield curve in the United States predicts economic activity in Canada. Cozier and Tzack (1994) and Clinton (1995) have suggested that the U.S. yield curve added little explanatory power to their output equations, when the Canadian yield curve and other financial variables were included in the regressions. Here, we focus on the univariate ability of the U.S. yield curve to forecast Canadian turning points. Chart 11,

summarizes the main findings: a flattening in the U.S. yield curve occurs about a year before the onset of recession (much the same as the timing in the Canadian yield curve); the term structure captures six of the last seven turning points; the yield flattens nearly 70 percent of the time in either the period preceding the recession or the recession itself; false signals are given only about 1/3 of the time. Indeed, the U.S. yield curve does almost as well as the Canadian yield curve in predicting economic activity in Canada, attesting to the importance of the U.S. business cycle for Canada.

(12) Industrial production in the United States. The last external influence we examine is that of an explicit measure of real economic activity--industrial production. To the extent that the U.S. is, by far, the largest market for Canadian exports (with about an 80 percent share), this raises the issue of the extent to which the economic cycles are synchronous. We find that U.S. industrial production had an equal number of called and missed turning points (Chart 12) and that a decline in production only preceded the turning point about 11 percent of the time. However, while its leading indicator properties are limited, U.S. industrial production is clearly a reliable coincident indicator, turning down either before or during every postwar recession in Canada.

3. Composite variables: the nominal MCI

(13) The nominal MCI and (14) changes in the nominal MCI. The monetary conditions index (MCI), designed by the Bank of Canada to capture the impetus of monetary policy, is a wieghted average of the three-month bill rate and the change in the weighted average exchange value of the Canadian dollar from a base year. The weights were determined from simulations of the Bank's large-scale macro model, and, as explained in Freedman (1994), the weight on the exchange rate varies between 1/3 and 1/2. The Bank of Canada's use of the MCI as an operational target (see Freedman (1994)) makes it an obvious candidate as a potential indicator of economic turning points.[6] The predictive abilities of the level of the nominal MCI as

[6] While the MCI is a useful description of monetary policy, the Bank of Canada does not attempt to maintain a precise target for the MCI, particularly on a day-to-day basis.

well as its rate of change are summarized in Charts 13 and 14. The performance of the level of the MCI is mixed. As would be expected if monetary conditions are tightened in a countercyclical fashion, the MCI tends to rise in the period preceding the recession (and peak shortly after the peak in economic activity). Indeed, the MCI rises above its twentieth percentile 12 months prior to the economic peak nearly 30 percent of the time, and two-thirds of the time either before or during a recession. However, the level of the MCI has missed as many turning points as it has called. An inspection of the top panel of Chart 13 reveals the presence of a negative trend in the level of the MCI, which resulted from the decline in nominal interest rates since its base period (1987). This secular decline (unlike cyclical easings of monetary policy) reflects the trend decline in inflation over the sample. The percent change in the MCI does much better as a leading indicator, accurately signaling the last four recession and rising above its twentieth percentile either before or during a recession in about two-thirds of the time. Hence, by this accounting criterion, it ranks with real M1 growth and the Canadian and U.S. term structure.

4. Real-side quantities

Having reviewed the performance of a variety of domestic and foreign financial variables, as well as foreign real variables, the last two indices examined are the changes in the composite leading indicators and the ratio of real inventory to shipments.

(15) Composite leading indicator. The main conclusions drawn from the information provided by Chart 15 are: the (smoothed) leading indicator does not lead--it coincides with economic downturns; the composite leading index only captured two of the last seven recessions and declined prior to the onset of a recession less than 10 percent of the time; the fact that the percent decline in the index declines exceeds its twentieth percentile in 64 percent of time suggests, however, that the indicators provide a good pulse of the coincident state of economic activity.

(16) Inventory-to-shipments ratio. The inventory-to-shipments ratio provides a good leading indicator of economic activity (Chart 16). However, its predictive ability still falls short of financial variables, such as

the term structure. Still, the inventory shipments ratio accurately called seven of the last eight recessions. The ratio has risen above its twentieth percentile just prior to or during recessions more than 70 percent of the time, suggesting it is less likely to give false signals than many other indicators, such as the stock market, the Canadian-U.S. interest rate spread, and M2 and the credit aggregates.

