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Article

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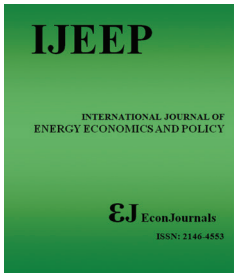

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Do European Central Bank Asset Purchase Programmes Matter for the Euro-area Stock Markets and Brent Crude Market?

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ABSTRACT

This paper examines macroeconomic impacts of European Central Bank (ECB) unconventional policy on Euro stock markets and Brent crude market respectively. We use actual and confidential asset purchase programmes (APPs) data to capture the unconventional effect and apply the vector auto-regression (VAR) model. We find that when the percentage change in ECB APPs leads stock market returns in French, England and Italy as controlling either the Germany or French stock market. Controlling both French and Germany stock markets simultaneously, we find that the percentage change in ECB APPs leads stock market returns only in Italy, suggesting that ECB APPs for the segments of European stock markets matter. Finally, we find the causality from the percentage change in APPs to crude oil returns. Similar results are obtained when controlling positive percentage change in APPs. Hence, our results shed valuable lights on conducting conventional monetary policy in times of crisis.

Keywords: European Central Bank, Asset Purchase Programme, Stock Market, Crude Market, Granger Causality
JEL Classifications: G15, G14, E52.

1. INTRODUCTION

The European Central Bank (ECB) launches asset purchase programmes (APPs), known as quantitative easing (QE) program, following Britain, Japan and the United States, to solve the European financial crisis. The inclusion of actual purchases is important because the volumes of official purchases exhibited high volatility and varied significantly among stock markets. On 2 July 2009, the ECB launched its first covered bond purchase programme (CBPP1). It is designed to improve market functioning and the monetary policy transmission mechanism. The aim of the CBPPs is not only to improve market liquidity in covered-bond markets, but also eases funding conditions for both banks and non-financial corporations. On 10 May 2010, the ECB started purchasing securities in the context of the securities markets programme (SMP). In November 2011, the ECB launched a CBPP2. On 4 September 2014, the ECB announced a purchase programme of covered bonds (CBPP3) and a purchase programme of asset-backed securities (ABSPP). On 22 January 2015, the ECB decided that asset purchases should be expanded to include a public-sector asset purchase programme (PSPP). Thus, ECB APPs, which combines CBPP1, SMP, CBPP2, CBPP3, ABSPP and PSPP, leads to substantial increases in their balance sheets through repurchase agreement (repo) operations. Table 1 reports the details related to ECB APPs.

As central back launching APP, two alternative channels, portfolio balance and signaling, can be used to affect real activity (Krishnamurthy and Vissing-Jorgensen, 2011; D'Amico et al., 2012; Bauer and Rudebusch, 2014; Sahuc, 2016). Through the portfolio balance channel, purchases of longer term securities can lower the long end of yield curve and lead investors to buy assets with greater duration or higher credit risk. This can increase prices for a range of private assets, including home and equity prices. On the other hand, through the signaling channel, asset purchase modifies market expectations about further credit easing in committing to bring down interest rates. The signaling channel suggests that central banks use asset purchase to convey information about future monetary policy to the market.

Some literature discusses the effects of large-scale asset purchase programmes (LSAPs) but mixed results. Some literature suggests

Table 1: Details of ECB APPs

APPs	Duration	Size	Objections
CBPP1	2 July 2009-30 June 2010	€60 billion	To conduct in both the primary and the secondary markets
SMP	May 2010-March 2011 and August 2011-February 2012	€240 billion	To conduct interventions in the euro area public and private debt securities markets to ensure depth
CBPP2	November 2011-October 2012	€40 billion	Covered bonds issued in the euro area will be carried out by the Euro system by means of direct purchases
CBPP3	20 October 2014-now	€213,137 million	Nominal and inflation-linked central government bonds
PSPP	9 March 2015-now	Amount to €60 billion	Nominal and inflation-linked central government bonds and bonds issued by regional and local governments, international organizations and multilateral development banks located in the euro area
CSPP	8 June 2016-now		Buy corporate sector bonds
ABSPP	4 September 2014		Helps banks to diversify funding sources and stimulates the issuance of new securities

