

Hamouda, Foued

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Identifying economic shocks with stock repurchase programs

Foued Hamouda^{1*}

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*Corresponding author: Foued Hamouda, URRED-Higher Institute of Management of Gabès, Rue Jilani Habib 6000 Gabès- Tunisia, Gabès University
E-mail: foued.hamouda@isg.rnu.tn

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Stirling United Kingdom

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Abstract: This paper aims to identify economic shocks in four developed countries that authorize different buyback programs. Previous research has revealed that there are few public debates about buyback activities and economic conditions. According to the free cash flow hypothesis, the total payout policy is in line with the real economy of each country. Using linear and non-linear bivariate causality tests, we find that buybacks and industrial production are endogenously determined. In Japan, prior buyback programs indicated a change in economic growth. However, in the United States, changes in economic growth will increase repurchase activity before the financial crisis. This finding is interesting because it supports the idea that repurchase programs are a significant factor in determining economic shocks. It has extended and confirmed the knowledge and perception that stock repurchases could be used by financial economists to predict economic shocks.

Subjects: Development Economics; Corporate Finance; Industry & Industrial Studies

Keywords: industrial production; payout policy; buyback; business cycle; financial crisis

1. Introduction

Why firms repurchase stocks have been a puzzle for more than 20 years. Firms have two ways of distributing liquidity to their shareholders; dividends or share repurchases. Without a doubt, shareholders will prefer the least expensive method that provides them with greater satisfaction. Unlike dividend, stock repurchase is a financial transaction in which firms offer to buy back a specific number of shares from their shareholders at a price that is generally higher than the market price. Many practitioners have questioned why firms are repurchasing shares and how this repurchase affects investors' wealth. For example, according to the tax assumption, firms frequently use buyback programs to provide

ABOUT THE AUTHOR

Foued Hamouda is an assistant professor (and HDR) in the Accounting and Finance Department of Gabès University (Tunisia) and the Director of the "Observatory of Tunisian Southeast Companies". His research interests include share buyback, insider trading, statistic modeling, corporate governance and risk management. He also serves as a volunteer reviewer of research projects with the Ministry of Higher Education. He has a number of publications (articles and book) in the field of accounting and finance.

PUBLIC INTEREST STATEMENT

This study aims to determine if buyback programs, and economic shocks are related. We employ linear and nonlinear causality between buyback programs and business cycle for the period of 1998–2016 using data from four developed countries. Our results show that buyback programs facilitate our knowledge of rapid economic growth change. With a focus on Japan, country that do not seem to promote buyback activities due to a number of barriers, prior buyback programs indicate a shift in economic growth. However, in the United States with a mature market, change in economic growth will boost repurchase activity. Since this research was conducted in major developed countries, it can be replicated and validated in other developing countries.

shareholders with a lower tax rate than dividends (Grullon & Michaely, 2002). As a result, shareholders receive an income (known as a capital gain) taxed at a lower rate than a dividend. Repurchases can also signal to the market that future revenues will be higher than anticipated. It can also signal that a firm's shares are undervalued. Firms can buy back shares to report this undervaluation, which is not possible with dividend distribution. Furthermore, firms can use repurchase when they have excess cash flows that far exceed investment opportunities and reflect weak economic prospects. According to this hypothesis, multiple conflicts between directors and shareholders could arise. There is a high risk that executives will invest this cash flow in unprofitable (negative NPV) projects that do not maximize shareholder value. Repurchase programs can provide information that executives are not going to invest in unprofitable projects. As a result, repurchase programs will give a firm greater flexibility over dividends with multiple advantages. Given this flexibility, it is not hard to understand why firms repurchase stocks.

However, stock repurchase has considerably evolved, especially following several stock market crashes or distress (e.g.: October 1987, 2007–2008 crisis) and during other periods, this growth was even higher. For example, the S&P 500 companies paid out more than 100% of their free cash in repurchase in 2019. According to Murphy (2012) “... Buybacks surged to a record \$180 billion in the fourth quarter of 2007 ...”. Firms spent about 26% of their total annual earnings on repurchases between 1984 and 2000 (Grullon & Michaely, 2004). After the September 11th attack, 329 companies made buyback announcements (September 12–28) compared to 565 before September 12th (Gu & Schinski, 2003). Thomson Financial's aggregate data shows that firms that made up the S&P500 index in 2003 bought back \$284 billion of shares and then \$973 billion in 2006. In 2018 alone, they did a combined \$806 billion in buybacks, and about \$200 billion more than the previous record set in 2007. Overall, all these studies show a staggering upsurge in the magnitude of repurchases around financial distress. In this regard, repurchase programs determine what funds flow to investors and what funds are paid as dividends. It provides information about firm performance and the nature of the signal sent to the market (Comment & Jarrell, 1991; Fried, 2001; Ikenberry et al., 1995; Stephens & Weisbach, 1998). Since, the pioneering work of Lintner (1956); Millert and Modigliani (1961) who put down the foundation for the modern understanding of payout policy, empirical and theoretical models have described repurchase as part of the free cash flow (Jensen, 1986) or the signaling hypothesis (Vermaelen, 1981). Between 1999 and 2000, expenses of industrial companies on share buybacks exceeded, for the first time, those allocated in dividends.

