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Preliminary report

Sadullah Çelik
Corresponding author
Marmara University,
Faculty of Economics,
Department of Economics,
Istanbul,
Turkey
scelik@marmara.edu.tr

Pınar Deniz
Marmara University,
Faculty of Economics,
Department of Economics,
Istanbul,
Turkey
pinar.deniz@marmara.edu.tr

Globalization of Consumer Confidence

Summary: The globalization of world economies and the importance of nowcasting analysis have been at the core of the recent literature. Nevertheless, these two strands of research are hardly coupled. This study aims to fill this gap through examining the globalization of the consumer confidence index (CCI) by applying conventional and unconventional econometric methods. The US CCI is used as the benchmark in tests of comovement among the CCIs of several developing and developed countries, with the data sets divided into three sub-periods: global liquidity abundance, the Great Recession, and post-crisis. The existence and/or degree of globalization of the CCIs vary according to the period, whereas globalization in the form of coherence and similar paths is observed only during the Great Recession and, surprisingly, stronger in developing/emerging countries.

Key words: Consumer confidence, Emerging markets, Advanced economies, Wavelet comovement analysis.

JEL: C22, E20, G01, O57.

The leading economic indicators are crucial because they are expected to provide information about future economic conditions. Among others, consumer confidence index (CCI) is one of the most popular as the responses to survey questions should theoretically include information about households' plans for future purchases and perceptions of current and future economic conditions (Olivier Blanchard 1993; George A. Akerlof and Robert J. Shiller 2009). The employment opportunities, the condition of goods and services markets, the financial market indicators as well as the political and social indicators have all been emphasized as underlying factors affecting consumer behavior. Whether globalization can be added to this long list is an intriguing question. During the Great Recession, many studies advocated recoupling (Sébastien Walti 2009; Robert P. Flood and Andrew K. Rose 2010). However, M. Ayhan Kose, Christopher Otrok, and Eswar Prasad (2012) found empirical evidence in favor of both recoupling and decoupling using different groups of advanced and developing/emerging countries. So, we question whether globalization in consumer confidence occurs at *only* contraction periods or in all cycles using conventional and unconventional econometric methods. Section 1 provides a brief review of the literature, Section 2 introduces the methodology, Section 3 explains the data set and presents the empirical results, and Section 4 concludes.

1. Literature Survey

Thus far, there is no real consensus on the issue at hand. However, many studies have argued in favor of the usefulness of consumer confidence surveys because these leading indicators predict changes in total consumer expenditures and/or show the link between consumer sentiment and economic fundamentals (Daron Acemoglu and Andrew Scott 1994; Christopher D. Carroll, Jeffrey C. Fuhrer, and David W. Wilcox 1994; Stephane Dees and Pedro S. Brinca 2013; Mark Hutson, Fred Joutz, and Herman Stekler 2014; Hamid Baghestani 2015).

Nevertheless, there is also extensive literature that is critical of the outcomes derived from the information content of consumer confidence indices. These studies have mainly claimed that the link between consumer expectations and changes in future consumer sales activity is rather weak (Sydney Ludvigson 1996; Nicholas S. Souleles 2001; Jeff Dominitz and Charles F. Manski 2004; Rutger van Oest and Philip Hans Franses 2008). Many of the studies in the latter group have applied similar methods to those in the former group but have surprisingly reached contradictory empirical findings. Nevertheless, it is clear that the recent literature captures the leading role of consumer confidence indices. The literature focusing on consumer confidence/sentiment indices, as well as the methodology used in the empirical analysis, is quite broad. Due to the qualitative nature of the data, simple methods are not capable of detecting the information content of the surveys. Hence, many studies have used spectral density analysis, including such techniques as frequency domain analysis, to detect cross-country synchronization (or cohesion) given that different variables are considered. Aziz N. Berdiev and Chun-Ping Chang (2015), who used wavelet analysis, found that the growth rates of China, Japan, and the United States were synchronized, at different levels, with those of other Asia-Pacific countries. Bernd Süssmuth and Ulrich Woitek (2004) applied a frequency domain approach to observe similarities in the overall business cycle structures of EU economies; they found that Mediterranean countries were dependent on the fluctuations in EU countries.

Some studies have used confidence indicators to observe synchronization. Zbigniew Matkowski and Mariusz Próchniak (2004), by using the industrial confidence indicator, observed that Central and Eastern European countries had a sensible synchronization with the EU. Reyes R. Araiza and Jesus C. González (2002) investigated the synchronization of the cyclical behavior of the US and Mexico, coupled with an analysis of the cyclical indicators of the Mexican economy. By applying correlation and Clive W. J. Granger (1981) causality techniques, these authors observed that the Mexican coincidence indicators followed the US consumer confidence index. Similarly to our study, Aurélie Lemmens, Christophe Croux, and Marnik G. Dekimpe (2007), by using dynamic correlation through frequency domain analysis, investigated the similarities between 14 European consumer confidence indicators; their results showed that the correlation was low at high frequencies but was high at low frequencies.

In this study, similar to the existing literature, the data is examined by correlation and Granger causality analysis. However, unlike the previous literature, the correlations within and between developing and developed economies are considered along with the wavelet comovements. We group the consumer confidence data ac-

cording to some critical sub-periods and check whether there are any structures inherent to these sub-periods. Moreover, the leading role of the US consumer confidence index in other economies is analyzed through the conditional Granger causality.

2. Methodology

The empirical analyses carried out in this study include correlation, causality tests, and wavelet comovement analysis.