III. Testing the Predictive Power of Various Indicators

We have argued that reliable leading indicators should behave differently in advance of recession than elsewhere. As a result, an analyst can be more confident about an estimate of the probability of recession given the value of the indicator than an unconditional estimate of the probablity of recession. In this section, we will make more precise comparisons of the distributions of each indicator across the three subsets of our sample, again using the information already provide in Charts 1 through 16. We will go on to examine the robustness of these results by examining if the innovations to each of the indicators behave differently in recession and in expansion.

1. Testing the Equality of Distributions

We employ parametric (a t-test of equality of means) and nonparametric statistics (Kolmogorov-Smirnov and the Wilcoxon Rank Sum tests) to the conditional distributions discussed in the previous sections. The t-test, of course, makes an explicit assumption about the underlying distribution of the data and can be quite sensitive to extreme values. The other two tests, in contrast, are nonparametric. The Kolmogorov-Smirnov statistic is simply the largest spread between the cumulative density functions of the two samples and has an exact distribution that can be calculated readily. In the Wilcoxon Rank Sum procedure, the two samples are pooled and ordered by rank. The test statistic compares the sum of the ranks of the two separate samples and has a distribution that is approximately normal for large numbers of observations.

Table 4 presents the marginal significance levels of the test of equality of means (columns 1 and 4), of the Kolmogorov-Smirnov test (columns 2 and 5), and the Wilcoxon Rank Sum (columns 3 and 6). To test whether a variable is a leading indicator, these tests compare monthly data within twelve months prior to the onset of a recession (columns 1 to 3) to the observations during economic expansion not directly preceding a recession. Similarly, to test whether the variable is a coincident indicator (columns 4 to 6), the test compares the observations during recessions (defined from peak to trough, as in Table 3) to the observations during economic expansion not directly preceding a downturn.

The results suggest we can drop several variables from our earlier list of potential leading indicators, as we cannot reject the null hypothesis of equality of distributions (at the five percent significance level). It turns out that changes in real stock prices, real M2 growth, real credit growth, changes in the multilateral and bilateral exchange rate, the Canada-U.S. Treasury bill spread, and U.S. industrial production do not act differently in the twelve months before an economic contraction than they do during sustained economic expansions. Many of these variables, however, can be included in the list of potential coincident indicators. As columns 4 to 6 highlight, the three variables that drop out from the coincident list are real credit growth and changes in the bilateral and multilateral exchange rates.

2. Extracting the Effects of History

As has long been known, at least since Slutzky (1937), the current movement in an economic time series may in part reflect the lagged effect of its earlier movements. In Slutzky's terms, that is the distinction between the impulse--the news in an index--and the propagation mechanism--or the dynamics associated with lagged adjustments to news. As a result, simple comparisons of the level or change in a series may unfairly penalize those time series that have very inertial dynamics. In principle, shocks to such variables could have important consequences for the business cycle, but because they move in a smooth manner, our technique would not necessarily detect the signal. In recognition of this, we investigated if the variables in question retained their signaling ability if purged of their own recent history.

We proceeded in two steps: in the first, each variables was regressed against a constant term, a time trend, and twelve lags; in the second, the residuals from intermediate regression were subjected to the same equality of distributions tests that were described earlier. As shown in Table 5, this exercise added several more casualties to the list of variables that do not classify as leading indicators: the Canadian commercial paper spread, the Canada-U.S. ten-year treasury spread; the level and change in the real MCI; and the composite leading indicator. The composite leading indicator is a good example of Slutzky's principle at work. Statistics Canada averages some of the entries in the index, which explains why its growth in Chart 15 evolves smoothly. The first-stage regression, controlling for that smoothness through lagged values of the index, extracts the news from that time series. In fact, there is little news to be had that bears on predicting turning points. The index of leading indicators, judging from line 15 in the table, is a coincident indicator of recession. Hence, at this stage we have narrowed the number of potential leading indicators to: the Canadian term structure; real M1 growth; the U.S. term structure; and the level and change in the nominal MCI; and the change in the ratio of real inventories to shipments.

However, that first-stage regression, before the second stage of parametric and nonparametric testing, can be made more general than an autoregression, permitting the examination of the influences of other variables on the indicators. The section that follows examines this issue by focussing on the influence of domestic and U.S. monetary policy.