Research on buyback programs is weak compared to dividend distribution. Research on buybacks has predominantly focused on their impact on corporate performance (Chan et al., 2004; Chen et al., 2018) and shareholders' value (Manconi et al., 2019), particularly in the financial crisis when economic growth is weak. These studies underline the importance of the buyback to stabilize prices. Lambrecht and Myers (2012), for example, argue that buyback programs would be used when there are unexpected increases in free cash flow and that a positive economic shock should therefore correspond to a share repurchase increase. In this context, Bhabra and Luu (2015) showed that exogenous shocks to growth opportunities cause payout policy to change significantly, particularly with stock repurchase. Most of the current evidence supports the idea that repurchases have given managers more freedom to pay cash dividends on more stable terms and to repurchase in unstable conditions. Grullon and Michaely (2002) show that repurchases have become an important form of payout for corporations, but firms finance their buybacks with funds that otherwise would have been used to increase dividends. Accordingly, these studies show little public policy debate in the United States (US) and worldwide on repurchase activity and its implications for value creation, employment, income distribution, and economic growth. Straehl and Ibbotson (2017) show that it is statistically impossible to distinguish the long-run total payout growth rates from the macroeconomic growth rates. The authors find that the total payouts grow in line with the real economy. Similarly, Ibbotson and Chen (2003) show that earnings per share growth for US stocks is in line with US Gross Domestic

Product (GDP) per capita. In the same vein, Bernstein and Arnott (2003) show that during the twentieth century, a relationship has existed between net buyback and economic growth. Recently, Wang (2020) shows how repurchase programs grow in unconventional monetary policy. In this study, we seek to look for the relationship that may exist between buybacks and economic conditions according to the free cash flow and the signaling theory.

When the economy is running below capacity, firms may distribute their cash flows differently to residual claimants compared to a higher or a booming state (Benartzi et al., 1997). In the environment of the Global Financial Crisis (GFC), markets are either stagnating or slowly recovering. In contrast, in a booming economy, firms experience abnormal increases in excess cash flow. This economic instability may encourage firms to prefer repurchases to dividends. Yet, many practitioners continue to rely on traditional models using dividends as a unique source of payment for corporate payouts. Firms are more likely to conduct investments in a bullish market period and a stock buyback in a bear market when economic conditions are unfavorable. However, the two payout methods are similar because, as dividend payments reduce retained earnings and hence common equity, repurchases are a direct reduction in the outstanding amount of common equity. Previous research has documented that buybacks generally vary more over time than dividends, and they are used more frequently with volatile earnings, particularly following periods of higher-than-expected profitability. All this supports the idea of a relationship between buybacks and economic conditions.

In most cases, firms repurchase shares using the free cash flow or the conversion of stock options. According to the Free cash flow theory, firms will have the financial resources when investment opportunities are rare. This situation happens during periods of low economic activity, especially for large firms. As a result, we anticipate a significant relationship between buybacks and economic growth. We aim to show that these two variables have a causal relationship. We expect a rapid increase in buyback programs to signal the start of an economic slowdown because firms in this situation are confused about where to spend their free cash flow. Likewise, we also predict a business cycle slowdown as a result of inadequate investment opportunities, which pushes firms to buy back their shares. Consequently, our two hypotheses are:

H1: The increase in buyback programs indicates a change in economic growth.

H2: The fall in economic growth will cause an increase in repurchase decisions.

This article contributes to the literature by analyzing the repurchase activity and business cycle in the United States (US), Canada (CAN), the United Kingdom (UK), and Japan (JAP) using nonlinear causality tests. First, we seek to understand how business cycles and repurchases are mutually determined. Second, we want to identify why, during the economic recession, major firms experienced different buyback decisions.¹ Usually, firms in developed markets repurchase their shares during the Financial Crisis period. In other words, we investigate the relationship between repurchase programs and business cycle by relying on nonlinear bivariate causality tests where repurchase and business cycle are endogenous. Our methodology has the merit to identify indirect causalities between the two variables. It is important to understand the aggregate buyback program, particularly in financial crisis and take into consideration both earnings and the overall economy. If repurchase occurs in a wave, we predict a shortfall in the economic conditions in developed economies. Such an empirical exercise has not yet been conducted and remains largely unexplored. Specifically, this study explains some recent empirical research (Farrugia et al., 2011; Huang et al., 2017; Liang et al., 2013).

The analysis reveals a nonlinear causality between repurchases and business cycle during 1998–2016 and, to a certain extent, after the 2007–2008 financial crisis in Japan, Canada, and the UK. In the US,

however, there is no evidence that buybacks and business cycles cause each other. This finding indicates that countries have different legislation, resulting in substantial differences in how buybacks are used, especially during the financial crisis. In the US, for example, we show massive use of buybacks even after the 2007–2008 financial crisis. In other countries, however, we conclude that firms use buybacks preceding a period of instability. This finding confirms that the financial crisis played a big role in increasing the cost of external financing and, hence, many firms tend to boost their payouts in the form of repurchases.

The paper is organized as follows: Section 2 describes the data and outlines the empirical methodology. Section 3 discusses empirical results. Section 4 presents robustness checks and gives implications. Section 5 concludes the paper.