2.1 Conditional Granger Causality

Given that not all variables in a data set have the same integration order, the bounds test approach of M. Hashem Pesaran, Yongcheol Shin, and Richard J. Smith (2001) is preferable because it is free from any *a priori* integration order restrictions. This method involves checking the joint statistical significance of α_1 and α_2 in the following regression:

$$\Delta y_t = \mathrm{c}_0 + \alpha_1 y_{t-1} + \alpha_2 x_{t-1} + \sum_{i=1}^{p-1} \beta_i \Delta y_{t-i} + \sum_{j=0}^{q-1} \delta_j \Delta x_{t-j} + \varepsilon_t, \quad (1)$$

where y_t and x_t reflect the CCI of the domestic economy and the US, respectively. The calculated *F*-statistic measures the joint significance of α_1 and α_2. If it is statistically significant (higher than the critical values given in Pesaran, Shin, and Smith (2001)), then x_t and y_t are said to have a level relationship. The existence of a level relationship is the necessary condition to consider conditional Granger causality analysis, which could be done by using Equation (2):

$$\Delta y_t = \mathrm{c}_0 + \sum_{i=1}^{p-1} \beta_i \Delta y_{t-i} + \sum_{j=0}^{q-1} \delta_j \Delta x_{t-j} - \pi \hat{e}_{t-1} + \varepsilon_t, \quad (2)$$

where π is the error correction term (ECT) and shows the speed of the short-run adjustment to the long-run equilibrium. According to the conditional error correction model for causality tests, significant *F*-statistics reflect a short-run causality, and significant *t* tests for ECT denote a long-run causality[1].

2.2 Wavelet-Based Measure of Comovement

Wavelet measures provide a powerful analysis of the time-frequency representation of the data set. Croux, Mario Forni, and Lucrezia Reichlin (2001) proposed an analysis method for measuring comovements in the frequency domain. However, such analysis does not consider cases in which the degree of comovement may change over time. Under this criticism, António Rua (2010) developed a method that allows

[1] The frequency domain causality analysis of Jörg Breitung and Bertrand Candelon (2006) is not included in this report because the conditional Granger causality is more commonly used in the literature. Nonetheless, the results of Breitung and Candelon (2006) tests are available from the authors on request.

for such change. His wavelet method combines the comovement at the frequency level and over time simultaneously. The wavelet test is given by:

$$\psi_{\tau,s}(t) = 1/\sqrt{s}\,\psi\left(\frac{t-\tau}{s}\right), \tag{3}$$

where τ is the time position (translation parameter); s is the scale (dilation parameter), which is related with the frequency; and $1/\sqrt{s}$ is a normalization factor to ensure that the wavelet transforms are comparable across scales and time series.

Similarly to the measurement in Croux, Forni, and Reichlin (2001), the correlation coefficient between two series ranges between -1 and 1 in the formula provided by Rua (2010). In this method, the correlation coefficient provides information not only at the frequency level but also over time. A high frequency refers to a short-run, whereas a low frequency denotes a long-run.

3. Data and Empirical Findings

The CCI is calculated by using consumer surveys and ranges between 0 and 200 with a base value of 100. Index values above/below 100 indicate the optimism/pessimism of households regarding their consumption patterns and perceptions of current and/or future periods. CCI data sets are obtained from the OECD database, in which each variable is given an amplitude and is seasonally adjusted. The data sets cover monthly data between January 2003 and August 2013. The only exception is the Turkish CCI data set, which starts in December 2003. The data are divided into three subperiods: January 2003 to November 2007, which represents the period of global liquidity abundance (GLA); December 2007 to June 2009, which represents the period of global financial and economic crisis (mainly in the US); and July 2009 to August 2013, which stands for the post-crisis period. The countries are classified as either developed (Australia, Canada, France, Germany, Italy, Japan, the UK, and the USA) or developing (Brazil, China, Hungary, Mexico, Poland, Slovakia, Turkey, and South Africa). The country selection is based on the data availability; the abbreviations used for the countries are listed in the Appendix.

The descriptive statistics are shown in Table 1 of the Appendix. Figures 1 and 2 also in the Appendix display our data set. First, we check for significance of correlation in the sub-periods, with the additional sub-period of the global financial crisis (GFC), defined as December 2007 to April 2010; Tables 2 and 3 present the results. In the US crisis period, the US CCI shows a statistically significant and high correlation with the consumer sentiment in the developed countries AUS, CAN, FR, JP, and UK and the developing countries MEX and TUR. The standard correlation analysis indicates the strength of the long-run relationship because it considers the given data set as a whole without taking into account the lags. Only the POL and SLO CCIs show a statistically significant and high correlation with European developed economies (FR and GER) in the GLA period. In other periods or country groups, no statistically significant correlations are observed.

Second, the leading role of the US consumer sentiment in the consumer confidence indices of other economies is investigated through causality tests in the time

domain. Tables 4 to 6 show the results of the conditional Granger causality (short-run causality), ECT (long-run causality), and bounds test (level relationship) considering the USA *vis-à-vis* other countries. For the GLA period, in the short term, the calculated *F*-statistics are statistically significant for BRA, FR, IT, JP, and UK. This means that the US CCI causes the CCIs of these countries. A negative and significant ECT indicates the existence of long-run causality. The bounds test is applied to determine the existence of a level relationship. The developed countries FR, IT, and UK, and the emerging countries CH, POL, TUR, and ZAF reflect a long-run causal link from the US CCI. In the US crisis period, the short-run US causality shows a change in direction for CH, GER, HUN, and SLO. In the long-run, the developed countries AUS, FR, and GER, and the emerging economies BRA, CH, HUN, POL, SLO, and ZAF have a statistically significant causal link from the US CCI. After the US crisis, only MEX shows a statistically significant short-run causal link from the US CCI. In the long-run, the developed economies CAN and GER and the emerging markets of CH, HUN, MEX, and SLO have a causal link from the US CCI. Further, in the long-run, only CH seems to follow the US throughout the whole period. FR, POL, and ZAF follow the US in the GLA and crisis periods, whereas GER, HUN, and SLO follow in the crisis and post-crisis periods. Therefore, the causality analysis shows some form of globalization in the sense of cohesion to the US CCI for both developed and emerging markets. However, these relationships are not continuous, probably due to the lagging improvement in the domestic economies of some of these nations.