IV. The Sources of Business-Cycle Variation

Focusing strictly on a univariate approach, a variable may emerge as a reliable leading indicator by one or more of the criteria discussed in the preceding sections. However, that variable's ability to forecast economic activity may stem directly from its ability to accurately portray the current stance of monetary policy (domestic or foreign) and not from any information about the phase of the business cycle that is idiosyncratic to the variable. Such a variable may be of limited use to the central bankers, who are already

aware of the current stance of monetary policy. To examine which of the macroeconomic and financial time series analyzed are actually providing information about monetary policy in Canada or the United States, we revisit the two-step procedure outlined in the previous section.

1. Canadian monetary policy and the indicators

To extract the systematic effect of domestic monetary policy, we regressed each of the indicators on a constant term and twelve lags of the Canadian three-month Treasury bill rate. In the second step, we examined whether the residuals from that regression still retained their ability to signal turning points by behaving differently in the months leading up to a recession and "normal" expansion periods. The results of this exercise are reported in Table 6. These regressions result in a further winnowing of the list of potential leading and coincident indicators. The most notable item in the table reports the demise of real M1 as a leading indicator. While both the accounting exercise in Chart 4 and the preceding univariate analysis suggested that changes in real M1 were a reliable indicator of future economic activity, the news contained in real M1, that ability to discriminate between expansions and contractions appears to have stemmed from the lagged effect of domestic interest rates and not from intrinsic information about, say, the demand for money. As shown by line 4 in the table, the residuals from a reduced form regression of the change in real M1 on a constant and twelve lags of the Canadian short rate are indistinguishable in expansion and recession. At best, after extracting the effects of domestic monetary policy, real M1 might be considered a useful coincident indicator. The other casualty from this exercise was the change in the ratio of real inventories to shipments, which behaves undiscernibly in advance of recession and in sustained economic expansions once the systematic element of Canadian monetary policy is extracted.

2. U.S. monetary policy and the indicators

Given that the Canadian economy is so closely linked to that of the United States, we next broadened our analysis to gauge the systematic effect of U.S. monetary policy on each indicator. We regressed each of the indicators on a constant term and the current and twelve lags of the U.S. three-month treasury bill rate,

with Table 7 summarizing the results.[7] The results in this table bear witness to the close links between Canada and the United States. Only four of the original sixteen variables behave differently in expansion than before recession, judging by the standard of a five-percent significance level across the three tests given in columns one through three. Among the variables not included among those four is the change in the nominal MCI, which appears to be neither a leading nor coincident indicator once controlling for the effects of Federal Reserve policy. With the change in the nominal MCI falling by the way side, only the domestic and foreign yield curves and the level of the nominal MCI, out of the original sixteen, provide information about impending recessions that is not already known from their own lagged behavior and the stances of domestic and foreign monetary policies.

V. Comparing Indicators

Table 8 provides a final reckoning of our findings regarding the usefulness of the various indicators in predicting major turning points in economic activity. The first two columns of the table summarize the key features of the accounting exercise documented in Charts 1 through 16. The first column presents the percent of turning points accurately predicted, while the second gives the "noise-to-signal" ratio, or the proportion of false signals (signals given when the economy was neither in a recession nor about to enter one) to accurate signals given in the twelve months prior to the onset of recession. Hence, the lower the ratio in column 2, the better the indicator. Columns 4 through 6 summarize the results of the various versions of the parametric and nonparametric tests. An "X" denotes a variable with a distribution that differs significantly in the twelve months before recessions from that in economic expansion, according to the five percent critical value of both the Wilcoxon Rank Sum and Kolmogorov-Smirnov tests.

[7] Because it can be argued plausibly that U.S. monetary policy within a month is not influenced by that month's developments in Canada, these first-stage regressions included the current U.S. short rate. In the regressions of the previous subsection, the current value of the Canadian short rate was omitted to guard against simultaneity bias.

The "top-tier" indicators combine three features: they capture most of the turning points; false signals are rare (a ratio less than unity in column 2 would capture this); and the variable behaves differently prior to recessions, even when controlling for other factors, such as domestic and foreign monetary policy. The term structure in Canada and in the U.S. are the only two indicators of our set that fulfill these criteria. This, perhaps, is not surprising, since the yield curve not only conveys information about the current stance of monetary policy, but also reflects market expectations about future policy (monetary and fiscal) as well. The level of the MCI, although it behaves differently in advance of recessions fails to meet the first two criteria.

