

The universal banking feedback effect: U.S. and Canada evidence

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Abstract

Bank non-traditional business lines have significant feedback effects on both economic activity and the stock market. These effects appear in the non-interest income series after the 1997 structural break. Based on U.S. and Canadian data, we also find that the banking cycle tends to lead the business cycle in both countries over the whole sample period (first quarter of 1984 to last quarter of 2013), and particularly in the last decades. Despite these results, the impact of monetary policy on net interest income growth remains surprisingly stable after the emergence of universal banking.

Keywords: Universal banking; Banking cycle; VAR; feedback effects.
JEL classification: C32; G20; G21.

L'effet de rétroaction du banking universel : expérience américaine et canadienne

Les activités bancaires non traditionnelles exercent des effets de rétroaction importants sur l'activité économique et les marchés boursiers. Ces effets se manifestent dans les séries sur les revenus autres que d'intérêt à la suite du changement structurel de 1997. Sur la base des données américaines et canadiennes, nous trouvons aussi que le cycle bancaire tend à devancer le cycle économique dans les deux pays au cours de la période échantillonnale (premier trimestre de 1984 au dernier trimestre de 2013), et plus particulièrement durant les dernières décennies. En dépit de ces résultats, l'impact de la politique monétaire sur la croissance du revenu net d'intérêt demeure très stable à la suite de l'émergence du banking universel.

Mots-clefs : Banking universel; cycle bancaire; VAR; effets de rétroaction.
Classification JEL: C32; G20; G21.

1. Introduction

Since the revision of the *Bank Act* of 1987 and its subsequent amendments, the traditional four pillars¹ of Canadian banking have progressively been blurred by the rise of universal banking. In the U.S., commercial banks and investment bankers coexisted as separate entities until the subprime crisis but commercial banks have been absorbing the investment banking industry since that time (Saunders et al., 2014). The advent of universal banking may have important repercussions, both in terms of banking cyclicity and the business cycle. For example, since the credit cycles tend to destabilize the economy (e.g., Kiyotaki and Moore, 1997), universal banking could help mitigate this impact thanks to the diversification benefits it entails (Calmès and Théoret, 2015). Indeed, fee-based activities might be less cyclical than traditional banking and provide valuable buffer against fluctuations. On the other hand, banking is also influenced by macroeconomic factors—such as GDP growth—and financial factors—like interest rates and the stock market, and it is also possible that the impact of these factors on the various components of banking activities—e.g., traditional versus fee-based—has changed.

The RBC models embedding financial intermediation feature a banking cycle related to firm’s bankruptcy costs, and the impact of banks on the real sector is propagated through a credit supply effect or a financial accelerator (Williamson 1987; Bernanke et al., 1999). More recent papers try to take also into account bank non-traditional activities and assume that financial institutions are confronted with financial or capital constraints aside non-financial borrowers (e.g., Gertler and Kiyotaki, 2011; Dewachter and Wouters, 2014). Interestingly, in this kind of models, the feedback effect from the banking to the real sector may be substantial. In the same vein, some financial models put the emphasis on the tail-risk (systemic risk) driven by diversification in off-balance-sheet activities such as securitization (e.g., Shleifer and Vishny, 2010; Gennaioli et al., 2013).

However, on the empirical front, researchers tend to focus on the relationship between loan defaults and the credit cycle, but they rarely incorporate fee-based activities explicitly (e.g., Bikker and Hue, 2002; Jacobson et al., 2005; Marcucci and Quagliariello, 2006). In general, studies on bank fee-based activities are more focused on the instability generated by these activities and the lack of overall diversification they entail², than on the relative cycles of traditional and fee-based activities *per se* (Stiroh, 2004; Stiroh and Rumble, 2006; Calmès et Liu, 2009; Calmès and Théoret, 2010, 2014). Following the SVAR approach first introduced by Peersman and Wagner (2014), this paper aims at studying both the U.S. and Canadian banking income cyclicity—and particularly the feedback effect these cycles may have on the real economy—on a period stretching from 1984 to 2013. Peersman and Wagner (2014) find that securitization indeed has an important feedback effect on U.S. real GDP over the period 1970-2008³.

¹ i.e., banking, insurance, fiduciary and brokerage activities.

² Brown (2010) refers to the myth of diversification to qualify this situation. In fact, “overdiversification” in OBS activities reduces idiosyncratic risk but increases systematic risk which progresses towards systemic risk because of the interconnectedness between financial institutions overdiversification entails. Neglect of this systemic risk, or tail risk, evolves toward a financial crisis (Gennaioli et al., 2013).

³ According to Peersman and Wagner (2014), a securitization shock leads to a permanent rise of real GDP. Its effects are similar to a conventional technological shock in standard RBC models. The authors also find that an expansionary monetary policy shock leads to an increase in securitization in their model.

In this study instead, we concentrate on the three sources of banking cyclicality (shocks to GDP growth, to the stock market and to the short-term interest rate) and our VAR experiments aim primarily at gauging the feedback effect of banks' fee-based activities on the real sector. Our main contribution is to show that the feedback effects from banks' non-traditional activities to the stock market are particularly pronounced, and actually stronger than the ones associated with the real economy. We also find that the feedback effect from non-traditional activities, to both the real sector and to the stock market, is more significantly at play after 1997—this year corresponding to a structural break in the Canadian and U.S. shares of non-interest income in net operating income (Calmès and Théoret, 2010)⁴. In line with the standard bank duration gap model, our analysis supports the idea that net interest income reacts negatively to the short-term interest rate. In other words, our results suggest that monetary policy continues to impact net interest income in the same way, despite the multiplication of hedging vehicles and the influence of universal banking.

This article is organized as follows. Section 2 presents the VAR methodology we use in this paper. Section 3 provides the data sources and exposes the stylized facts related to the banking cycle in both countries. In section 4 we analyze our VAR experiments before concluding in Section 5.

2. Methodology

We rely on VAR (vector autoregression) to study the impact of business cycles and financial fluctuations on bank income flows. We compute the impulse response functions (IRF) of the two income flows—i.e., net interest and non-interest—to shocks to the short-term interest rate, GDP growth and the return of the stock market portfolio. An impulse response function is computed using a vector autoregressive system (VAR) defined as follows: $\mathbf{Y}_t = \mathbf{A}_0 + \sum_{i=1}^n \mathbf{A}_i \mathbf{Y}_{t-i} + \boldsymbol{\varepsilon}_t$ where \mathbf{Y}_t is the vector of endogenous variables included in the VAR. If the matrix of the residuals ($\boldsymbol{\varepsilon}_t$) is diagonal, the identification of the shocks associated with the variables is straightforward. For instance, if there are two variables—say a real variable and financial variable—the residuals matrix provides directly on its diagonal the respective shocks related to these variables—i.e., the real shock and the financial shock. However, the residuals are usually correlated so that the residuals matrix is not diagonal. Hence, we need a method to identify the shocks related to the variables of the VAR. Sims (1980) proposes the Cholesky decomposition of the reduced form residuals' covariance matrix, but to avoid the variables ordering dependency, we rely on the generalized impulse response analysis (Pesaran and Shin, 1998).

To build the IRF, we first transform the VAR equation into its infinite moving average representation—i.e., an $\text{MA}(\infty)$ (Wold, 1938; Hamilton, 1994, p. 318-319). Then, we compute the partial derivative of the $\text{MA}(\infty)$ as follows: $\frac{\partial Y_t}{\partial \varepsilon_t} = \Psi_s$, where ε_t is the vector of innovations of the $\text{MA}(\infty)$

⁴ Peersman and Wagner (2014) do not investigate structural breaks in their sample.

representation. The last step consists in plotting the row i , column j element of Ψ_s —i.e., the $\frac{\partial Y_{i,t+s}}{\partial \varepsilon_{jt}}$.

This plot is the IRF. Each VAR is composed of the two income flows expressed in logarithmic differences or growth rates, and of one of the three variables associated with shocks: the change in the short-term interest rate⁵, the rate of growth of GDP and the return on the stock market portfolio. We compute these VAR for the aggregate of U.S. and Canadian banks.

3. Data and stylized facts

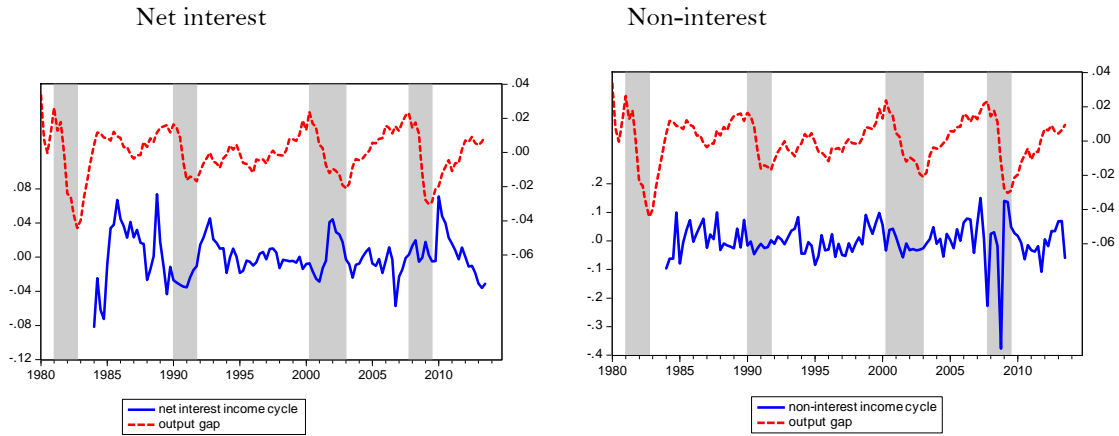
3.1. Data

We estimate our VAR on two samples: the U.S. sample of all commercial banks, and the sample of all Canadian banks. The U.S. banks' statistics span the period ranging from the first quarter of 1984 to the fourth quarter of 2013. These statistics are provided by the Federal Deposit Insurance Corporation (FDIC). U.S. macroeconomic and financial time series are drawn from FRED, a database managed by the Federal Reserve Bank of St-Louis. The Canadian banks' sample comes from the Canadian Bankers Association, the Office of Superintendent of Financial Institutions, and the Bank of Canada. Finally, Canadian data on macroeconomic and financial time series are drawn from Cansim (from Statistics Canada).

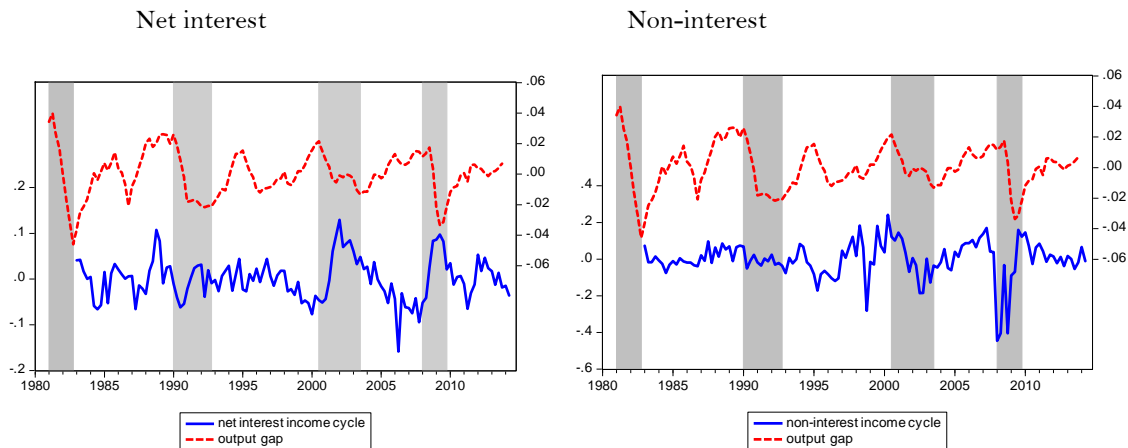
⁵ Since the series related to the short-term interest rate is not stationary, we include it in first differences in the VAR.

