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Effectiveness of monetary policies in OECD countries

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Abstract. *In this study, it was analysed whether monetary policies have an effect on stock price index in 13 OECD countries (Australia, Canada, Denmark, Iceland, Japan, Korea, New Zealand, Norway, Poland, Sweden, Switzerland, the United Kingdom and the United States) with High Income Level for the period after 2008 financial crisis (2010-2013). In the analysis results, it was determined that there is a unidirectional relationship from short term interest rates and M1 money supply towards stock price indexes; and a unidirectional relationship from stock price index towards interbank interest rates and M3 money supply. In this respect, it was concluded that effectiveness of monetary policies in 13 OECD countries with high-income level are weak after 2008 financial crisis.*

Keywords: stock price index, short term interest rates, interbank interest rates, m1 money supply, m3 money supply, dynamic panel data models.

JEL Classification: C50, E40, E44, E50.

1. Introduction

The relationship between monetary policy and stock market has attracted the attention of policy makers, academics and investors for a long time. In this context, whether stock prices could be used as an indicator or whether monetary policy decisions will be affected by the stock prices has always been a serious matter of discussion. In the literature, the relationship of monetary policy with respect to stock prices is addressed within the asset prices channel of monetary transfer mechanism.

Monetary transfer mechanism explains how changes in the nominal money stock or nominal interest rates warn real variables such as financial markets, employment, and total output. In the literature, there are two fundamental approaches explaining how the monetary transfer mechanism – also expressed as the compatibility process of money demand to money supply – works. These approaches are indirect transfer mechanisms proposed by Keynesian economists and direct transfer mechanisms proposed by Monetarist economists (Ireland, 2005: pp. 1). Determining through which channel is the monetary policy going to affect the economy is very vital in terms of the success of the monetary policy as much as the policies to be applied. Different views of Keynesian and Monetary economists on how monetary policy and, as a matter of fact, the money influences the economy, reveal themselves in the assessment related to the process of monetary transfer mechanisms.

According to Keynesian and Neo-classical (Wicksell) economists who defend indirect transfer mechanism, the transfer mechanism is actualized through interest rates. According to these streams of economy, the amount of money demanded in economy is susceptible to interest rates. According to Monetarist economists who defend indirect transfer mechanisms, the amount of money people want to hold is defined as a constant and non-changing steady size. Monetarists are more interested in price changes rather than the effects the monetary processes create in economic life. The changes the monetary processes create in relative prices also comprise the changes created in the income rates of capital and financial assets as well as changes in the prices of goods and services (Spencer, 1974: pp. 8).

Within the literature, the studies carried out by Rudebusch (1998), Rotondi and Vaciago (2003), Bernanke and Kuttner (2004), Ehrmann and Fratzscher (2004), Rigobon and Sack (2004), Caruana (2005), Lapodis (2006), Garg (2008), Kholodilin et al. (2008), Stoica and Diaconaşu (2012) – all studied the relationship of stock prices and monetary policy – used short term interest rates as monetary policy too n a way that supports Keynesian indirect transfer mechanisms. In the studies carried out by Wong (2005), Maskay (2007), Bennaceur et al. (2009), Demir and Yağcılar (2009), Castro and Sousa (2012) Money supply (M1, M2, M3) sizes are used as monetary policy tools in a way that supports the Monetarist point of view.

The aim of this study is to determine the relationship between stock prices index and monetary policies in 13 OECD countries with High Income Levels after the 2008 financial crisis (2010-2013) using the dynamic data analysis method. The study will make great contributions to the literature by putting forward whether monetary transfer

mechanism works in OECD countries with High Income Levels by testing the activities of monetary policies on asset market after the 2008 crisis period. The financial crisis of 2008 made a negative effect on OECD countries with high-income levels. The shrink in the size of these economies in this group made a reflection on developing countries. As a matter of fact, OECD countries with high-income levels have an inevitable role in the globalization of the crisis that started in the USA. Therefore, OECD countries with high-income levels were analysed in this study. The study is organized as follows: First section covers the literature review about the topic of paper; Second Section, comprises the variables used in this study as well as the methods and data used with these variables; Third Section, includes the empirical findings; Fourth section, contains the result and recommendation.