A "second-tier" indicator (from the vantage point of someone who already has knowledge about the stance of current monetary policy), is one which fulfills the first two criteria discussed above, but may not provide any additional information over and beyond reflecting what policy is doing. Changes in the nominal MCI, real M1, and to a lesser extent, the real inventory shipments ratio fall into this category. The first two have the decided advantage over the real inventory shipments ratio in that they provide twice the lead time (see Charts, 4, 13, and 16). The remaining thirteen indicators fail to meet two or more of our criteria.

We can turn to the definition of conditional probabilities once again, this time to form time varying estimates of the probability that the Canadian economy is about to enter into recession. In terms of equation (1), we are interested in the conditional probability of being within twelve months of recession, given the slope of the term structure, or $Pr[B \mid I]$. Of course, we will have two estimates, because we have two term structures--from Canada and from the United States--that appear to have leading-indicator abilities. We can evaluate the three smoothed estimates of conditional distributions in the lower left panels of Charts 1 and 12 for Canadian and U.S. rates, respectively, $Pr[I \cap B]$, $Pr[I \cap R]$, and $Pr[I \cap E]$, to track how that probability moved over time as the slope of the yield curve shifted. The results are plotted in the two panels of Chart 17. As one would expect from leading indicators, both indicators tend to move well

above the unconditional probability of entering recession in advance of a turning point. Indeed, in most cases, the two term structures put the chance of entering recession at better than 1/2 before the cyclical peak. The flattening of the yield curves in Canada and the United States in early 1995 raised some warning flags, but unconditional probabilities remain below 30 percent.

VI. Concluding Comments

To summarize the main results that emerge from examining Canadian and U.S. data over a period that spans the seven post-war recessions are summarized as follows:

First, measures of the slope of the yield curve appear to offer the most timely readings on recession. This confirms the earlier findings of Clinton (1994) and Cozier and Tkacz (1994) for Canada and Hu (1993) for the G-7 countries. In the past few decades, an inverted term structure--particularly at short to intermediate maturities--led most economic contractions while providing relatively few false alarms. Second, reflecting the high degree of integration in the two economies, the term structure in the United States emerges as a reliable leading indicator of Canadian economic turning points. Indeed, its performance is comparable to the Canadian term structure, in both the number of turning points accurately called and the relatively low incidence of false signals. The yield curve offers information about the stage of the business cycle even after controlling for the stance of domestic and foreign monetary policy, highlighting the role played by market expectations.

Third, the level of the nominal MCI does appear to contain unique information, over and beyond that contained in its own lags or readings on domestic and foreign monetary policies. However, a forecaster should use it at his or her own peril: It has signaled only one-half of the recessions since 1972 and its

warnings are more often noise than not. The change in the nominal MCI does much better, although its signalling ability comes from summarizing changes in monetary policy.

Fourth, the commercial paper-Treasury bill spread, which has been much lauded as a superior leading indicator for the United States (by Stock and Watson (1989) among others), calls accurately most of the turning points in economic activity in Canada. However, like stock prices, this spread tends to be noisy, setting off considerably more warnings than warranted by subsequent developments. Moreover, some of the news that makes the spread useful in predicting downturns appears related to U.S., not Canadian, monetary policy.

Fifth, confirming the results of earlier studies (Hostland, Poloz, and Storer (1988) and Muller (1992)) changes in real M1 do better in predicting future economic activity than M2 or the credit aggregates. However, what this literature did not investigate was whether M1 had intrinsic leading indicator properties or whether its predictive power stemmed exclusively from capturing the stance of domestic or U.S. monetary policy. Our results suggest that, once the effects of domestic or U.S. monetary policy are controlled for, M1 has little residual explanatory power.

Sixth, the leading composite indicator is not much of a leader, as it has missed most of the postwar turning points; after controlling for domestic monetary policy, it provides no additional signaling information. Indeed, the index behaves more as a coincident indicator would.

Last, our investigation offers support for a traditional view of the monetary transmission mechanism in Canada, much as was found by Duguay (1994). Both the interest-rate and exchange-rate channel of monetary policy show through in the data, in that both short- and long-term interest rates (through the yield curve slope and the MCI) and exchange rates (embodied in the MCI) do move ahead of economic downturns. The exchange rate by itself, however, is too volatile an indicator to systematically signal the major turning points. In contrast, real domestic credit is completely acyclic, suggesting that if there is some truth to the credit view, it must work its effect on economic activity subtly.