Figure 1 Net interest and non-interest income cycles: U.S. and Canada

Panel A: U.S.



Panel B: Canada



Notes: Shaded areas are associated with periods of economic slowdown. To compute the quarterly output gap, we first take the log of real GDP. We then detrend this transformed series with the Hodrick-Prescott filter using a smoothing coefficient (λ) equal to 1600—the trend of the series being a measure of potential output. The resulting residuals are the output gap measure.

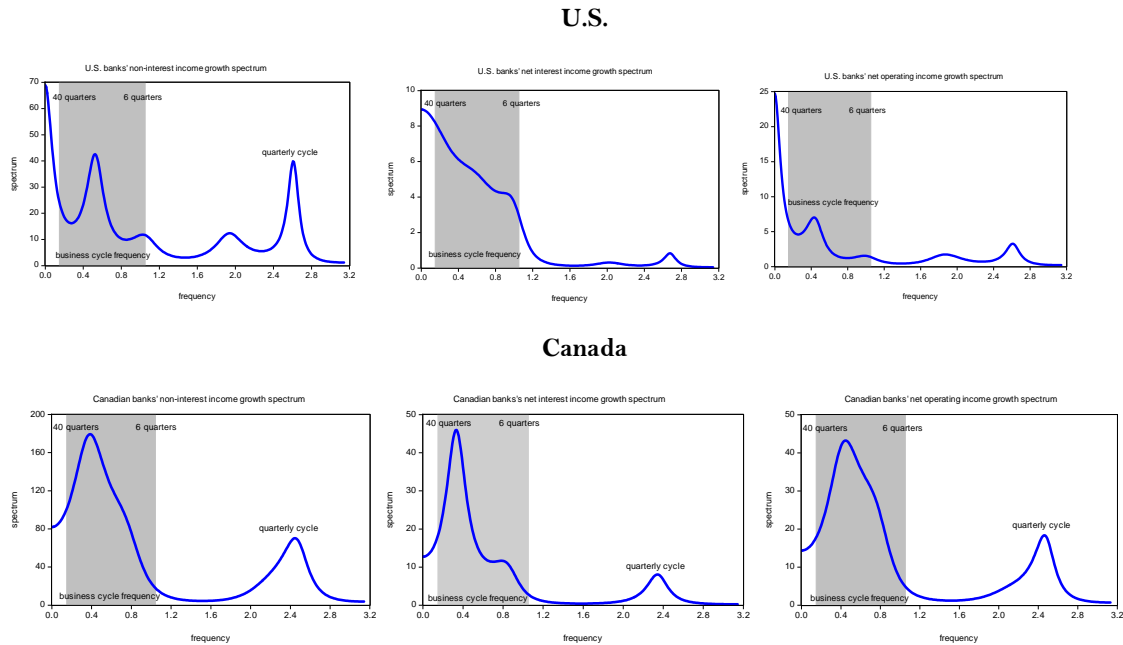
3.2. Stylized facts

3.2.1 Banking cyclicality

Figure 1 provides the cycles of net interest and non-interest income growth computed with the Hodrick-Prescott filter. U.S. banks show no obvious cycle for net interest income growth while, for Canadian banks, the growth tends to be higher during recessions. Net interest income growth thus tends

to be countercyclical in Canada⁶. Regarding non-interest income growth, there is also more procyclicality in the Canadian than in the U.S. series. These observations are supported by the spectral analysis of the growth of bank income flows (Figure 2). In the U.S., non-interest income growth shows a moderate peak at business cycle frequency—between 6 and 40 quarters (DeJong and Dave, 2007)—and another one at the quarterly frequency. The spectrum of U.S. bank net interest income growth displays no obvious cycle at business cycle frequency. It rather indicates that the series is persistent. The spectrum of U.S. bank net interest income growth displays no obvious cycle at business cycle frequency. It rather indicates that the series is persistent.

Figure 2 Spectral analysis of bank income components: U.S. and Canadian banks



Notes: These spectra are built using an $AR(p)$ model. Specifically, the spectrum is a decomposition of the variance of a time series by frequency—the cycle frequency being low near the origin and increasing progressively till π . Comparisons of the height of the spectrum for alternative values of frequency indicate the relative importance of fluctuations at the chosen frequencies in influencing variance of the time series. A spectrum having a peak near the origin indicates that the series is very persistent through time: its autocorrelation function declines very slowly. A spectrum having a peak in the shaded area indicates that this time series has a cycle in the conventional business cycle frequency. A spectrum which shifts to the left through time indicates less volatility for the series, i.e. a more stable series. Shaded areas correspond to the business cycle frequency, which is comprised between 6 and 40 quarters (DeJong and Dave, 2007).

⁶ Net interest income thus acts as a buffer during bad times.

In Canada, non-interest income growth has a clearer peak at business cycle frequency, which is stronger than the U.S. one according to the ordinate of the spectrum. We also observe a peak at the quarterly frequency. In contrast to the U.S., the spectrum of net interest income growth indicates that the series has a standard cycle, but less pronounced than the one of non-interest income growth.

Table 1 Granger causality tests: U.S. and Canada

Test	U.S.	Canada
Real GDP growth GC non-interest income growth		
<i>F-Statistic</i>	2.64	0.67
<i>p-value</i>	0.04**	0.61
Non-interest income growth GC real GDP growth		
<i>F-Statistic</i>	3.98	3.47
<i>p-value</i>	0.01**	0.01**
Real GDP growth GC net interest income growth		
<i>F-Statistic</i>	1.16	1.01
<i>p-value</i>	0.33	0.40
Net interest income growth GC real GDP growth		
<i>F-Statistic</i>	0.93	0.96
<i>p-value</i>	0.44	0.43
Stock market return GC non-interest income growth		
<i>F-Statistic</i>	0.98	3.32
<i>p-value</i>	0.41	0.01**
Non-interest income growth GC stock market return		
<i>F-Statistic</i>	1.21	2.50
<i>p-value</i>	0.30	0.04**
Stock market return GC net interest income growth		
<i>F-Statistic</i>	0.61	3.17
<i>p-value</i>	0.65	0.02**
Net interest income growth GC stock market return		
<i>F-Statistic</i>	0.71	1.45
<i>p-value</i>	0.58	0.22
Change in T-bills rate GC non-interest income growth		
<i>F-Statistic</i>	1.04	0.54
<i>p-value</i>	0.38	0.70
Non-interest income growth GC change in T-bills rate		
<i>F-Statistic</i>	0.82	1.33
<i>p-value</i>	0.50	0.26
Change in T-bills rate GC net interest income growth		
<i>F-Statistic</i>	3.77	2.36
<i>p-value</i>	0.01**	0.05**
Net interest income growth GC change in T-bills rate		
<i>F-Statistic</i>	1.63	1.07
<i>p-value</i>	0.17	0.37

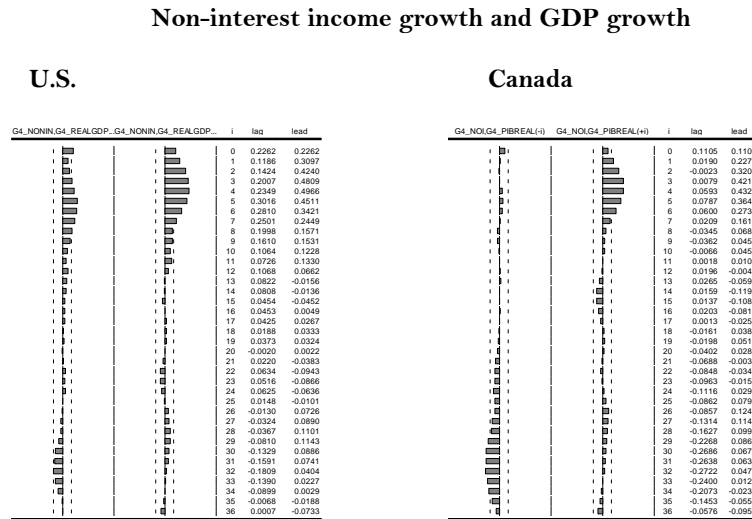
Notes: * indicates that the test is significant at the 10% level and ** indicates that the test is significant at the 5% level.

3.2.2 Granger causality tests

VAR embed many interactions between the selected variables, and this ought to be first captured by Granger causality tests (Table 1). Our tests suggest that GDP growth Granger causes non-interest income growth only for U.S. banks, but the reverse also holds true in both countries, the tests being significant at the 1% level. Overall, the growth of non-interest income seems to lead GDP growth, a *prima facie* evidence of a feedback effect from the banking sector to the real economy. Moreover, in Canada, stock market return Granger causes non-interest income growth and the reverse, albeit less significant, is also true. Granger causality tests related to the short-term interest rate are negative for both countries, suggesting that non-interest income growth is not very sensitive to changes in the short-term interest rate.

Net interest income growth does not lead any of the three selected shocks. In contrast to non-interest income, the feedback effects from the traditional banking activities to the real sector do not seem to be operative. In both countries, tests are negative when linking net interest income growth to GDP growth. Concerning tests involving the stock market return, note that this variable Granger causes net interest income growth only in Canada. Finally, as well documented in the literature, a change in the short-term interest rate seems to Granger cause net interest income growth, the test being more conclusive in the U.S. (an increase in the interest rate leads to a decrease in net interest income growth).

Figure 3 Cross-correlations: U.S. and Canada



Net interest income growth and GDP growth

U.S.

G4_NETIN_G4_REALGDP...	G4_NETIN_G4_REALGDP...	i	lag	lead
+	+	0	0.1445	0.1445
+	+	1	0.0721	0.1531
+	+	2	-0.0086	0.0810
+	+	3	-0.0871	0.0189
+	+	4	-0.1184	-0.0350
+	+	5	-0.0924	-0.0035
+	+	6	0.0090	0.0470
+	+	7	0.1134	0.1107
+	+	8	0.2108	0.1558
+	+	9	0.2903	0.1440
+	+	10	0.2975	0.1162
+	+	11	0.3027	0.0906
+	+	12	0.2865	0.0797
+	+	13	0.2986	0.0765
+	+	14	0.3162	0.0817
+	+	15	0.3445	0.0691
+	+	16	0.3404	0.0202
+	+	17	0.2937	-0.0396
+	+	18	0.2112	-0.1094
+	+	19	0.1300	-0.1683
+	+	20	0.0879	-0.1879
+	+	21	0.0489	-0.1828
+	+	22	0.0180	-0.1421
+	+	23	-0.0150	-0.0984
+	+	24	-0.0427	-0.0628
+	+	25	-0.0447	-0.0545
+	+	26	-0.0467	-0.0674
+	+	27	-0.0389	-0.0830
+	+	28	-0.0221	-0.0787
+	+	29	-0.0113	-0.0589
+	+	30	0.0038	-0.0092
+	+	31	-0.0059	0.0326
+	+	32	-0.0295	0.0539
+	+	33	-0.0564	0.0755
+	+	34	-0.0750	0.0708
+	+	35	-0.0866	0.0582
+	+	36	-0.0862	0.0246

Canada

G4_NIG4_PIBREAL(-)	G4_NIG4_PIBREAL(-)	i	lag	lead
+	+	0	-0.2809	-0.2809
+	+	1	-0.2258	-0.3111
+	+	2	-0.0895	-0.2944
+	+	3	0.0224	-0.2190
+	+	4	0.1009	-0.1493
+	+	5	0.1528	-0.0779
+	+	6	0.1338	-0.0390
+	+	7	0.1071	-0.0354
+	+	8	0.0657	-0.0304
+	+	9	0.0177	-0.0159
+	+	10	-0.0068	0.0417
+	+	11	-0.0345	0.0926
+	+	12	-0.0322	0.1113
+	+	13	0.0261	0.1007
+	+	14	0.0595	0.0563
+	+	15	0.1019	0.0178
+	+	16	0.1324	-0.0152
+	+	17	0.0719	-0.0286
+	+	18	0.0150	-0.0537
+	+	19	-0.0671	-0.0724
+	+	20	-0.1698	-0.0337
+	+	21	-0.2598	-0.0089
+	+	22	-0.2590	0.0469
+	+	23	-0.2439	0.1141
+	+	24	-0.1487	0.1211
+	+	25	-0.0628	0.1255
+	+	26	-0.0228	0.0834
+	+	27	0.0302	-0.0143
+	+	28	0.0639	-0.1194
+	+	29	0.0695	-0.2032
+	+	30	0.0871	-0.2114
+	+	31	0.0982	-0.1436
+	+	32	0.0818	-0.0281
+	+	33	0.0968	0.0653
+	+	34	0.1008	0.1481
+	+	35	0.0758	0.1743
+	+	36	0.0741	0.1637

Net operating income growth and GDP growth

U.S.