Third, a wavelet-based measure of comovement (computations are done by using MATLAB) with the US is applied and it is shown in Figure 3. This technique combines the frequency bands and time intervals. In the wavelet-based measure of comovement, the vertical axis refers to the frequencies (converted into time units in years), and the horizontal axis denotes the time series data set (2003-2013). In the figure, the gray area (right) describes the values: the darker the scale, the higher the values of comovement. AUS, CAN, FR, JP, UK, and CH are shown to have a short-run comovement with the US throughout the whole period. In the medium- and long-run, only BRA, GER, and IT have no comovement with the US in the crisis period. GER has a comovement after the US crisis, whereas IT has a significant comovement with the USA in the GLA period. Rua (2010) argued that the usual statistical significance should be a positive (negative) correlation coefficient of more (less) than 0.75 (-0.75) comovement for a sample of approximately 100 observations. Thus far, no statistical significance test has been developed for the wavelet comovement analysis due to its Brownian motion characteristic.

Of the three sub-periods (GLA, US crisis, and post-crisis), the US crisis has the highest correlation coefficient for wavelet comovement and for causal links with the emerging markets. China is affected by the US CCI throughout the period, whereas BRA does not show a comovement but instead follows the US CCI. Geographic proximity does not have a role in the causality, correlation, or wavelet comovement. However, as the causality analysis clearly shows, developing countries tend to be affected by the US CCI.

Hence, by using conventional and unconventional empirical methods, we examine whether there is correlation, causality, and comovement between the US con-

sumer sentiment and the consumer sentiment in several developing and developed/emerging economies. Our findings show that the US CCI has a leading effect, especially in emerging economies, during the crisis period, which possibly supports the existence of globalization of consumer confidence indices in the crisis period. It is hard to argue that the comovement after the crisis is as strong as that during the crisis. Nevertheless, there still exists some sort of relation that ties the emerging markets to the US, probably due to the dependence of these markets on capital flows, which affect growth, employment, income, and consumer sentiment.

Moreover, we find support for a recoupling in the world economy during periods of contraction. This is mainly indicated by the recoupling (or globalization) of consumer confidence given the consensus on the paradigm that consumer perceptions theoretically show parallel trends to consumption and GDP growth.

The world has been increasingly integrated under many different structures, and technological advances that were not available in past decades, such as the Internet and social media, have now become accessible. The widespread use of these new economic by-products are possibly affecting consumer perceptions in an unprecedented way, making it harder to model the information content of the leading economic indicators. Therefore, unconventional methodologies are used in this study to determine certain patterns that may develop in consumer attitudes. Besides, it is almost common knowledge that consumer confidence is affected not only by domestic fluctuations but also by global developments. Thus, decoupling can easily occur globally during vulnerable periods. Indeed, the pre-crisis and post-crisis periods in our study show significant differences compared to the crisis period in terms of correlation and causality analysis for both developing and developed economies. Hence, our findings suggest the existence of a decoupling due to economic performance, which is reflected in the consumer confidence across countries when the world economy is in an expansionary cycle.

The decoupling during the expansionary period may be due to several factors. First, the average growth rates of developing countries tend to be higher than those of developed countries over long periods. High domestic demand due to a high marginal propensity to consume is one of the basic factors behind the diverging growth rates between developed and developing countries. In periods of liquidity abundance, it is reasonable to expect high capital inflows into countries where the growth forecasts are more attractive. The abundance of global liquidity at low cost would probably boost consumer confidence more in developing than in developed countries.

Another factor behind the decoupling, especially in the post-US crisis period, is that the crisis in developed countries originated from the high debt stocks of households. High debt stocks, together with high unemployment and low wages, probably caused a falling sentiment among consumers in developed countries.

It is difficult to argue in favor of a strong globalization of consumer confidence during expansionary periods of the world economy. On the other hand, a major policy implication of the current results is the need for greater cooperation across countries during periods of unprecedented global financial and economic crisis, such as the Great Recession, without considering the developmental stage of the economy. This is very crucial in creating new markets, especially after a crisis.

The measures taken by advanced economies may have outcomes that are hard to observe in the short and medium term because the growth rates in advanced economies do not jump back to the pre-crisis levels, as the Great Recession has shown. Policies that aim to help emerging/developing countries would have faster effects on the global growth rates given that these nations have stable economic markets and political scenes and are willing to be part of the global world rather than merely seeking to end the crisis. This could probably be achieved by providing major assistance to these nations, which would be directed toward the most efficient sectors in each economy and could possibly create the highest levels of increase in employment and income. Therefore, successful global coordination can help influence the household expectations for the future, change the perceptions of the current stance, and lead to increasing levels of consumer confidence, which seems to be one of the major economic indicators globally, especially after the Great Recession.