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Table 1. The Indicator Literature on Canada

Hostland, Poloz, Storer (1988): ***46 Monetary aggregates, quarterly data, 1969:1 to 1986:4***
GDP and other nominal and real measures of economic activity were regressed against the various monetary aggregates to weed out subset that is informative according to the final prediction error criterion (FPE). Granger causality tests were performed to assess the information content of alternative aggregates. The main conclusion that emerges is that narrow aggregates (i.e. M1) was a better leading indicator of nominal income, whereas the broader aggregates were a coincident indicator; real M1 was found to be a good leading and coincident indicator of real income. Interest rates, equity prices, and exchange rates are added to the bivariate framework; they concluded that the financial variables added significant information, and reduced but not eliminated the information content of M1.

Milton (1988): ***25 credit aggregates, quarterly data, 1971:1 to 1985:4***
The same vector autoregression selection criteria methodology as Hostland, Poloz, Storer (1988). Several measures of credit, including residential mortgage, household, and business credit are informative about real spending, but most of the relationship is either contemporaneous or with very short lags (one to two quarters); the credit aggregates are outperformed by M1 and M2.

Mishkin (1989): ***The yield curve, 10 OECD countries, monthly data, 1973:3 to 1986:12***
Changes in inflation are regressed against the slope of the slope of the lagged term structure. He finds little evidence that the term structure helps predict future changes in inflation. However, he finds the nominal term structure contains evidence on the real term structure.

Muller (1992): ***Monetary and credit aggregates, quarterly data, 1971:1 to 1989:4***
The same indicator models of Hostland, Poloz, Storer (1988) and Milton (1988). The main conclusions are: the predictive ability of real M1 1 to 2 quarters ahead is confirmed; consumer bank credit as well as M2 predict GDP deflator movements; many of the credit aggregates are lagging indicators of economic activity and; despite the financial innovation of the 1980s, these results appear to be robust.

Hu (1993): ***The yield curve, G-7 countries, for Canada it is quarterly data, 19571:1 to 1991:4***
Changes in real GDP are regressed against lags yield spread. The results indicate that the yield spread is significant in almost all the subsamples for all seven countries and that, particularly for Canada and the United States, its predictive ability has increased since the mid-1970s. A forecasting model based on real stock returns underperforms the yield curve in five of the countries, including Canada. The theoretical model developed indicates that expectations of higher growth will produce higher long-term interest rates and a steeper yield curve.

Cozier and Tkacz (1994): ***12 measures of the yield curve, quarterly data, 1961:1 to 1991:4***
As in the earlier studies, the approach is parametric and involves regressing the real activity variable of interest on lagged values of the term structure and other potential leading indicators. The term structure is found to be a significant predictor of economic activity, particularly consumption at two years or less and investment at longer time horizons. The inclusion of other financial variables, (real M1, stock prices, and interest rates) does not reduce the predictive ability of the term structure. Indeed, it is real M1 that becomes insignificant. The inclusion of the U.S. term structure in the model does not add much to its predictive ability over short horizons, but significantly improves the fit over longer horizons.

Clinton (1995): ***The yield curve, quarterly data, 1961:1 to 1991:4***
Very similar approach and methodology to Cozier and Tkacz (1994). The main results include: the yield curve outperforms other indicators, particularly at longer time horizons; the peak relationship with output occurs about one year ahead; it is a better predictor of aggregate demand than its components; the U.S. yield curve is not significant in the regressions; while the term structure is not, however, a good predictor of inflation and is outperformed by M2.

Table 2. Chronology of Turning Points in Canada
During the Post World-War-II Period

Peak	Trough
May 1951	December 1951
May 1953	June 1954
January 1957	January 1958
March 1960	January 1961
February 1970	June 1970
May 1974	March 1975
January 1980	June 1980
June 1981	November 1982
April 1990	December 1991 1/

Memo:

Percent of months since 1958:

within twelve months of recession	17
in recession	15
all else	68

Source: Statistics Canada
1/ As yet, there is no official date for the 1990-91 recession trough; while GDP ceased to contract earlier in 1991, production and employment did not bottom out until December of that year.

