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Credit Intermediation Lessons from the Canadian Great Depression

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ABSTRACT

This study empirically tests the credit intermediation hypothesis in Canada at the time of the Great Depression. Regulatory policy at that time disallowed bank failures, such that an implicit deposit guarantee and coincident moral hazard risk existed. Based on vector autoregression analyses in the period 1926-1939, we find that the rapid expansion of bank credit prior to 1929 to finance the growth of durable goods investment was a major factor in explaining Canadian output increases. After the crash of 1929, despite government forebearance to keep insolvent banks open, negative credit shocks had a strong dampening effect on output from 1930 to 1932 and again from 1936 to 1938. We conclude that bank bailouts of insolvent institutions do not prevent credit intermediation effects on the economy.Policy implications to recent financial and economic crises are discussed.

INTRODUCTION

The present study empirically examines the relationship between bank credit and macroeconomic activity during the Canadian Great Depression.[1]Previous work by Friedman and Schwartz (1963) observed that general economic conditions during the Great Depression in the U.S. were worsened by a monetary contraction and disruptions in the banking sector. Regarding banking effects on output, Bernanke (1983) argued that financial panic, disintermediation of bank deposits, and bank failures and credit losses adversely impacted business conditions during the U.S. Depression. His well-known *credit intermediation hypothesis* proposed that banking problems which seriously disrupt the intermediation of public savings to business investment can have long-run, negative consequences for the macro economy. With respect to the U.S. Great Depression when over 5,000 banks failed, Bernanke reported empirical evidence that strongly supported the credit intermediation hypothesis. More recent papers by Anari and Kolari (1999) and Anari, Kolari, and Mason (2004) have confirmed that bank credit intermediation effects significantly worsened U.S. output during the Depression.

Given the many parallels between the Great Depression in the U.S. and Canada (see Figure 1) as well as their close geographic proximity, it is somewhat surprising that past studies have not detected a credit intermediation effect in Canada. Safarian (1959) sought to explain this apparent inconsistency by noting that, "The general strength of the Canadian banking system would tend to ameliorate the downswing relative to that of the United States." (1959, p. 40). Bank stability was attributed to the large, geographically-diversified, branch-banking system in Canada, as well as prohibitions on longer-term, illiquid lending in real estate, recourse to Dominion notes to meet cash demands for loans or deposit withdrawals, and a reputation for soundness in Canadian banks (see Bordo, Rockoff, and Redish (1994)). While the U.S. economic downturn was accompanied by large-scale bank failures, no banks were closed in Canada during an equally severe economic collapse. Following Bernanke's U.S. Depression analyses, Haubrich (1990) conducted an empirical study of bank credit intermediation effects on output during the Canadian Depression. Consistent with Safarian's

inferences, but in contrast to Bernanke, he found little empirical evidence in favor of a bank credit intermediation effect on output. Since Canadian output was affected by U.S. output declines, he inferred that the depth and persistence of the Canadian Depression was due to the export-oriented Canadian economy, rather than a credit intermediation effect associated with a troubled banking sector. Further work by Amaral and MacGee (2002) inferred that, since Canada experienced both no bank failures during the Depression and a lower increase in commercial failures in the period 1929-1932 compared to the U.S., the debt crisis explanation of the Depression was not supported. They cited the fact that between 1929 and 1932 commercial failures in Canada rose from 2,310 to 2,938 (i.e., 27 percent increase), whereas in the U.S. they rose from 22,900 to 31,822 (i.e., 39 percent increase). An alternative interpretation of these data is that credit markets were under distress in Canada. While the increase in the number of commercial failures was less in Canada than the U.S., Canada experienced a considerable increase in commercial failures associated with the onset of the Depression era.

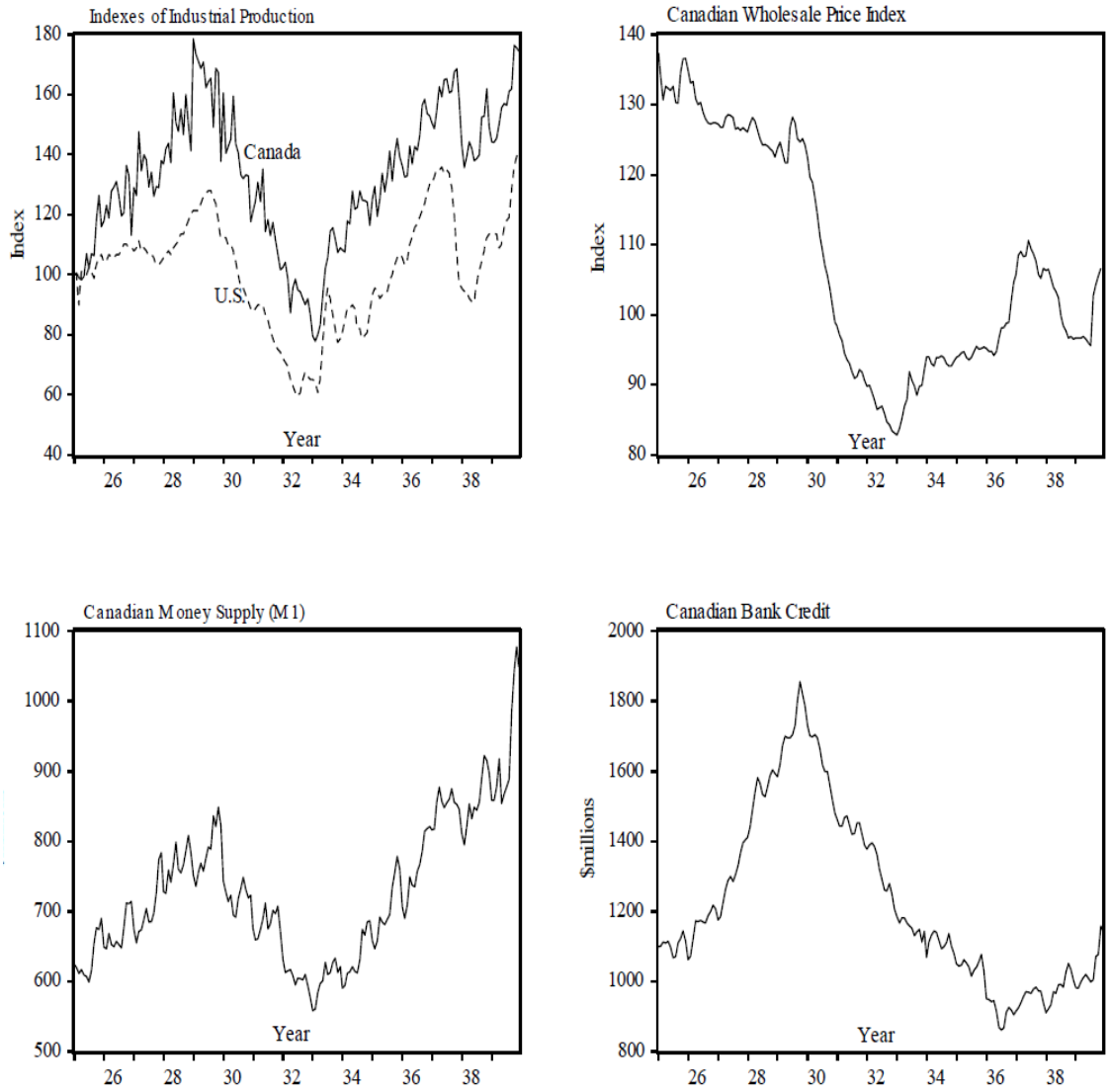


Figure 1. *Data series for Canadian and U.S. indexes of industrial production as well as Canadian wholesale price index, money supply, and bank credit*