It is possible to stimulate expectations in a positive manner and to create an optimistic perspective so as to spur the world economy to higher growth, with all the market economies being involved and consumers and producers working to improve the welfare of their nation.

In the meantime, the speculative attacks on economic and financial variables and the possible existence of bubbles should also be carefully monitored, and the necessary policy decisions should be made to prevent possible future damage to the world economic growth pattern and forward-looking pre-emptive policies should be continued by the monetary authorities without any step taken backwards.

4. Conclusion

Consumer confidence indices contain very important economic information on developed/developing economies. This study shows that the CCIs in developing countries reflect the worsening perceptions of households better compared with the CCIs in developed countries. This is probably due to the low levels of income *per capita* and the high rates of unemployment in these markets, the flawless functioning of which is always questioned. Hence, the participants in consumer confidence surveys show an asymmetric response in developing countries with too much (little) pessimism (optimism) during a recession (expansion). Volatile and persistent levels of inflation, permanent positive real interest rates in a zero lower bound world, and the continuous depreciation of the domestic currency are also possible contributing factors to such consumer attributes. Technological advances seem to be the only cure.

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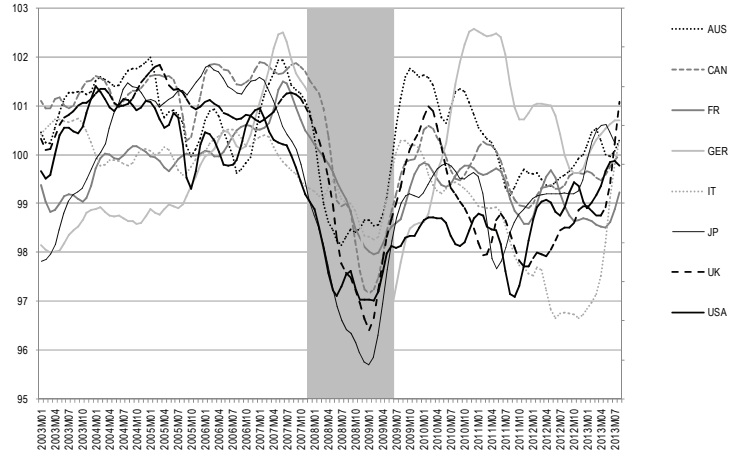
Appendix

Abbreviations

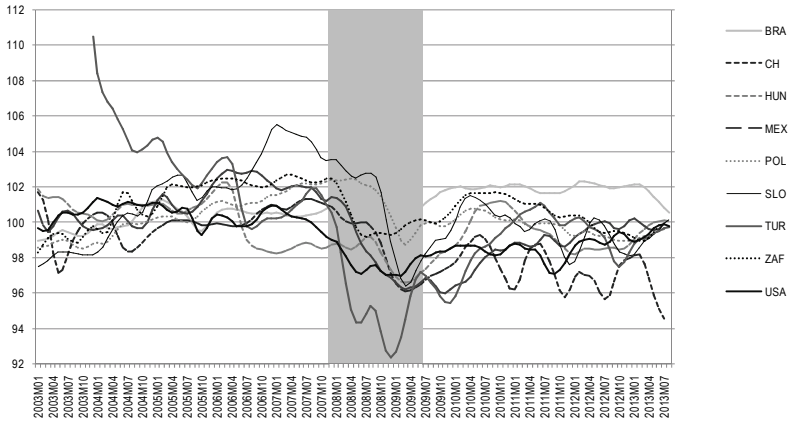
AUS: Australia
BRA: Brazil
CAN: Canada
CH: China
CCI: consumer confidence index (used interchangeably with consumer sentiment)
CGC: conditional Granger causality (short-run causality)
ECT: error correction term (long-run causality)
FR: France
GER: Germany
GFC: global financial crisis (the Great Recession)
GLA: global liquidity abundance
HUN: Hungary
IT: Italy
JP: Japan
MEX: Mexico
POL: Poland
SLO: Slovakia
TUR: Turkey
UK: the United Kingdom
USA: the United States of America
ZAF: South Africa



Note: The gray area indicates the US recession period based on the NBER business cycle dates.

Source: Authors' calculations.

Figure 1 CCIs for Developed Economies (2003-2013)



Note: The OECD obtained the CCI for Turkey from TURKSTAT, which was first released in December 2003. The divergent initial figures may be attributed to this delayed release.

Source: Authors' calculations.

Figure 2 CCI for Developing/Emerging Economies (2003-2013)

Table 1 Descriptive Statistics

	AUS	CAN	FR	GER	IT	JP	UK	USA	BRA	CH	HUN	MEX	POL	SLO	TUR	ZAF
Mean	100.4	100.4	99.5	99.8	99.5	99.4	99.9	99.4	101.1	98.7	99.4	99.6	100.3	100.8	100.0	100.9
Med.	100.6	100.9	99.6	99.8	99.7	99.3	100.6	99.5	101.1	98.8	99.1	99.8	100.1	100.5	100.1	101.0
Max.	101.9	102.0	101.5	102.5	102.3	101.8	101.8	101.4	102.3	101.3	102.3	102.9	102.4	105.5	110.5	102.6
Min.	98.1	97.1	97.9	96.2	96.6	95.7	96.4	97.0	99.5	95.1	96.6	96.0	98.7	96.4	92.4	98.9
Std.	0.9	1.2	0.7	1.5	1.3	1.5	1.4	1.2	0.8	1.6	1.3	1.9	1.1	2.2	3.4	1.1
Skew.	-0.5	-0.7	0.01	-0.04	-0.5	-0.3	-0.6	-0.2	-0.15	-0.2	0.1	-0.2	0.5	0.2	0.2	-0.1
Kurt.	2.4	2.8	2.8	2.6	3.1	2.5	2.1	1.9	1.8	1.8	2.2	2.1	2.1	2.3	3.18	1.5
J.B.	8.5	12.8	0.1	0.9	6.8	4.5	14.3	8.1	6.9	8.0	2.8	4.0	7.5	3.2	0.6	9.9
Prob.	0.01	0.00	0.94	0.65	0.03	0.10	0.00	0.02	0.03	0.02	0.25	0.13	0.02	0.20	0.74	0.01
Obs.	139	139	139	139	139	139	139	139	115	115	115	115	115	115	115	115

Source: Authors' calculations.