2. Literature review

Rudebusch (1998) who studied the reactions of the financial market against the monetary policy shocks in the United States of America (USA) through VAR analysis came to the conclusion that there is a very little correlation between the fund rates of futures and future financial market incomes for the period comprising 1988 to 1995. Deloda and Lippi (2000) – in their VAR model they created for five industrialized OECD countries (Germany, France, Italy, the United Kingdom and the United States of America) – came to the conclusion that real output levels of these countries got influenced by monetary policy shocks through price changes in the share market of the countries for the period between 1970 to 1993. Durham (2001) – in the Regression Model comprising 16 developed OECD countries for the period between 1956:Q4 to 2000:Q4 concluded that there is a negative and meaningful relationship between strict monetary policies and stock market performance.

Rigobon and Sack (2004) studied the relationship between monetary policy and stock prices for the USA from 1994:Q1 to 2001:Q3 using the time series analysis. According to the empirical findings of the study, it was expressed that while a change in the short term interest rate, which is used as policy interest, creates important effects on stock prices on one hand, on the other hand, changes in the long term market interest rates make a little effect on stock prices. In the study of Bernanke and Kuttner (2004) it was concluded that an unexpected 25 basis points decline in the USA Federal Fund Rates leads to 1% decline of the whole share market index. Moreover, findings were obtained related to the fact that such unexpected monetary policy shocks bring excessive income in the share market.

Wong et al. (2005) – in their study where a VAR model comprising the period from 1982:Q1 to 2002:Q3 for Singapore and the USA – found that there is a strong co-integration relationship between M1 money supply and stock prices before 1997 Asian crisis for Singapore and before 1987 financial crisis for the USA. That this relationship got weaker in the preceding periods is among the findings of the study. Maskay (2007) studies the relationship between money supply (M2) and stock prices for the USA from 1959:Q1 to 2006:Q3. In the study, where a two level Regression Model was deployed, it

was concluded that there is a positive relationship between money supply and stock prices.

In the analysis by Garg (2008) where he deployed Least Squares Method (LSM) model, findings were obtained suggesting that a 0.2 % change in the futures fund rates in the USA from 2001:Q4 to 2007:Q3 leads to a change of 1 % in the sector based stock index. Kholodilin et al. (2008) analysed the reactions of European Sector Share Market against the monetary policies of the European Central Bank using the Generalised Method of Moments (GMM) Model. In the study, a 0.2% - 0.3 % increase in the interest rates announced by the European Central Bank within the period causes a fall of 25 basis points in sector stock exchange index. Additionally, it was observed that an increase in the policy interest during the period causes a 1% decrease in the total stock level.

In the study by Bennaceur et al. (2009), the monetary policy and it's relationship with stock prices in MENA countries was analysed using the VAR model for the period from 1990:Q4 to 2005:Q4. According to the empirical findings of the study, it was concluded that the monetary policy has an important effect on the stock incomes in Bahrain, Oman, Jordan and Saudi Arabia; that the monetary policy has no major effect on stock prices in Tunisia, Morocco and especially in Egypt; and that the reactions of monetary policy against the stock price changes are not homogenous in all these countries. In the study by Hayo et al. (2011), the monetary policy announcements as well as its relationship with asset prices were analysed using the GARCH model for the USA through the period data of 1998-2009. The result of the analysis revealed that extraordinary monetary policy precautions increase the fluctuations in asset prices.

In the study by Stoica and Diaconaşu (2012), the effect of monetary policy on stock market was analysed using the VAR model for 27 European Union countries through monthly data between January 2000 and February 2012. According to the empirical results of the study, a long-term relationship between policy interest and stock price index is in question only for The Netherlands, France, Finland and Italy for the period under focus. The reaction of stock price index against policy interest in these countries is strong and negative.

