EFFECTS OF MONETARY ASSET-PRICE TRANSMISSION ON INVESTMENT AND INFLATION IN THE EURO AREA

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I
INTRODUCTION

Since the onset of the financial markets' crisis in late 2008, the Eurozone has been subject to rather volatile headline inflation, occasionally even turning into (an admittedly modest) deflation. As eventually, conventional monetary policy seemed to be exhausted, the European Central Bank (ECB) resorted to unprecedented unconventional measures. In 2010, it launched a first government bond purchasing programme, which was followed by a series of different programmes, swelling its balance sheet to c. €4.7tn as per May 2019. The induced asset-price-inflation in conjunction with a continuous and persistently low HICP inflation rates inevitably raises the question how effective monetary transmission – particularly via asset-prices – (still) is.

This contribution will investigate the effects of monetary asset-price transmission on investments and inflation. First, it analyses the reliability of stock markets as an indicator for firms'

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investment, while emphasising the importance of uncertainty. Second, the paper examines how rising stock prices affected firms' balance sheet and lending. Further, it provides an explanation as to why monetary policy failed to amplify lending in peripheral member states and why it had a comparatively low effect on borrowing costs in these regions. Third, it scrutinises the implication of an output gap, which monetary policy seeks to create, on different inflation parameters. Thus, the paper illustrates why the effects on HICP-inflation are less pronounced compared to other inflation measures.

II
STOCK MARKETS AS AN INDICATOR FOR FIRMS' INVESTMENTS

According to the Dividend Discount Model, a firm's stock price corresponds to its discounted future cash flows. Therefore, the stock market is said to contain valuable information about the economy. Tobin (1969) proposed an indicator, referred to as *Tobin's q*, which explains how changes in stock market valuation can affect the economy. It is determined by dividing a firm's market value by its replacement cost of capital:

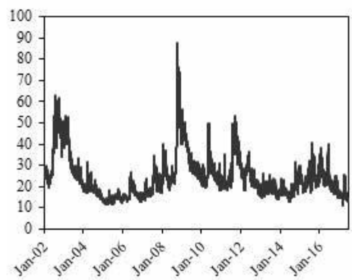
$$q = \frac{V_m}{C_r} \tag{1}$$

An economy is in equilibrium if $q = 1$. If $q > 1$, a firm's market price is higher than its replacement cost of capital, meaning corporations receive a relatively high price for every newly issued stock compared to the price of new investments. Thus, investment is rising. A central bank operating under such assumptions could now argue that an expansionary monetary policy which increases the money supply ($M_{\uparrow}$) makes fixed-income markets less, and stock markets more attractive for investors. In conjunction with higher stock market valuation ($S_{\uparrow}^{P}$), this results in an increasing q as well as more investments ($I_{\uparrow}$); expressed in the following transmission mechanism (Mishkin, 2001):

$$\underset{\uparrow}{M} \Rightarrow \underset{\uparrow}{S^{P}} \Rightarrow \underset{\uparrow}{q} \Rightarrow \underset{\uparrow}{I} \Rightarrow \underset{\uparrow}{Y} \tag{2}$$

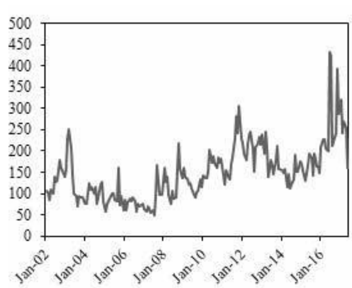
By examining stock markets as an indicator for investment, we analyse whether this transmission mechanism holds true empirically. Notably, however, stock prices are forward-looking – thus any econometric test for causality is likely to be deceptive. As the price in t reflects expectations about discounted future cash flows, it entails information about investment in t+1. Time series analysis could therefore indicate causality for stock prices, although they are, in fact, the result of the variable they allegedly determine.

Figure 1
EURO-STOXX 50 VOLATILITY INDEX



Source: STOXX Ltd.

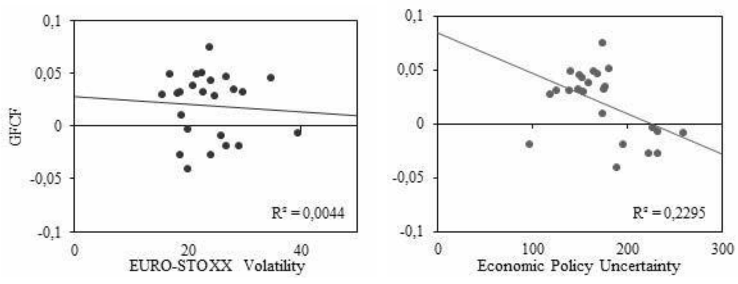
Figure 2
ECONOMIC POLICY UNCERTAINTY INDEX



Source: Baker *et al* .