G4_NETINCOME_G4_REA...	G4_NETINCOME_G4_REA...	i	lag	lead
+	+	0	0.2636	0.2636
+	+	1	0.1416	0.3138
+	+	2	0.1066	0.3022
+	+	3	0.0962	0.3654
+	+	4	0.0980	0.3456
+	+	5	0.1587	0.3398
+	+	6	0.2067	0.2913
+	+	7	0.2325	0.2554
+	+	8	0.2828	0.2140
+	+	9	0.3038	0.1919
+	+	10	0.2792	0.1501
+	+	11	0.2595	0.1394
+	+	12	0.2707	0.0875
+	+	13	0.2593	0.0325
+	+	14	0.2687	0.0385
+	+	15	0.2672	0.0111
+	+	16	0.2512	0.0144
+	+	17	0.2120	-0.0050
+	+	18	0.1527	-0.0494
+	+	19	0.1146	-0.0887
+	+	20	0.0834	-0.1262
+	+	21	0.0548	-0.1550
+	+	22	0.0401	-0.1698
+	+	23	0.0307	-0.1386
+	+	24	0.0207	-0.0984
+	+	25	-0.0107	-0.0495
+	+	26	-0.0313	0.0012
+	+	27	-0.0401	0.0071
+	+	28	-0.0382	0.0293
+	+	29	-0.0714	0.0459
+	+	30	-0.1019	0.0444
+	+	31	-0.1301	0.0762
+	+	32	-0.1593	0.0626
+	+	33	-0.1423	0.0616
+	+	34	-0.1154	0.0431
+	+	35	-0.0505	0.0177
+	+	36	-0.0232	-0.0465

Canada

G4_NETINC_G4_PIBREAL...	G4_NETINC_G4_PIBREAL...	i	lag	lead
+	+	0	-0.0335	-0.0335
+	+	1	-0.0878	0.0547
+	+	2	-0.0405	0.1467
+	+	3	0.0209	0.2742
+	+	4	0.1043	0.3245
+	+	5	0.1591	0.3021
+	+	6	0.1026	0.2383
+	+	7	0.0444	0.1358
+	+	8	-0.0338	0.0457
+	+	9	-0.0540	0.0238
+	+	10	-0.0305	0.0429
+	+	11	-0.0266	0.0258
+	+	12	-0.0008	0.0207
+	+	13	0.0336	0.0861
+	+	14	0.0356	-0.1074
+	+	15	0.0520	-0.1037
+	+	16	0.0705	-0.0862
+	+	17	0.0304	-0.0306
+	+	18	-0.0051	0.0226
+	+	19	-0.0364	0.0271
+	+	20	-0.0771	0.0227
+	+	21	-0.1506	0.0057
+	+	22	-0.1613	0.0032
+	+	23	-0.1646	0.0532
+	+	24	-0.1322	0.1006
+	+	25	-0.0742	0.1458
+	+	26	-0.0603	0.1660
+	+	27	-0.0846	0.1124
+	+	28	-0.0777	0.0468
+	+	29	-0.1749	0.0010
+	+	30	-0.2155	-0.0194
+	+	31	-0.2205	0.0038
+	+	32	-0.2401	0.0334
+	+	33	-0.2111	0.0415
+	+	34	-0.1837	0.0285
+	+	35	-0.1313	0.0038
+	+	36	-0.0461	-0.0415

Non-interest income growth and stock market return

U.S.

Canada

G4_NONIN.RSP4_500(-)	G4_NONIN.RSP4_500(+)	i	lag	lead
		0	0.2877	0.2877
		1	0.0599	0.3730
		2	-0.0129	0.4063
		3	-0.0099	0.3649
		4	0.0078	0.3113
		5	0.1487	0.2705
		6	0.2205	0.1810
		7	0.2417	0.0882
		8	0.2606	-0.0116
		9	0.2686	-0.1134
		10	0.2097	-0.2112
		11	0.1649	-0.2179
		12	0.1182	-0.2244
		13	-0.0032	-0.2185
		14	-0.0203	-0.0982
		15	0.0622	-0.0241
		16	-0.0558	-0.0272
		17	0.0036	-0.0120
		18	0.0014	-0.0418
		19	0.0343	-0.0994
		20	0.0906	-0.1428
		21	0.1220	-0.1528
		22	0.1841	-0.1478
		23	0.2347	-0.0930
		24	0.1993	0.0016
		25	0.1765	0.0069
		26	0.1118	0.0235
		27	0.0756	0.0096
		28	0.0821	0.0120
		29	0.0873	0.0632
		30	0.0662	0.0551
		31	0.0391	0.0668
		32	0.0264	0.0469
		33	0.0112	0.0094
		34	0.0716	-0.0015
		35	0.0982	-0.0675
		36	0.0892	-0.1146

G4_NOIRTSX4(-)	G4_NOIRTSX4(+)	i	lag	lead
		0	0.3303	0.3303
		1	0.1854	0.3611
		2	-0.0409	0.4237
		3	-0.0898	0.3674
		4	-0.1516	0.2407
		5	-0.1475	0.0868
		6	-0.0297	-0.0810
		7	-0.0467	-0.1665
		8	-0.0733	-0.1530
		9	-0.0110	-0.1257
		10	-0.0407	-0.1132
		11	-0.0160	-0.1256
		12	0.0629	-0.1694
		13	0.0482	-0.1349
		14	0.0846	-0.0397
		15	0.0971	0.0276
		16	0.0222	0.0831
		17	-0.0150	0.0620
		18	-0.0488	-0.0388
		19	-0.0582	-0.1375
		20	-0.0037	-0.1766
		21	0.0090	-0.1817
		22	0.0533	-0.1118
		23	0.0840	0.0289
		24	0.0717	0.1023
		25	0.0947	0.1980
		26	0.0750	0.2284
		27	0.0418	0.1557
		28	-0.0409	0.1312
		29	-0.1106	0.0909
		30	-0.2407	0.0681
		31	-0.3019	0.0792
		32	-0.2744	0.0502
		33	-0.2526	0.0208
		34	-0.1403	-0.0245
		35	-0.0402	-0.0670
		36	0.0486	-0.0860

Net interest income growth and stock market return

U.S.

Canada

G4_NETIN.RSP4_500(-)	G4_NETIN.RSP4_500(+)	i	lag	lead
		0	0.0236	0.0236
		1	0.0188	0.0141
		2	0.0005	-0.0222
		3	-0.0534	-0.0277
		4	-0.0857	-0.0455
		5	-0.0764	-0.0417
		6	-0.0322	-0.0099
		7	0.0211	0.0163
		8	0.0749	0.0281
		9	0.1373	-0.0045
		10	0.1609	-0.0526
		11	0.1094	-0.0101
		12	0.1277	-0.0702
		13	0.1656	-0.0222
		14	0.1240	0.0168
		15	0.1587	0.0646
		16	0.1943	0.0410
		17	0.1824	0.0207
		18	0.1323	0.0282
		19	0.0790	0.0365
		20	0.0472	0.0551
		21	0.0306	0.0903
		22	0.0341	0.0985
		23	0.0477	0.0898
		24	0.0493	0.0705
		25	0.0449	0.0307
		26	0.0286	0.0143
		27	-0.0171	-0.0592
		28	-0.0645	-0.0802
		29	-0.0795	-0.0650
		30	-0.1177	-0.0223
		31	-0.0838	0.0376
		32	-0.0243	0.0711
		33	0.0170	0.0675
		34	0.0451	0.0322
		35	0.0471	-0.0029
		36	0.0491	-0.0372

G4_NIRTSX4(-)	G4_NIRTSX4(+)	i	lag	lead
		0	-0.3936	-0.3936
		1	-0.4369	-0.3453
		2	-0.3624	-0.2859
		3	-0.1730	-0.1967
		4	-0.0081	-0.1728
		5	0.1597	-0.1031
		6	0.2801	-0.0519
		7	0.2630	-0.0214
		8	0.2772	0.0816
		9	0.2485	0.0508
		10	0.1532	0.0678
		11	0.0683	0.0601
		12	-0.0363	0.0015
		13	-0.0938	0.0272
		14	-0.0693	0.0711
		15	0.0107	0.0947
		16	0.0673	0.1114
		17	0.1396	0.1095
		18	0.2015	0.0610
		19	0.1958	0.0502
		20	0.1634	0.0921
		21	0.0888	0.1003
		22	-0.0515	0.1277
		23	-0.1200	0.1453
		24	-0.1540	0.0845
		25	-0.1538	0.0350
		26	-0.1150	-0.0571
		27	-0.1392	-0.1879
		28	-0.1312	-0.2529
		29	-0.1432	-0.2583
		30	-0.1269	-0.1842
		31	-0.0245	-0.0338
		32	0.0447	0.1095
		33	0.1440	0.1697
		34	0.2012	0.2167
		35	0.1359	0.2102
		36	0.0839	0.1503

Net operating income growth and stock market return

U.S.

G4_NETINC_RSP4_5...G4_NETINC_RSP4_5...		i	lag	lead
			0	0.1951 0.1951
			1	0.0430 0.2720
			2	-0.015... 0.2866
			3	-0.042... 0.2642
			4	-0.043... 0.2183
			5	0.0708 0.1857
			6	0.1508 0.1251
			7	0.1967 0.0638
			8	0.2322 0.009...
			9	0.2798 -0.105...
			1...	0.2544 -0.205...
			1...	0.2223 -0.244...
			1...	0.1712 -0.226...
			1...	0.0899 -0.189...
			1...	0.0625 -0.072...
			1...	-0.0527 0.0200
			1...	-0.0759 0.0094
			1...	0.1108 0.0094
			1...	0.0842 0.006...
			1...	0.0795 -0.042...
			2...	0.1075 -0.070...
			2...	0.1238 -0.059...
			2...	0.1644 -0.052...
			2...	0.2019 -0.020...
			2...	0.1712 0.0444
			2...	0.1514 0.0257
			2...	0.1012 0.0126
			2...	0.0515 -0.021...
			2...	0.0249 -0.028...
			2...	0.0072 0.0172
			3...	-0.022... 0.0352
			3...	-0.021... 0.0759
			3...	0.0080 0.0768
			3...	0.0079 0.0427
			3...	0.0818 0.0125
			3...	0.1008 -0.054...
			3...	0.0970 -0.113...