3. Data and methodology

In this study, the relationship between stock price index and monetary policy of 13 OECD countries with High Income Level (Australia, Canada, Denmark, Iceland, Japan, Korea, New Zealand, Norway, Poland, Sweden, Switzerland, the United Kingdom and the United States) was tested for the period after 2008 financial crisis (2010-2013). The High Income Group classification is a classification that comprises an income of 12,615 USD of GDP or more for 2012, made by the World Bank. In the study, the definitions of M1 and M3 money supply – on behalf of monetary policy -, short-term interest rates, and interbank interest rates were used. The stock price index was used as dependant variable. The relationship among the variables was analysed making use of the monthly data between 2010-2013 within the scope of the study. The data of the study were obtained from OECD and electronic database. The data used in the study are as follows:

SP: Share Price Index (stock price index)
IIR: Interbank overnight interest rates
SIR: Short term interest rates
M1: M1 money supply (Index)
M3: M3 money supply (Index)

3.1. Panel unit root tests

In the study, the Pesaran et al. (2004) CD_{LM} test, Breusch-Pagan (1980) CD_{LM1} test and Pesaran et al. (2004) CD_{LM2} test were used in order to test whether the units making up the panel has cross-sectional dependence. According to other CD_{LM} tests in the APPENDIX, it was concluded that there is a cross-sectional dependence problem both for variables and for the model. Thereby, due to the fact that using methods discarding the cross-sectional dependence might return incorrect estimate results, methods taking cross-sectional dependence into consideration were used in the study. In the first place, the cross-sectionally Augmented Dickey-Fuller (CADF) test – developed by Pesaran (2007) – was used.

The CADF test uses the first differences of each series in ADF regression as well as delayed cross-sectional averages and assumes the fact that each cross-section that makes up the panel data gets influenced by time effects (Pesaran, 2007: p. 265). The CADF test supports the idea that real economic phenomena cannot be analysed with a single variable on general basis. With this respect, test regressions can be more efficient by creating finer inferences with the use of additional information in the unit root series (Constantini and Lupi, 2011: pp. 4). The CADF test created by Pesaran (2007) is as follows:

$$\Delta Y_{it} = \chi_i + \beta_i Y_{i,t-1} + \sum_{j=1}^{\rho j} c_{ij} \Delta Y_{i,t-j} + d_{it} + h_i \overline{Y} + \sum_{j=0}^{\rho j} \eta \Delta \overline{Y}_{i,t-j} + \varepsilon_{i,t} \qquad (1)$$

$$i = 1, 2....., t$$

In the equation above, α_i is for the constant term while t is time, $\Delta\overline{Y}$ is difference lags, $\overline{Y}_{t-1}$ is a one term lag value of $\overline{Y}$. In this equation, $\overline{Y}_t$ shows the average of N observations, which is included in the model, according to t. the CADF test expresses that the series are not stable under null hypothesis and that all units making up the panel are stable under alternative hypothesis. In the CADF test, the critical values are taken from Pesaran (2007). In the phase after the CADF regression is predicted, the averages of t statistics of lagged values (CADF) are taken in order to obtain CIPS statistics.

$$CIPS = \frac{1}{N} \sum_{1}^{N} CADF_i \qquad (2)$$

In the CIPS test, the null hypothesis expresses that all units containing panel regression contain unit – namely series are not stable – and the alternative hypothesis expresses that all units making up the panel are stable.

3.2. Panel co-integration test

In order to determine whether there is cointegration relationship among the series in the study, the Durbin-Hausman panel co-integration test – developed by Joakim Westerlund (2008) was used. The Durbin-Hausman panel co-integration test – different from other panel co-integration tests – allows the independent variables to have different stability levels (Westerlund, 2008). In this method, it is mostly investigated whether one or more explanatory variables are endogenous in a regression model (Chmelarova, 2007: pp. 199). In the Durbin-Hausman test, two tests are calculated – panel and intragroup. While panel-wide inferences are made with panel statistics, inferences for the units making up the panel are made with the group statistics. The null hypothesis of the panel statistics is expressed as "There is no co-integration for all cross-sectional units" whereas the alternative hypothesis of the statistics is expressed as "There is co-integration for all cross-sectional units. The null hypothesis for the group statistics is known "to have no co-integration for all cross-sectional units". The alternative hypothesis is expressed to have co-integration for some countries and no co-integration for some others.