Figure 1 shows the EURO-STOXX 50 Volatility Index, which is based on options and measures the implied variance of all options from a given time to maturity. Figure 2 depicts the Economic Policy Uncertainty (EPU) Index of Baker, Bloom and Davis (Baker et al., 2015), which comprises quantified newspaper coverage of policy-related uncertainty, the number of federal tax code provisions set to expire in future years, and the disagreement among economic forecasters. The upswing of economic uncertainty in Europe caused by Brexit, or the frequently recurring Euro-crisis, among others, is reflected only in the EPU Index. While stock market volatility declined, EPU rose. It becomes evident that the degree of uncertainty in financial markets, approximated through volatility, does no longer reflect the amount of real economic uncertainty that prevails.

Figure 3
GFCF GROWTH AGAINST EURO-STOXX VOLATILITY AND AGAINST EPU INDEX



Note: Values are y/y growth rates
Source: ECB, STOXX Ltd., Baker et al., Authors' Calculations

Figure 3 scatterplots the quarterly year-on-year growth rate of corporations GFCF, as a measure of investment, against the quarterly level of the Euro-STOXX 50 Volatility Index and against the quarterly levels of the EPU index. The underlying data was minimised using averages and stems from 2010 to 2017. The indices are lagged by two quarters, as a decline in investment is unlikely to manifesting itself immediately. Increasing (decreasing) the number of lags by one does only lead to small changes in the goodness-of-fit. This builds on an approach taken by the European Investment Bank (2013), where the authors analysed the EPU index exclusively, and used annual values. Our comparative analysis visualises that the negative correlation of firms' investment growth with real economic uncertainty is distinctly higher than with stock market volatility, where a negative trend is unobservable. It amounts to -0.31 and is significant at the 5%-level, whereas the correlation for stock market volatility is estimated at -0.08 and insignificant. This exemplifies that current stock market developments are not reflective of real economic conditions, thereby being a less reliable indicator than before the crisis, when examining investment growth. With many investments being made for the long run and often irreversible, firms are cautious to commit their capital if they are uncertain about future economic stability.

As it is inherently more difficult for central banks to soften real economic conditions, compared to mitigating volatility in financial markets, they can be identified as a cause of this divergence. That is not to say the ECB's policy has been ineffective to this regard, as it still contributes to alleviating economic uncertainty. The influence of the discussed transmission mechanism on investment, especially in crisis-countries, is nevertheless limited for the time being. Mediterranean member states require supply-side reforms to foster these economic variables, as low productivity growth and relatively high factor costs deter investors. This channel's effectiveness is thus higher in countries where other determinants suffice.

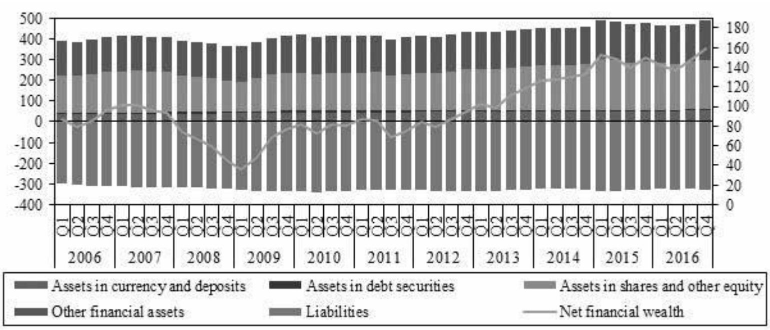
III
LENDING AND FIRMS' BALANCE SHEET

Stock prices influence firms' balance sheets. For example, lower net worth implies less collateral for (potential) loans made to corporations, meaning the lender must (potentially) bear higher losses. As a consequence, fewer loans are being granted and investment declines. In addition, firm owners are induced to engage in riskier projects to increase the shareholder-value. This may lead to asset substitution problems. That is, replacing low-risk assets for high-risk assets, resulting in a debt overhang and finally an under-investment problem (moral hazard). With losses becoming more plausible, creditors reduce credit supply even further. In an attempt to combat or prevent the latter, the ECB acted accommodating by adopting a policy that raises stock prices and thereby firms' net worth ($W_{\uparrow}^{N}$). Thus, the central bank hopes to minimise asset substitution problems and increase lending ($L_{\uparrow}$). In turn, this should lead to higher investments, output and inflation. The transmission channel is described as (Belke and Polleit, 2010):

$$M_{\uparrow} \Rightarrow S_{\uparrow}^{P} \Rightarrow W_{\uparrow}^{N} \Rightarrow L_{\uparrow} \Rightarrow I_{\uparrow} \Rightarrow Y_{\uparrow} \tag{3}$$

To investigate this mechanism, we approximate firms' net worth by their financial wealth (figure 4), which belongs to its shareholders. This figure is obtained from European sector accounts by subtracting liabilities (excluding shares and other equity) from the sum of assets in currency and deposits, assets in shares and other equity as well as assets in debt securities and other financial assets. Figure 4 shows that the average net financial wealth of Eurozone non-financial corporations (NFC) has been rising since 2009.