Table 3

Variables Used to Forecast Turning Points in Canada

Financial

Rates and Prices

1. Ten-year Treasury note less three-month Treasury bill rate
2. Three-month corporate less Treasury bill rate
3. Real Toronto Stock Exchange Index (TSE)

Quantities

4. Real M1
5. Real M2
6. Real Domestic Credit

International

7. G-10 Weighted Exchange Rate
8. U.S.-Canadian Dollar Exchange Rate
9. Three-month Canadian Treasury less U.S. Treasury bill rate
10. Ten-year Canadian Treasury less U.S. Treasury note yield
11. U.S. Industrial Production
12. U.S. Treasury ten-year note less three-month U.S. Treasury bill rate

Composite

13. Nominal Monetary Conditions Index (MCI)
14. Change in MCI

Real-Side

15. Index of Leading Indicators
16. Real Inventories to Shipments

Table 4. Canada: Signaling Ability of Various Indicators

	Is the Indicator:					
	----------Leading----------			---------Coincident---------		
	Equal Means (1)	K-S (2)	WRS (3)	Equal Means (4)	K-S (5)	WRS (6)
Financial						
10-year note less 3-month bill	--	--	--	--	--	--
3-month corporate less 3-month bill	--	0.01	0.01	--	--	--
Real Toronto stock exchange	0.19	0.27	0.43	--	--	0.01
Real M1 growth	--	--	--	--	--	--
Real M2 growth	0.13	0.40	0.31	--	0.012	0.02
Real domestic credit growth	0.61	0.58	0.66	0.26	0.09	0.21
International						
G-10 exchange rate growth	0.03	0.05	0.06	0.19	0.38	0.21
US$/Can$ exchange rate growth	0.03	0.10	0.05	0.59	0.40	0.90
Canadian 3-month less U.S. 3-month bill rates	0.46	0.19	0.47	--	--	--
Canadian 10-year less U.S. 10-year note yields	0.01	--	--	--	--	0.01
U.S. industrial production	0.15	--	0.01	--	--	--
U.S. 10-year less U.S. 3-month bill	--	--	--	--	--	--
Composite						
Nominal MCI	--	--	--	--	--	--
Nominal MCI changes	--	--	--	--	0.01	0.02
Real side						
Leading indicators growth	--	--	--	--	--	--
Real inventories to shipments growth	0.04	0.03	0.04	0.01	--	0.03

Note: Marginal significance levels of test of equality of means (columns 1 and 4), of Kolmogorov Smirnov test (columns 2 and 5), and of Wilcoxon Rank Sum test (columns 3 and 6). These tests compare the monthly data within twelve months of recessions (columns 1, 2, and 3) and during recessions (columns 4, 5, and 6) to the observations during economic expansion not directly preceding a downturn.

Table 5. Canada: Signaling Ability of Various Indicators,
After Extracting Information About Their Own Histories

	Is the Indicator:					
	----------Leading----------			---------Coincident---------		
	Equal Means (1)	K-S (2)	WRS (3)	Equal Means (4)	K-S (5)	WRS (6)
Financial						
10-year note less 3-month bill	--	--	--	0.09	0.05	0.13
3-month corporate less 3-month bill	0.02	0.11	0.08	0.90	0.23	0.77
Real Toronto stock exchange	0.40	0.31	0.78	0.02	--	0.02
Real M1 growth	--	--	--	0.04	0.01	0.04
Real M2 growth	0.51	0.33	0.88	0.03	0.02	0.09
Real domestic credit growth	0.54	0.72	0.57	0.16	0.10	0.08
International						
G-10 exchange rate growth	0.10	0.10	0.19	0.57	0.59	0.61
US$/Can$ exchange rate growth	0.17	0.31	0.39	0.96	0.40	0.82
Canadian 3-month less U.S. 3-month bill rates	0.45	0.19	0.20	0.20	0.22	0.34
Canadian 10-year less U.S. 10-year note yields	0.90	0.32	0.76	0.07	--	0.09
U.S. industrial production	0.17	0.02	0.03	--	--	--
U.S. 10-year less U.S. 3-month bill	--	--	--	--	--	--
Composite						
Nominal MCI	--	--	--	0.53	0.65	0.80
Nominal MCI changes	--	0.01	0.01	0.01	0.01	0.02
Real side						
Leading indicators growth	0.01	0.02	0.02	--	--	--
Real inventories to shipments growth	0.05	0.01	0.04	0.01	0.01	0.01

Notes: Residuals from the regression of each variable against a constant term, a time trend, and twelve lagged values of the variable. Marginal significance levels of test of equality of means (columns 1 and 4), of Kolmogorov Smirnov test (columns 2 and 5), and of Wilcoxon Rank Sum test (columns 3 and 6). These tests compare the monthly data within twelve months of recessions (columns 1, 2, and 3) and during recessions (columns 4, 5, and 6) to the observations during economic expansion not directly preceding a downturn.