2. Data and methodology

2.1. Sample construction

We employ monthly data from four developed economies (Canada, Japan, the United Kingdom, and the United States) for two reasons. According to previous studies, the buyback decision is usually announced in a developed market rather than in a less developed market. Second, our choice appears to be reasonable, because we want to know how these programs are used in countries that encourage buybacks, such as the United States and Canada, as well as countries that have strict rules before allowing firms to repurchase (such as Japan and the United Kingdom). Many countries prohibit repurchases and allow firms to repurchase only under certain conditions.² The choice of the above sample can improve our understanding of the stock repurchase volume before and after economic shocks. Our dataset is derived from the Thomson Financial DataStream between 1998 and 2016. The analysis relies on accurate measurement of stock repurchases. The measure is computed from the value of the “Purchases of Common and Preferred Stock” from the Worldscope Cash flow statement for the US, Canada and UK. This is the standard proxy developed by Stephens and Weisbach (1998). It is the funds used to decrease the outstanding shares of common and/or preferred stock.³ This measure is a reasonable proxy that should capture the movements in buyback activity. Because Japan prohibited repurchases before 2001, we collected repurchase decisions from “Treasury shares” available in Financial Statements Statistics of Corporations by Industry and this data is available after 2004.⁴

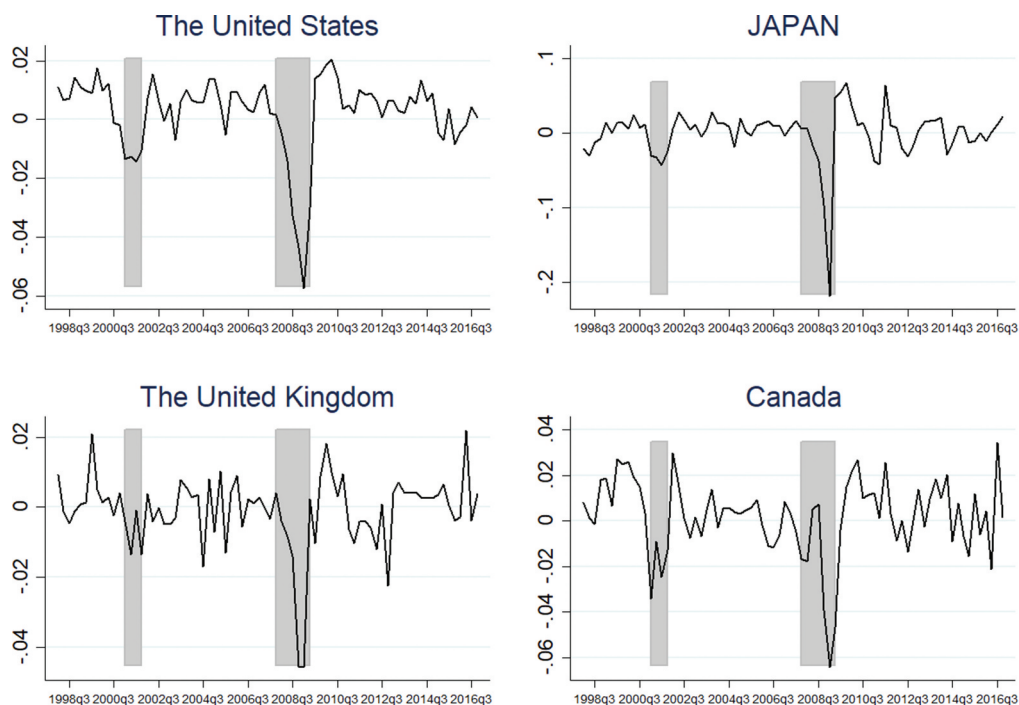
Similar to Stephens and Weisbach (1998), we compute the number of shares repurchased assuming that the shares were purchased at either (1) the average closing price or (2) the lowest price. Because stock repurchase is a rare decision, we collect all repurchases made by all firms in the corresponding country. On the other hand, the business cycle is presented by the total industrial production growth rate as suggested by Hamilton and Lin (1996). These data are derived from the The Organisation for Economic Co-operation and Development (OECD) dataset. Industrial production rate (IPR) is used in log term and computed as follows:

$$\ln[IPR(t)] = \ln[IP(t)] - \ln[IP(t - 1)] \quad (1)$$

Where $IP(t)$ is the Industrial Production on quarter t . Focusing on data characteristics and because buyback is a rare decision, we used the quarter rate of de-seasonalized buyback because of the seasonal characteristics of the series and on the restrictions placed in some countries. To make the series stationary, the first difference on repurchase data was used.

Figure 1 shows the total industrial production index for the US, Canada, Japan, and the UK. As provided in this figure, we found a pronounced decrease in the industrial production growth rate of all countries (2 shaded areas)⁵; The first, in 2001 and the second in 2009. Results based on autocorrelations and partial autocorrelations graphs show that buyback data exhibits seasonal

Figure 1. Industrial Production Growth rate. This figure depicts the Industrial Production Growth rate (in log) for the United States, United Kingdom, Canada and Japan between 1998q1 and 2016:q4.



behavior. For this reason, we used the fourth-quarter differences to remove the seasonal influence. According to the augmented Dickey and Fuller (1979) unit root tests, some series are stationary (when only seasonally adjusted).

Accordingly, there is no need to differentiate the series to make them stationary⁶. Figures 2 and 3 illustrate the buyback growth rate in the full sample. Because Japan did not have sufficient data before 2007, we presented only figures after this date. We observe in Figures 2 and 3 two different breaks: the first in 2001 and the second in 2009 (in accordance with the industrial production growth rate). Therefore, we suggest that in the developed market, firms used buyback programs during the Global Financial Crisis (GFC) and we can ask how economic conditions and buybacks are related. As a result, we looked at causality before the GFC and for the entire sample to see whether buyback programs would detect economic shocks in the post-crisis period.

2.2. Methodology

We develop our empirical analysis of the relationship between buybacks and business cycle using the linear Granger causality test. We are interested in whether buyback decisions lead to change in business cycle, or whether economic shocks lead to buyback activities. Because we're interested in the "incremental predictability" of these variables, a Granger causality model looks like a good fit for our research. Granger causality can be modelled as follows:

$$BC_t = \sum_{j=1}^n \alpha BC_{t-j} + \sum_{j=1}^n \theta REP_{t-j} + \varepsilon_t \quad (2)$$

Figure 2. Stock repurchase growth rate. This figure depicts stock repurchase growth rate computed as „Purchase of common and preferred stock divided by the lowest price during the quarter between 1998:q1 to 2016:q4. Data for Japan was NA before 2006.