Canada

G4_NETINC_RTSX4(-)		G4_NETINC_RTSX4(+)		i	lag	lead
					0	0.1508 0.1508
					1	-0.0163 0.2080
					2	-0.2052 0.3036
					3	-0.1705 0.2931
					4	-0.1666 0.1802
					5	-0.0812 0.0490
					6	0.0859 -0.1022
					7	0.0556 -0.1865
					8	0.0454 -0.1493
					9	0.0855 -0.1238
					10	0.0186 -0.1079
					11	0.0232 -0.1240
					12	0.0484 -0.1933
					13	0.0120 -0.1397
					14	0.0636 -0.0177
					15	0.0853 0.0687
					16	0.0339 0.1317
					17	0.0294 0.1171
					18	0.0167 0.0055
					19	0.0176 -0.0873
					20	0.0742 -0.0941
					21	0.0574 -0.0904
					22	0.0582 -0.0231
					23	0.0576 0.1059
					24	0.0307 0.1299
					25	0.0562 0.1897
					26	0.0450 0.1837
					27	-0.0044 0.0657
					28	-0.0955 0.0265
					29	-0.1679 -0.0097
					30	-0.2869 -0.0038
					31	-0.3021 0.0562
					32	-0.2470 0.0859
					33	-0.1844 0.0779
					34	-0.0500 0.0540
					35	0.0226 0.0152
					36	0.0854 -0.0349

Non-interest income growth and change in the T-bill rate

U.S.

G4_NONINTB_3MOIS(-)		G4_NONINTB_3MOIS(+)		i	lag	lead
					0	0.0285 0.0285
					1	-0.0017 0.1043
					2	0.0263 0.1298
					3	0.0408 0.1194
					4	-0.0875 0.1996
					5	-0.0295 0.1081
					6	-0.0673 0.0178
					7	-0.1748 0.0018
					8	-0.1095 0.0182
					9	-0.0020 -0.0065
					10	0.0230 -0.0515
					11	0.0108 -0.0467
					12	0.0694 -0.0104
					13	0.0694 -0.0219
					14	0.1140 -0.0199
					15	0.0968 -0.0355
					16	0.0812 -0.0807
					17	0.0016 -0.1322
					18	-0.0383 -0.0655
					19	0.0722 -0.0892
					20	-0.0429 -0.1311
					21	-0.0604 -0.0759
					22	-0.0429 -0.1264
					23	-0.0759 -0.0892
					24	-0.0432 0.0217
					25	-0.0708 0.0608
					26	0.0020 0.1113
					27	-0.0224 0.1498
					28	-0.0451 0.1740
					29	-0.0813 0.1419
					30	-0.0832 0.0798
					31	-0.0966 0.0896
					32	-0.2255 0.0647
					33	-0.0907 0.0487
					34	-0.0689 0.0406
					35	-0.0031 0.0094
					36	0.2369 -0.0391

Canada

G4_NOLDTB_3MOIS(-)		G4_NOLDTB_3MOIS(+)		i	lag	lead
					0	0.1496 0.1496
					1	-0.0130 0.2035
					2	-0.0131 0.2107
					3	-0.1048 0.1656
					4	-0.1569 0.1405
					5	-0.0415 0.0682
					6	-0.0729 0.0152
					7	-0.1022 0.0178
					8	-0.0372 -0.0427
					9	0.0945 -0.0037
					10	-0.0799 0.0111
					11	0.0212 0.0038
					12	-0.0662 0.0146
					13	0.0813 -0.0761
					14	0.0541 -0.1039
					15	-0.0664 -0.0964
					16	0.0251 -0.0969
					17	-0.0325 -0.1144
					18	-0.0745 -0.0869
					19	0.0385 -0.0398
					20	-0.0893 -0.0299
					21	0.0091 -0.0059
					22	0.0680 -0.0115
					23	-0.0247 0.0194
					24	-0.0312 0.0662
					25	-0.0205 0.0935
					26	-0.0462 0.0835
					27	0.0366 0.0528
					28	0.0754 -0.0091
					29	-0.0569 -0.0020
					30	-0.0374 -0.0175
					31	-0.1136 -0.0529
					32	-0.1016 -0.0460
					33	-0.0617 -0.0276
					34	-0.1362 -0.0094
					35	0.0139 0.0191
					36	-0.0269 -0.0073

Net interest income growth and change in the T-bill rate

U.S.

G4_NETIN.DTB_3MOIS(+)	G4_NETIN.DTB_3MOIS(+)	i	lag	lead
0	-0.1989	-0.1989		
1	-0.2282	-0.1926		
2	-0.2771	-0.2172		
3	-0.3588	-0.1976		
4	-0.2933	-0.0951		
5	-0.1608	0.0283		
6	-0.0221	0.0776		
7	0.0967	0.1040		
8	0.0971	0.1335		
9	0.0822	0.1585		
10	0.0418	0.2186		
11	0.0072	0.2492		
12	0.1355	0.2554		
13	0.1488	0.2583		
14	0.1519	0.1257		
15	0.1427	0.0573		
16	0.1912	0.0358		
17	0.2197	-0.0051		
18	0.2149	-0.0297		
19	0.1701	-0.0550		
20	0.0524	-0.1010		
21	0.0114	-0.1439		
22	0.0065	-0.1655		
23	-0.0844	-0.1756		
24	-0.1688	-0.2483		
25	-0.2277	-0.2514		
26	-0.2896	-0.2163		
27	-0.2477	-0.2002		
28	-0.1603	-0.0571		
29	-0.0930	0.0539		
30	-0.0052	0.1096		
31	0.0120	0.1544		
32	0.0202	0.1970		
33	-0.0082	0.1225		
34	-0.0284	0.1271		
35	-0.0539	0.1390		
36	-0.0718	0.1225		

Canada

G4_NL.DTB_3MOIS(+)	G4_NL.DTB_3MOIS(+)	i	lag	lead
0	-0.2329	-0.2329		
1	-0.2316	-0.0154		
2	-0.2609	0.0184		
3	-0.2993	-0.0041		
4	-0.0671	0.1443		
5	0.0378	0.1066		
6	0.0743	0.0174		
7	0.1645	0.0559		
8	0.1046	-0.0515		
9	0.1013	-0.0463		
10	0.1242	0.0745		
11	0.1002	0.0372		
12	0.0869	0.0840		
13	0.0578	0.1403		
14	0.0112	0.0774		
15	0.0370	0.1258		
16	0.0645	0.0928		
17	0.0877	-0.0584		
18	0.1068	-0.0355		
19	-0.0224	-0.0818		
20	-0.0797	-0.1196		
21	-0.0806	-0.0169		
22	-0.1331	-0.0392		
23	-0.0819	-0.0165		
24	-0.0197	0.0779		
25	-0.0403	0.0296		
26	0.0257	0.0213		
27	0.0528	-0.0466		
28	0.0708	-0.1431		
29	0.0869	-0.1653		
30	0.0818	-0.1644		
31	0.0524	-0.1428		
32	0.0086	0.0547		
33	-0.0474	-0.0060		
34	-0.0550	0.0681		
35	0.0255	0.1728		
36	-0.0203	0.1277		

Net operating income growth and change in the T-bills rate

U.S.

G4_NETINC.DTB_3M...	G4_NETINC.DTB_3M...	i	lag	lead
0	-0.0898	-0.0898		
1	-0.1329	-0.0447		
2	-0.1547	-0.0534		
3	-0.2178	-0.0306		
4	-0.2670	0.0800		
5	-0.1354	0.1005		
6	-0.0664	0.0631		
7	-0.0589	0.0676		
8	-0.0172	0.0976		
9	0.0442	0.0916		
10	0.0340	0.1043		
11	0.0532	0.1345		
12	0.1476	0.1605		
13	0.1768	0.1241		
14	0.1901	0.0708		
15	0.1655	0.0052		
16	0.1895	-0.0424		
17	0.1508	-0.1034		
18	0.1151	-0.0779		
19	0.1634	-0.1605		
20	-0.0006	-0.1641		
21	-0.0416	-0.1504		
22	-0.0279	-0.1883		
23	-0.0881	-0.1629		
24	-0.1380	-0.1371		
25	-0.1964	-0.1146		
26	-0.1792	-0.0610		
27	-0.1781	-0.0300		
28	-0.1420	0.0670		
29	-0.1285	0.1425		
30	-0.0797	0.1330		
31	-0.0622	0.1689		
32	-0.1557	0.1366		
33	-0.0715	0.1091		
34	-0.0621	0.1066		
35	-0.0248	0.0935		
36	0.1338	0.0499		

Canada

G4_NETINC.DTB_3MOIS(+)	G4_NETINC.DTB_3MOIS(+)	i	lag	lead
0	0.0376	0.0376		
1	-0.0874	0.1822		
2	-0.1123	0.2058		
3	-0.2174	0.1453		
4	-0.1564	0.1884		
5	-0.0242	0.1066		
6	-0.0380	-0.0013		
7	-0.0154	0.0240		
8	-0.0036	-0.0709		
9	-0.0399	-0.0387		
10	-0.0112	0.0388		
11	0.0599	0.0066		
12	0.0327	0.0371		
13	0.0715	-0.0041		
14	0.0325	-0.0594		
15	-0.0626	-0.0297		
16	0.0377	-0.0514		
17	-0.0059	-0.1422		
18	-0.0170	-0.1035		
19	0.0236	-0.0782		
20	-0.1123	-0.0849		
21	-0.0083	-0.0037		
22	0.0100	-0.0112		
23	-0.0443	0.0291		
24	-0.0115	0.1270		
25	-0.0292	0.1278		
26	-0.0245	0.1185		
27	0.0619	0.0508		
28	0.0906	-0.0525		
29	-0.0384	-0.0697		
30	-0.0080	-0.0850		
31	-0.0993	-0.1095		
32	-0.1060	-0.0663		
33	-0.0964	-0.0342		
34	-0.1600	0.0134		
35	0.0099	0.0976		
36	-0.0546	0.0552		

Notes: Each panel provides the correlations of the first factor with the lags and leads of the second factor. The confidence intervals of the correlations appear on the plots.

3.2.3 Cross-correlations between bank income flows and macroeconomic and financial variables

Cross-correlations between bank income flows variables, on the one hand, and the set of macroeconomic and financial variables, on the other hand, are an important input in the preliminary interpretation of our VARs. In the U.S., non-interest income growth is more positively correlated with leads of GDP growth than with its lags, although the correlation with lags is significant and quite persistent (Figure 3). In Canada, the cross-correlation between non-interest income growth and lags in GDP growth is not observed in the short-run, and the positive correlation with leads of GDP growth is quite high but less persistent. These properties are further evidence that there might indeed exist a feedback effect from bank non-interest income growth to the real sector in both countries.

Turning to the stock market return, note that the positive correlation of U.S. non-interest income growth with lags of this variable is significant during twelve quarters, but the positive correlation with leads is much higher (albeit shorter). Not surprisingly, the waves are less persistent than for GDP growth. In Canada, non-interest income growth is correlated positively with the stock market return and its one-quarter lag. The profile is thus less persistent than in the U.S., and it reverses more quickly. The positive correlation between non-interest income growth and the stock market return leads is higher than in the U.S. (it is also less persistent than in the case of GDP growth). These results corroborate our previous findings, as the cross-correlation profiles suggest the presence of a feedback effect from non-interest income growth to the stock market in both countries.