Table 6. Canada: Signaling Ability of Various Indicators,
After Extracting Information About Canadian Monetary Policy

	Is the Indicator:					
	----------Leading----------			---------Coincident---------		
	Equal Means (1)	K-S (2)	WRS (3)	Equal Means (4)	K-S (5)	WRS (6)
Financial						
10-year note less 3-month bill	--	--	--	--	0.02	0.01
3-month corporate less 3-month bill	--	--	--	--	--	--
Real Toronto stock exchange	0.83	0.69	0.82	0.05	--	0.07
Real M1 growth	0.32	0.27	0.47	0.03	--	0.02
Real M2 growth	0.09	0.40	0.20	0.07	0.41	0.44
Real domestic credit growth	0.71	0.75	0.68	0.97	0.23	0.89
International						
G-10 exchange rate growth	0.17	0.06	0.29	0.82	0.55	0.90
US$/Can$ exchange rate growth	0.30	0.64	0.60	0.68	0.30	0.85
Canadian 3-month less U.S. 3-month bill rates	--	--	--	0.43	0.04	0.41
Canadian 10-year less U.S. 10-year note yields	--	--	--	--	--	0.02
U.S. industrial production	0.12	--	0.04	--	--	--
U.S. 10-year less U.S. 3-month bill	--	--	--	--	--	--
Composite						
Nominal MCI	--	--	--	--	--	--
Nominal MCI changes	--	--	--	0.10	0.37	0.37
Real side						
Leading indicators growth	--	0.11	0.03	--	--	--
Real inventories to shipments growth	0.73	0.73	0.90	0.13	0.03	0.15

Notes: Residuals from the regression of each variable against a constant term and twelve lags of the Canadian three-month bill rate. Marginal significance levels of test of equality of means (columns 1 and 4), of Kolmogorov Smirnov test (columns 2 and 5), and of Wilcoxon Rank Sum test (columns 3 and 6). These tests compare the monthly data within twelve months of recessions (columns 1, 2, and 3) and during recessions (columns 4, 5, and 6) to the observations during economic expansion not directly preceding a downturn.

Table 7. Canada: Track Record of Potential Leading Indicators
Points in Canada

	Accounting Exercise		Does the variable behave differently in advance of recessions?			
			----------After Extracting:----------			
	Percent of turning points called	Noise to-signal ratio 1/	Intrinsically	Own lags	Monetary Policy in: Canada	United States
	(1)	(2)	(3)	(4)	(5)	(6)
Financial						
1. 10-year Treasury note less 3-month Treasury bill rate	83 X	0.62	X	X	X	
2. 3-month corporate less Treasury bill rate	83	3.32	X		X	
3. Percent Change in Real Toronto Stock Exchange Index (TSE)	66	6.71				
4. Real M1 Growth	83	0.39	X	X		
5. Real M2 Growth	--	--				
6. Real Domestic Credit Growth	17	14.00				
International						
7. G-10 Weighted Exchange Rate	50	2.52				
8. U.S.-Canadian Exchange Rate	50	4.07				
9. 3-month Canadian Treasury less U.S. Treasury bill rate	44	1.47			X	
10. 10-year Canadian Treasury less U.S. Treasury note yield	83	3.33	X		X	
11. U.S. Industrial Production	50	3.27	X		X	X
12. U.S. Treasury 10-year note less 3-month U.S. Treasury bill rate	86	0.67	X	X	X	X
Composite						
13. Nominal Monetary Conditions Index (MCI)	50	1.18	X	X	X	X
14. Change in the nominal MCI	100	.95	X	X	X	
Real-side						
15. Index of Leading Indicators	40	3.50	X			
16. Inventories to Shipments	88	1.40	X	X		X

Source: Charts 1 through 16 and Tables 5 through 8.

1/ The dashed line next to M2 indicates that the noise to signal ratio is infinite, since this indicator has not sent any signals in advance of recession, see Chart 5.