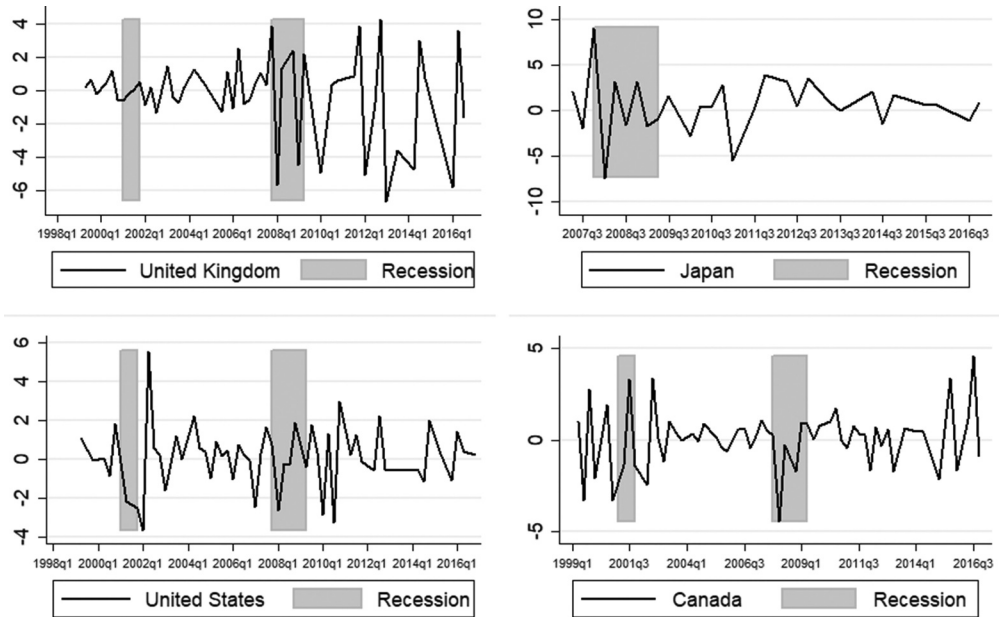
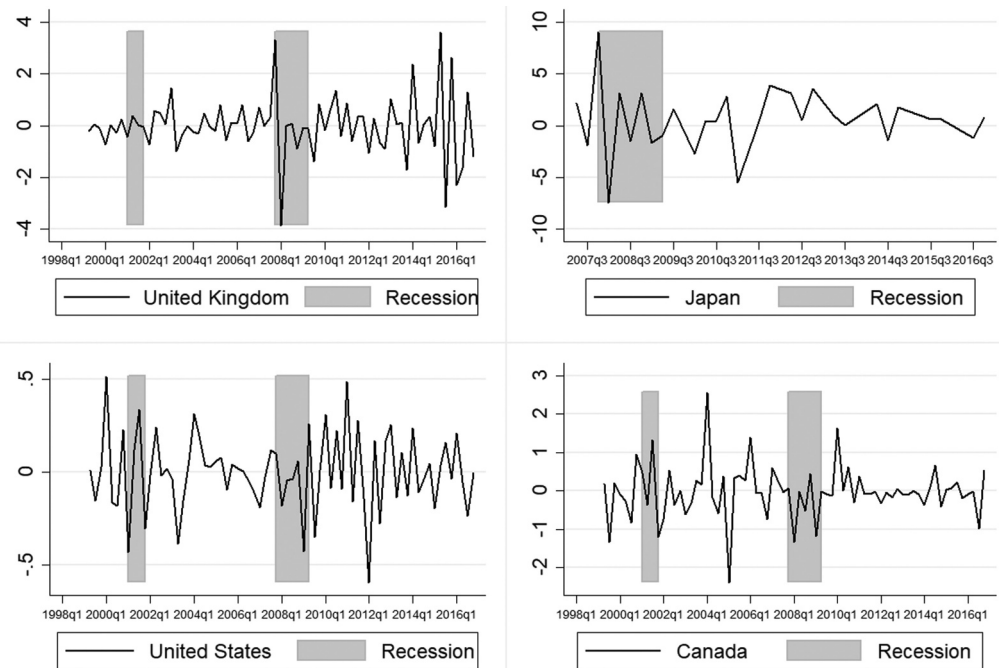


Figure 3. Stock repurchase growth rate. This figure depicts stock repurchase growth rate computed as „Purchase of Common and Preferred Stock divided by the monthly average price during the quarter between 1998:q1 to 2016:q4. Data for Japan was NA before 2006.



$$REP_t = \sum_{j=1}^n \omega REP_{t-j} + \sum_{j=1}^n \psi BC_{t-j} + \varepsilon_t \tag{3}$$

where BC is the business cycle, REP is the shares repurchased, and n is the optimal lag length based on the Akaike information criterion (AIC). All variables are in log and the ε_t s are the residual terms supposed to be white noise.

There are four possible outcomes from the analysis.

- (1) Repurchase (REP) Granger causes Business Cycle (BC) if, in equation 1, $\sum^d \neq 0$,
- (2) Business Cycle (BC) Granger causes Repurchase (REP) if, in equation 2, $\sum^d \neq 0$,
- (3) bi-directional Granger causality if both (1) and (2) hold, or
- (4) no Granger causal relationship between BC and REP, if neither (1) nor (2) is true.