Table 2 Correlation Coefficients

	AUS	BRA	CAN	CH	FR	GER	HUN	ITA	JP	MEX	POL	SLO	TUR	UK	USA	ZAF
AUS		0.57	0.59	-0.06	0.43	0.14	0.47	0.37	0.73	-0.19	-0.17	-0.03	0.74	0.72	0.53	0.54
BRA	0.13		0.53	-0.11	0.45	0.62	0.59	-0.3	0.78	0.6	-0.32	-0.01	0.61	0.33	0.64	0.26
CAN	0.27	0.65		0.46	0.82	0.52	0.53	0.26	0.61	0.43	0.36	0.55	0.44	0.83	0.57	0.61
CH	-0.13	0.19	0.45		0.53	0.24	0.24	0.35	-0.2	0.23	0.82	0.8	-0.27	0.39	-0.17	0.33
FR	0.15	0.58	0.5	0.54		0.62	0.54	0.38	0.31	0.32	0.52	0.71	0.32	0.62	0.24	0.71
GER	0.05	0.44	0.61	0.63	0.88		0.77	-0.15	0.38	0.66	0.19	0.44	0.37	0.08	0.29	0.42
HUN	0.01	-0.25	-0.46	-0.58	-0.7	-0.73		0.12	0.56	0.29	0.17	0.44	0.55	0.32	0.36	0.52
IT	-0.28	-0.31	0	-0.29	-0.54	-0.28	0.18		-0.15	-0.54	0.54	0.37	0.08	0.45	-0.3	0.51
JP	-0.05	0.7	0.28	0.08	0.57	0.38	-0.16	-0.37		0.33	-0.32	-0.06	0.71	0.58	0.82	0.28
MEX	-0.4	0.55	0.47	0.37	0.61	0.71	-0.36	0.05	0.55		0.14	0.33	0.01	0.05	0.43	0.03
POL	-0.06	0.66	0.53	0.49	0.89	0.91	-0.6	-0.4	0.58	0.79		0.9	-0.39	0.29	-0.35	0.36
SLO	-0.04	0.71	0.55	0.51	0.87	0.85	-0.67	-0.36	0.66	0.73	0.94		-0.2	0.4	-0.06	0.41
TUR	0.59	-0.05	-0.15	-0.44	-0.29	-0.46	0.43	-0.23	0.07	-0.5	-0.44	-0.38		0.36	0.53	0.48
UK	0.52	0.58	0.24	-0.01	0.24	0	0.06	-0.55	0.44	-0.07	0.12	0.2	0.65		0.46	0.54
USA	0.54	0.15	0.19	-0.28	-0.1	-0.31	0.06	-0.02	0.23	-0.37	-0.33	-0.13	0.64	0.45		0.12
ZAF	-0.17	0.69	0.41	0.34	0.75	0.73	-0.4	-0.44	0.79	0.76	0.9	0.89	-0.31	0.24	-0.22	

Notes: The white and gray areas indicate the sub-periods of GLA and GFC, respectively; the corresponding data sets cover the periods January 2003 to November 2007 and December 2007 to April 2010.

Source: Authors' calculations.

Table 3 Correlation Coefficients

	AUS	BRA	CAN	CH	FR	GER	HUN	IT	JP	MEX	POL	SLO	TUR	UK	USA	ZAF
AUS		-0.06	0.64	0.34	0.41	-0.38	0.27	0.78	0.28	-0.81	0.6	0.34	0.45	0.78	-0.02	0.44
BRA	0.24		0.08	0.19	0.37	0.35	0.18	-0.41	0.11	0.31	-0.13	0.11	0.12	-0.21	0.26	0.1
CAN	0.63	0.86		0.48	0.59	-0.08	0.36	0.55	0.06	-0.52	0.54	0.55	0.48	0.68	0.22	0.46
CH	0.22	0.85	0.82		0.36	0	0.33	0.29	-0.15	-0.3	0.5	0.44	0.24	0.45	-0.17	0.45
FR	0.49	0.89	0.97	0.91		0.34	0.43	0.49	-0.29	-0.39	0.62	0.74	0.53	0.3	-0.18	0.73
GER	0.19	0.88	0.81	0.99	0.91		0.62	-0.19	-0.22	0.52	0.07	0.25	0.49	-0.61	-0.12	0.38
HUN	0.04	0.77	0.68	0.96	0.79	0.94		0.26	0.32	0.05	0.56	0.66	0.73	0.08	0.01	0.63
IT	0.37	0.77	0.73	0.61	0.73	0.6	0.59		-0.1	-0.88	0.79	0.43	0.48	0.62	-0.34	0.66
JP	0.81	0.66	0.89	0.5	0.78	0.48	0.34	0.75		0.1	-0.06	0.07	0.06	0.27	0.59	-0.22
MEX	0.52	0.87	0.95	0.89	0.98	0.9	0.74	0.59	0.75		-0.69	-0.3	-0.19	-0.75	0.33	-0.5
POL	0.15	0.88	0.78	0.98	0.88	0.99	0.96	0.64	0.45	0.85		0.77	0.57	0.52	-0.43	0.89
SLO	0.17	0.84	0.77	0.99	0.87	0.98	0.98	0.6	0.44	0.85	0.99		0.48	0.45	-0.11	0.7
TUR	0.68	-0.09	0.26	-0.17	0.1	-0.23	-0.2	0.37	0.58	0.02	-0.23	-0.21		0.1	-0.16	0.62
UK	0.73	0.78	0.96	0.66	0.9	0.66	0.49	0.74	0.97	0.88	0.62	0.6	0.39		0.09	0.27
USA	0.91	0.47	0.82	0.44	0.68	0.39	0.3	0.56	0.91	0.67	0.37	0.39	0.67	0.86		-0.41
ZAF	0.89	0.5	0.83	0.44	0.71	0.43	0.23	0.4	0.88	0.76	0.36	0.38	0.46	0.89	0.92	