Source: Press releases of the ECB. ECB: European central bank, APPs: Asset purchase programmes

that LSAPs tend to be more effective on asset prices in periods of high financial distress. Neely (2013) and Bauer and Neely (2014) document that the Federal Reserve's LSAPs significantly influence international bond yields. In addition, Bauer and Neely (2014) find some differences in the relative importance of the signaling and portfolio re-balancing channels across major advanced economies. In contrast, some studies show the effects became smaller for later extensions of the APPs (Meaning and Zhu, 2011). Ahmed and Zlate (2014) find that while capital flows to emerging market economies, it does not systematically increase in response to US unconventional monetary policies. Their composition shifts towards more volatile portfolio flows. Bowman et al. (2015) find that unconventional monetary policies in the US have a large impact on emerging market economies with substantive cross-country heterogeneity. Carpenter et al. (2015) show that there is some segmentation in the markets for these securities. They also find evidences to prove the Federal Reserve purchases do not only simply affect the yields on the assets purchased, but also induce investors to buy other assets. Tillmann (2016) suggests that QE has significant effects on emerging market economies' financial conditions and plays a sizable role in explaining capital inflows, equity prices and exchange rates.

Some studies examine the effects of the ECB APPs on bond markets. Gibson et al. (2016) examine the impact of the ECB's securities market program (SMP) and the ECB's two CBPPs on sovereign bond spreads and covered-bond prices, respectively. They focus on five euro-area stressed countries, including Greek, Ireland, Italy, Portugal and Spain. Their results indicate that the respective APPs reduce sovereign spreads and raise covered bond prices. They further find a small negative effect on Greek spreads from the SMP. On the other hand, few studies examine the effect of APPs on equity prices. Hau and Rey (2006) show that unconventional monetary policy, depreciating currencies, could rebalance the international portfolio. They suggest that higher returns in the home equity market relative to the foreign equity market are associated with a home currency depreciation. Georgiadis and Gräb (2016) show that the APPs announcement boosted equity prices around the world by supporting investor confidence and reducing the risk of deflation and persistent stagnation in the euro area. That is, domestic and global equity prices responded positively to all announcements of ECB unconventional monetary policy measures. Conversely, Laopodis (2013) find that there is no consistent dynamic relationship between monetary policy and the stock market. Gertler and Karadi (2013) argue that purchases of securities with some private risk have stronger effects than purchases of government bonds.

The European financial crisis seems far from being resolved. The Eurozone is not the best currency zone, which will lead to increase tensions within the European Monetary Union. In response to the crisis, all major central banks have introduced non-standard measures in their monetary policies. However, compared with the Federal Reserve, Bank of England or Bank of Japan, ECB's response is clearly more cautious. The main reason to stop the ECB from taking more aggressive measures is that European politicians continue to disagree on this issue.

This paper investigates the macroeconomic impact of the percentage change in ECB APPs on equity price returns of euro-area stock markets, including Greek, Ireland, Italy, Portugal, Spain, French, England and Germany, as well as Brent crude oil return respectively. We use actual purchases to capture effects of the percentage change in APPs rather than a zero-one dummy because of the magnitude and the sign of the percentage change in APPs on the stock market and Brent crude market. It is noted that we use the percentage change in APPs to capture the unconventional effect and daily data covered the period from July 1, 2009 to December 31, 2016.