Finally, note that the cross-correlation between non-interest income growth and the short-term interest rate is much lower than with GDP growth or the stock market return. More precisely, there is a positive feedback effect from non-interest income growth to the short-term interest rate—especially in Canada—but this feedback effect is much weaker than in the case of GDP growth or the stock market. In other respects however, the correlation between U.S. net interest income growth and the lagged short-term rate has a profile which is consistent with the standard bank duration gap model⁷, being negative for the first lagged quarters and positive thereafter. In Canada, there is also a negative correlation between net interest income growth and lagged interest rate which lasts over four quarters. The correlation is lower in Canada and we observe no obvious correlation with the leads of the interest rate in Canada.

Net interest income growth is correlated positively and significantly with GDP growth, beginning at the $t-6$ lag in the U.S., and this correlation is still persistent for remote lags. In contrast, in Canada, the correlation of net interest income growth is negative over periods t and $t-1$. We observe also a significant negative correlation for leads $t+1$ to $t+4$. This counterintuitive profile is consistent with the negative correlation between the two components of net operating income in Canada, which reflects a different bank product-mix. For the same reason, the correlation profile between U.S. net interest income growth and the stock market return is similar to GDP growth, whereas in Canada net interest income

⁷ Since banks have usually a positive duration gap, the duration of assets being greater than the durations of liabilities.

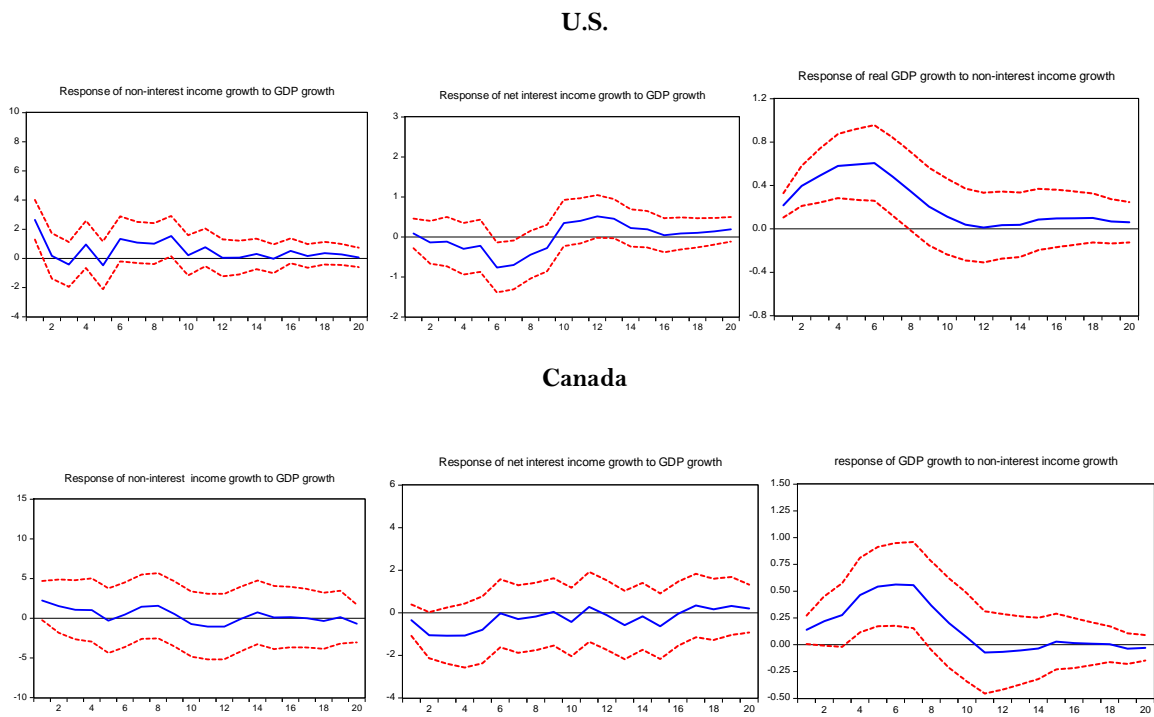
growth is correlated negatively with the stock market return over four-quarter lags and leads. Not surprisingly, the correlation is also higher than with GDP growth. Overall, the relationship between net interest income growth and GDP growth is more in line with the traditional banking channel in the U.S. than in Canada—an increase in real GDP growth being associated with a rise in lending. More importantly, the feedback effects from net interest income growth to real GDP growth or the stock market are weak or non-existent.

Summarizing, we arrive at a two-part phenomenon: (i) net interest income is influenced by the macroeconomic shocks, but do not lead them; (ii) Non-interest impacts GDP and especially the stock market and is not much influenced by the interest rate. These are the two stylized facts motivating the VAR analysis presented in the next section.

4. VAR analysis

An IRF plots the impact of a one-time shock to one of the innovations of the variables which constitute the VAR system. A shock is equal to one standard deviation of the innovation. The variables which constitute our VAR analysis are: bank non-interest income growth; bank net interest income growth; bank net operating income growth—net operating income being the sum of net interest income and non-interest income; real GDP growth; the stock market return—i.e., the S&P500's in the U.S. and the S&P/TSX in Canada; the short-term interest rate—i.e., the three-month Treasury bills rate.

Figure 4 IRFs: Growth of income components and GDP growth

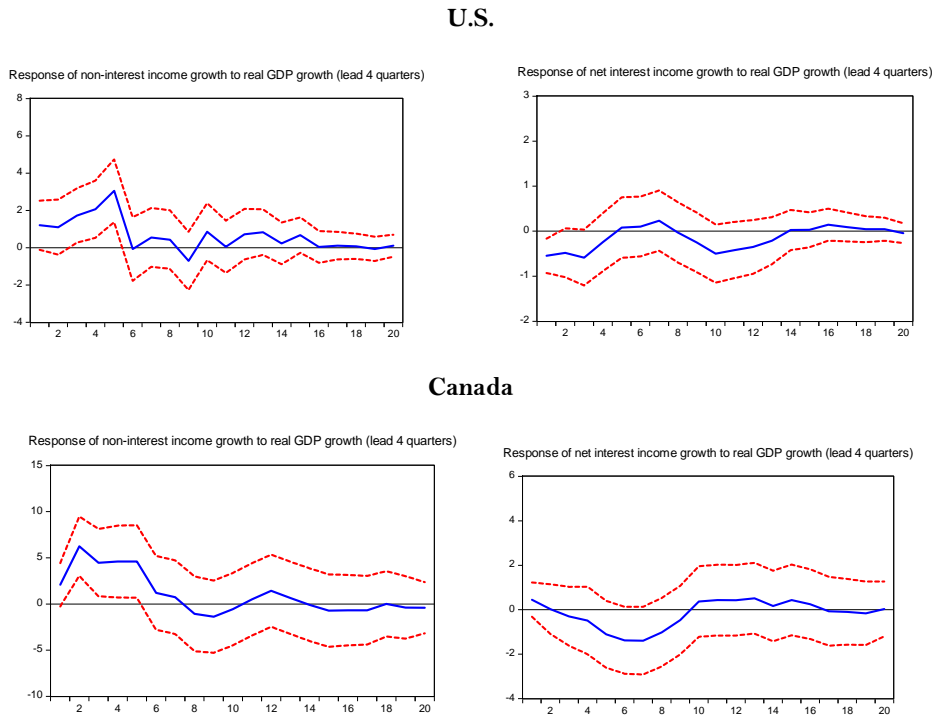


4.1. Interactions between the growth of income flows and real GDP growth

Figure 4 provides the IRFs linking the two components of net operating growth and real GDP growth in the U.S. and in Canada. In the U.S., non-interest income growth reacts positively and significantly to a GDP growth shock, but this impact is short-lived while in Canada there is no significant impact. Regarding net interest income growth, there is a lagged significant non-linear response to the shock in the U.S. In Canada, the corresponding response is again not significant. Therefore, banks' income flows seem slightly sensitive to the lagged values of real GDP growth.

More importantly, the response of real GDP growth to a non-interest income growth shock is positive and significant in both countries⁸. This effect is quite persistent since it lasts eight quarters. Consistent with the Granger causality tests, this result confirms the presence of a significant feedback effect from non-interest income growth to GDP growth, and this effect is stronger than the traditional direct effect (from the real sector to the banking industry).

Figure 5 IRFs: Growth of income components and GDP growth (4-quarter lead)



As a robustness check, Figure 5 provides the IRFs associated with a lead of four quarters to GDP growth⁹. In both countries, non-interest income growth still reacts positively and significantly to the lead

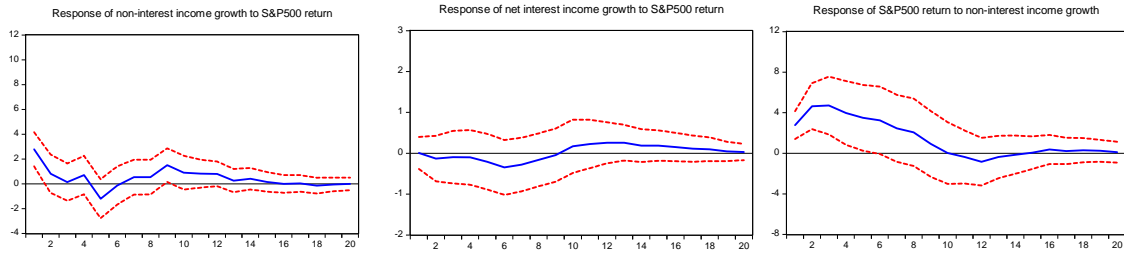
⁸ Note that all variables of our VAR system are endogenous—i.e., real GDP growth, the stock market return and the short-term interest rate are endogenous aside the components of net operating income growth.

⁹ More precisely, we regress the growth of banks' income flows on a lead of four quarters in GDP growth. This lead follows from the analysis of the cross-correlation plots.

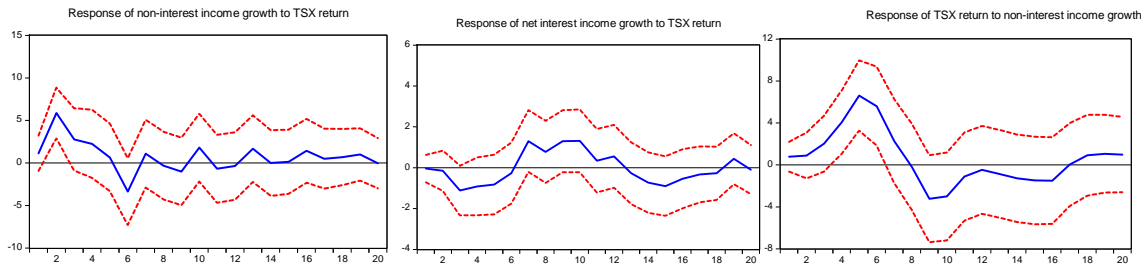
of GDP growth, this impact being stronger in Canada than in the U.S. By contrast, net interest income growth does not respond significantly to this lead. In other words, if there is a significant impact of banking fluctuations on the real economy, it is more likely stemming from off-balance-sheet activities than from the loan business.

Figure 6 IFRs: Growth of income components and stock market return

U.S.