Particularly relevant to the present study, research by Kryzanowski and Roberts (1993) and Betts, Bordo, and Redish (1993) has challenged the notion that the Canadian banking system was not experiencing credit intermediation problems. Kryzanowski and Roberts reported evidence contradicting the previously-held notion that national branching in Canada protected the banking industry from macroeconomic shocks during the Great Depression (e.g., see Grossman (1994)). Importantly, they found that all but one Canadian bank was insolvent in the first half of the 1930s. Only regulatory forbearance prevented the closure of troubled Canadian banks. Given

that Canadian banks were capital deficient, it is reasonable to believe that bank credit supplies were disrupted. Furthermore, Betts, Bordo, and Redish documented a close symmetry of output, prices, and money supply movements in the U.S. and Canada during the Great Depression (see also Amaral and MacGee (2002)). Applying vector autoregression (VAR) analyses, the authors found that common factors were driving forces underlying the Depression in both countries, in contrast to the widely-held notion that world Depression was transmitted by the U.S. economic collapse. Importantly, although not directly tested, they inferred that a bank credit intermediation effect likely occurred in the Canadian Depression.[2]

In this paper we employ VAR analyses to investigate the credit intermediation hypothesis in Canada during the Great Depression using macroeconomic data series. Based on historical decomposition of Canadian industrial production using the wholesale price index, money supply, bank credit, and U.S. industrial production during the period 1926-1939, we provide estimates of the relative influence of each variable on Canadian output during the Depression. In general, the empirical results support the credit intermediation hypothesis. In brief, we find that prior to the economic collapse in 1929, the rapid expansion of bank credit was a major factor in explaining Canadian output increases. After the crash of 1929, credit contraction had a strong dampening effect on output from mid-1931 to year-end 1933 and again from 1936 to 1938. Bank credit shocks (or unexpected changes) in these periods exacerbated negative shocks from Canadian output, U.S. output, prices, and (to a lesser extent) money supply. Canadian bailouts of failing large banks did not immunize the macroeconomy from potential credit shocks. Thus, we conclude that the evidence supports the credit intermediation hypothesis.

Anecdotal support for this conclusion can be found in the recent 2008-2009 financial crises and coincident Great Recession.Large losses on home-mortgage-related assets triggered global financial panic. Aggressive government intervention was implemented to prevent many large institutions from failing. Domestic and international credit markets severely contracted. These Great Recession events are reminiscent of the Canadian Great Depression. An important policy implication of the Canadian experience is that, after financial system crises and credit shocks, bank regulatory and monetary authorities need to restore credit markets to normal conditions to foster economic growth and stability. In this regard, we propose that credit should be more prominently recognized as an economic goal among policymakers in much the same way as output, employment, prices, and trade.

The remainder of the paper is organized as follows. Section I briefly overviews closely related literature. Section II discusses our research methodology. Section III reports the empirical results, and the last section contains conclusions and implications.

LITERATURE REVIEW

A growing body of literature suggests that financial system development and performance play an important role in macroeconomic activity (e.g., see Gertler (1988), Bernanke (1995), Wheelock (1995), Levine (1997), Moore (1997), Levine and Zervos (1998), Rajan and Zingales (1998), Levine (1999), and Brandt and Zhu (2000) for discussion and citations). Concerns about bank credit intermediation effects on the macro economy during the Great Depression motivated Canada, the U.S., and other countries to enact laws that established prudential regulations designed to ensure the safety and soundness of the banking sector. However, over the last two decades many of these Depression-era banking laws have been repealed in view of major changes in the banking industry, such as new technology, global competition, financial innovations, and other factors. The resultant consolidation and expansion of banking services has been restructuring the banking industry at an unprecedented pace in Canada, the U.S., Europe, and Southeast Asia (e.g., see Berger, Kashyap, and Scalise (1995), Armstrong (1997), Canadian government Staff Study (1998), and Berger, Demsetz, and Strahan (1999)). If there is a credit intermediation effect, systemic shocks to the banking sector are serious threats to future economic productivity and should be contemplated in formulating bank policy. On the other hand, if there is no credit intermediation effect, consistent with arguments by Lucas (1972) and others (see Robinson 1952), the financial system is passive in nature and not related to economic growth. As such, the lack of a positive, first-order relationship between bank credit and economic growth would imply that deregulatory policy making need not be unduly concerned with banking system stability and its relationship to national economic goals.

The notion that credit is an economic force began with work by Austrian business cycle theorists. Ludwig von Mises (1912) and Friedrich Hayek (1935) argued that: (1) low interest rates initially stimulate excessive borrowing from banks by firms that motivates over-investment and strong economic growth, and (2) many poor investments later cause bank credit losses, severe credit contraction or a "credit crunch", and economic recession. This theory became controversial and gradually faded from mainstream economics. Nonetheless, over the past 20 years many studies have been published on the related subject of the credit intermediation effect (e.g., see Bernanke (1983), King (1985), Bernanke (1986), Samolyk (1990), Calomiris, Hubbard, and Stock (1986), Bernanke and Gertler (1987), Gertler (1988), Gilbert and Kochin (1989), Haubrich (1990), Bernanke and James (1991), Gunther and Moore (1993), Bernanke and Carey (1994), Bernanke (1995), Anari and Kolari (1999), Peek, Rosengren, and Tootell (2000), Lown and Morgan (2002), Anari, Kolari, and Mason (2004), and others). As observed by Repullo and Suarez (1999), the credit intermediation effect literature has two branches. One branch concerns a *broad credit channel* that relates the general financial strength or credit condition of borrowers on monetary shocks and the macro economy. The second branch emphasizes the *bank lending channel* by considering how banks' intermediary function affects the macro economy.

The seminal study in this area is Bernanke's (1983) empirical analyses of bank credit intermediation effects during the Great Depression in the United States. Applying a reduced-form money model with unanticipated money and inflation changes (see Lucas 1972 and Barro 1978), he initially examined the effects of money shocks and price shocks on real output in two separate regressions.[3] Price shocks were found to have a stronger relationship to output than money shocks. More importantly, while both effects were statistically significant, they explained only about half of the decline in output during the 1930-1933 period. Consequently, nonmonetary factors were added to the model to test their potential role in explaining residual variance – namely, the liabilities of failed businesses and the deposits of failed banks measured in first difference form. In both the money shocks and price shocks regression models, these nonmonetary variables were significant, and money and price variables were unchanged for the most part. Bernanke concluded that "... nonmonetary effects of the financial crisis augmented monetary effects in the short-run determination of output." (Bernanke, p. 270) In general, inclusion of the nonmonetary proxies for the financial sector predicted a more severe and longer decline in output than would have been forecasted by models of monetary contraction alone.

Bernanke further observed that the Great Depression was a global crisis and that countries experiencing banking crises (i.e., the U.S., Germany, Austria, Hungary, and others) suffered the most severe economic downturns. In this regard, he commented that Canada would be an interesting case to study due to the fact that it suffered a debt but not banking crisis (as previously believed prior to Kryzanowski and Roberts (1993)). Based on anecdotal evidence, he suspected that the debt crisis in Canada disrupted credit intermediation. In this regard, Siklos (2000) noted that Canadian banks reallocated their asset portfolios by decreasing loans by more than 50 percent in the period 1929-1936 and increasing investment in government securities.