We apply the vector auto-regression (VAR) model to discuss the relationship between the percentage change in ECB APPs and stock market returns in the European Union (EU) as well as Brent crude market. We take both (either) Germany and (or) French stock markets returns as exogenous variables because both Germany and French economies affect other EU countries significantly. Empirical results reveal that when the percentage change in ECB APPs leads stock market returns in French, England and Italy as taking the Germany or French stock market as exogenous variable. When both French and Germany stock markets are taken as exogenous variables simultaneously, we find that the percentage change in ECB APPs leads stock market returns only in Italy. It suggests that ECB APPs for the segments of European

stock markets can be effective. Finally, we find the causality from the percentage change in APPs to crude oil returns. Similar results are obtained when controlling positive percentage change in APPs. Hence, our results for APPs and Euro stock markets as well as Brent crude market shed some lights on the conduction of unconventional monetary policy in times of crisis.

The organization of the rest of the paper is as follows. The next section reviews methods and explains the data used, and section 3 summarizes the estimated results. Section 4 presents discussions. Finally, section 5 concludes the article.

2. METHODOLOGY AND DATA

In order to capture the effects of the changes rate in APPs on the euro stock markets, we create a vector auto-regression (VAR) model as follows:

$$R_t = c_{10} + \sum_{p=1}^{p1} w_{1p} R_{t-p} + \sum_{p=1}^{p1} s_{1p} GAPP_{t-p} + a*X_t + \varepsilon_{1t} \quad (1)$$

$$GAPP_t = c_{20} + \sum_{p=1}^{p1} w_{2p} R_{t-p} + \sum_{p=1}^{p1} s_{2p} GAPP_{t-p} + b*X_t + \varepsilon_{2t} \quad (2)$$

Where, R_t represents the return changed on the stock market, $GAPP_t$, represents a growth rate of APPs, and ε_{1t} and ε_{2t} denote the error term respectively. X notes either (both) German or (and) French stock market returns for DAX 30 index and the CAC40 index as exogenous variables because both Germany and French economies affect other EU countries significantly. The optimal length of the lag with p is using by Schwarz information criterion (SIC).

On the other hand, in order to investigate the dynamics of R_t and $GAPP_t$, we employ the Granger-causality analysis. If the coefficients of s_{1p} are significant, then GAPP causes the stock market returns, implying that the change in APPs (GAPP) leads returns. It suggests that ECB APPs effectively affects the stock market index return. Conversely, if the coefficients of are significant, then GAPP follows the stock market returns, indicating the change in APPs following the stock market returns. It suggests investors self-confidence restored.

We discuss some representative indexes, including Germany (DAX 30 index), England (FTSE 100 index), Greek (ASE index), Ireland (OVERALL index), Portugal (PSI index), Italy (FTSE MIB index), Spain (Madrid stock exchange general index) and French (CAC 40). The data of both stock returns of investigated stock markets and the APPs are collected from Taiwan Economy Journal database and ECB website, respectively. The daily data period covers from July 1, 2009 to December 31, 2016 and included totally 1846 observations. Table 2 documents the variables description and notations.

3. EMPIRICAL RESULTS

This paper first examines the macroeconomic impact of ECB unconventional policy in euro stock markets including French, England, Germany, Greek, Ireland, Portugal, Italy and Spain. We discuss the effects of the growth rate of APPs on the stock markets.

Table 2: Euro stock markets description and notations

Stock index (country)	Abbreviation	Notations for Return
ASE index (Greek)	ase	R_AS
DAX 30 index (Germany)	daxix	R_DAX
FTSE 100 index (England)	ftseix	R_FT
OVERALL index (Ireland)	overall	R_OVER
PSI index (Portugal)	psiix	R_PSI
FTSE MIB index (Italy)	itix	R_IT
CAC 40 (French)	frix	R_FR
Madrid stock exchange general index (Spain)	spix	R_SP

Figure 1 plots price movement of Euro stock markets and level in APPs. From Figure 1, we can see that most of stock markets are growing up during the late APPs period. It is noted that Italy stock index is more violate; Ireland stock index had the opposite performance; the other stock market indexes are growing up quite normal. Besides, the unit of vertical axis is million euro dollars for the APPs. On the other hand, we turn to look at the percentage change in APPs in Figure 2. It implies that the ECB played an important role in stabilizing the markets through APPs. Thus, ECB APPs matter for the Euro-area stock markets.