Canada

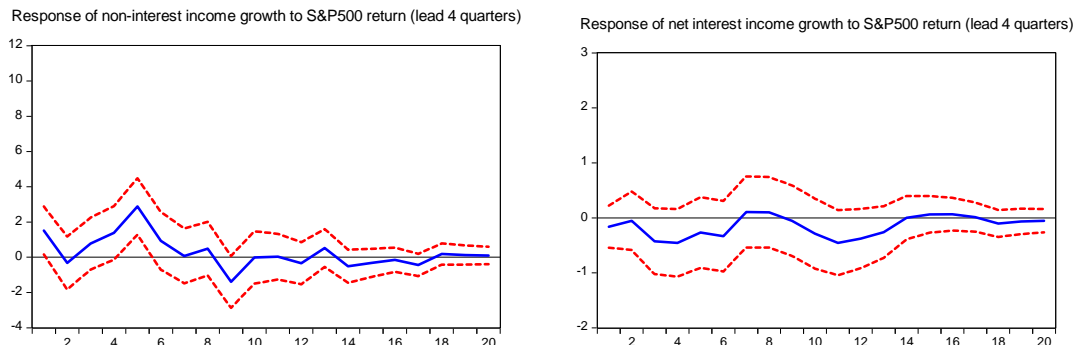


4.2. Interactions between the growth of income flows and the stock market return

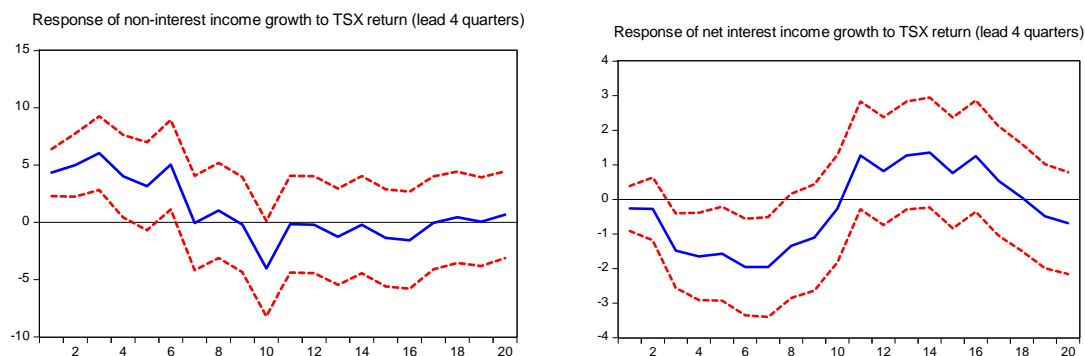
In the U.S., non-interest income growth also reacts positively and significantly to a shock to the stock market return, but this effect is shorter-lived (Figure 6). It is stronger in Canada. On the other hand, net interest income growth shows no significant response to the same shock in both countries. More importantly, and in line with our previous finding, non-interest income growth impacts positively and significantly the stock market returns. In Canada, this feedback effect is actually stronger than the one associated with GDP growth, albeit shorter-lived. Hence, there seems to exist a feedback effect from banks' fee-based activities to the stock market.

Figure 7 IRFs: Growth of income components and stock market return (4-quarter lead)

U.S.



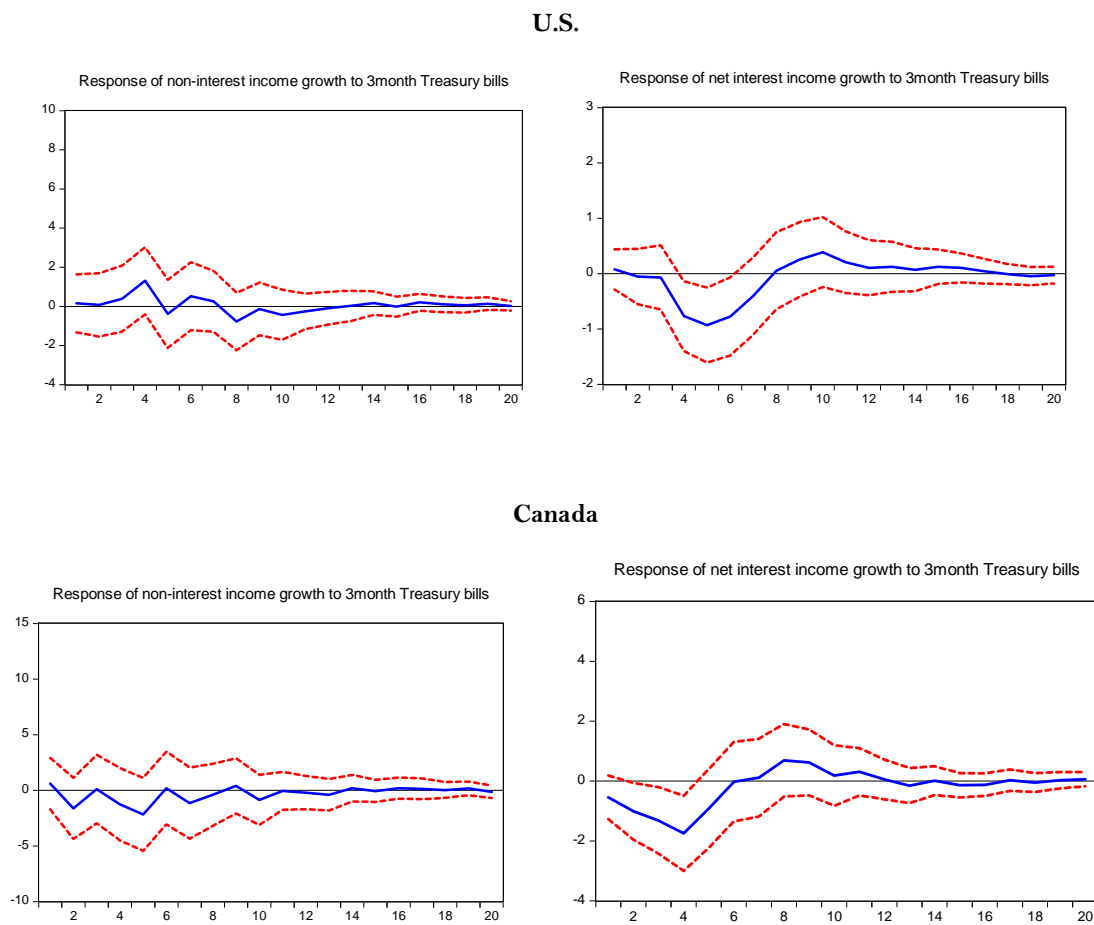
Canada



The IRFs with a lead of four quarters to the stock market return corroborate this result. Consistent with the response of the stock market return to non-interest income growth, the response of non-interest income growth to the lead of the stock market return is stronger and more significant in Canada than in the U.S. (Figure 7). This is consistent with the different product-mix of the two banking systems, Canadian banks focusing more on market-based activities than their U.S. counterparts (Calmès and Théoret, 2015).

Overall, this set of results again supports the idea that there might well be a feedback effect, with banking fluctuations significantly leading stock market fluctuations.

Figure 8 IRFs: Growth of income components and change in the T-bills rate



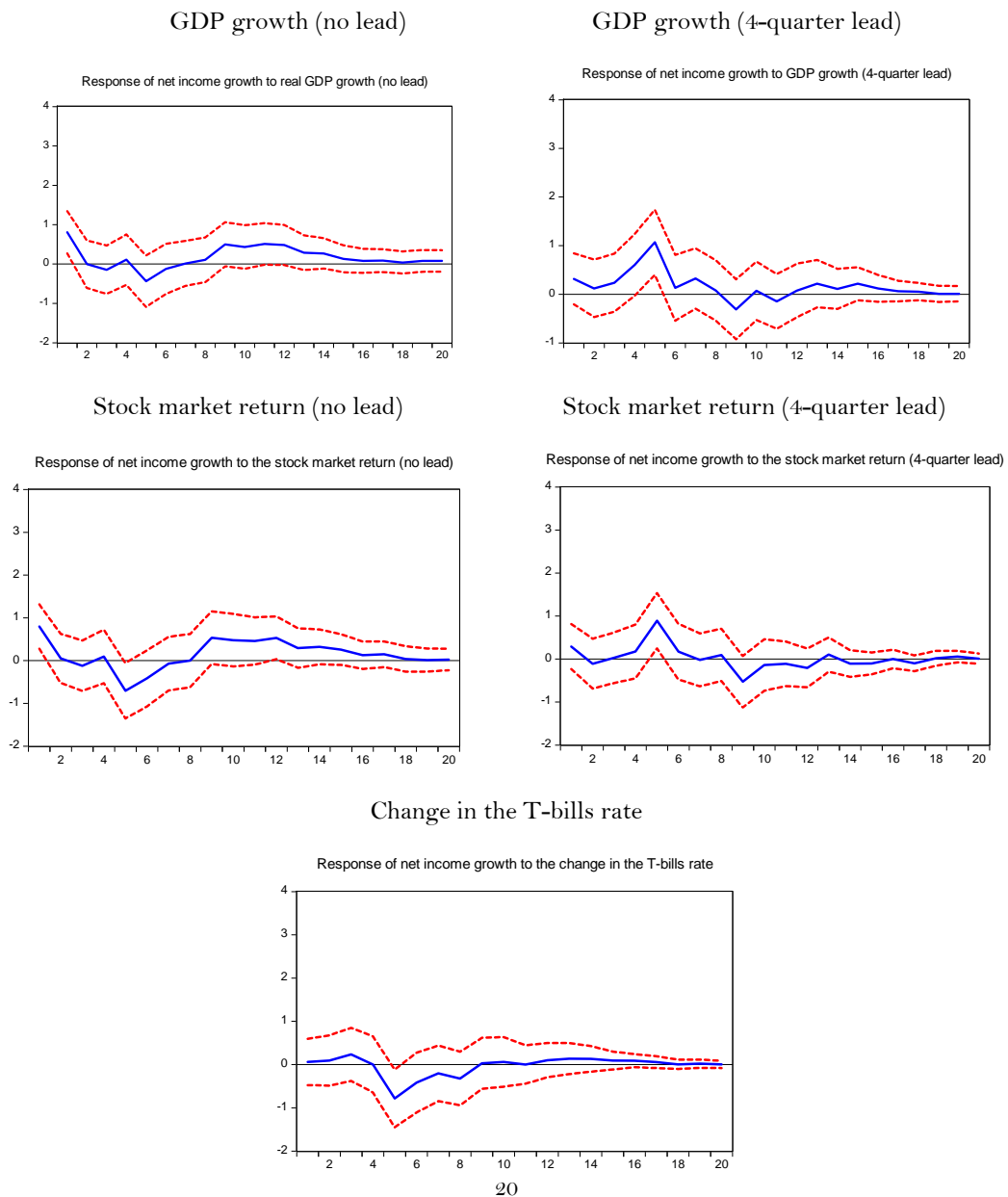
4.3. Interactions between the growth of income flows and the short-term interest rate

Consistent with the plots of the cross-correlations, the response of non-interest income growth to a shock to the short-term interest rate is not significant in both banking systems (Figure 8). However,

following a positive shock to the short-term interest rate, net interest income growth decreases in both countries, as expected. This result is consistent with the standard duration gap model, as the duration of banks' assets is longer than the duration of their liabilities—i.e., banks fund long-term assets with deposits and liabilities which have a shorter duration than assets. According to the IRFs' profiles, monetary policy seems to impact more the income associated with traditional activities in the U.S. than in Canada (which could partly be attributable to the price stability targeting versus inflation targeting policies of the two countries).