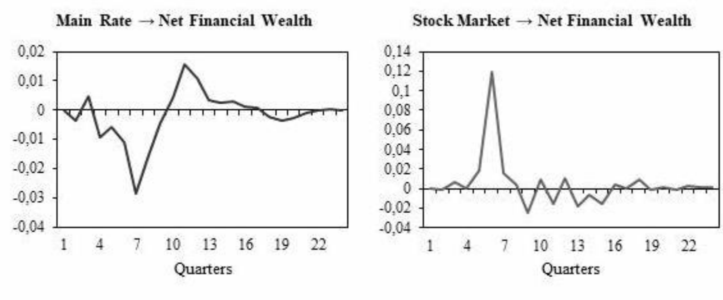
Figure 4
EURO AREA NFC'S NET FINANCIAL WEALTH (RIGHT) AND INFLUENCING POSITIONS (LEFT)



Source: Eurostat

Using the VAR methodology, a closer look is taken at the response of financial wealth to a one standard deviation increase in stock prices and the main rate. The underlying data stems from 2001 to 2016. Net financial wealth corresponds to logarithms of the data in figure 4. The quarterly main rate is used as set by the ECB. Stock prices are represented by logarithms of EURO-STOXX values. As all variables are integrated of order one, the model is set up using first differences. In the Cholesky ordering, the vector of endogenous variables ends with the main rate and begins with net financial wealth. Figure 5 shows the impulse reaction of net financial wealth to a one standard deviation increase in both variables. A shock in the main refinancing rate leads to a recognisable drop in financial wealth after one year. In the eleventh quarter, net financial wealth peaks at a higher than original level, which could be explained by the fact that a rate hike was in the past often followed by a rate cut after some time, as a crisis emerged. A shock in stock prices causes financial wealth to rise after four quarters. Considering that the recent increase in financial wealth is mainly accounted for by fluctuating share prices, four quarters are a plausible time span for firms to reallocate their assets. After the 10th quarter, net financial wealth oscillates around its base level, most likely due to a declining stock market following the shock. One can therefore conclude that firms' net financial wealth has reacted positively to expansionary monetary policy and responds negatively, should circumstances tighten. In what follows, it is analysed whether improved financial conditions stimulated borrowing.

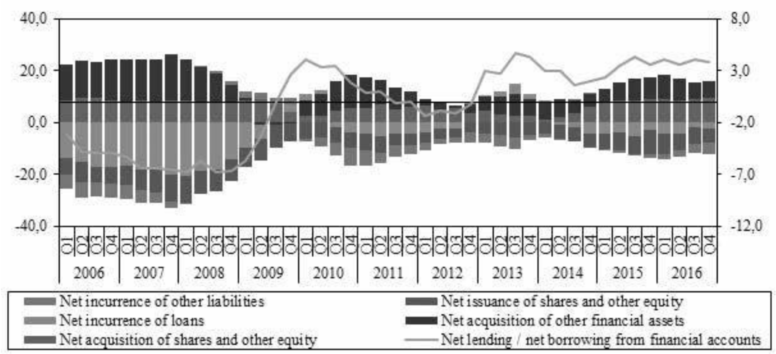
Figure 5
IMPULSE RESPONDS OF EUROPEAN NFC'S NET FINANCIAL WEALTH



Note: Figures depict reaction to a one standard deviation increase in main rate and stock market (EURO-STOXX)
Source: Authors' Calculations

Net borrowing (net lending) of non-financial corporations can also be obtained from European sector accounts financial positions by subtracting the positions net incurrence of loans, net issuance of shares and other equity, and net incurrence of other liabilities from the sum of net acquisition of shares and other equities, and net acquisition of other financial assets. Generally, firms are said to be net borrowers, as their investments are partly debt financed. Figure 6 plots the decomposition of net borrowing (net lending) on the right ordinate and the aforementioned positions on the left ordinate. Over the course of the crisis, firms started deleveraging, which is why net incurrences of loans and other liabilities declined and turned positive in some quarters. Since 2008, net incurred loans diminished. Conversely, net acquisitions of shares rose. In conjunction with a constant net issuance rate of shares, this has turned European firms, on average, to net lenders to the rest of the economy. In contrast to the theoretical framework of monetary transmission, neither has there been a significant increase in net incurrence of loans, nor have firms issued a larger net number of shares.