In this paper, Augmented Dickey–Fuller (ADF) test is employed to test the stationarity of the return series. Besides, in order to conduct VAR of the percentage change in APPs (GAPP) and return series, the optimal length of lag for GAPP and their corresponding return should be determined. The descriptive statistics, unit root test and the optimal length of lag are shown in Table 3.

From Table 3, we can see that R_DAX and R_AS are the highest mean but negative means for R_PSI and R_OVER. Specifically, there is the higher return (volatility) in the Ireland stock market than other markets. For the unit root test, the return series for all investigated stock markets are significantly at the 1% level. It means the return series data are stationary. The optimal length of lag for GAPP and their corresponding return is 4 for all eight cases.

Next, we discuss the dynamics of the percentage change in APPs (GAPP) and return series (R) by considering Granger causality test. Table 4 show the relationship between return *R* and *GAPP* under given exogenous variables. We provide the Chi-square statistics.

From Table 4, we can see that when we take R_DAX as exogenous variable, the percentage change in ECB APPs leads stock market returns of R_FT, R_FR and R_IT respectively. It means that there exists strengthening integration between international stock markets. On the other hand, it fails to detect the directional causality from stock market return to the percentage change in ECB APPs. Thus, our findings are not consistent with the argument of Laopodis (2013) that there is no consistent dynamic relationship between monetary policy and the stock market. Therefore, there

Figure 1: Price movement of Euro stock markets and level in asset purchase programmes