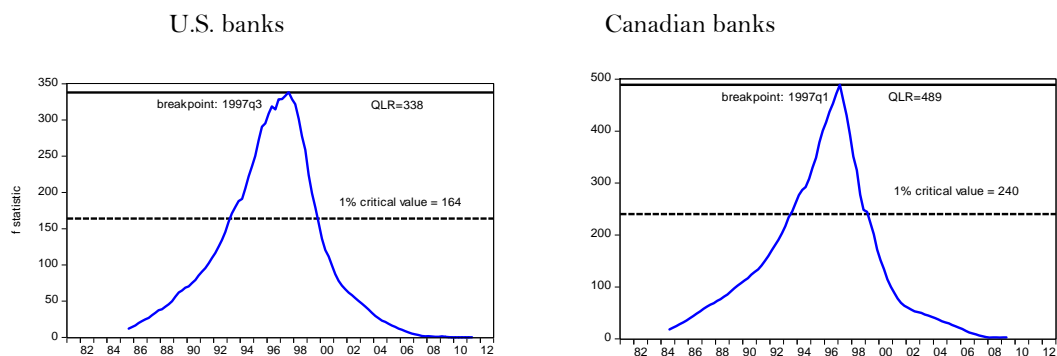
Figure 9 IRFs: Net operating income growth and various shocks

U.S.



Finally, Figure 9 displays the response of net operating income growth to various shocks for the two banking systems. It is interesting to note that in both countries, net operating income growth reacts positively and significantly to the leaded values of GDP growth and the stock market return. The responses of net operating income growth to the lagged values of GDP growth are lower and less persistent in both countries. Regarding the interest rate shock, we observe a decrease in net operating income growth in the U.S. while no such effect is observed in Canada.

Figure 10 Quandt-Andrews unknown breakpoint test on U.S. banks' *snoin*.



4.4 The 1997 structural break and the development of the feedback effect

Figure 10 shows that a structural break occurred in the banks' non-interest income series around 1997, both in the U.S. and in Canada. The Quandt-Andrews unknown breakpoint test¹⁰ reveals that a breakpoint is depicted for the U.S. *snoin* (share of non-interest income in total net operating income) series around the third quarter of 1997, and around the first quarter of 1997 for the Canadian banks' corresponding time series¹¹. In this section, we study the incidence of this structural break on our VAR results. Accordingly, we thus recast our analysis over two subperiods: 1984-1996 and 1997-2013.

¹⁰ For more detail on this test, see Quandt (1960), Andrews (1993, 2003), and Stock and Watson (2003, 2011). According to Stock and Watson (2011, p. 560), the *QLR* (Quandt likelihood ratio) statistic is given by:

$$QLR = \text{MAX} [F(\tau_0), F(\tau_0 + 1), \dots, F(\tau_1)] \quad \tau_0 \leq \tau \leq \tau_1 \quad \text{where } F(\cdot) \text{ refers to the standard } F \text{ statistic evaluated at time } \tau. \text{ In other}$$

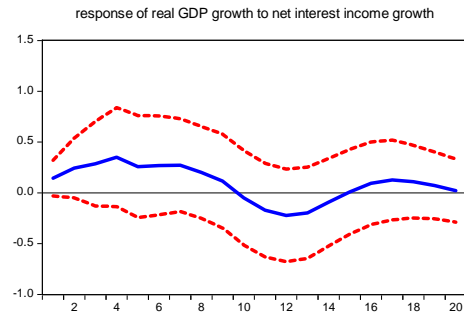
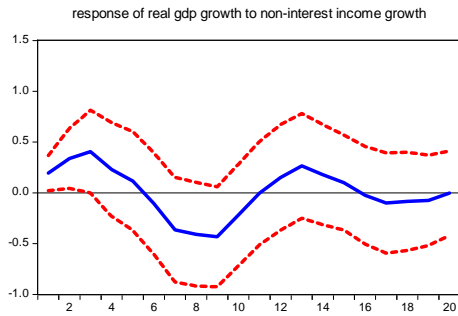
words, the *QLR* statistic is the maximum *F* statistic computed over a possible set of breakpoints stretched over the sample. It is thus a generalization of the basic Chow test.

¹¹ For more detail on this structural break, see Calmès and Théoret (2010, 2014). This break is associated with a consolidation of the growth of non-interest income in Canada and in the U.S. It is also related to the adoption of the VaR by banks as a gauge of market risk. Finally, a risk premium was added to Canadian bank returns around 1997 which account for the greater risk embedded in bank non-traditional business lines (Calmès and Théoret, 2010).

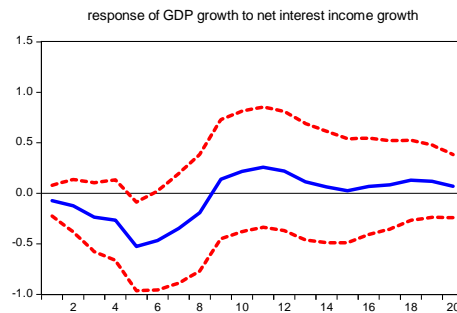
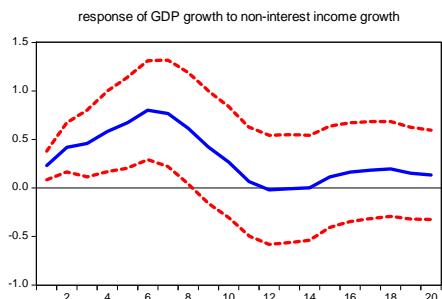
Figure 11 Feedback effect from banks' fee-based and traditional activities to real GDP on two subperiods: 1984–1996 and 1997–2013.

Panel A: U.S.

1984–1996

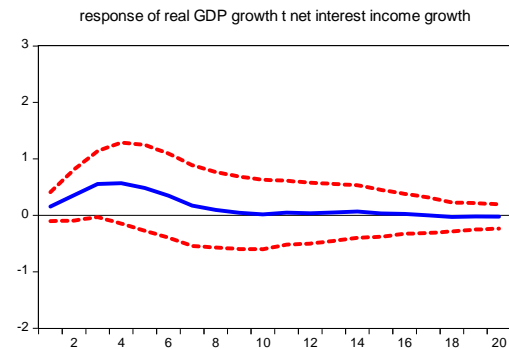
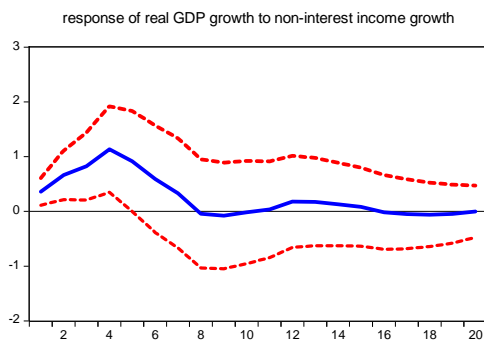


1997–2013

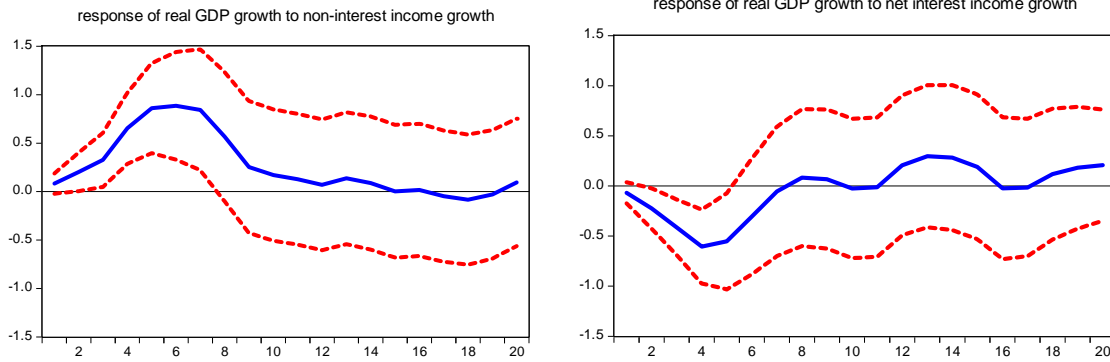


Panel B: Canada

1984–1996



1997-2013



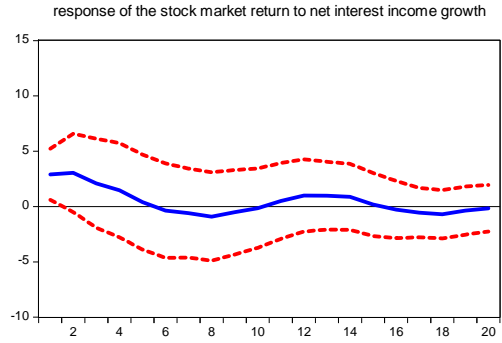
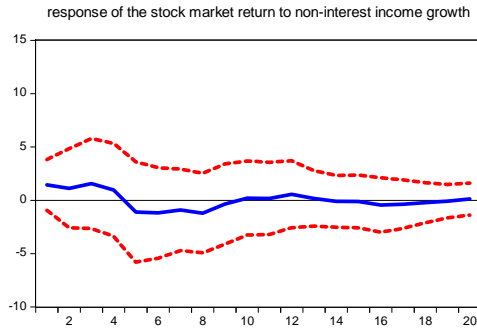
Before 1997, there is no significant feedback effect from U.S. bank income growth to GDP growth (Figure 11, Panel A). The situation materializes only during the last period (1997-2013): a significant positive feedback effect from non-interest income growth to GDP growth appears after 1997. A significant negative feedback effect is also observed for net interest income growth, although it is much weaker.

In Canada, there is a significant positive feedback effect from non-interest income growth to GDP growth over the period 1984-1996, but it clearly gains strength over the second period (1997-2013) (Figure 11, Panel B). Recall that universal banking has developed since 1987 in Canada, which might explain the earlier presence of the feedback effect. On the other hand, there is no feedback effect from net interest income growth to GDP growth from 1984 to 1996. However, similarly to the U.S., a significant negative feedback effect has emerged since 1997.

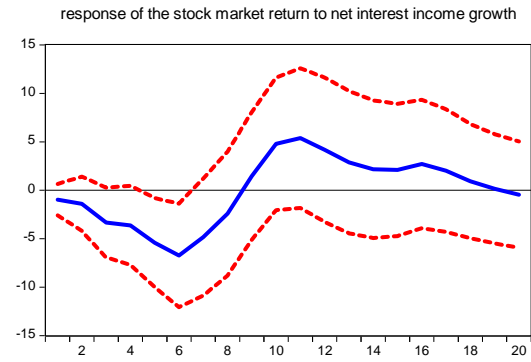
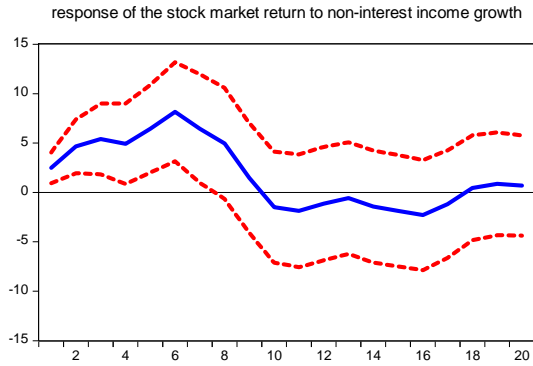
Figure 12 Feedback effect from banks' fee-based and traditional activities to the stock market on two subperiods: 1984-1996 and 1997-2013.

Panel A: U.S.