In a formal test of Bernanke's casual inference, Haubrich (1990) extended empirical tests on bank credit intermediation effects to the Canadian Depression. The magnitude of Canada's economic downturn equaled the U.S. collapse and was motivated by similar problems of speculative optimism, excessive financing, and over expansion in the 1920s. One difference between the two countries was that Canada had a much larger increase in private and public investment in durable goods than the U.S. in the 1926-1929 period (i.e., according to Safarian (1959), a 60 percent increase in Canada versus 4 percent in the U.S). This investment was financed primarily by debt, which was raised from foreign issues for the most part. When the Depression struck, many Canadian firms were burdened by heavy debt loads that curtailed their demand for credit. However, as noted by Haubrich, there were no bank closures in Canada (except for one bank closure in 1923 prior to the Depression years). For this reason he proxied the disruption of credit intermediation using alternative measures of banking distress, including changes in the number of bank branches, bank stock prices, the yield spread between commercial and Dominion bonds, and the liabilities of failed businesses. Utilizing reduced-form regression models with industrial production as a function of lagged

output and money variables in the spirit of Bernanke and adding credit intermediation proxies, Haubrich did not detect a credit intermediation effect. He inferred that the magnitude of U.S. bank failures was a salient factor in the financial mechanism that worsened the U.S. economic collapse. Like Safarian, he argued that geographically-dispersed and large branch office systems in the Canadian banking industry mitigated shocks to the macroeconomy from credit services. Moreover, as previously cited, Amaral and MacGee (2002) observed that Canada had a lower increase in commercial failures than the U.S. in the period 1929-1932 (i.e., an increase of 27 percent in Canada versus 39 percent in the U.S.). While they interpreted this comparative data to mean that the credit crisis story did not help to explain the Depression in Canada, this data could be interpreted to imply an increase in financial distress in the early years of the Canadian Depression.

As already mentioned, Betts, Bordo, and Redish (1993), Amaral and MacGee (2002), and others have noted that the Canadian and U.S. economies closely paralleled one another during the Great Depression in terms of industrial production, money supply, inflation, and other macroeconomic series. Given that Bernanke found that the depth and persistence of the U.S. Depression was exacerbated by the loss of bank intermediated credit and associated increase in the cost of credit intermediation, and that Haubrich could not confirm this nonmonetary factor was important in Canada, the rationale for the equally deep and persistent Depression in Canada is subject to question. In this respect Haubrich argued that U.S. output declines were transmitted to Canada. Adding U.S. output to the aforementioned Canadian equations, he found that this factor was statistically significant. However, based on VAR analyses of output, money supply, and velocity, Betts, Bordo, and Redish (1996) examined the effects of idiosyncratic U.S. disturbances on Canada during the interwar years and concluded that "… the Depression in Canada derived from the same sources as that in the U.S. economy rather than being transmitted through export demand..." (Betts, Bordo, and Redish, 1996, p. 35)

Of course, an obvious difference between the U.S. and Canadian experiences was the apparent absence of a banking crisis in Canada, in contrast to systemic bank runs and failures in the U.S. While this popular belief appears to persist (e.g., see Grossman (1994)), work by Kryzanowski and Roberts (1993) demonstrated that regulatory forbearance in Canada, rather than the safety of a small number of banks (i.e., ten private chartered banks) with many branches (i.e., about 3,000 offices), explained the lack of bank runs and failures. In fact, the authors determined that nine-out-of-ten Canadian banks were insolvent with negative market values of capital in the period 1930-1935. Government policy after a major bank failure in 1923 dictated that no banks would be allowed to fail, such that an implicit deposit guarantee existed in Canada. They inferred that the recent consolidation trend in the U.S. banking industry toward larger, more geographically-diversified organizations does not necessarily protect it from systemic national or international economic shocks. In turn, given potential moral hazard risk associated with implicit deposit guarantees, deregulatory policy needs to vigilantly encompass safety and soundness practices (e.g., risk-based capital rules).

In sum, we interpret the findings of extant Great Depression studies to imply that the determinants of output declines in Canada were similar to those in the U.S., and that evidence for banking crises in both countries suggests that a bank credit intermediation effect may well be a common explanatory factor. Also, as observed by Bernanke, Canada experienced a credit bubble prior to the 1929 economic collapse, which later depressed demand for credit by firms (see also Safarian (1959)). In combination with widespread bank insolvency in Canada, large debt burdens could possibly have contributed to causing a significant credit intermediation effect. As discussed briefly in the introduction, recent 2008-2009Great Recession events in Europe and the U.S. appear to parallel those in Canada during the Great Depression. A credit bubble fueled excessive economic expansion and later burst as the economy entered a downturn. Resultant global turmoil in credit markets was been worsened by high debt levels among consumers, businesses, and financial institutions. Problems of bank capital solvency required government intervention to prop up faltering commercial banks, insurance companies, investment banks, etc. Panic led to historic volatility in the stock, bond, and commodity markets that lowered public confidence in financial markets. As a first step to restore confidence, government intervention was neededto inject liquidity and loanable funds into distressedfinancial institutions to mitigate systemic risk in the financial system. Subsequently, to restore economic growth and stability, forthcoming research results in this

paper suggest that bank regulatory and monetary authorities need to mitigate severe credit contractions and help return credit markets to normalcy.

EMPIRICAL METHODOLOGY

To investigate the impact of credit shocks on the Canadian aggregate output during the Depression, we estimate a VAR model of the Canadian economy containing the most important macroeconomic variables in the economy as well as an index of U.S. macroeconomic activity. Our empirical tests of the credit intermediation hypothesis during the Canadian Depression differ from Haubrich in terms of using a new revised macroeconomic data series as well as VAR analyses rather than single equation time series regression methods.

We measure Canadian aggregate output using the Canadian index of industrial production in order to estimate month-to-month shocks to aggregate output. The Canadian macroeconomic variables include the monthly time series for industrial production (CNY), the wholesale price index (CNP), M1 money supply (CNM), and bank credit (CNC) [4] for the period from January 1925 to December 1939. Given that Canada can be described as a small open economy bordered by the U.S., and following Cushman and Zha (1997), we assume that the U.S. economy represents the rest of the world in developing a VAR model of the Canadian economy. This assumption is consistent with Haubrich's (1990) finding that declining U.S. output during the Great Depression played a significant role in the fall of the Canadian output at that time. Due to this linkage, we included the U.S. index of industrial production. Our focal variable, or Canadian bank credit, is defined as the sum of current loans and discounts, call and short loans, and loans to the federal government, provincial governments, cities, towns, municipalities, and school districts. Since Canada entered World War II in the fall of 1939, a longer sample period would encompass a war-time economy and potentially contaminate the analyses. Also, despite the fact that the Depression in Canada started in July 1929 and ended in March 1933, it is well-known that this episode was the outcome of economic forces over a longer period, such that the sample period 1925-1939 encompasses the pre-Depression economic upswing, downturn, and later recovery periods.

Figure 1 provides graphs of the macroeconomic data series. As shown there, Canadian and U.S. industrial production had very similar patterns over the sample period (where both series have base 100 in January 1925). In the period 1929-1933 the wholesale price index sharply declined. Notice that bank credit expanded rapidly from 1925 to 1929 (i.e., about 70 percent in nominal terms) and, like the price level, sharply declined in the period 1929-1933 (i.e., about 35 percent). The co-movement of bank credit and output in the period 1925-1933 suggests that there may well be a relationship between the two variables. Certainly, the large decline in bank credit volume in the Canadian Depression implies that there was severe disruption of credit intermediation services at that time. Unlike the price level, bank credit continued to decline from 1933 to 1937 (i.e., a total decline from 1929 of about 50 percent). Money supply also increased prior to 1929 and then declined in the subsequent years but not as dramatically as bank credit. In contrast to bank credit but similar to output and price levels, money supply began to rebound after 1933.