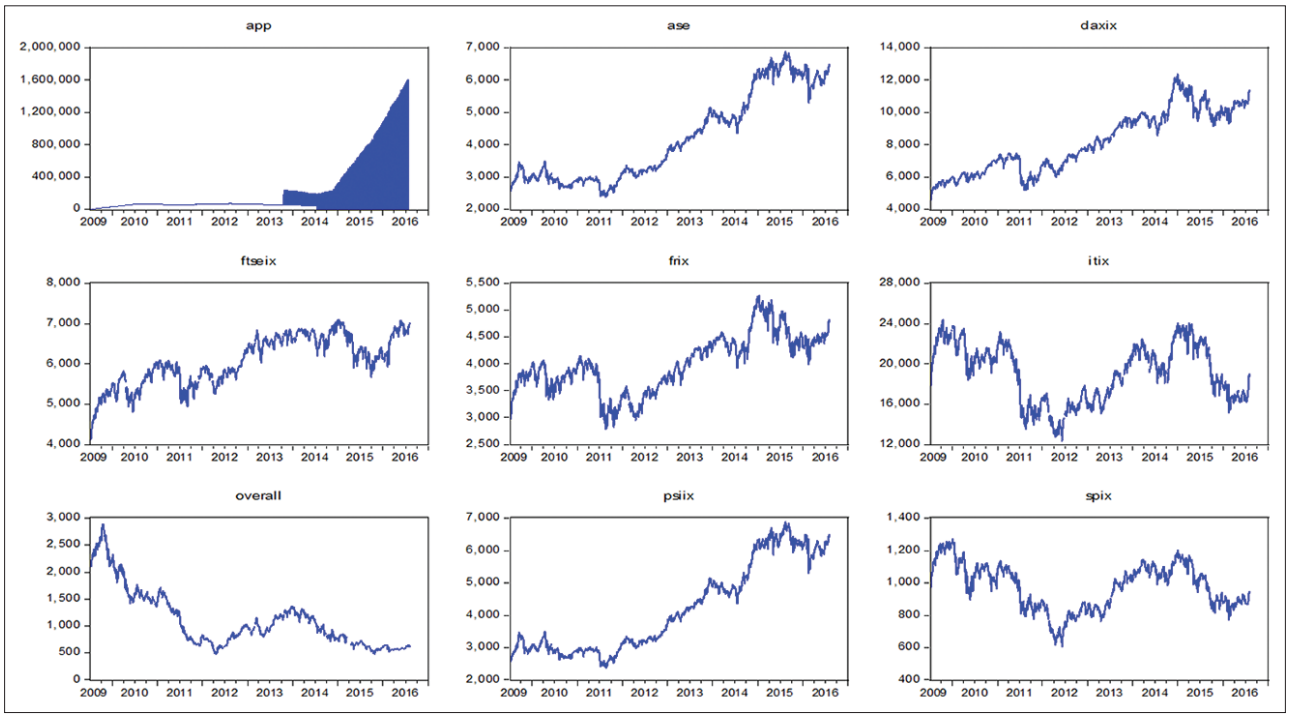

Table 3: Descriptive statistics, unit root test and the optimal length of the lag

Variable	Mean	Standard deviation	Skewness	Kurtosis	Unit root test	SIC	Lag
R_DAX	0.0005	0.0134	−0.2640	5.2218	−11.79***	−1.9028	4
R_FT	0.0002	0.0139	−0.1170	6.4056	−20.77***	−1.9317	4
R_FR	0.0003	0.0104	−0.1210	5.2295	−21.75***	−1.7875	4
R_PSI	−0.0001	0.0127	−0.1120	6.9960	−20.51***	−2.3245	4
R_IT	0.0001	0.0171	−0.3360	7.1045	−20.44***	−1.3233	4
R_OVER	−0.0004	0.0231	−0.1550	6.5741	−18.3***	−0.6597	4
R_AS	0.0005	0.0130	−0.6430	8.2383	−25.83***	−1.9428	4
R_SP	0.0000	0.0157	−0.1380	10.8010	−20.5***	−1.5393	4

*.**.***Represent significant at the 10%, 5%, and 1% level respectively. SIC: Schwarz information criterion

Table 4: Granger causality test results by adding various exogenous variables

R_DAX as exogenous variable			R_FR as exogenous variable			R_DAX and R_FR as exogenous variables		
	R→GAPP	R←GAPP		R→GAPP	R←GAPP		R→GAPP	R←GAPP
R_AS	4.52	5.39	R_AS	4.188	3.69	R_AS	4.47	4.04
R_FR	3.17	12.67**	R_Dax	2.55	15.4***	R_FT	2.35	5.24
R_FT	4.14	20.26***	R_FT	2.01	4.75	R_IT	2.97	15.7***
R_IT	2.93	20.38***	R_IT	2.83	3.83	R_OVER	3.75	5.96
R_OVER	3.59	6.32	R_OVER	3.66	5.35	R_PSI	5.04	3.52
R_PSI	5.32	6.94	R_PSI	4.50	1.98	R_SP	0.74	2.29
R_SP	0.84	4.04	R_SP	0.77	2.97			

*.**.***Represent significance at the 10%, 5%, and 1% level respectively. A→B means that A leads to B and A←B means that A is behind to B

are strong indications that the ECB APP had a positive impact on their stock markets.

From Table 4, when we continue to take R_FR as exogenous variable, we obtain the similar result as controlling R_DAX. It is interesting that Germany and French stock markets follow the percentage change in APPs because of the first two important countries in European. On the other hand, both R_FR and R_Dax are taken as exogenous variables simultaneously. We find that the percentage change in ECB APPs only leads stock market returns in R_IT, implying that an increase in the percentage change in ECB APPs increase stock market return in Italy. The possible reason is that Italy is the third largest economy behind the euro zone and is grantee and political instability, so that the destabilizing status in euro zone have been declined.