3. Empirical result and discussion

Our methodology produces a total of 6 VARs estimated for each of Canada, the UK and the US and of four VARs for Japan. The results of the causality tests are reported in [Table 1](#) and indicate a little evidence of bidirectional causality between the buyback and business cycle for the full sample period except in Japan. This finding is in line with Japan's strict regulatory regime, which prohibited repurchases prior to 2001, (Kobayashi & Irome, 2001) and suggested that the inclusion of the financial crisis led to stronger relationships. Thus, the distinction between pre- and post-financial-crisis periods is significant.

Whereas in Canada and the US we strongly share a causality running from the business cycle to repurchase before 2007, it is different for the other regions. Specifically, we can observe significant causal relationships in the US suggesting that the business cycle is an important explanatory variable of buyback decisions and firms may consider buybacks as a tool to absorb the negative effects of the financial crisis. This is why buybacks are commonly used by US firms. The direction of causality is unidirectional and statistically significant at 5% level. As A.K. Dittmar and Dittmar (2008) explain, "GDP growth has positive and significant power for predicting future repurchase activity." A different picture arises when we consider the sub-period after 2007. Business cycle does not Granger cause repurchase in the United States because there is no motivation for firms to buyback after the financial crisis. As suggested by Liang et al. (2013) and A.K. Dittmar and Dittmar (2008) the motivations during the financial crisis period could be entirely different than longer sample periods and repurchases essentially depend on the firm's life cycle stage.

In Canada, it should be clear that, unlike other countries, we make no distinction between the pre and post-financial crisis, i.e. business cycle Granger causes repurchase. This means how persistent and strong the relationship is. It is clear that this result could be due to the strained ties between the free cash flow and the decision to repurchase. Straehl and Ibbotson (2017), for example, show that the total payouts (dividend and repurchase) and GDP grew at roughly the same annualized rate of 3.27% and 3.36% respectively.

In the United Kingdom, however, business cycle coefficients on repurchase are also positive, but not statistically significant. This finding could be due to the timing of the repurchase. In the UK, firms may use of repurchase programs for different purposes other than to distribute the free cash flow.

It should be clear that in Canada and the United States, there is no causal effect of buyback on the business cycle. We found relatively weak evidence that repurchase Granger cause business cycle. Our interpretation of this result is that buyback programs are used in both countries following a big change in the business cycle to distribute the surplus of free cash flow when

**Table 1. Bivariate Granger linear causality between business cycle and stock repurchase
 Business cycle → stock repurchase**

	stock repurchase → Business cycle															
	Country						Country									
	Canada		Japan		UK		US		Canada		Japan		UK		US	
	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}
Panel I: Pre-crisis period (1998:01–2007:4)																
Number of lags	1-1	1-1	2-2	4-4	1-1	1-1	1-1	1-1	1-1	1-1	2-2	4-4	1-1	1-1	1-1	1-1
F-stat	0.19863	3.1758*	0.34089	NA	0.16111	0.31534	6.7552**	2.4191*	0.6335	0.43538	0.2954	NA	0.58538	1.1363	1.9321	1.2904
Panel II: post-crisis period (2008:01–2016:04)																
Number of lags	1-1	1-1	1-1	1-1	2-2	1-1	3-3	2-2	1-1	1-1	1-1	1-1	2-2	1-1	3-3	2-2
F-stat	0.80141	5.9366**	1.0236	0.32923	0.05876	0.97247	1.2187	0.79401	0.03311	0.03967	0.45287	5.3037**	11.121*	0.02222	1.9661	0.09254
Panel III: Full sample period (1998:01–2016:04)																
Number of lags	1-1	1-1	5-5	6-6	5-5	5-5	2-2	2-2	1-1	1-1	5-5	6-6	5-5	5-5	2-2	2-2
F-stat	0.22357	5.6555**	1.3621	1.9417*	1.1657	1.5463	0.0348	1.9645	0.26089	0.51825	5.8983***	3.1229**	1.138	2.3709*	1.2414	0.30095

This table presents the results of the bivariate linear causality tests, described in Section 2.2 between business cycle and stock repurchase for all countries under consideration. Panel I shows the results with respect to the pre-crisis period while Panel II and panel III shows the results with respect to the post-crisis and the full sample period and assesses the impact of the financial crisis. Asterisks ***, ** and * denote significance at the 1%, 5% and 10% conventional levels respectively. BC: business cycle represented by the industrial production growth rate; REP_{min}: stock repurchase measured by the lowest prices. REP_{ave}: stock repurchase measured by the average prices. Na: Non Available data because no repurchase has been recorded.

investment opportunities are rare. This suggests that the market has already recognized the shock. For example, Farrugia et al. (2011) found that in the high economic state, repurchases go up by 32% relative to the medium economic state. Iyer and Rao (2017) also found that during the financial crisis, the proportion of repurchasing firms that reduced repurchase payouts was high.

On the contrary, we found remarkable robust results in Japan. The F statistics are high and significant at 5% and 1% level. The results show that buyback programs Granger cause business cycle after the financial crisis. As can be seen from Panel II and III, our results largely support the difference in causality before and after financial crisis.

4. Robustness checks

4.1. Nonlinear model

To support results from linear causality, we construct a nonlinear model. We start by introducing the general framework of our model. The nonlinear Granger causality test was developed by Baek and Brock (1992) and modified by Hiemstra and Jones (1994). In this paper, we follow Diks and Panchenko (2006) who provide some important improvement to the modified Hiemstra and Jones (1994) test.