1984-1996

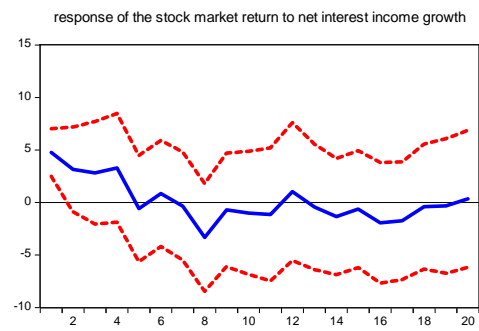
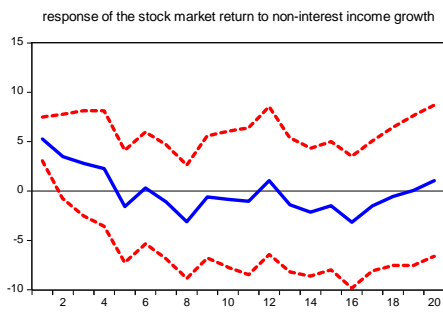


1997-2013

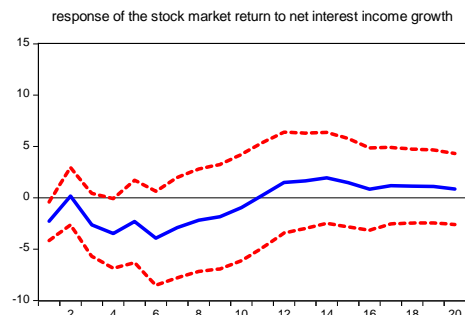
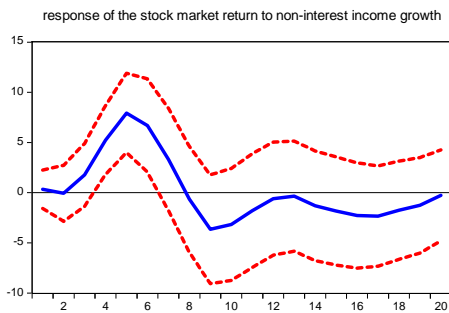


Panel B: Canada

1984-1996

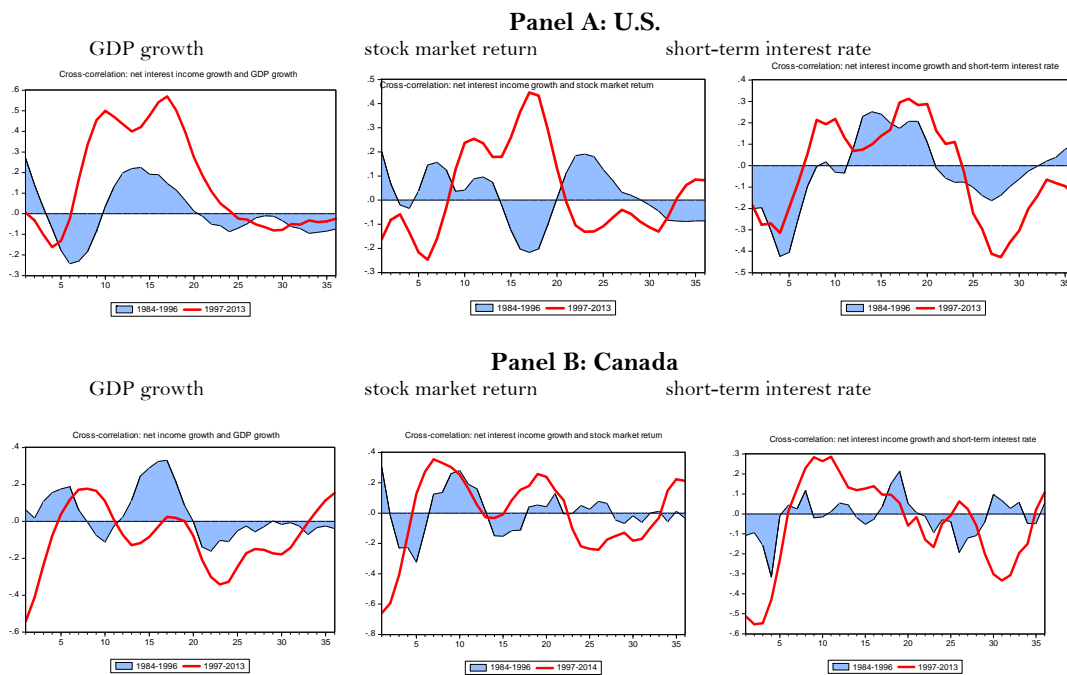


1997-2013



The feedback effect from bank income growth to the stock market has a similar pattern in both countries (Figure 12, Panels A and B). In the U.S., a significant positive feedback effect from bank non-interest income growth to the stock market appears over the last period. This feedback effect has developed earlier in Canada, but it is also stronger over the second period.

Figure 13 Response of net interest income growth to the lagged values of macroeconomic and financial shocks on two subperiods: 1984-1996 and 1997-2013

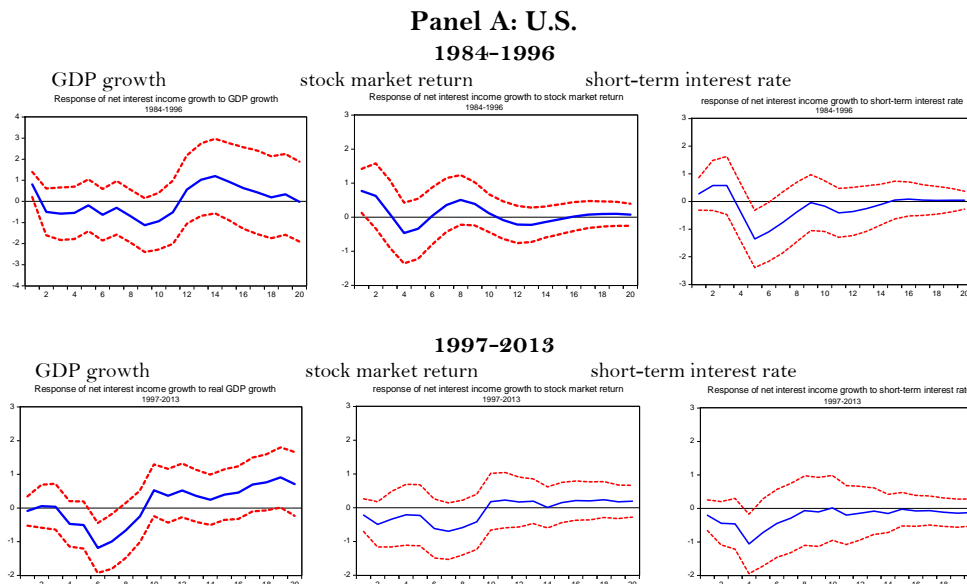


4.5 The behaviour of net interest income growth before and after the structural break

Since monetary policy essentially impacts the banking system through net interest income, it is interesting to examine how the behaviour of net interest income growth might have changed before versus after the structural break. Based on the cross-correlations analysis, U.S. banks' net interest income growth is much more responsive to GDP growth and to the stock market after the 1997 structural break (Figure 13, Panel A)¹². Moreover, the sensitivity of U.S. banks' net interest income growth to the short-term interest rate does not decrease after the structural break. This result might seem counterintuitive since more financial instruments working as insurance vehicles (like credit derivatives) are available during the last period. The fact that banks remain evenly exposed to monetary shocks despite these vehicles is broadly consistent with the argument that financial innovation is mainly used to take more calculated risks rather than to protect the banking business (Demsetz and Strahan, 1997).

In Canada, the sensitivity of net interest income growth to GDP growth and the stock market turns from positive to negative in the short-run after the structural break (Figure 13, Panel B). This may be due to the negative correlation between Canadian bank net interest and non-interest income flows, the latter being in stark expansion during the second period. As in the U.S., net interest income growth also reacts more negatively to a positive interest rate shock in the short-run after the structural break¹³.

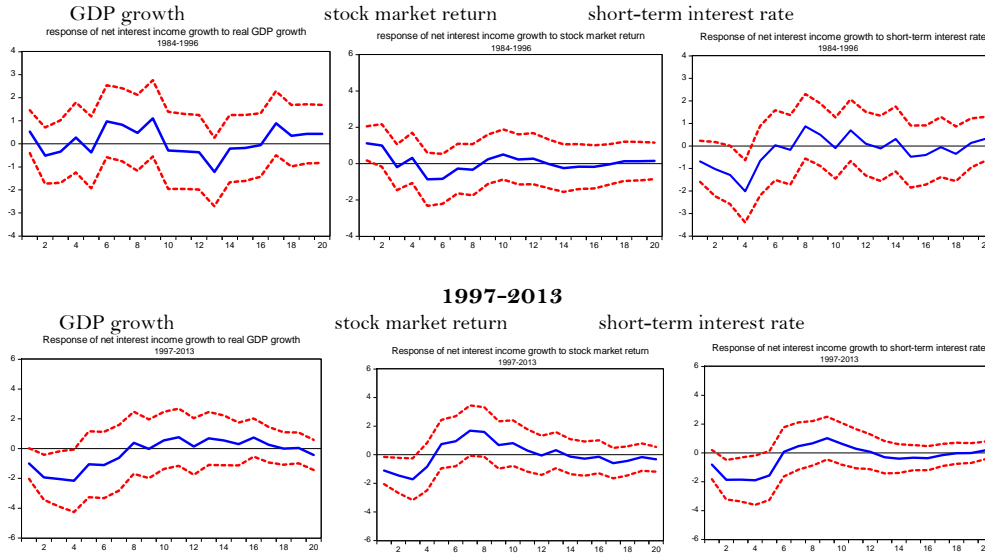
Figure 14 IRFs: response of net interest income growth to various shocks over two subperiods: 1984–1996 and 1997–2014



¹² This may be attributable to increasing complementarities between bank traditional and non-traditional activities.

¹³ It recuperates very quickly thereafter, a pattern which may be explained by the higher weight of wholesale funds in Canadian banks' funding after the structural break.

Panel B: Canada
1984-1996



The IRFs of net interest income growth support our preliminary results. In the U.S., the short-term response of net interest income growth to GDP growth and to the stock market turns from positive to negative after the structural break (Figure 14, Panel A). More importantly, the negative short-term impact of a monetary shock on net interest income growth shows no obvious change.

In Canada, the response of net interest income growth to GDP growth and the stock market has switched from positive to negative even more (Figure 14, Panel B), and again, the IRFs do not signal any change in the negative relationship between net interest income growth and interest rate shocks.

To summarize, bank net interest income growth has become countercyclical, at least in the short-run, both in Canada and in the U.S. In other words, net interest income seems to act as a buffer against fluctuations since the 1997 structural break¹⁴. A positive shock originating from the stock market also tends to decrease net interest income growth in both countries. That may be explained by the “search-for-yield” effect on the side of bank depositors, which tends to increase banks’ cost of funds and decrease net interest income. Finally, monetary policy does not seem to have lost its effectiveness over the behaviour of net interest income.

5. Conclusion

Prior to the advent of universal banking, banks were based on the originate-to-hold model, and loan growth was strongly linked to GDP growth. However more recently, counteracting forces seem to have surfaced. *On the one hand*, fee-based activities offer greater diversification opportunities. With the

¹⁴ As Calmès and Théoret (2014) suggest however, this might be due to a simple risk shifting, as the detrimental impact of OBS activities seem to have increased, whilst credit risk was becoming more manageable.

accelerated development of derivatives—especially credit derivatives like credit swaps—banks can better manage credit and market fluctuations. *On the other hand*, diversification in fee-based activities increases the volatility of banks' income flows and, *ceteris paribus*, this factor tends to increase the amplitude of the business cycle. The main contribution of this paper is to show that such a feedback effect is indeed at play in the data.

In the U.S., given banks' product-mix, lagged values of GDP growth still have a significant impact on non-interest income growth. However, non-interest income growth seems to give rise to significant feedback effects, both on real GDP and on the stock market, a result much in line with Peersman and Wagner (2014). In particular, we show that these feedback effects gained strength after the 1997 structural break in banks' share of non-interest income in net operating income.

In the universal banking era, banks might have a greater impact on economic activity and on the stock market but central banks nevertheless continue to impact net interest income growth, although this effect seems to have become shorter-lived.

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