To investigate the relationship between return R and GAPP under given the positive or negative percentage change in APPs, we also take R_FR or R_DAX as exogenous variable respectively. ECB often uses growing APPs during high financial distress periods

Figure 2: Euro stock markets returns and the percentage change in asset purchase programmes

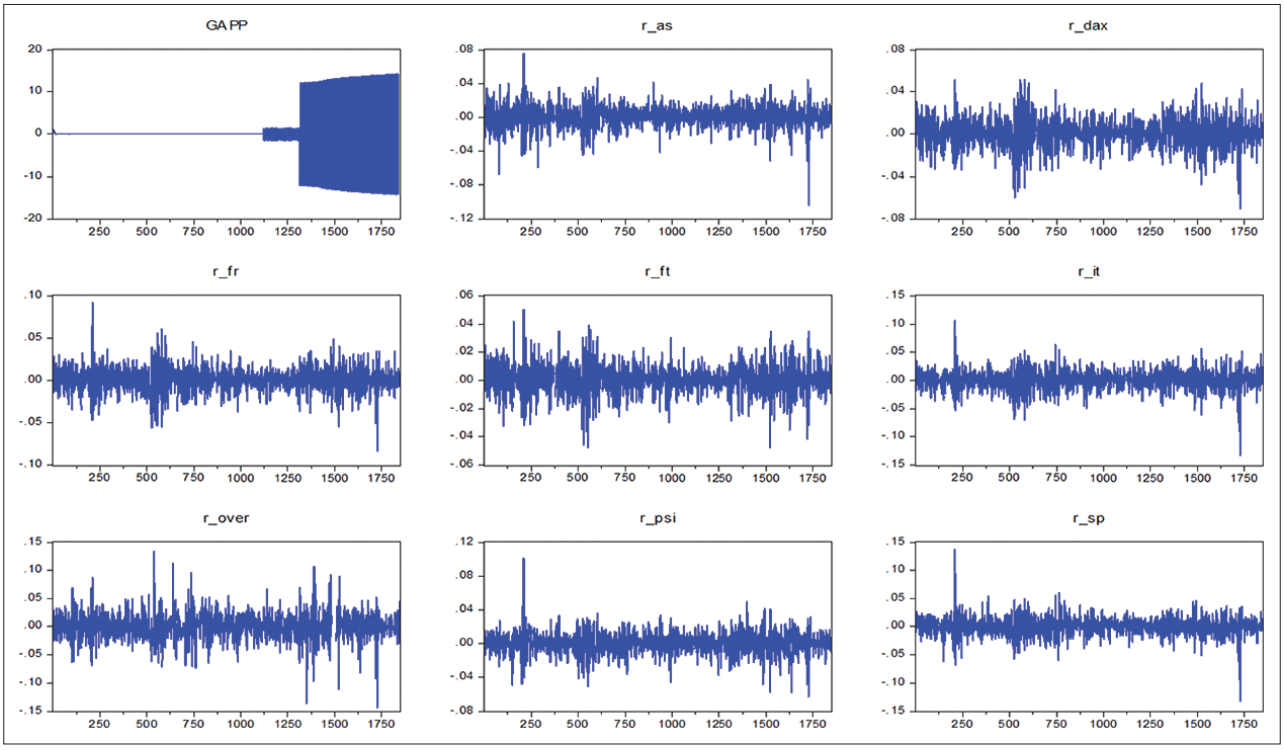

Table 5: Empirical results with positive and negative the positive percentage change in APP

Exogenous variable	The positive percentage change in APP				The negative percentage change in APP			
	R_DAX		R_FR		R_DAX		R_FR	
	R→GAPP	R←GAPP	R→GAPP	R←GAPP	R→GAPP	R←GAPP	R→GAPP	R←GAPP
R_AS	5.46	3.13	5.46	4.55	1.62	2.34	1.82	2.20
R_DAX	-----	------	1.96	7.56	-----	------	1.86	3.83
R_FR	4.54	9.88**	------	------	2.34	2.87	------	------
R_FT	8.30*	7.60	8.06*	2.49	3.24	3.18	3.20	2.84
R_IT	6.64	17.68***	7.24	10.86**	3.70	4.25	4.02	4.23
R_OVER	2.97	3.14	3.36	1.95	6.45	3.96	6.85	3.28
R_PSI	2.67	2.68	2.70	1.2	1.07	0.83	0.96	0.96
R_SP	2.69	5.60	3.11	1.43	1.03	2.68	0.97	3.27