As mentioned in the previous section, Safarian observed that the boom-bust cycle in Canadian bank credit from 1925 to 1937 was attributable to large swings in private and public investments in durable assets during these years. In this regard, he documented a rapid increase in Canadian durable goods investment prior to 1929. Comparing the years 1929 and 1937, Safarian (1959, p. 135) also noted that, while U.S. durable goods investment was 18.7 percent and 14.5 percent, respectively, of gross national expenditure (GNE) in these years, they were 24.6 percent and 15.5 percent, respectively, in Canada. Thus, durable investment recovered more slowly in Canada than in the U.S. Since banks were not allowed to make long-term or nonliquid loans, bank credit was commercial in nature, with little real estate exposure. For this reason a large proportion of durable goods investment would have been financed by the banking sector.

We should also mention that the Canadian economic recovery after 1933 suffered periodic interruptions, with a minor slowdown in early 1935 and later (like the U.S.) a steep recession in 1938 prior to World War II. These events are worth noting in view of forthcoming historical decompositions of output.

To generate historical decompositions of the variables under study, we employ Sims' (1980) vector auto regression (VAR) technique.[5] Historical decomposition analysis is especially useful in testing whether credit availability played an important role in Canadian output during the Depression. The main advantage of this approach

is that we can examine how Canadian output was affected by shocks from prices, money supply, bank credit, and U.S. output on a month-by-month basis. Unlike previous credit intermediation effect studies, we can observe both positive and negative credit shocks and the time path of these shocks during the sample period.

Defining Y_t as a vector of macroeconomic time series variables observed at time t, we estimate the following reduced-form VAR model

$$Y_t = \sum_{k=1}^{n} A_k Y_{t-k} + e_t , \qquad (1)$$

where A_k are matrices of coefficients to be estimated, n is the number of lags, e_t is the error term, and it is assumed that $\boldsymbol{\varepsilon}_t$is a $n \times 1$ vector of disturbances, such that: $E(\boldsymbol{\varepsilon}_t) = \mathbf{0}$, $E(\boldsymbol{\varepsilon}_t \boldsymbol{\varepsilon}_t') = \boldsymbol{\Sigma}$for all t, with $\boldsymbol{\Sigma}$an $n \times n$ positive-definite matrix and $E(\boldsymbol{\varepsilon}_t \boldsymbol{\varepsilon}_{t'}) = \mathbf{0}$for all $t \neq t'$.By partitioning the moving average representation of the VAR model in equation (1), an historical decomposition of Canadian output can be derived

$$Y_{t+j} = \sum_{s=0}^{j-1} A_s e_{t+j-s} + \sum_{s=j}^{\infty} A_s e_{t+j-s} , \qquad (2)$$

where $\sum_{s=0}^{j-1} A_s e_{t+j-s}$represents that part of Y_{t+j} due to shocks in period $t+1$ to $t+j$, and the term

$\sum_{s=j}^{\infty} A_s e_{t+j-s}$is the expected value of Y_{t+j} based on information available at time t. Equation (2) generates time series of shocks for each variable in the VAR system -- namely, for each variable it provides estimates of the shocks attributable to each of the other variables as well as itself (i.e., own shock).

Since VAR models are estimated as a reduced-form system and are subject to system-wide shocks, the estimated vector of shocks contains cross-equation feedback due to the contemporaneous influence of shocks in the other system equations. Sims used Cholesky factorization for purging the contemporaneous shocks from an equation in the system to other equations. However, the Cholesky decomposition of covariance matrix has been criticized on the ground that it imposes a semi-structural interpretation on the model being investigated. This and other criticisms led to the development of structural VAR models (Bernanke (1986), and Sims (1980, 1986)). However, these models contain many zero restrictions and do not allow the variables to fully capture the dynamics of the system by letting each variable be expressed in terms of all other variables in the system (as in standard versions of VAR models).

In view of this controversy, we developed and estimated two VAR models of the Canadian economy during the Great Depression: (1) a just-identified structural model and (2) a near-VAR model. The just-identified structural model is comprised of the following equations:

$$CNIN = f_1(CNIN, CNPX, CNMS, CNCR, USIN)$$

$$CNPX = f_2 (CNIN, CNPX, CNMS, CNCR)$$

$$CNMS = f_3 (CNIN, CNMS)$$

$$CNCR = f_4 (CNIN, CNPX, CNCR)$$

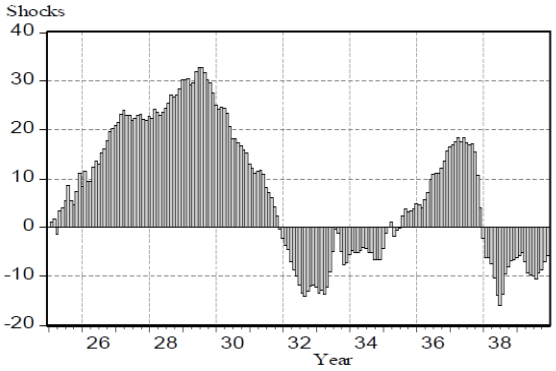
$$USIN = f_5 (USIN). \qquad (3)$$

In the near-VAR model the equations for the Canadian and the U.S. index of industrial production are as in the structural model. The equations for the Canadian price index, money supply, and credit contain only Canadian variables.

Empirical Results

Since the data are monthly, a VAR model of order 12 was specified and estimated (see Hamilton, 1994). Figures 2 to 5 show the estimated shocks to the Canadian index of industrial production from the four Canadian variables, as well as from the U.S. index of industrial production, over the sample period from 1925 and 1939 (i.e., the historical decomposition begins in 1926 due to 12 month lags in the variables). The Appendix reports the estimates used to construct these figures.

A. Shocks to Canadian output from credit based on the structural Model



Because the U.S. economy is large relative to Canada, the U.S. variable is ordered first before the other variables. Assuming no

contemporaneous feedback from Canada to the U.S., the order in the Canadian output equation (3) forf_1 is USIN, CNIN, CNPX, CNMS, CNCR. Nonetheless, we examine the sensitivity of the results to changes in the ordering of the variables also.

Because our focus is on Canadian output, to conserve space we only report the historical decomposition of Canadian index of industrial production. Historical decompositions of Canadian prices, money supply, credit, and U.S. output are available from the authors upon request. If Canadian output is substantially affected by positive or negative credit shocks, we infer that the evidence supports a credit intermediation effect.

B. Shocks to Canadian output from credit based on the near-VAR model

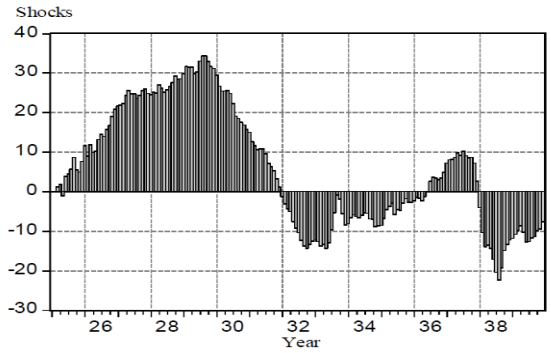


Figure 2. *Shocks to Canadian output from Canadian credit when variables are ordered as US output and Canadian output, prices money supply, and credit, 1925-1939*

Figure 2 shows how credit impacted output in our sample period using the structural model in panel A and the near-VAR model in panel B. As shown in panel A, the pre-Depression results prior to November 1931 indicate that positive shocks from credit availability played an important role in boosting Canadian output. These large, positive credit shocks are consistent with the rapid expansion of debt- financed durable goods investment discussed earlier. As reported in the Appendix, which provides the detailed results used to construct panel A of Figure 2, the maximum positive contribution of credit availability to output expansion occurred in July 1929, when a positive credit shock of 32.8 units accounted for about 25 percent of the Canadian output.