3.3. Panel causality test

The model below is generally used in most of the standard causality tests: (Dumitrescu and Hurlin, 2012: p. 1451):

$$\gamma_{it} = \alpha_0 + \alpha_j \gamma_{i,t-1} + b_j \alpha_{i,t-1} + \int_i u_{i,t} \qquad (3)$$

$i = 1, 2, \ldots\ldots, n$

$\int_i$ indicates the constant effect. The constant effect can be eliminated by taking the first difference of the model above: When the difference of the model above is taken, the main model is as follows:

$$\left(\gamma_{it} - \gamma_{i,t-1}\right) = \alpha_j \left(\gamma_{it} - \gamma_{i,t-1}\right) + b_j \left(\gamma_{it} - \gamma_{i,t-1}\right) + \left(u_{i,t} - u_{i,t-1}\right) \qquad (4)$$

Dumitrescu and Hurlin (2012) developed a causality test apart from heterogeneous panel data models. In this test, two variables that can be observed in T period at an amount of N are expressed as x and y. For each i = 1, 2, …, N and t = 1, 2, …,T, the lateral regression model is as follows (Dumitrescu and Hurlin, 2012: p. 1451):

$$\gamma_{it} = \alpha_i + \sum_k^K \gamma_i^{(k)} \gamma_{i,t-k} + \sum_{k=1}^K \beta_i^{(k)} \alpha_{i,t-k} + \varepsilon_{i,t} \qquad (5)$$

In this equation, $\beta_i = \beta_i^1, \beta_i^2, \beta_i^3, \ldots\ldots \beta_i^k$. It is assumed that individual effects (α_i) are stable, that lag parameters $\gamma_i^{(k)}$ are constant, and that $\beta_i^{(k)}$ regression incline coefficients are changeable among the units. As a matter of fact, constant effects model is set up for the causality test carried out. The lag length mentioned here is identical to all cross-sectional units of K (Bozoklu and Yılancı, 2013: p. 176).

The null and alternative hypotheses of the model tested by making use of Equation (5) are as follows (Dumitrescu and Hurlin, 2012: p. 1453):

$$H_0 : \beta_i = 0 \rightarrow \forall_i = 1, 2, ...N$$

$$H_1 : \beta_i = 0 \rightarrow \forall_i = 1, 2, ...N$$

$$\beta_i \neq 0 \rightarrow \forall_i = N+1, N+2, ...N$$

The null hypothesis shows that all the individual vectors equal to zero, while the alternative hypothesis shows that some of the individual vectors equal to zero. The $W_{N,T}^{HNC}$ mean statistics hypothesis is formulized as below:

$$W_{N,T}^{HNC} = \frac{1}{N}\sum_{i=1}^{N} W_{I,T} \tag{6}$$

Here, $W_{i,T}$ stands for the individual Wald statistical values for cross-section units. The average statistic, $W_{N,T}^{HNC}$, which has asymptotic distribution, associated with the null HNC hypothesis, is defined as:

$$z_T^{HNC} = \sqrt{\frac{N}{2k}}\left(W_{N,T}^{HNC} - K\right), (T, N) \rightarrow \infty N(0,1) \tag{7}$$

$$W_{i,T} = \left(T - 2K - 1\right)\left(\frac{\breve{\varepsilon}_i \theta_i \varepsilon_i}{\breve{\varepsilon} M_i \tilde{\varepsilon}_i}\right) \rightarrow i = 1, ...N \tag{8}$$

The average statistic, $W_{N,T}^{HNC}$, which has semi-asymptotic distribution, associated with the null HNC hypothesis, is defined as:

$$Z_N^{HNC} = \frac{\sqrt{N\left[W_{N,T}^{HNC} - N^{-1}\sum_{i=1}^{N} E\left(W_{i,T}\right)\right]}}{\sqrt{N^{-1}\sum_{i=1}^{N} Var\left(W_{i,T}\right)}} \tag{9}$$

Here, $E(W_{i,T})$ is also $Var(W_{i,T})$ and is the variant statistic of Equation (8). If there is cross-sectional dependency, 5% of the simulated critical values from 50.000 replications of the benchmark model and 5% of the approximated values are used. The biggest advantage of the panel causality test developed by Dumitrescu and Hurlin (2012) is that the Wald statistics, which are meanly standardized have standard asymptotic distribution and that the calculation is easy (Dumitrescu and Hurlin, 2012: p. 1459).

4. Findings of the research

The CD_{LM} test results, also available in the Appendix section, show that there is cross-sectional dependency issue not only in all variables but also in the model. The fact that

there is cross-sectional dependency makes it possible to apply 2nd generation unit root tests on short-term interest rates and to obtain more relevant results.