For a strictly stationary bivariate process $\{(X_t, Y_t)\}$ X_t is a Granger cause of Y_t if past and current values of X contain additional information on future values of Y that is not contained only in the past and current Y - values alone. If we denote the information contained in past observations X_s and Y_s , $s < t$ by $F_{X,t}$ and $F_{Y,t}$ respectively. And let $\bar{\sim}$ denote equivalence in distribution. Then series $\{X_t\}$ Granger causes $\{Y_t\}$ if for some $K > 1$ (the predicted horizon):

$$(Y_{t+1}, \dots, Y_{t+k}) \setminus (F_{X,t}, F_{Y,t}) \bar{\sim} (Y_{t+1}, \dots, Y_{t+k}) \setminus F_{Y,t} \quad (4)$$

In practice, conditional independence is tested using finite lags L_x and L_y , where $X_t^{L_x} = \{X_{t-L_x+1}, \dots, X_t\}$ and $Y_t^{L_y} = \{Y_{t-L_y+1}, \dots, Y_t\}$, ($L_x, L_y > 1$)

Thus, the null hypothesis assumes that the past observations of $X_t^{L_x}$ contain no more additional information about Y_{t+1} than those $Y_t^{L_y}$. Hence, the null hypothesis is:

$$H_0 : Y_{t+1} \setminus (X_t^{L_x}; Y_t^{L_y}) \bar{\sim} Y_{t+1} \setminus Y_t^{L_y} \quad (5)$$

For a strictly stationary bivariate time-series $\{(X_t, Y_t)\}$, this is a statement about the invariant distribution of the $(L_x + L_y + 1)$ – dimensional vector $W_t = (X_t^{L_x}, Y_t^{L_y}, Z_t)$, where $Z_t = Y_{t+1}$. Drop the time index to keep notation compact and assume $L_x = L_y = 1$. Under the null hypothesis, the conditional distribution of Z given $(X, Y) = (x, y)$ is expected to be the same as that of Z given $Y = y$. In terms of ratios of joint distributions, the null hypothesis in Equation(4) can be changed into that the joint probability density function $f_{X,Y,Z}(x, y, z)$ and its marginals must satisfy the following relationship:

$$\frac{f_{X,Y,Z}(x, y, z)}{f_Y(y)} = \frac{f_{X,Y}(x, y)}{f_Y(y)} \cdot \frac{f_{Y,Z}(y, z)}{f_Y(y)} \quad (6)$$

Accordingly, X and Z are independent conditionally on $Y = y$ for each fixed value of y . Thus, the revised null H_0 shows:

$$q = E[f_{X,Y,Z}(x, y, z)f_Y(y) - f_{X,Y}(x, y)f_{Y,Z}(y, z)] = 0 \quad (7)$$

we denote the local density estimators of ad_w -variate random vector W at W_i by

$$\hat{f}_w(w_i) = \frac{(2\varepsilon)^{-dw}}{n-1} \sum_{j:j \neq i} I_{ij}^w \tag{8}$$

Where $I_{ij}^w = I(w_i - w_j < \varepsilon_n)$ is the indicator function and the bandwidth ε_n depending on the sample size. The test statistic can be formulated in terms of a scaled sample version of q .

$$T_n(\varepsilon_n) = \frac{n-1}{n(n-2)} \cdot \sum_i \left(\hat{f}_{X,Y,Z}(X_i, Y_i, Z_i) \hat{f}_Y(Y_i) - \hat{f}_{X,Y}(X_i, Y_i) \hat{f}_{Y,Z}(Y_i, Z_i) \right) \tag{9}$$

Under certain situations the test statistics $T_n(\varepsilon_n)$ satisfy:

$\sqrt{n} \frac{T_n(\varepsilon_n) - q}{S_n} \xrightarrow{d} N(0,1)$ with $\varepsilon_n = Cn^{-\beta}$, C a constant >0 , $\beta \in 14, 3$, S_n the estimator of the asymptotic variance of $T_n(\cdot)$, where \xrightarrow{d} denotes convergence in distribution

Diks and Panchenko (2006) demonstrate that the value to be arbitrarily assigned to the distance ε is highly conditional on the length n of the time series. The larger the value n , the smaller the assigned value for ε and, the better and more accurate the results. For further details regarding the definition and the estimator, see Diks and Panchenko (2006).

In our case, the causality test assumes that the information relevant to the prediction of the respective variables Repurchase (REP) and Business Cycle (BC) is contained solely in the time-series data on these variables. To apply the nonlinear causality in our model, we use the residuals from the Vector Autoregression model (VAR) in Equation (2) and Equation (3).

This method has been applied successfully to other papers (Choudhry et al., 2016; Hiemstra & Jones, 1994). The test statistic T_n is then applied to these residuals to detect the causal relationship between repurchases and business cycle. Since the VAR models remove the linear predictive power, the remaining incremental predictive power of one series is an indication of the nonlinear predictive power. According to Diks and Panchenko (2006), the rejection rate decreases with $Lx = Ly = 1, 2, \dots, 5$ and Tn test is progressively conservative for increasing lag lengths. Hence, selected bandwidth values smaller (larger) than 0.5 resulted, in general, in larger (smaller) p-values. In this paper, we use typical values between 0.5 and 1.5 as suggested by Diks and Panchenko (2006) and Hiemstra and Jones (1994).⁷

4.2. Discussions

The results are illustrated in Table 2. First, we show that there is no evidence that buybacks (business cycle) Granger causes business cycle (buybacks) before 2008. Accordingly, we failed to find nonlinear causality in this case. However, for the full sample, different results were obtained. In this case, buybacks and the business cycle are endogenously determined in Japan and the United States. As reported in Table 2, the distinction between the two measures of buybacks (REPmin and REPave) confirms that repurchase granger non-linearly business cycle, in Japan. This is particularly interesting since some authors, like Chen et al. (2018) found that before the financial crisis, overvalued and undervalued firms were more likely to announce share repurchase programs and repurchase more shares after announcements. Also, Floyd et al. (2015) reported that prior to financial crisis, an increase in repurchases pushed payouts to historical levels. However, in the US, we found a little relationship showing that the decision to repurchase shares does not mean a change in the business cycle. This result extends the linear Granger causality result in Table 1 and supports the study of Hamouda et al. (2020) who show no evidence of linear causality in the US after the financial crisis and confirms the striking contrasts between the results of U.S. and Japanese firms found by Wang (2020).