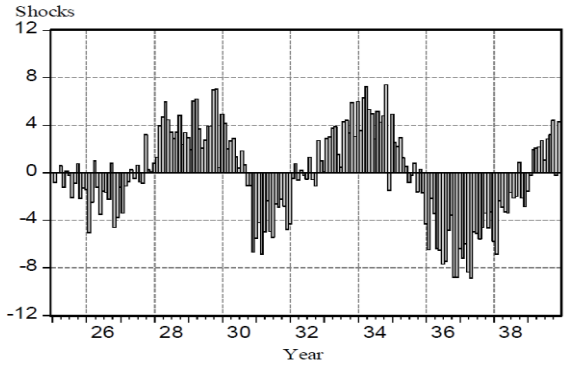
Negative credit shocks during the Depression began to impact Canadian output in December 1931, peaked in September 1932, and persisted through February 1935. Large negative credit shocks occurred in the period July 1932 to May 1933. Notice that credit shocks went from positive to highly negative in only six months. This means that the banking crisis in Canada precipitated and grew in intensity rapidly, not unlike the 2008-2009 global credit crisis. The speed and magnitude of negative bank credit shocks no doubt disrupted the intermediation of savings and credit flows in the financial system. Detailed results in the Appendix reveal that large negative credit shocks reduced output levels by about 15 percent in this period and were much higher in magnitude than other sources of shocks to output. Negative credit shocks again surged in 1938 and 1939, in which they are most important among the variables in explaining the economic slowdown in Canadian output at that time. Panel B in Figure 2 shows shocks to the Canadian index of industrial production from credit generated based on the historical decompositions using the near-VAR model. The pattern of these shocks is very similar to those obtained from the structural model (i.e., positive shocks before 1929 followed by negative shocks in the Depression years). Because of the close similarity of these two models' results, to conserve space we report only shocks generated from the structural model in forthcoming results.

Table 1. *Correlation coefficients between monthly contemporaneous and lagged annualized growth rates of credit availability (GRC) and credit shocks to the Canadian index of industrial production (CR) for the structural and near-VAR models*

Variables	Structural Model	Near-VAR Model
(GRCt, CRt)	0.54	0.55
(GRC t-6, CRt)	0.53	0.58
(GRCt-12, CRt)	0.57	0.61
(GRCt-18, CRt)	0.69	0.72
(GRC t-19, CRt)	0.69	0.74
(GRCt-20, CRt)	0.69	0.75
(GRCNCRt-21)	0.68	0.75
(GRCt-22, CRt)	0.67	0.75
(GRCt-23, CRt)	0.65	0.73
(GRCt-24, CRt)	0.63	0.71

Table 1 shows the correlation coefficients between the contemporaneous and lagged annualized growth rates of credit availability and credit shocks to the Canadian index of industrial production for the two models. The correlation coefficients are larger for more lagged values of the credit growth rates.For example, the maximum correlation occurs when the growth rate of credit availability is lagged 20 months. Thus, the maximum impact of a credit shock on the index of industrial production occurred after 20 months.

A. Shocks to Canadian output from the Canadian money supply



B. Shocks to Canadian output from Canadian price index

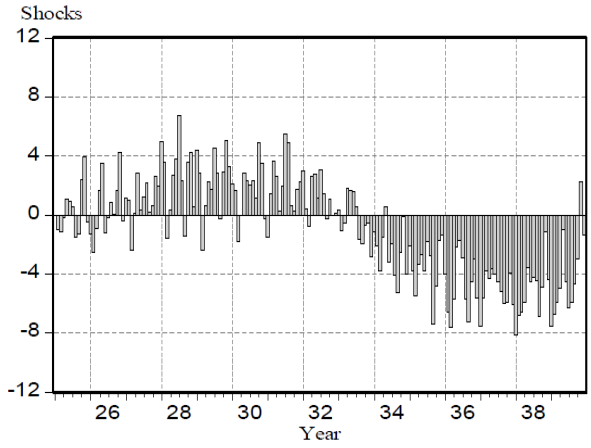
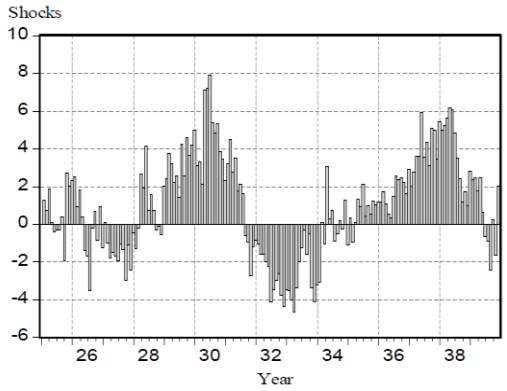


Figure 3. *Shocks to Canadian output from Canadian money supply and prices, 1925-1939*

Figure 3 shows shocks to the Canadian index of industrial production from Canadian money supply and price in panels A and B, respectively, using the structural model. Results for the near-VAR model are the same for the most part. As shown in panel A, negative money supply shocks began to impact Canadian output from October 1930 and reached a peak of –6.9 in March 1931. In this respect Bordo and Redish (1990, p. 362) have argued that Canadian banks themselves were responsible for monetary contraction. Banks were considerably below their available lines of credit from the Department of Finance, which restrained high-powered bank reserves. As noted by Safarian (1959, p. 16), banks' reticence to borrow from the government stemmed from not only declining credit demand (due to decreases in both exports and consumption) but pressure on banks to decrease their credit exposures and raise liquidity. At times the Canadian government acted to forcefully increase bank reserves but bank loans continued to fall despite these occasional interventions. Concerning price effects, we find both positive and negative shocks to Canadian output from changes in the price level during the Great Depression episode of 1929-1933.

A. Shocks to Canadian output from Canadian output (own shocks)



B. Shocks to Canadian output from U.S. output

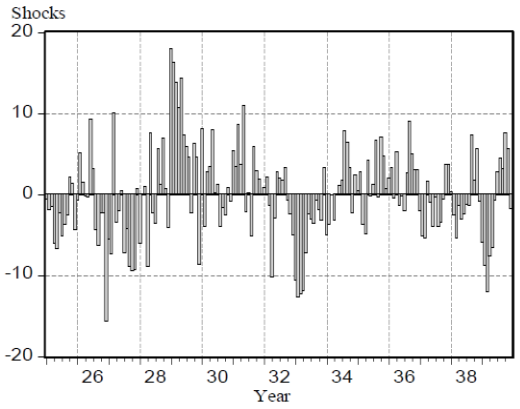
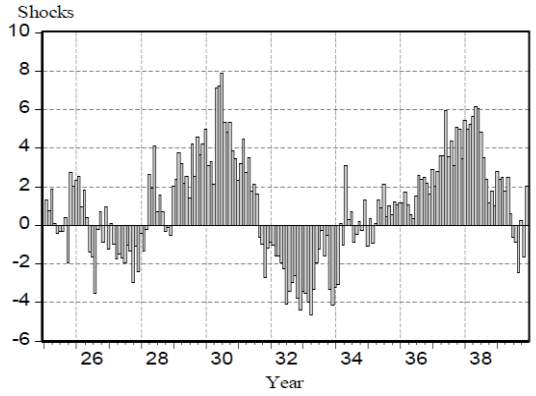