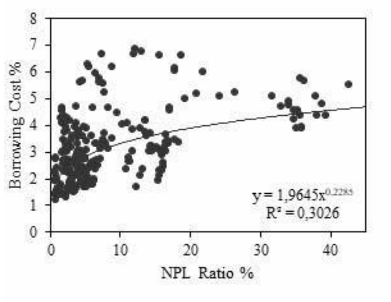
Figure 6
NET LENDING/NET BORROWING (RIGHT) OF EURO AREA NFC AND INFLUENCING POSITIONS (LEFT)



Note: Data in percentage of NVA, based on quarterly cumulated sums
Source: Eurostat, ECB

In literature, this is phenomenon often referred to as a "balance sheet recession" (Koo, 2003). That is, high leverage resulting in corporations paying back debt instead of investing. It is furthermore argued that this recession should be combated by higher government spending, i.e. the state remedying shortcomings in NFC's net borrowing to foster investment, and expansionary monetary policy to either stimulate lending or inflation so as to reduce existing debt burdens (Krugman, 2015). However, when looking at the composition of net lending (net borrowing) in figure 6, such demands must be rejected. Taking into account that the only position, which has been growing since the crisis, is net acquisition of shares and equities, it is evident that expansionary monetary policy has contributed to the presumed balance sheet recession by causing stock prices to rise. However, it is important to note that figure 6 resembles the Euro area average, which hides large national discrepancies. In crisis-ridden countries circumstances are somewhat different compared to sounder member states.

Figure 7
NPL AND BORROWING COSTS IN THE EURO AREA

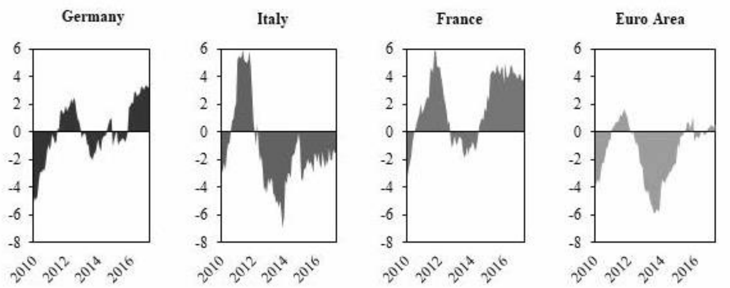


Note: % of total loans
Source: ECB, Authors' Calculations

Figure 7 shows the monthly year-on-year percentage change of loans to NFC in Germany, Italy, France and the entire Euro area since 2010. Italy exemplifies that monetary transmission aiming at an increase in lending has malfunctioned in crisis-torn countries. In contrast, Germany and France exhibit strong inclines since 2014, implying monetary policy has had a positive influence on lending in these countries. Question arises, how these diametrical results came about.

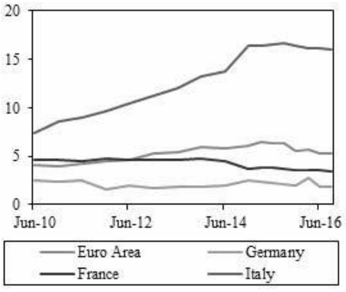
Aiyar et al. (2015) suggest that non-performing loans cause lending to decrease, because they require banks to raise loan provisions, tie up a larger amount of capital and generate comparatively lower income streams. What is more, higher NPL hinder the pass-through of monetary policy to lending rates in the short-run; up to the point that banks cease to pass alterations through for a higher level of NPL (Byrne and Kelly, 2017).

Figure 8
LOANS TO NFC IN GERMANY, ITALY, FRANCE AND EURO AREA



Note: Monthly annual increase in %
Source: ECB, Authors' Calculations

Figure 9
NPL IN GERMANY, ITALY, FRANCE AND EURO AREA

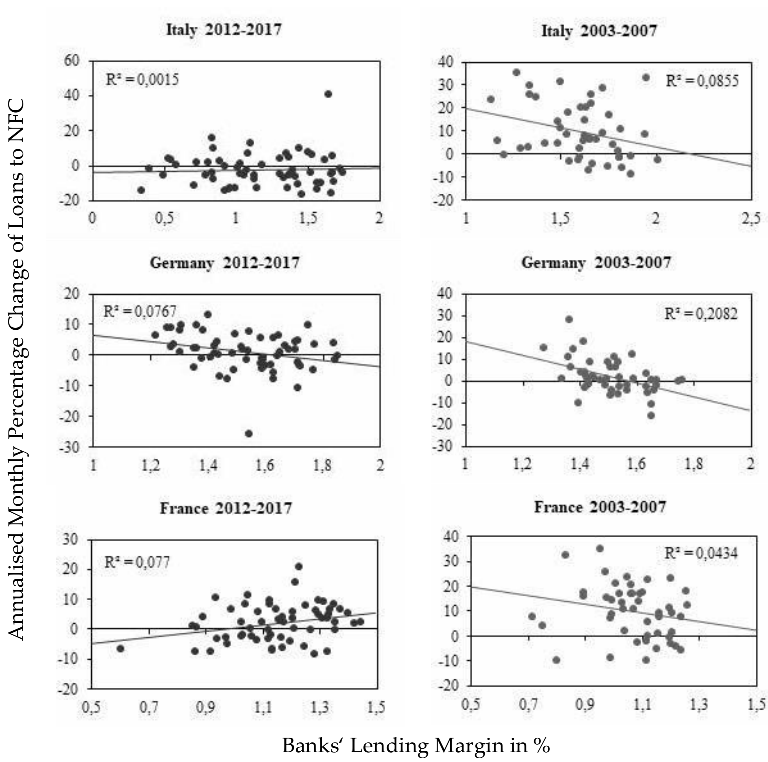


Note: NPL in % of total loans
Source: ECB

Figure 8 shows the ratio of NPL relative to all loans in Germany, Italy, France and the Euro area. The increasing NPL in Italy coincide with decreasing overall loans. The same holds true for Germany and France, where NPL declined — as well as for the Euro area, where they have risen until 2015 and fell afterwards. Figure 9 scatter plots the ratio of NPL against borrowing costs in per cent for all monetary union members. Both the Pearson and Spearmen coefficient indicate significant correlation of 0.507 and 0.522, respectively.