Table 1. *The CADF Test Results in Countries with High Income Levels*

	CADF-Stat				
Countries	**SIR**	**IIR**	**M1**	**M3**	**SP**
Australia	-3.662**	-3.662**	-1.664	-1.693	-2.268
Canada	-4.222***	-4.222***	-1.180	-0.026	-1.264
Denmark	-5.636***	-5.636***	-2.286	-0.415	-1.407
İceland	-3.566**	-3.566**	-0.827	-2.459	-2.391
Japan	-4.297***	-4.297***	-3.086*	0.736	-2.147
Korea	-5.638***	-5.638***	-2.117	-2.518	-1.401
New Zealand	-5.643***	-5.643***	-2.705	-1.722	-1.127
Norway	-3.672**	-3.672**	-1.114	-1.412	-2.197
Poland	-3.003*	-3.003*	-2.448	-2.335	-1.809
Sweden	-6.61***	-6.63***	-2.800	-2.863	-2.090
Switzerland	-4.303***	-4.303***	-1.461	-2.027	-1.948
The UK	-3.997***	-3.997***	-1.267	-2.170	-2.389
The USA	-4.283***	-4.283***	-0.247	-1.679	-1.686
CIPS-Stat	-4.498***	-2.24*	-1.785	-1.583	-1.856

***, **, * shows that they are meaningful at a rate of 1%, 5%, and 10%, respectively. The critical values are -3.98%, -3.30% and -2.98% at 1%, 5% and 10% level respectively. The critical table values were obtained from Pesaran (2006) Case III Intercept and Trend. The critical table values for CIPS were obtained from Pesaran (2006) Table 2c Intercept and Trend.

According to the CADF unit root tests shown in Table 1, short term interest rate series are statistically meaningful at 1% level in Canada, Denmark, Japan, Korea, need Zeeland, Sweden, Switzerland, the United Kingdom, and the United States; at 5% level in Australia, Iceland, and Norway; and at 10% in Poland. Therefore, the alternative hypothesis is accepted by rejecting the Null Hypothesis for all of the countries. According to the results of the CIPS test that test whether the series contain root in the panel overall, short-term interest rate is meaningful at a level of 1%. Thus, it is understood that short-term interest rate series in 13 countries with High Level of Income are stable after the 2008 financial crisis period.

The interbank interest rate series is statistically meaningful at a level of 1% in Canada, Denmark, Japan, Korea, New Zealand, Sweden, Switzerland, the UK and the USA; at a level of 5% in Australia, Iceland, and Norway; at a level of 10% in Poland. Thus, the alternative hypothesis is accepted on one hand while the null hypothesis is rejected for the countries under discussion. The CIPS values are meaningful at a level of 10% when they are compared to the critical values presented in the study by Pesaran (2006) Table 2c (constant and trend). Therefore, it can be concluded that the interbank interest rate series have a stable structure after 2008 financial crisis in 13 OECD countries with High Level of Income.

The M1 series is only meaningful at a level of 10% in Japan. In the other countries making up the panel, the null hypothesis cannot be rejected due to the fact that the CADF test value is lower than the critical table values. The CIPS value for M1 series are not statistically meaningful. According to this, all the countries making up the panel contains root. It can be concluded that these countries has been in a non-stable process after the 2008 financial crisis.

According to CADF unit root test results for M3 series, the CADF test statistical value is lower than critical table values in the countries making up the panel. Thus, the null hypothesis cannot be rejected. The CIPS value for M3 series is not statistically meaningful. Therefore, it can be concluded that all the countries making up the panel has been in a non-stable process after 2008 financial crisis.

Finally, the CADF test results for stock price index show that the null hypothesis cannot be rejected in the countries making up the panel. Moreover, the CIPS test results – testing whether there is unit root on the overall panel – also confirm the fact that stock price index contains unit root. Thus, it can be concluded that 13 OECD countries with High Level of Income is in a non-stable process in terms of stock price index.