Figure 4. *Output shocks, 1925-1939*

The adverse impact of negative shocks from credit, money supply, and prices were exacerbated by output shocks from the U.S. as well as own shocks (shocks to Canadian output from Canadian output). Figure 4 shows shocks to Canadian output from own output and U.S. shocks based on the structural model. Panel A of Figure 4 shows that negative shocks from the Canadian output to Canadian output (own shocks) began in September 1931 and reached a peak of -4.7 in April 1933, one month after the announcement of a Bank Holiday in the U.S. As shown in panel B, positive shocks from U.S. output played a significant role in the expansion of Canadian output prior to the Depression. Persistent negative shocks from U.S. aggregate output to Canadian index of industrial production began in October 1932 and peaked in March 1933. At their height U.S. output had as large a negative effect on Canadian output. The large, negative U.S. influence on Canadian output is consistent with Safarian and Haubrich. Also, these results are consistent with Betts, Bordo, and Redish, who observed that there were very close similarities in aggregate fluctuations in Canada

and the U. S. due to the close economic ties between the countries.

A. Shocks to Canadian output from credit based on the structural model



B. Shocks to Canadian output from credit based on the near-VAR model

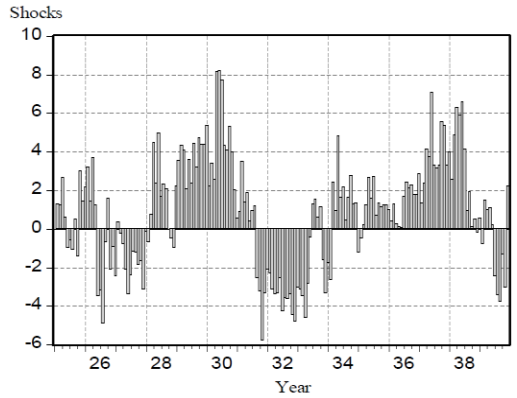


Figure 5. *Shocks to Canadian output from Canadian credit when variables are ordered as U.S. output and Canadian credit, prices, money supply, and output, 1925-1939*

To examine the sensitivity of the results to the ordering of the variables in the VAR model, the variables in the Canadian output equation f_1 were alternatively ordered as USIN, CNCR, CNPX, CNMS, CNIN. As Figure 5 shows, changing the order of the variables does not alter the patterns of the shocks from credit to Canadian output.

CONCLUSION

The present study examined the relationship between bank credit and macroeconomic activity in Canada during the Great Depression. Employing macroeconomic data series and VAR analyses, we provided historical decomposition results for Canadian output with respect to shocks in Canadian output, wholesale prices, money supply, bank credit, and U.S. industrial production during the period 1926-1939. In brief, prior to the economic collapse in 1929, we found that the rapid expansion of bank credit to help finance the extraordinary growth of durable goods investment at that time was a major factor in explaining Canadian output increases. After the crash of 1929, negative credit shocks had a strong dampening effect on output from mid-1931 to year-end 1933. Bank credit shocks in this period rivaled Canadian and U.S. output shocks and exceeded negative shocks from prices and money supply. Bank credit shocks continued to be a salient factor in explaining the Canadian economic downturn in 1938 and economic rebound in 1939. Thus, decomposition results for Canadian output in the years surrounding the Great Depression support Bernanke's credit intermediation hypothesis. We conclude based on these findings that, even in the presence of government bailouts, widespread bank distresscan cause serious credit intermediation effects on economic productivity.

The 2008-2009 Great Recession in Europe and the U.S. due to massive credit losses on home mortgagerelated assets and spillover effects on the banking system and financial markets provides anecdotal support for this conclusion. A number of large bank and securities firm failures were triggered by credit losses that ignited a global liquidity crisis. U.S. regulators acted to inject capital into distressed banks.Moreover, the Federal Reserve offered discount window services to a wide variety of market participants to overcome liquidity problems in the financial system. Similar government interventionswere implemented in many European countries.While theseinterventions prevented major bank insolvencies and mitigated associated credit effects, economic output can be depressed for extended periods of time due to continued credit effects. An important policy implication is that, after financial system crises and credit shocks, bank regulatory and monetary authorities need to restore credit markets to normal conditions to foster economic growth and stability. In this regard, we propose that credit should be more prominently recognized as an economic goal among policymakers in much the same way as output, employment, prices, and trade.

FOOTNOTES

- Our focus on bank credit shocks is consistent with monetary economics studies by Lucas (1972), Barro (1978), Sargent and Wallace (1975) and others. These authors have argued that, because rational expectations theory posits neutral responses of output or employment with respect to anticipated changes in macroeconomic variables,

unanticipated changes in these variables better explain output or employment responses over time.

- In the later published version, Betts, Bordo, and Redish (1996) downplayed their earlier working paper's inference about Bernanke's bank credit intermediation.
- Nonetheless, they observed that the significant unanticipated deflation in 1930 and 1931 was likely related to bankruptcies and financial crises.
- Specifically, the dependent variable in the OLS regression model is the rate of growth of industrial production (relative to the exponential trend), and the independent variables are the rate of growth of M1 (nominally and seasonally adjusted) less the predicted rate of growth and the rate of growth of the wholesale price index less its predicted growth.
- We would like to express special thanks to Dr. Angela Redish, Department of Economics, University of British Columbia, for valuable assistance in collecting the data series.
- This data series covered the period 1925-1939. Canadian data were gathered from the following resources:*Monthly Review of Business Statistics*, Department of Trade and Commerce, Dominion Bureau of Statistics, General Statistics Branch, selected issues; and *1946 Supplement Bank of Canada Statistical Summary*, Bank of Canada. U.S. data was obtained from *Banking and Monetary Statistics*, Board of Governors of the Federal Reserve System, selected issues.
- The VAR methodology has been utilized in many studies on the validity of hypothesized relationships between macroeconomic variables (e.g., see King 1985, Litterman and Weiss 1985, and Bernanke 1986). RATS developed by ESTIMA (Evanston, IL) was used in the computation of the models.