Table 2. Bivariate nonlinear causality between stock repurchase and business cycle

		Stock repurchase → Business cycle DP Test-stat						Business cycle → Stock repurchases DP Test-stat						
		Pre-crisis period (1998:01–2007:4)		Post-crisis period (2008:01–2016:04)		Full sample period (1998:01–2016:04)		Pre-crisis period (1998:01–2007:4)		Post-crisis period (2008:01–2016:04)		Full sample period (1998:01–2016:04)		
		REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	REP _{min}	REP _{ave}	
Canada	Lx = Ly	1	1.101	-1.262	0.502	-0.222	0.917	0.015	2.084**	0.264	0.820	0.948	1.569*	0.475
		2	0.759	-1.661	1.278	0.290	1.899**	0.025	1.653**	-0.685	-0.309	1.656**	1.405*	1.062
		3	-0.733	-1.598	0.940	0.421	2.029**	-0.679	1.007	-0.056	-0.706	0.07	0.883	1.076
		4	-0.100	-0.566	0.590	-0.20	1.760**	-1.094	0.996	-0.396	-0.624	-0.66	0.908	0.747
Japan	Lx = Ly	1	-1.371	-1.316	0.146	0.148	1.504**	0.960	-1.738	-0.849	0.593	-0.159	0.767	0.635
		2	-1.413	-1.270	1.520**	0.191	-1.509	1.456*	-0.890	-0.868	-0.807	1.363*	-1.029	0.243
		3	-1.332	-0.889	1.253	-0.935	1.397**	1.285*	-0.997	-0.841	0.371	1.076	-0.108	-0.809
		4	-1.293	-0.940	1.015	-1.278	1.379**	1.243	-1.077	-0.752	1.040	0.850	0.785	-0.618
UK	Lx = Ly	1	-1.321	-1.112	0.010**	-0.229	0.469	0.474	-1.306	-0.591	1.128	-0.480	0.628	-0.952
		2	-1.357	-0.424	0.281	-0.268	1.483*	0.818	-0.015	-0.984	0.649	1.183	0.417	-1.482
		3	-1.211	-1.295	-0.013	-0.325	1.509*	0.426	-0.236	-1.069	0.156	0.396	-1.229	-0.765
		4	-0.809	-1.02	-0.248	0.209	1.150	0.372	0.341	-0.808	0.000	0.308	-1.409	-0.312
US	Lx = Ly	1	-0.573	1.156	0.997	0.244	1.354*	0.341	0.793	0.667	-0.507	0.649	1.336*	0.793
		2	-0.562	1.130	1.155	0.733	0.856	-0.026	0.429	0.890	0.595	0.969	1.561*	1.164
		3	0.379	0.397	-1	1.354*	0.563	0.419	0.973	0.651	0.755	-1	1.684**	1.372*
		4	1.239	0.190	-1	1.156	0.384	-0.045	0.972	0.454	1.200	-1	1.723**	1.475*

This table presents the results of the Diks and Panchenko (2006) test T-statistics (DP) with bandwidth 1.5 to test nonlinear causality between stock repurchase and the business cycle (represented by the industrial production growth rate), for all countries. Results are for the pre-crisis, post-crisis period and for the full sample to assesses the impact of the recent financial crisis.

* Significant at the 10% level. ** Significant at the 5% level. ***Significant at the 1% level

As shown by Chen et al. (2018), the financial crisis has an exogenous negative liquidity shock to industrial firms that support the idea that share repurchase authorization values dropped considerably during the financial crisis. Also, Bliss et al. (2015) document significant reductions in corporate dividends and share repurchases during the 2008–2009 financial crisis. Iyer and Rao (2017) supported this conclusion. Diminished growth opportunities may also explain the causality in Japan according to agency costs of cash retention in the recession period.

We also note that causality is more meaningful in Japan. One might conclude that the causal effect of the buyback was not perceived before the financial crisis and the huge popularity of repurchases in financial distress shows the importance of these programs to absorb the effects of the financial crisis. According to the free cash flow hypothesis, firms with excess cash and a poor investment opportunity will face sizeable agency costs if the excess cash is not distributed to shareholders. In such cases, firms have incentives to invest the excess cash in empire-building, and other negative net present value projects. Therefore, one advantage arising from repurchase is that it eliminates the incentive for wasteful investment.

When we focus on the causality from the business cycle to stock repurchases, the pattern observed before and after the financial crisis is somewhat the same. The most important finding is that we found statistically insignificant causality for the two subsamples (before and after the 2007–2008 financial crisis). In the US and Canada, the relationship is significantly high for the full sample. This result can be explained by more freedom to buyback shares without announcement (particularly in

the US) and the need to report monthly how many shares they repurchased (in Canada). As reported by Floyd et al. (2015), most firms increased repurchases before the crisis to more than twice the level of dividends. Bliss et al. (2015) also find that before the financial crisis (between 2002 and 2007), the aggregate payout increased significantly, and it is mainly driven by the change in aggregate repurchase volume⁸ Consequently, buyback represents a much more flexible form of payout. This result is confirmed by Farrugia et al. (2011) who found a significant relationship between economic conditions and the decision to repurchase shares. As suggested by R.F. Dittmar and Dittmar (1997), variations in repurchase activity are driven by changes in aggregate cash flows associated with changes in business cycles.