Notes: The white and gray areas indicate the sub-periods of US crisis and post-US-crisis respectively; the corresponding data sets cover the periods of December 2007 to June 2009 and July 2009 to August 2013.

Source: Authors' calculations.

Table 4 Conditional Granger Causality and Bounds Test: GLA Period

Dependent var.	Conditional Granger causality test			Bounds test - *F* stat.
	US causes	Other causes	ECT(*t*-1)	
USA	-	0.481 (0.691)	-1.460 (0.150)	*F*_iii
AUS	1.818 (0.156)	-	-3.016 (0.004)	3.567
USA	-	0.684 (0.566)	-1.311 (0.196)	*F*_iii
BRA	2.955 (0.041)	-	-2.677 (0.01)	3.636
USA	-	0.101 (0.958)	-1.348 (0.183)	*F*_iii
CAN	0.771 (0.515)	-	-2.160 (0.035)	2.635
USA	-	0.375 (0.771)	0.150 (0.881)	*F*_v
CH	2.178 (0.103)	-	-3.032 (0.004)	7.412*
USA	-	0.966 (0.416)	0.233 (0.816)	*F*_v
FR	4.401 (0.008)	-	-3.928 (0.001)	9.226**
USA	-	1.040 (0.3834)	0.021 (0.983)	*F*_v
GER	1.535 (0.217)	-	-0.651 (0.517)	2.650
USA	-	0.726 (0.541)	-1.288 (0.204)	*F*_v
HUN	0.735 (0.536)	-	-1.695 (0.096)	5.814
USA	-	2.781 (0.051)	2.699 (0.009)	*F*_v
IT	2.979 (0.040)	-	-2.484 (0.016)	9.785**
USA	-	1.088 (0.363)	2.033 (0.047)	*F*_v
JP	3.927 (0.013)	-	1.884 (0.065)	5.697
USA	-	0.439 (0.725)	0.731 (0.468)	*F*_v
MEX	0.129 (0.942)	-	-1.891 (0.064)	1.635
USA	-	0.599 (0.618)	0.405 (0.686)	*F*_v
POL	2.151 (0.106)	-	-3.889 (0.001)	10.493**
USA	-	2.899 (0.044)	-0.440 (0.661)	*F*_v
SLO	1.446 (0.241)	-	-2.917 (0.005)	5.018
USA	-	0.393 (0.758)	-0.804 (0.425)	*F*_v
TUR	1.295 (0.287)	-	-3.252 (0.002)	10.504**
USA	-	1.835 (0.153)	-1.461 (0.150)	*F*_v
UK	3.619 (0.019)	-	-3.677 (0.001)	7.147*
USA	-	0.079 (0.970)	-0.918 (0.362)	*F*_iii
ZAF	0.321 (0.809)	-	-1.737 (0.088)	6.769*

Notes: Due to the small sample size, the Paresh K. Narayan (2005) critical values were used to obtain more efficient results. The Narayan (2005) critical values with 5% and 10% significance levels, respectively, are 6.00 and 4.95 for case 3 (unrestricted intercept and no trend) and 7.73 and 6.50 for case 5 (unrestricted intercept and trend). (*) and (**) denote significance at the 10% and 5% levels, respectively; the *p*-values are shown in brackets.

Source: Authors' calculations.