This adds further evidence to high NPL obstructing monetary transmission due to increased borrowing costs. As higher costs and losses on loans hamper banks' ability to raise capital, their capability to lend is reduced. Therefore, financial institutions suffering from such problems remain partly insensitive to expansionary monetary policy. This supports the view that the pass through of stimuli exacerbates if the problem persists. Thus, it is adequate that such countries engage in consolidating measures to reduce NPL and borrowing costs, which can subsequently prompt higher lending.

Figure 10
BANKS' LENDING MARGIN AGAINST CHANGE OF LOANS



Note: Left side presents post-euro-crisis data, right side pre-financial crisis data
Source: ECB, Authors' Calculations

What is more, Borio and Gambacorta (2017) as well as Borio and Hofmann (2017) argue that decreasing bank margins resulting from persistently low interest rates have adverse effects on lending. In what follows, we corroborate their argument. Figure 10 scatterplots the monthly annualised growth of lending to NFC against banks' monthly lending margins for the same type of loans in Italy, Germany and France. The right graphs show the data since the OMT announcement in 2012, while the left graphs show the numbers from 2003 until the outburst of the financial crisis 2007. During the chronologically first period, all countries exhibit a negative trend. That is, higher margins are accompanied by lower or negative lending growth rates. However, in the second period, only Germany maintains this negative trend. Noticeably, margins did not observably decrease in Germany or France. For France, the trend of 2003-2007 reversed, indicating that more loans where granted for higher margins. In contrast, margins did sink in Italy but opposite to the previous period, they have failed to affect lending at all; the trend line runs almost parallel to the abscissa. Banks' deposits are usually priced as a markdown on market rates. With this markdown diminishing, because of deposit rates being bound at zero, banks' profits decline (Borio and Gambacorta (2017) p. 3).

Claessens et al. (2017) detect that adverse effects on banks margins are higher when rates are low and increase over time. Their findings suggest that lending margins are reduced by 8 basis points at high rates, and 20 basis points at low rates, respectively, for a one-percentage point interest rate reduction. For each additional year of low interest rates, they argue, bank margins fall by another 9 basis points, while banks' profitability declines by an additional 6 basis points. They find that banks are unable to fully offset the implications of lower margins in the short and medium-term by reducing interest expenses. This takes place regardless of banks financing themselves increasingly through negative money market rates as the deposit base limits possible benefits. The effect is intensified if there are copious amounts of variable rate loans as in Italy, Spain or Portugal.

To elucidate another adverse impact of low interest rates on lending, two conjunctures must be named. First, the TARGET2 settlement causes increasing excess liquidity in countries with a current account surplus against other member states. Second, the additional liquidity created by APP is largely being redistributed to central European countries through the interbank market, thereby creating a highly imbalanced distribution of excess liquidity (Jobst and Lin, 2016). As banks in Mediterranean member states are therefore faced with scarce bank capital despite excess reserves rising on an aggregate level, they employ capital in a way that is, at the margin, more profitable than lending — to i.a. meet shareholders' demands. Potentially, this exacerbates a debt-overhang and complicates raising capital for banks, thereby deteriorating the foundation for higher lending (Shin and Gambacorta, 2016). Clearly, such effects worsen if interest rates continue to be low, suggesting that rate cuts in the post-crisis form are effective only in the short-run and should be accompanied by a subsequent rate hike. It would, however, be wrong to infer that lending increases, if interest rates rise.

IV
OUTPUT AND INFLATION

Assuming that the ECB exerted a positive influence on investment or consumption, this results in an output gap. With short-run aggregate supply being upwards sloping, the economy produces above its long-run capacity, thereby causing inflation. How this actually influenced inflation is subsequently analysed. The output gap is defined as:

$$x = y_t - y_t^* \tag{4}$$

Where y_t is log-real GDP and y_t^* its five-year moving average. In what follows, we analyse to what extent inflation is driven by an occurring output gap. We assume the following relation:

$$\pi_t = \alpha + \pi_t^e + \psi x_t + \varepsilon_t \tag{5}$$

Where π_t is inflation, π_t^e expected inflation, and x_t the output gap. As inflation parameters we use HICP-inflation, core inflation