Whether there is cross-sectional dependency in the model must be analysed before analysing whether there is a long-term relationship among the series after the unit root test. The results of the cross-sectional dependency for the model are available in the appendix. CD_{LM} test results show that there is horizontal cross-sectional dependency issue for the model. Therefore, since using methods that do not take horizontal cross-sectional dependency into consideration may return erroneous results, panel co-integration test that takes horizontal cross-sectional dependency into consideration was used.

Table 2. *Durbin-Hausman Panel Co-Integration Test*

Dependent Variable	test	t-statistics	Probability value
Stock Price Index	DH_g	38.015	0.000
	DH_p	13.852	0.000

Note: All the tests were applied as constant and stable. DH_g stands for the group statistics, while DH_p stands for the panel statistics.

According to Durbin-Hausman test results in Table 2, both the panel statistics (H_p) and the group statistics (H_g) returned as meaningful for the period after 2008 financial crisis. Therefore, the null hypothesis expressing that there is no co-integration for both statistics is rejected. According to the panel statistics allowing inferring for the general panel, there is co-integration in cases where stock price index is dependent variable and short-term interest rate, interbank interest rate, M1 money supply, and M3 money supply are explanatory variable for the period between 2010-2013, a period also known as post-crisis period for 13 OECD countries with High Level of Income. Thus, it can be concluded that there is a long-term relationship among these variables. The group statistics (Hg) that allows inference for each unit making up the panel also returned as meaningful statistically. According to this, the null hypothesis expressing that there is co-integration for some units and there is no co-integration for some others is accepted.

Following the panel co-integration test, whether there is causality relationship among the variables was analysed using the Dumitrescu-Hurlin Granger causality test.

Table 3. *The Causality Test Results*

Causality Direction	W^{HNC}	Z_{NT}^{HNC}	Z_{N}^{HNC}
SIR→SP	7.58E-07 (5.132849)	4.72008*** (5.647825)	2.04E-06 (4.936452)
SP→SIR	0.012970 (2.617687)	0.214609 (1.113552)	0.280543 (0.839156)
IIR→SP	2.74E-05 (4.378471)	4.06005 (4.2878509	0.000413 (3.707540)
SP→IIR	0.000219 (3.875427)	0.001314*** (3.380974)	0.006162 (2.888062)
M1→SP	0.000134 (4.000546)	0.000598*** (3.606536)	0.003350 (3.091886)
SP→M1	0.013544 (2.601109)	0.221772 (1.083665)	0.286868 (0.812149)
M3→SP	0.006800 (2.853729)	0.122050 (1.539082)	0.188694 (1.223676)
SP→M3	0.000529 (3.640265)	0.005037*** (2.957030)	0.017311 (2.504975)

For all variables, 2 lag length were taken into consideration. ***, **, and * represent the meaning levels of 1%, 5%, and 10%, respectively. The values presented in parenthesis shows t-statistic values.

According to the panel causality test results in Table 3, the null hypothesis, which is expressed as "SIR is not the reason of SP's granger causality", is rejected. According to this result, there is a causality relationship from Short-term interest rates to Stock price index in 13 OECD countries after the 2008 financial crisis. The null hypothesis defined as "SP is not the cause of IIR granger" is rejected. In parallel to this, there is a unilateral causality relationship from stock price index to interbank interest rate in 13 OECD countries in the post-crisis period. When the causality relationship between stock price index and M1 money supply, the hypothesis of "M1 money supply is not the cause of SP granger" is rejected. According to this result, there is a unilateral causality relationship from M1 money supply to stock price index. As far as the causality relationship between stock price index and M3 money supply is concerned, the null hypothesis defined as "SP is not the cause of M3 money supply" is rejected. According to this result, there is a causality relationship discovered from stock price index to M3 money supply.

Throughout the Central banks of OECD countries with high level of income, Interbank overnight interest rates are used as a basic policy tool in signalling to the markets. Overnight interest rates that exist in interbank money market affect the interest rates, which are interpreted as the income curve of securities (stock, bond, bill, etc.) that have different risk and liquidity features, via money policy transfer mechanism. Although, a causality relationship could not be detected from this variable towards stock price index in the post 2008 financial crisis period. This result can be interpreted as a condition in which the financial markets do not respond to policy signals coming from the Central banks and in which the money authorities are not effective in providing financial stability. As widely known, there should not be any problems in the monetary transfer mechanism that makes monetary policy transfers or changes in the interest rate possible to transfer into real economy so that monetary policies can be used efficiently. Financial institutions and markets that function seamlessly are required so that monetary transfer mechanisms can function in the way it is expected. The problems in the process of financial

institutions and markets influence the process of monetary transfer mechanism, the monetary policy activity, and total demand and inflation level, as a result. With this respect, not being able to determine any causality relationship from interbank overnight interest rates towards stock price index in developed countries after post 2008 financial crisis period can be interpreted as the fact that monetary policy cannot function in the way it is expected.