Table 5 Conditional Granger Causality and Bounds Test: US Crisis Period

Dependent var.	Conditional Granger causality test			Bounds test - *F* stat.
	US causes	Other causes	ECT(*t*-1)	
USA	-	0.367 (0.778)	-0.288 (0.781)	*F*_v
AUS	2.620 (0.132)	-	-3.414 (0.011)	9.566**
USA	-	0.937 (0.471)	1.872 (0.103)	*F*_v
BRA	1.580 (0.277)	-	-2.592 (0.035)	7.770*
USA	-	0.518 (0.682)	0.762 (0.470)	*F*_v
CAN	0.057 (0.980)	-	-0.643 (0.540)	6.029
USA	-	4.607 (0.044)	-0.011 (0.991)	*F*_v
CH	8.577 (0.009)	-	-5.457 (0.001)	9.204**
USA	-	0.325 (0.807)	-0.131 (0.899)	*F*_v
FR	1.120 (0.403)	-	-2.012 (0.084)	8.220*
USA	-	1.105 (0.408)	0.138 (0.893)	*F*_v
GER	23.969 (0.001)	-	-5.536 (0.001)	9.494**
USA	-	0.879 (0.496)	-0.164 (0.873)	*F*_v
HUN	9.448 (0.007)	-	-4.192 (0.004)	8.765**
USA	-	0.146 (0.928)	0.457 (0.660)	*F*_v
IT	1.266 (0.357)	-	-3.873 (0.006)	6.198
USA	-	0.670 (0.596)	0.756 (0.474)	*F*_v
JP	2.965 (0.106)	-	3.308 (0.012)	1.974
USA	-	1.793 (0.2360)	-0.570 (0.586)	*F*_iii
MEX	0.394 (0.760)	-	-1.739 (0.125)	11.924**
USA	-	0.364 (0.780)	0.186 (0.857)	*F*_v
POL	2.158 (0.181)	-	-3.092 (0.017)	11.219**
USA	-	0.551 (0.663)	-0.157 (0.879)	*F*_v
SLO	8.194 (0.010)	-	-3.715 (0.007)	10.993**
USA		0.731 (0.565)	-0.151 (0.884)	*F*_v
TUR	1.950 (0.210)		-1.971 (0.089)	5.901
USA	-	0.475 (0.709)	-0.415 (0.689)	*F*_v
UK	0.930 (0.4747)		2.145 (0.069)	2.421
USA	-	0.160 (0.919)	-1.472 (0.184)	*F*_v
ZAF	1.634 (0.266)	-	-6.410 (0.001)	10.693**

Notes: The Narayan (2005) critical values with 5% and 10% significance levels, respectively, are 6.35 and 5.08 for case 3 (unrestricted intercept and no trend) and 8.265 and 6.78 for case 5 (unrestricted intercept and trend). (*) and (**) denote significance at the 10% and 5% significance levels, respectively; the *p*-values are shown in brackets.

Source: Authors' calculations.

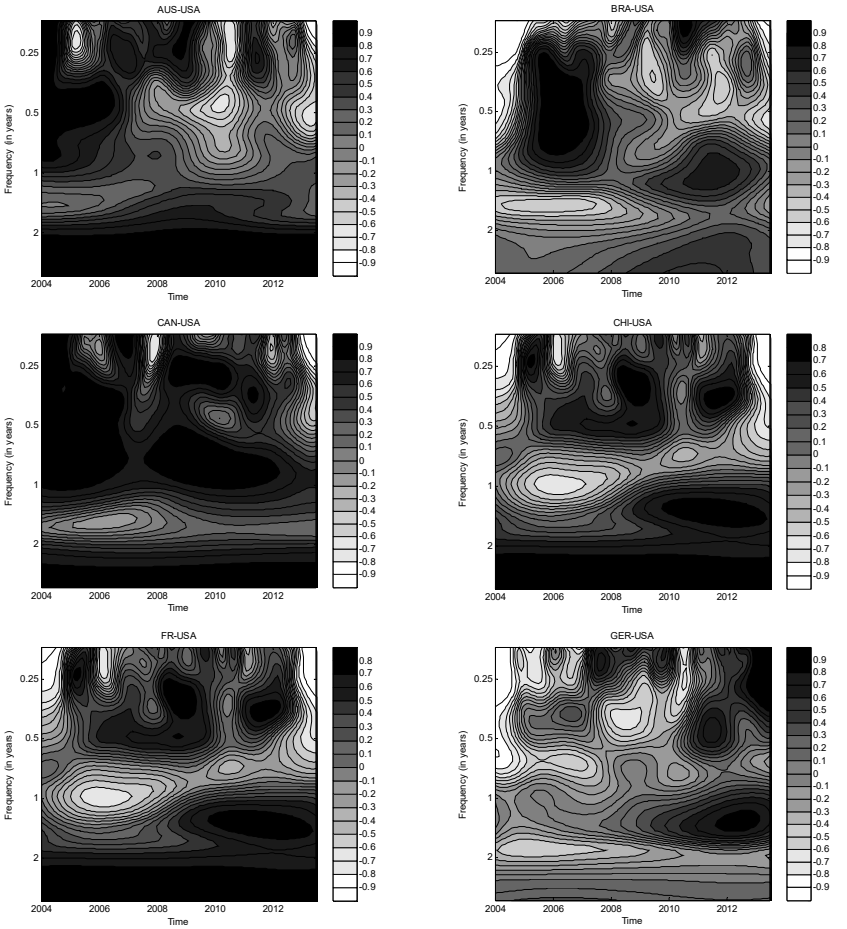
Table 6 Conditional Granger Causality and Bounds Test: Post-US Crisis Period