Though buyback programs are commonly used in the US, we did not find any significant causality before and after the 2007–2008 financial crisis. Indeed, most of the studies done on share repurchase programs were in the United States and the total number of buyback announcements is higher in the US compared to the rest of the world. Manconi et al. (2019), found that between 1998 and 2010, the number of buyback announcements surpassed those of the rest of the world in 9 out of 13 years. With regards to results found in linear causality, we did not find a nonlinear causality in this market.

Finally, comparing the pre-crisis and post-crisis periods gives evidence that economic conditions provide to some extent why firms buy back shares. As reported earlier in Figure 1, the Japanese economy has experienced long periods of recession compared to other countries. This strengthens the idea of the market timing hypothesis discussed by A.K. Dittmar and Dittmar (2008). Hence, nonlinear causality showed high test improvement because of the specific characteristics of the buyback programs, and consequently, buyback seems to be more flexible than dividends in financial distress (Floyd et al. (2015).; Jagannathan et al., 2000).

5. Conclusion

Understanding the nexus between buyback programs and the business cycle is of great importance in the field of financial economics. The goal of the present study was to examine the potential connection between buyback activity and the business cycle. Our study differs from many prior studies in that we study the extent to which buyback programs adjust in response to a shock in industrial production. Specifically, we based our analysis on signaling and the free cash-flow theory. In the first step, we tested the Granger linear causality, taking into account several measures of buybacks and considering two sub-periods to consider the effect of the 2007–2008 financial crisis. In the second step, we test non-linear causality using Diks and Panchenko (2006) tests.

Our results have the following simple intuition; share buybacks are not used in the same manner in the United States, Canada, United Kingdom, and Japan. We observed important disparities with changes in the business cycle. The relationship is from repurchase to the business cycle for Japan. There is a body of evidence that justifies the different occurrences of buyback programs in all these countries. Though we do not find the same result, we suggest two possible explanations. First, repurchases occur according to the differing responses to economic conditions. In Japan, buyback programs indicate a change in economic growth, while in the United States, changes in economic growth cause an increase in buyback activity. To put it another way, some firms may be financing investment opportunities at the peak of the economic cycle, while others may have realized cash flows and less investment opportunities, resulting in excess cash to allocate.(see, R.F. Dittmar & Dittmar, 1997). This finding is useful both for forecasting buybacks and for identifying economic turning points. Since economic growth generates varying degrees of uncertainty, therefore increasing the need for flexibility, buybacks become favorable in some firms. However, according to the free cash flow hypothesis, as suggested recently by Henderson and Platt (2020), buybacks by US firms nearly halved in the COVID-19 pandemic period to the lowest level in 8 years as businesses grappled with a sharp rise in uncertainty and a swift decline in profits. Second, after the 1980s, corporate capital

allocation shifted from the retain-and-reinvest mode to the downsize-and-distribute mode of resource allocation. This downsizing and redistribution mode will benefit shareholders at the expense of workers who have contributed to the value creation process and introduced the newfound philosophy of “maximizing shareholder value.” Firms can use share repurchase programs to protect shareholder value at the expense of other stakeholders, particularly during financial turmoil. Accordingly, buyback programs become more advantageous under uncertain economic conditions. And because of the informational content and their impact on the firm’s capital structure, buybacks can have an impact on stakeholders such as creditors, analysts, and external investors.

The non-linear causality analysis results indicate many policy actions for policymakers. First, in the long run, buyback programs and the business cycle are interconnected. As a result, policymakers should exercise caution when developing financial market policies. Second, the increase in repurchase activity provides useful information for forecasting future economic activity. As a consequence, more considerable efforts are required to ensure the proper use of repurchase activities in developing countries, as they can be used to estimate potential economic activity values.

Supplemental data and underlying research materials:

the underlying research materials for this article can be accessed at <https://data.mendeley.com/datasets/9vxm5y3zy8/draft?a=c7e1070b-ce8d-4685-86c4-ac0360e5d5e7>

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Author details

Foued Hamouda¹

E-mail: foued.hamouda@isg.rnu.tn

ORCID ID: <http://orcid.org/0000-0003-4902-5164>

¹ URRED-Higher Institute of Management of Gabès, Rue Jilani Habib 6000 Gabès- Tunisia, Gabès University.

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Notes

1. For example, repurchases among S&P 500 firms dropped in the fourth quarter of 2008, as buyback activity was constrained by cash restrictions in a bear market (Standard and Poor’s 2009).
2. For an excellent review on countries that allow or prohibit buybacks, see Kim et al. (2004)
3. Including Purchase of treasury shares, Repurchase of stock, Conversion of preferred stock into common stock, Retirement of preferred stock and Exchange of common stock for debentures
4. <https://www.mof.go.jp/english/pri/reference/ssc/historical.htm>
5. We assess business cycle phases using the National Bureau of Economic Research (NBER) package of economic cycles.
6. Diagnostics Correlogram, partial correlogram and unit root tests are available upon request
7. Hiemstra and Jones (1994) use a value of $\epsilon = 1.5$ for the Dow Jones data and Diks and Panchenko (2006) use $\epsilon = 0.6$, for an ARCH process.
8. Kahle and Stulz (2013) also report that they document a significant rebound in net equity issues (issuance—repurchase) in 2009.

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