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Appendix. *Historical decomposition of the Canadian index of industrial production*

Date	Credit Shocks	Money Shocks	Price Shocks	Canadian Output Shocks	U.S. Output Shock	Output After Shocks	Output Before Shocks
1925M01	0.0	0.0	0.0	0.0	-0.5	79.2	79.7
1925M02	1.1	-0.9	-1.0	1.3	-1.9	79.6	81.0
1925M03	1.7	-0.1	-1.2	0.7	-1.5	78.4	78.7
1925M04	-1.4	0.6	-0.2	1.8	-6.1	77.9	83.3
1925M05	3.4	-1.2	1.1	0.1	-6.8	78.8	82.2
1925M06	4.0	0.1	0.9	-0.4	-2.3	84.7	82.4
1925M07	5.4	-0.3	0.6	-0.3	-5.1	80.9	80.7
1925M08	8.5	-2.1	-1.5	-0.4	-3.7	84.7	83.9
1925M09	5.4	-0.9	-1.3	0.4	-2.6	84.2	83.3
1925M10	4.6	0.8	2.4	-1.9	2.2	93.7	85.7
1925M11	7.3	-2.2	3.9	2.7	1.3	100.1	87.1
1925M12	11.2	-1.3	-0.5	2.0	-4.4	91.8	84.8
1926M01	8.4	-1.4	-1.3	2.3	-0.8	93.4	86.2
1926M02	11.4	-5.0	-2.5	2.5	5.1	97.5	86.1
1926M03	9.3	-2.5	-0.9	0.9	1.4	94.2	86.0
1926M04	9.5	1.0	1.6	1.8	-0.2	101.2	87.5
1926M05	12.4	-1.2	3.5	0.4	-0.3	102.4	87.7
1926M06	13.4	-3.5	-1.2	-1.4	9.3	103.8	87.3
1926M07	13.0	-1.6	-0.2	-1.7	3.1	99.8	87.2
1926M08	15.1	-1.7	0.8	-3.5	-4.5	94.7	88.4
1926M09	15.9	-2.3	0.0	-0.2	-6.3	95.5	88.4
1926M10	17.8	0.8	1.6	0.7	-2.2	108.0	89.3
1926M11	19.6	-4.6	4.2	-0.9	-2.3	105.3	89.3
1926M12	20.2	-3.8	-0.5	0.9	-15.6	89.6	88.3
1927M01	20.8	-1.2	1.1	-1.2	-5.6	102.2	88.4
1927M02	21.4	-3.4	0.9	0.1	-7.3	100.1	88.4
1927M03	23.1	-1.2	-2.4	-1.0	10.1	116.9	88.3
1927M04	23.9	-0.8	0.1	-1.8	-3.4	106.6	88.5
1927M05	22.9	0.2	2.8	-1.5	-2.1	110.8	88.5
1927M06	23.1	-0.5	0.3	-1.7	0.4	109.5	87.9
1927M07	21.9	0.6	1.2	-1.9	-7.2	102.3	87.8
1927M08	22.2	-0.8	2.1	-1.1	-4.2	106.2	88.0
1927M09	22.9	-0.9	0.2	-1.4	-8.8	99.9	87.9
1927M10	23.1	3.2	0.6	-3.0	-9.4	102.5	88.0
1927M11	22.1	0.2	2.6	-1.1	-9.4	102.2	87.8
1927M12	22.0	0.1	1.9	-2.4	0.7	109.3	87.1
1928M01	22.6	0.8	4.9	-0.5	-6.1	108.5	86.7
1928M02	22.3	1.3	3.6	-1.4	-0.1	112.4	86.6
1928M03	24.2	4.0	-1.6	-0.3	1.0	113.8	86.5
1928M04	23.6	4.7	0.3	2.6	-9.0	108.7	86.4
1928M05	22.9	5.9	2.6	1.9	7.5	127.1	86.2
1928M06	23.5	4.4	3.8	4.1	-2.3	119.2	85.7
1928M07	24.4	3.4	6.7	0.7	-3.6	117.0	85.3
1928M08	25.4	2.9	2.3	1.5	5.5	122.9	85.3
1928M09	27.1	3.4	-1.5	0.7	1.2	116.2	85.2
1928M10	26.6	4.8	3.6	-0.3	6.9	126.7	85.1
1928M11	27.1	2.4	4.2	-0.2	0.7	119.0	84.9
1928M12	28.4	3.4	0.5	-0.6	-4.1	111.9	84.3
1929M01	30.3	2.9	4.3	2.0	18.0	141.4	84.0
1929M02	30.3	1.9	2.8	2.4	16.3	137.4	83.8

1929M03	30.5	6.0	-2.5	3.7	13.8	135.4	83.8
1929M04	29.2	6.2	0.6	3.2	10.7	133.6	83.7
1929M05	29.5	3.6	2.3	2.2	14.2	135.3	83.5
1929M06	31.8	2.1	1.7	2.5	7.3	128.5	83.1
1929M07	32.8	2.7	4.5	1.4	5.8	130.1	82.8
1929M08	32.7	3.9	2.8	4.2	4.6	131.0	82.8
1929M09	31.5	3.9	-0.3	2.5	-2.3	118.1	82.8
1929M10	30.2	6.9	2.9	4.6	6.2	133.6	82.8
1929M11	29.6	7.0	5.0	3.6	4.6	132.5	82.7
1929M12	27.5	0.4	3.3	4.2	-8.6	109.1	82.3
1930M01	24.9	4.9	2.0	5.0	8.1	127.1	82.1
1930M02	24.2	4.1	1.6	3.1	-4.0	111.2	82.2
1930M03	24.5	2.0	-1.8	3.3	2.8	113.0	82.2
1930M04	24.5	2.7	-0.1	2.1	3.4	114.9	82.3
1930M05	23.3	2.9	2.8	7.1	8.0	126.3	82.2
1930M06	20.7	1.3	2.3	7.2	0.2	113.7	82.0
1930M07	18.0	0.3	2.0	7.9	1.2	111.4	81.9
1930M08	18.1	1.8	2.3	5.3	-4.0	105.6	82.0
1930M09	17.3	0.7	1.1	4.8	-1.7	104.5	82.2
1930M10	16.7	-1.1	4.9	5.3	-2.6	105.6	82.4
1930M11	15.8	-1.1	3.5	3.8	0.8	105.2	82.4
1930M12	15.2	-6.7	-0.3	3.4	-0.9	93.2	82.3
1931M01	13.0	-5.5	-1.5	2.3	5.3	95.9	82.4
1931M02	12.1	-4.2	1.4	3.2	3.4	98.5	82.6
1931M03	11.1	-6.9	3.6	4.5	8.5	103.6	82.8
1931M04	11.5	-5.0	2.6	2.7	3.6	98.5	83.0
1931M05	11.8	-2.4	0.3	3.5	10.9	107.1	83.1
1931M06	10.8	-4.9	2.0	1.8	-2.2	90.6	83.2
1931M07	8.1	-5.4	5.5	2.1	0.2	93.7	83.3
1931M08	7.1	-2.6	4.9	1.6	-5.1	89.5	83.6
1931M09	6.1	-2.9	0.6	-0.6	5.9	92.9	83.9
1931M10	4.2	-2.3	0.2	-1.0	2.9	88.3	84.2
1931M11	2.2	-2.8	1.7	-2.8	1.8	84.6	84.4
1931M12	-0.3	-4.8	2.3	-1.2	-0.1	80.5	84.6
1932M01	-2.3	-4.3	3.0	-0.9	0.8	81.1	84.8
1932M02	-3.7	-0.5	0.4	-1.1	2.1	82.4	85.2
1932M03	-4.6	0.7	-0.8	-1.6	-1.4	78.0	85.6
1932M04	-7.0	-0.6	2.6	-1.6	-10.2	69.1	86.0
1932M05	-8.7	0.2	2.7	-2.0	-2.9	75.6	86.2
1932M06	-9.9	-0.3	1.1	-2.3	2.8	78.0	86.5
1932M07	-12.0	-0.6	3.1	-4.1	2.0	75.2	86.8
1932M08	-13.6	1.3	1.4	-3.5	1.7	74.6	87.2
1932M09	-14.1	-0.6	-0.3	-3.0	3.3	72.9	87.7
1932M10	-13.2	-1.2	1.0	-2.6	-0.7	71.4	88.1
1932M11	-12.1	2.7	0.0	-3.8	-2.4	72.8	88.5
1932M12	-11.9	1.0	0.1	-4.4	-5.1	68.6	88.8
1933M01	-12.4	0.0	0.3	-3.5	-10.6	63.1	89.2
1933M02	-13.5	2.9	-1.1	-3.5	-12.7	61.7	89.7
1933M03	-12.9	3.0	-0.6	-4.0	-12.2	63.4	90.2
1933M04	-13.6	3.8	1.8	-4.7	-11.9	66.0	90.6
1933M05	-12.3	3.8	1.6	-3.4	-7.1	73.7	91.1
1933M06	-9.2	1.5	1.6	-2.0	-2.4	80.9	91.4
1933M07	-4.9	0.5	0.5	-1.2	-3.0	83.7	91.9
1933M08	-0.4	4.3	-1.6	-0.3	-3.6	90.7	92.4
1933M09	-1.4	4.4	-2.0	-1.6	-0.8	91.5	92.9
1933M10	-5.0	3.3	-0.7	-0.5	-1.9	88.6	93.5
1933M11	-7.6	5.9	-0.5	-3.4	-3.2	85.1	93.9
1933M12	-7.3	3.0	-2.9	-4.2	3.2	86.3	94.4
1934M01	-5.6	6.0	-1.2	-3.2	-5.1	85.7	94.8
1934M02	-4.8	3.5	-2.1	-3.1	-3.7	85.2	95.4