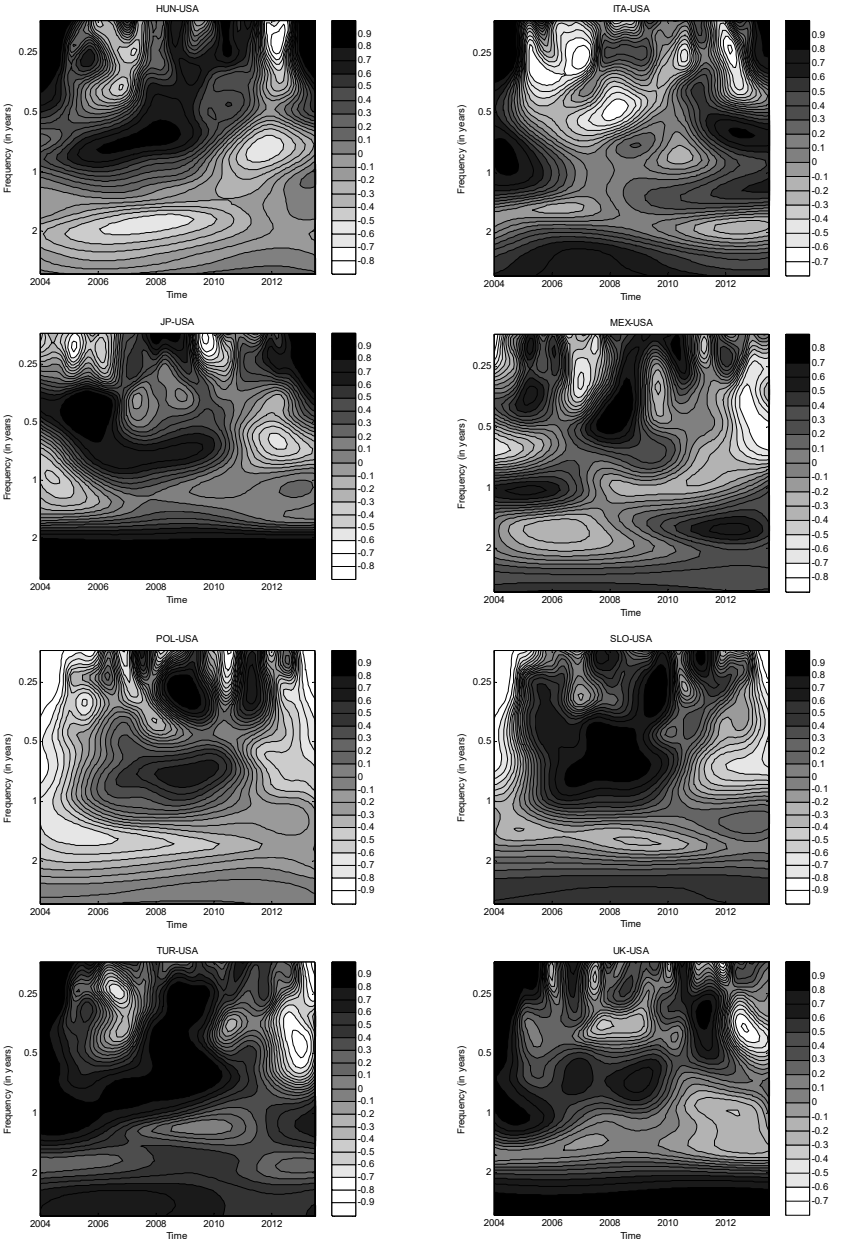
Dependent var.	Conditional Granger causality test			Bounds test - *F* stat.
	US causes	Other causes	ECT(*t*-1)	
USA	-	2.491 (0.074)	-0.265 (0.791)	*F*_iii
AUS	0.872 (0.4637)	-	-1.965 (0.056)	3.172
USA	-	1.104 (0.359)	-0.158 (0.874)	*F*_v
BRA	0.569 (0.6384)	-	-2.397 (0.021)	1.233
USA	-	0.055 (0.982)	-0.687 (0.495)	*F*_v
CAN	0.743 (0.533)	-	-2.541 (0.015)	8.329**
USA	-	0.380 (0.767)	-0.710 (0.481)	*F*_v
CH	0.179 (0.909)	-	-4.062 (0.001)	7.550*
USA	-	0.289 (0.832)	-0.599 (0.552)	*F*_v
FR	1.776 (0.168)	-	-2.118 (0.040)	2.246
USA	-	0.107 (0.955)	-0.489 (0.627)	*F*_v
GER	0.6449 (0.591)	-	-2.329 (0.025)	6.624*
USA	-	0.151 (0.928)	0.084 (0.932)	*F*_v
HUN	0.484 (0.694)	-	-2.769 (0.008)	6.555*
USA	-	0.730 (0.540)	-0.983 (0.331)	*F*_v
IT	1.086 (0.366)	-	2.574 (0.014)	5.182
USA	-	1.3925 (0.259)	0.7120 (0.480)	*F*_iii
JP	1.386 (0.262)	-	-1.824 (0.076)	3.549
USA	-	1.399 (0.258)	-0.073 (0.941)	*F*_iii
MEX	3.074 (0.039)	-	-2.799 (0.008)	8.198**

USA	-	0.509 (0.678)	0.396 (0.693)	*F*_v
POL	0.337 (0.798)	-	-2.586 (0.013)	4.228
USA	-	1.831 (0.157)	-1.305 (0.199)	*F*_v
SLO	0.2469 (0.863)	-	-4.417 (0.001)	7.234*
USA	-	0.462 (0.710)	-0.404 (0.687)	*F*_v
TUR	0.282 (0.837)	-	-2.256 (0.029)	3.405
USA	-	0.259 (0.854)	0.751 (0.456)	*F*_v
UK	0.272 (0.844)	-	-1.966 (0.056)	1.196
USA	-	1.371 (0.266)	-0.533 (0.596)	*F*_v
ZAF	0.625 (0.603)	-	-2.783 (0.008)	4.409

Notes: Check the notes for Table 4.

Source: Authors' calculations.

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UK-USA
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2010
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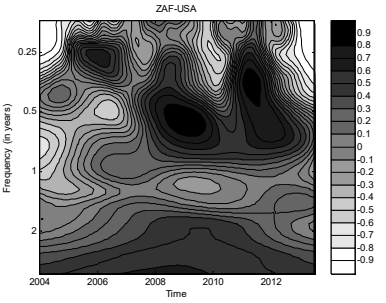

Source: Authors' calculations.

Figure 3 Wavelet-Based Measure of Comovement