(CI) and GDP Deflator growth. Expectations correspond to the ECB's 12-month Survey of Professional Forecasters. The data are logarithms and stem from 1999 to 2017. The ADF-test indicates integration of order one for all three inflation indicators and expectations. However, for the output gap the ADF-test suggests stationarity at the ten per cent level and the KPSS-test implies integration of order zero as well.[1] Thus, using the Akaike Information Criterion (AIC), we set up three different Autoregressive-Distributed Lag (ARDL) models (Pesaran et al., 1999; Pesaran and Shin, 1995):

$$gdp_t^{def} = c + \sum_{i=1}^{4} \beta_i gdp_{t-i}^{def} + \sum_{i=0}^{4} \delta_i \pi_{t-i}^{e} + \gamma_1 x_t + \varepsilon_t \qquad (6)$$

$$ci_t = c + \sum_{i=1}^{4} \beta_i ci_{t-i} + \delta_1 \pi_t^{e} + \gamma_1 x_t + \varepsilon_t \qquad (7)$$

$$hicp_t = c + \sum_{i=1}^{4} \beta_i hicp_{t-i} + \sum_{i=0}^{4} \delta_i \pi_{t-i}^{e} + \sum_{i=0}^{4} \gamma_i x_{t-i} + \varepsilon_t \qquad (8)$$

Table 1
GDP DEFLATOR REGRESSION COEFFICIENTS

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP_DEFLATOR(-1)	0.639378	0.126416	5.057745	0.0000
GDP_DEFLATOR(-2)	0.266480	0.147595	1.805476	0.0769
GDP_DEFLATOR(-3)	0.166268	0.147267	1.129024	0.2642
GDP_DEFLATOR(-4)	-0.408598	0.108220	-3.775633	0.0004
GAP	0.062845	0.017898	3.511213	0.0009
SPF	0.172885	0.179070	0.965462	0.3389
SPF(-1)	-0.142257	0.269811	-0.527247	0.6003
SPF(-2)	0.359581	0.284708	1.262981	0.2123
SPF(-3)	-0.542989	0.269552	-2.014410	0.0493
SPF(-4)	0.474422	0.172597	2.748736	0.0083
C	-0.001872	0.001647	-1.136801	0.2609

Source: Authors' Calculations

[1] For ADF-test null hypothesis is non-stationarity, for KPSS-test stationarity.

Table 2
HICP REGRESSION COEFFICIENTS

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
HICP(-1)	0.906315	0.119899	7.558962	0.0000
HICP(-2)	0.235121	0.176423	1.332714	0.1891
HICP(-3)	0.059871	0.184344	0.324781	0.7468
HICP(-4)	-0.642555	0.165189	-3.889820	0.0003
GAP	0.388767	0.122988	3.161007	0.0028
GAP(-1)	-0.367604	0.225247	-1.632004	0.1094
GAP(-2)	0.067858	0.237118	0.286177	0.7760
GAP(-3)	-0.422764	0.223824	-1.888822	0.0651
GAP(-4)	0.352168	0.127598	2.759990	0.0082
SPF	0.384439	0.503073	0.764181	0.4486
SPF(-1)	0.503373	0.628511	0.800898	0.4272
SPF(-2)	-0.005002	0.621982	-0.008042	0.9936
SPF(-3)	1.108371	0.597068	1.856357	0.0697
SPF(-4)	-1.242705	0.377745	-3.289799	0.0019
C	-0.004881	0.004321	-1.129653	0.2644

Source: Authors' Calculations

Table 3
CI REGRESSION COEFFICIENTS

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CI(-1)	1.084585	0.133723	8.110671	0.0000
CI(-2)	-0.078333	0.202548	-0.386737	0.7004
CI(-3)	0.015423	0.202433	0.076191	0.9395
CI(-4)	-0.187511	0.123318	-1.520551	0.1341
GAP	0.018933	0.007519	2.518119	0.0147
SPF	0.055445	0.064307	0.862200	0.3923
C	0.000844	0.000787	1.073219	0.2879

Source: Authors' Calculations

The models' coefficients are shown in tables 1 to 3. Q-statistics imply no autocorrelation, i.e. $corr\left(\varepsilon_t, \varepsilon_{t-1}\right) = 0$. To assess whether there exists a long-run relation between the variables, we employ a Bounds-test (Pesaran et al., 1999). Recalling the form of a regular Error-Correction Model:

$$\Delta y_t = c + \sum_{i=1}^{p} \alpha_i \, \Delta y_{t-i} + \sum_{i=1}^{j} \beta_i \Delta x_{t-i} + \sum_{i=1}^{k} \delta_i \Delta z_{t-i} + \theta \mu_{t-1} + \varepsilon_t \qquad (9)$$

Where $\mu_{t-1} = y_{t-1} - \alpha - \theta_i x_{t-1} - \theta_i z_{t-1}$. Note that denotations y, x and z were merely chosen as a proxy for simplicity. After substituting μ_{t-1} one has:

$$\Delta y_t = c + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + \sum_{i=1}^{j} \beta_i \Delta x_{t-i} + \sum_{i=1}^{k} \delta_i \Delta z_{t-i} + \theta_{1i} y_{t-1} + \theta_{2i} x_{t-1} + \\ + \theta_{3i} z_{t-1} + \varepsilon_t \quad (10)$$

Where the null hypothesis is: $\theta_1 = \theta_2 = \theta_3 = 0$, implying that there is no long-run equilibrium.