A unilateral relationship from stock price index towards interbank interest rate in the post-crisis period can be interpreted as a case in which changes occurring the in the stock price indexes influence overnight interest rates in the interbank money market and interbank interest rates have the qualification of an indicator that can predict stock price index.

The unilateral causality relationship from short-term interest rates and M1 money supply to stock price index in 13 OECD countries with high level of income during the post-crisis period shows that the central banks influences the stock price index by modifying short-term interest rate and M1. The unilateral causality relationship from stock price index to M3 money supply can be interpreted as a case in which stock price indexes have a qualification of indicator for Central Banks.

In the post-crisis period, another result that central banks of the countries can come to for the monetary policies is that the monetary policies are insufficient in preventing the crises, that price stability targets are not sufficient in achieving financial stability, and that banks should not ignore the risks and inflations in the asset prices in the markets.

4. Result and policy recommendations

A causality relationship from short-term interest rate to stock price index was determined in 13 OECD countries during post-2008 financial crisis period. These results show similarities with the results of the studies by Redebush (1998), Rigoban and Sack (2004), Bernanke and Kuttner (2004), Garg (2008), Kholodilin et al. (2008), Hoyo (2011) and Stoica and Diaconaşu (2012). Another causality relationship that was determined in the study is from M1 money supply to stock price index. This result is in parallel to the studies of Wong (2005), Maskay (2007) and Castro and Sousa (2012). Moreover, a causality relationship from stock price index to interbank interest rate and M3 money supply was determined for the post-crisis period in the study. These interactions show that both interest rates and changes done in the money supply influence stock price index. At this point, it can be interpreted as the fact that Keynesian and Monetarist transfer mechanisms co-operate.

The central banks of the countries reached to the conclusion that providing price stability – following the crisis experience – is not the final destination but more like a tool to reach the purpose and that providing price stability – with this respect – is not equal to providing stability in real economic variables such as sustainable economic growth and employment. It was concluded that low and stable inflation rates alone are not sufficient in providing stable real economy and fast real economic growth. Because, the last global

financial crisis proved that primary result of central banks' focusing on price stability could be the ignored financial instability itself.

The findings obtained at the end of the study revealed the requirement that the central banking view, which targets price stability only while creating the new framework of the monetary policies, should be abandoned. With this respect, the indicator used by monetary policy authorities in developed countries in the post-crisis period showed that the performance of the interest rates is insufficient in providing financial stability. Yet, another inference is the obligation of the fact that more flexible monetary policy practices should be deployed so that financial stability and financial stability targets can be reached together except for traditional monetary policy practices. It is crucial to deploy non-traditional monetary policy tools with multiple monetary policy instruments instead of traditional short-term interest rate only, which is appointed to price stability target of monetary policy for central banks within this context.

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Appendix 1. Cross Section Dependence Test Results for Variables

Test	SIR	IR	M1	M3	Sp
CD_{LM1}	(289.044)***	(111.487)***	(132.729)***	(93.552)***	(238.626)***
CD_{LM2}	(16.897)***	(2.681)***	(4.382)***	(1.245)*	(12.860)***
CD_{LM}	(-4.963)***	(-2.178)	(-3.659)***	(-1.818)**	(-1.119)*
Adjusted CD_{LM1}	(21.400)***	(20.304)***	(8.772)***	(5.909)***	(7.985)***

***, **, * indicate the significant level at 1%, 5% and 10% respectively.

Appendix 2. Cross Section Dependence Test Results for models

Test	t-statistical value	Probability value
CD_{LM1}	504.161***	0.000
CD_{LM2}	34.120***	0.000
CD_{LM}	16.045***	0.000
Adjusted CDLM1	38.032***	0.000

*** indicates the significant level at 1%.