1934M03	-5.2	6.3	-3.8	0.1	0.0	93.3	96.0
1934M04	-5.3	7.2	-1.5	-1.1	-3.2	92.7	96.5
1934M05	-4.7	5.3	0.5	3.0	0.0	101.3	97.0
1934M06	-4.0	4.9	-3.2	0.3	1.0	96.5	97.5
1934M07	-4.3	2.8	-2.0	0.7	1.7	96.9	98.0
1934M08	-5.3	5.1	-4.1	-0.9	7.8	101.2	98.6
1934M09	-5.2	4.2	-5.3	-0.5	6.5	98.9	99.2
1934M10	-6.7	4.8	-2.5	0.2	3.3	98.8	99.8
1934M11	-6.7	7.4	-0.1	-0.3	-2.3	98.3	100.3
1934M12	-6.6	-1.5	-4.1	1.3	2.4	92.3	100.8
1935M01	-4.3	4.9	-2.1	-1.1	0.4	99.2	101.4
1935M02	-1.3	2.5	-3.8	0.3	2.8	102.5	102.0
1935M03	0.0	2.2	-5.5	-1.0	-3.8	94.6	102.6
1935M04	1.1	2.9	-3.4	0.0	-4.8	99.1	103.2
1935M05	-1.8	1.2	-2.8	1.3	4.2	105.9	103.8
1935M06	-0.5	0.5	-3.8	0.9	-0.3	101.1	104.3
1935M07	-0.1	-0.9	-1.8	2.1	1.2	105.4	104.9
1935M08	2.2	-0.2	-2.8	0.4	6.7	111.8	105.5
1935M09	3.8	0.8	-7.4	1.0	-0.4	103.9	106.1
1935M10	3.1	-1.6	-4.8	0.5	7.1	111.0	106.7
1935M11	3.3	0.2	-1.7	1.2	4.7	115.1	107.3
1935M12	3.8	-1.7	-1.4	1.0	0.7	110.3	107.9
1936M01	4.7	-4.3	-4.1	1.1	1.9	107.9	108.5
1936M02	4.6	-6.5	-6.6	1.1	3.3	105.0	109.1
1936M03	4.0	-2.2	-7.6	1.7	-0.5	105.2	109.8
1936M04	5.6	-3.5	-5.7	1.0	5.2	113.1	110.4
1936M05	7.0	-6.4	-2.2	0.5	-1.5	108.5	111.0
1936M06	9.7	-6.6	-1.8	0.3	-0.3	113.0	111.6
1936M07	10.9	-7.7	-2.9	1.5	-2.0	112.0	112.2
1936M08	11.0	-7.5	-5.8	2.6	2.6	115.8	112.9
1936M09	11.1	-4.8	-7.3	2.3	9.0	123.9	113.6
1936M10	12.1	-3.6	-4.6	2.5	4.9	125.5	114.2
1936M11	13.5	-8.8	-3.0	2.2	3.1	121.7	114.8
1936M12	15.6	-8.8	-5.7	1.6	3.0	121.1	115.5
1937M01	16.5	-6.4	-7.6	2.9	-2.1	119.4	116.1
1937M02	17.0	-7.3	-5.6	2.0	-5.1	117.7	116.8
1937M03	17.5	-6.0	-3.8	2.8	-5.4	122.4	117.4
1937M04	18.3	-8.4	-4.3	3.6	1.5	128.8	118.1
1937M05	17.4	-8.9	-3.7	3.6	-1.1	126.1	118.7
1937M06	18.3	-5.0	-4.0	5.9	-3.9	130.6	119.4
1937M07	17.3	-5.2	-4.5	3.5	-0.3	130.9	120.0
1937M08	17.0	-5.6	-5.2	4.3	-4.0	127.2	120.7
1937M09	17.1	-4.6	-6.0	3.1	-3.5	127.5	121.4
1937M10	15.4	-3.4	-5.9	5.1	-0.7	132.6	122.1
1937M11	10.6	-4.7	-4.0	5.0	3.7	133.5	122.8
1937M12	4.0	-3.3	-6.1	3.5	3.7	125.2	123.4
1938M01	-2.3	-5.8	-8.2	5.4	0.3	113.5	124.1
1938M02	-6.1	-6.9	-6.9	5.0	-2.5	107.4	124.8
1938M03	-6.2	-2.4	-6.6	5.2	-5.4	110.2	125.5
1938M04	-7.5	-2.9	-5.9	5.6	-1.4	114.2	126.2
1938M05	-10.5	-3.3	-3.6	6.1	-3.1	112.5	126.9
1938M06	-13.9	-3.4	-4.6	6.0	-2.4	109.3	127.6
1938M07	-16.1	-1.7	-4.3	4.8	-1.3	109.8	128.3
1938M08	-13.6	-2.2	-4.5	3.5	-1.5	110.8	129.0
1938M09	-9.7	-2.0	-6.9	2.4	7.2	120.7	129.8
1938M10	-8.2	0.9	-4.9	1.1	1.7	121.1	130.5
1938M11	-6.9	-2.1	-1.2	1.7	5.6	128.3	131.2
1938M12	-6.6	-2.9	-4.4	1.0	-0.9	118.1	131.9
1939M01	-6.1	-1.6	-7.6	2.8	-5.9	114.2	132.6
1939M02	-5.8	-0.2	-6.8	2.3	-8.7	114.1	133.3

1939M03	-5.3	1.9	-5.9	2.4	-12.0	115.2	134.1
1939M04	-7.0	2.1	-5.0	1.8	-7.6	119.1	134.8
1939M05	-9.3	2.2	-1.0	2.4	-6.6	123.3	135.6
1939M06	-9.8	2.7	-4.5	0.6	-0.8	124.4	136.3
1939M07	-10.0	1.0	-6.3	-0.7	2.8	123.9	137.0
1939M08	-10.7	2.8	-5.9	-0.9	4.4	127.5	137.8
1939M09	-9.5	3.2	-4.7	-2.5	3.2	128.3	138.6
1939M10	-8.8	4.4	-3.0	0.2	7.6	139.7	139.3
1939M11	-7.1	-0.2	2.2	-1.7	5.7	139.0	140.1
1939M12	-5.7	4.3	-1.4	2.0	-1.8	138.2	140.8

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