Table 4
GDP DEFLATOR REGRESSION COINTEGRATING FORM

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP_DEFLATOR(-1))	0.039152	0.113332	0.345466	0.7312
D(GDP_DEFLATOR(-2))	0.281487	0.108175	2.602152	0.0121
D(GDP_DEFLATOR(-3))	0.404933	0.103746	3.903109	0.0003
GAP	0.000459	0.006658	0.068884	0.9454
D(SPF)	0.115168	0.167999	0.685524	0.4961
D(SPF(-1))	-0.322793	0.176671	-1.827082	0.0735
D(SPF(-2))	0.029422	0.171107	0.171949	0.8642
D(SPF(-3))	-0.511436	0.160903	-3.178536	0.0025
CointEq(-1)	-0.377329	0.090062	-4.189672	0.0001

Cointeq = GDP_DEFLATOR - (0.1868*GAP + 0.9559*SPF -0.0056)

Source: Authors' Calculations

Table 5
HICP REGRESSION COINTEGRATING FORM

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(HICP(-1))	0.347563	0.139533	2.490892	0.0163
D(HICP(-2))	0.582683	0.155077	3.757380	0.0005
D(HICP(-3))	0.642555	0.150888	4.258488	0.0001
D(GAP)	0.388767	0.114674	3.390201	0.0014
D(GAP(-1))	0.002739	0.136966	0.019997	0.9841
D(GAP(-2))	0.070596	0.135999	0.519095	0.6061
D(GAP(-3))	-0.352168	0.121761	-2.892281	0.0058
D(SPF)	0.384439	0.448934	0.856338	0.3962
D(SPF(-1))	0.139336	0.366548	0.380129	0.7056
D(SPF(-2))	0.134334	0.361875	0.371216	0.7121
D(SPF(-3))	1.242705	0.352344	3.526968	0.0010
CointEq(-1)	-0.441247	0.110117	-4.007094	0.0002

Cointeq = HICP - (0.0418*GAP + 1.6963*SPF -0.0111)

Source: Authors' Calculations

Table 6
CI COINTEGRATING REGRESSION COINTEGRATING FORM

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CI(-1))	0.246311	0.124855	1.972782	0.0536
D(CI(-2))	0.163423	0.127899	1.277742	0.2067
D(CI(-3))	0.195673	0.124198	1.575496	0.1209
GAP	0.001088	0.008074	0.134695	0.8933
SPF	-0.002714	0.017159	-0.158176	0.8749
CointEq(-1)	-0.169699	0.054619	-3.106940	0.0030
Cointeq = CI - (0.1142*GAP + 0.3343*SPF + 0.0051)				

Source: Authors' Calculations

Tables 4 to 6 show the co-integrating form of the regression for each case. After performing the Bounds-test, the null hypothesis is rejected at the 1%-level for GDP Deflator inflation, and at the 5%-level for both HICP inflation and CI. In the long-run equilib- rium one has $\Delta y_{t-i} = \Delta x_{t-i} = \Delta z_{t-i} = 0$. The long-run coefficients are therefore obtained from equation 10 as $-(\theta_2/\theta_1)$ and $-(\theta_3/\theta_1)$. Table 7 shows the long-run coefficients for inflation expectations, the output gap in case of the different dependent variables, and the respective error-correction terms m_{t-1}. Regarding HICP inflation, the output gap's coefficient is insignificant. Thus, the model fails to confirm a long-run relationship between the two time series. However, inflation expectations are found to be significant; according to the model, a 1.0 percentage point increase in inflation expectations leads to a 1.7 percentage point increase in HICP inflation. The error-correction term is negative as required and significant at the 1%-level, implying that 44% of any disequilibrium is corrected within one period.

Table 7
COEFFICIENTS OF ARDL

ICP	α	-0.011061	0.008265	-1.338401	0.1872
	π_t^e	1.696274	0.530265	3.198917	0.0025 ***
	x_t	0.041754	0.061641	0.677373	0.5015
	μ_{t-1}	-0.441247	0.110117	-4.007094	0.0002 ***
CI	α	0.005091	0.005027	1.012652	0.3157
	π_t^e	0.334340	0.326993	1.022468	0.3110
	x_t	0.114166	0.048864	2.336401	0.0231 **
	μ_{t-1}	-0.169699	0.054619	-3.106940	0.0030 ***
GDP Deflator	α	-0.005563	0.004457	-1.248073	0.2177
	π_t^e	0.955923	0.270874	3.529034	0.0009 ***
	x_t	0.186776	0.032812	5.692347	0.0000 ***
	μ_{t-1}	-0.377329	0.090062	-4.189672	0.0001 ***

Source: Authors' Calculations

For core inflation, expectations have an insignificant impact, while output gaps are significant at the 5%-level. The model signals that core inflation rises by 11 basis points, if the output gap increases by one. The error correction term is also significant and implies that 17% of any disequilibrium is corrected within one period. When running the regression with GDP Deflator growth as the dependent variable, all regressors show strong significance. In this model, a one-percentage point increase results in a 96 basis point rise in GDP Deflator growth. If the output gap grows by one, GDP Deflator growth increases by 19 basis points. The error-correction term indicates, that 38% of any disequilibrium is corrected within one period.