***.**Represent significance at the 10%, 5%, and 1% level respectively. A→B means that A leads to B and A←B means that A is behind to B. APP: Asset purchase programme

while as declining APPs during less financial distress periods. The empirical results are shown in Table 5.

From Table 5, under given the positive percentage change in APPs, we find that the positive percentage change in APPs affects R_IT, no matter taking R_FR or R_DAX as exogenous variable. R_FR is affected by APPs by taking R_DAX as exogenous variable, which means that French economic had joint relationship to Germany in periods of the positive percentage change in APPs. Under given the negative the positive percentage change in APPs, the empirical results reveal that the relationship among all investigated stock markets are not significant, no matter taking either R_FR or R_DAX as exogenous variable.

4. DISCUSSIONS

Table 6 reports the gross domestic product (GDP) for Euro nations. We find that Italy has the Europe's fourth largest by nominal GDP

Table 6: GDP for Euro nations

Country	1960 (million)	2016 (million)
Germany		3,477,796.27
United Kingdom	72,328.05	2,647,898.65
France	62,651.47	2,465,453.98
Italy	40,385.29	1,858,913.16
Spain	12,072.13	1,237,255.02
Ireland	1,939.33	304,819.02
Portugal	3,193.20	204,836.60
Greek	4,446.53	192,690.81

GDP datas are obtained from world bank. GDP: Gross domestic product

in 2016. Hence, ECB APPs for Italy stock market is more effective from Tables 4 and 5.

Additionally, we turn to look at the Granger causality test results of Brent crude oil and the percentage change in APPs (GAPP) in Table 7. The chi-statisitcs are reported. We find the Granger causality from GAPP to Brent crude returns but the reverse relation are not. We further document that similar results occur

Table 7: Granger causality test results of Brent crude oil and GAPP

Sample condition for GAPP	R-OIL→GAPP	R-OIL←GAPP
None	10.669	17.755**
Positive	26.598***	27.569***
Negative	1.898	13.277

*.**.***Represent significance at the 10%, 5%, and 1% level respectively. A→B means that A leads to B and A←B means that A is behind to B. The optimal length of the lag by SIC is 8 for GAPP and oil returns of west texas intermediate, Dubai crude and brent crude

when controling positive percentage change in APPs. It suggests ECB can use APPs to influence Brent crude market return. On the other hand, the percentage change in APPs follows Brent crude market return.

5. CONCLUSIONS

This study analyzes the macroeconmic impact on Euro stock markets and Brent crude market through the unconventional monetary policy adopted by the ECB APPs, known as QE.

We find that although the APPs announcements caused global equity prices increasing in domestic but not at all investigated markets. We still believe that global equity prices respond positively to ECB unconventional monetary policy measures. LSAPs tend to be more effective on euro stock markets in periods of high financial distress. Specifically, we further report that Brent crude market returns follow the percentage change in APPs, suggesting ECB APPs has more effective on Brent crude oil asset. On the other hand, we also find that the ECB APPs have weak effects on euro stock markets during times of low financial distress. Our findings are consistent with Lim and Mohapatra (2013), suggesting heterogeneity among different types of flows. In other words, they argue that portfolio (especially bond) flows tend to be more sensitive than foreign direct investment to our measured QE effects.

Our results for APPs and Euro stock markets and Brent crude market shed some lights on the conduction of unconventional monetary policy in times of crisis. Evidences reveal that the Germany and French stock markets are the key to the entire ECB APPs and their economic situations will directly affect the recovery of other countries, in particular for Italy stock market and Brent crude market.

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