The ARDL model outcomes are consistent with the above linear regression. Furthermore, the results of the last model assort best with economic theory as presented in equation 5.

The ARDL model illustrates, how a monetary policy that shifts short-run output above its long-run equilibrium influences GDP Deflator growth – and to a lesser extent CI. In light of these results, it is unsurprising that the ECB failed to get HICP inflation to the desired level: Given that this measure is extremely susceptible to shocks in food and energy prices, the outcome is compelling, as it indicates that HICP inflation is largely driven by other factors. Nevertheless, our results do not imply that the central bank's actions left the price level unaffected, as demonstrated by the GDP Deflator. With the latter and core inflation being more influenceable through shifts in domestic output, and showing no signs of moving into deflationary territories since seven years, our results bring the ECB's reasoning for sustained expansionary measures into question.

V
CONCLUSION

This contribution investigated the effects of monetary asset-price transmission on investments and inflation in the Euro area. The results corroborate the findings of Borio and Zabai (2016): zero interest rate policy as well as Quantitative Easing are subject to diminishing returns and adverse impacts successively outweigh benefits.

We further find that stock markets have lost their indicative function concerning investments, due to monetary policy mitigating uncertainty in financial markets to a larger extent than in the real economy. Further, we reject demands for higher government spending to combat a presumed balance sheet recession, as the latter is largely constituted by the asset-price inflation induced on the part of monetary policy. Instead, we argue in favour of reducing NPL levels so as to effectively lower borrowing costs.

Finally, declining lending margins and persistently low interest rates, respectively, appear to entail preponderating adverse longer-term implications on lending and thus investment. Our findings show that any attempt to spur inflation by shifting economic production above its long-run capacity is less effective regarding HICP-inflation compared to other parameters. Looking at core inflation and GDP Deflator growth, we find the ECB's justification for sustained expansionary policy to be inconsistent.

BIBLIOGRAPHIC REFERENCES

Aiyar, S., Bergthaler, W., Garrido, J., Ilyina, A., Jobst, A., Kang, K., Kovtun, D., Liu, Y., Monaghan, D. and Moretti, M. (2015): "A Strategy for Resolving Europe's Problem Loans", *IMF Staff Discussion Notes*.

Baker, S.R., Bloom, N. and Davis, S.J. (2015): "Measuring Economic Policy Uncertainty", *NBER Working Paper Series*, Cambridge, MA.

Belke, A. and T. Polleit. (2011): *Monetary Economics in Globalised Financial Markets*, Heidelberg, Springer.

Borio, C. and Gambacorta, L. (2017): "Monetary policy and bank lending in a low interest rate environment: diminishing effectiveness?", *BIS Working Papers*.

Borio, C. and Hofmann, B. (2017): "Is Monetary Policy Less Effective When Interest Rates are Persistently Low?", *BIS Papers*.

Borio, C. and Zabai, A. (2016): "Unconventional monetary policies: a re-appraisal", *BIS Working Papers*.

Byrne, D. and Kelly, R. (2017): *Monetary Policy Transmission and Non-Performing Loans*, Dublin.

Claessens, S., Coleman, N. and Donnelly, M. (2017): "«Low-For-Long» Interest Rates and Banks' Interest Margins and Profitability: Cross-Country Evidence", *International Finance Discussion Papers*.

European Investment Bank. (2013): *Investment and Investment Finance in Europe*.

Jobst, A. and Lin, H. (2016): "Negative Interest Rate Policy (NIRP): Implications for Monetary Transmission and Bank Profitability in the Euro Area", *IMF Working Paper*.

Koo, R. (2003): *Balance Sheet Recession: Japan's Struggle with Uncharted Economics and Its Global Implications*, John Wiley and Sons.

Krugman, P. (2015): "Not Invented Here Macroeconomics", *The New York Times*.
Pesaran, M.H. and Shin, Y. (1995): "An Autoregressive Distributed-Lag Modelling Approach to Cointegration Analysis", *Econometric Society Monographs*, Cambridge.
Pesaran, M.H., Shin, Y. and Smith, R.J. (1999): "Bounds Testing Approaches to the Analysis of Long Run Relationships", *Discussion Paper Series*, Edinburgh.
Shin, H.S. and Gambacorta, L. (2016): "Why Bank Capital Matters for Monetary Policy", *BIS Working Papers*.
Tobin, J. (1969): "A General Equilibrium Approach To Monetary Theory", *Journal of Money, Credit and Banking*, Vol. 1 No. 1, pp. 15–29.