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The CSPP at work - yield heterogeneity and the portfolio rebalancing channel

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Abstract

We assess the impact of the corporate sector purchase programme (CSPP), the corporate arm of the ECB's quantitative easing, over its first year of activity (June 2016 – June 2017). Focusing on the primary bond market, we find evidence of a significant impact of the CSPP on yield spreads, both directly on purchased and targeted bonds and indirectly on all other bonds. The magnitude and the timing of the changes in yield spreads, coupled with the evolution of bond placements, are fully consistent with the proper unfolding the portfolio rebalancing channel.

JEL classification: G15,G32, G38.

Keywords: Quantitative easing, unconventional monetary policy, bond yields, market segmentation.

Non-technical summary

In a context of prolonged low inflation and policy rates close to the zero bound, in January 2015, the ECB joined the group of central banks implementing large-scale asset purchases (also known as quantitative easing) by starting the purchase of securities issued by euro-area governments, agencies and European institutions. The following year (March 2016), in order to further strengthen the pass-through of the accommodative monetary policy stance to the financing conditions of the real economy, the quantitative easing was extended also to high quality bonds issued by euro-area corporations other than banks under the corporate sector purchase programme (CSPP).

Immediately after the CSPP announcement the yield on corporate bonds on secondary market trades (which is a proxy of the cost of financing) witnessed a steady decline, which involved also non-eligible bonds, however in the following months the behavior was different across market segments.

One relevant difference of the CSPP with respect to the purchase of government bonds is the possibility of a direct intervention of the ECB also on the primary market, namely the place where the (true) cost of the financing is set and corporations receive funds from investors. This circumstance allows us to investigate whether the CSPP was indeed able to ease the financing conditions of corporations.

Focusing on the first year of purchases on the primary bond market, the paper analyses the evolution of the yield on three categories of placements: eligible bonds actually purchased, eligible non-purchased bonds and non-eligible non-banks bonds.

Taking into account the different characteristics of over 7,000 bonds and around 1,000 issuers, we find that the spread with respect to a risk free rate decreased significantly for eligible bonds in the first six months of the CSPP (July – December 2016), regardless of whether they were or were not purchased by the ECB. In other words, the whole segment of eligible bonds witnessed a reduction in the cost of placements. At the same time the cost of bond financing slightly increased for non-eligible bonds. Instead, in the following six month (January – June 2017) also the cost of non-eligible placement significantly decreased.

By matching the changes in price (the reverse of yield) with those on quantity, the developments in the corporate bond market can be placed in a standard supply and demand framework. The evidence stemming from this exercise is consistent with the timing and working of the portfolio rebalancing channel.

In the first six months of CSPP, the contemporaneous increase in price and volume of eligible bonds was clearly due to a demand shift led the ECB, which started a massive purchasing up to 30% of the issuance volume of each selected bond. However, also the contemporaneous increase in price and volume of non-eligible bond in 2017 suggests a demand shift. Where did the latter increased demand come from? Certainly not from the ECB which was still targeting eligible bonds only. As already suggested, our interpretation is that the demand shifts was due to the portfolio rebalancing of bond market investors. The CSPP programme, after six months of

robust purchases and increasing prices, crowded out other investors in the eligible bond segment pushing them towards other securities and in particular towards non-eligible bonds, which are close substitutes but have higher expected returns. This excess demand in turn led to an increase in the price of bonds and to an easing of the financing conditions also in that segment.

All in all the paper provides evidence of an extensive effect of the CSPP on the euro-area primary bond market, involving not only the target eligible bonds but also non-eligible bonds.

1 Introduction

In a context of prolonged low inflation, actual and expected, and policy rates at the effective lower bound, in January 2015, the ECB joined the group of central banks implementing large-scale asset purchases (LSAP) by starting the purchase of securities issued by euro-area governments, agencies and European institutions in the secondary bond market up to 60 billion euros per month. In March 2016 an expansion of the LSAP was announced with the aim to strengthen the pass-through of the Eurosystem's asset purchases to the financing conditions of the real economy and to provide additional monetary policy accommodation. In particular, the ECB decided to start the outright purchases of investment-grade euro-denominated bonds issued by non-bank corporations on the primary and secondary markets. This new arm of the programme was named "Corporate sector purchase programme" (CSPP). The amount of purchases under the LSAP was expanded from 60 to 80 billion euros per month.

The announced aim of the CSPP, in addition to a broad signalling effect, was to lower the yield on targeted bonds and, mainly through the work of the rebalancing channel, influence also other asset prices, in particular (corporate) non-eligible bonds (Draghi 2015, ECB 2017). The idea being that by generating scarcity in the eligible bond segment investors would be encouraged to shift holding into other (riskier) asset classes (Vayanos and Vila 2009, Krishnamurthy and Vissing-Jorgensen 2011, Hancock and Passmore 2011). In addition, the presence of a large player in the euro-area bond market would encourage the issuance activity on the primary market and guarantee an increased liquidity in secondary market trades (Steeley 2015, Boneva and Linton 2017). In turn, the improved funding conditions of corporations would stimulate their business and support the euro-area growth.

Given the novelty of the CSPP in targeting corporate securities, it provides a new additional framework for the analysis of the effects of LSAP on the financing conditions of corporations. Recent papers, in a still scant literature, have provided evidence that the CSPP announcement immediately reduced the yield of both eligible bonds and bonds with similar risk characteristics but still non-eligible (Abidi and Miquel-Flores 2018) and that the programme affected bank lending (Arce et al. 2017, Grosse-Rueschkamp et al. 2017). Over a more extended period of work, Rischen and Theissen (2017) found that the CSPP mitigated the underpricing at issuance of corporate bonds. However, an analysis of the unfolding of the effects of the programme on bonds of different characteristics and the timing of the effects is missing.[1] We aim at filling this gap. In particular, we assess whether the CSPP was able to influence the price conditions of bond placements over the first year of purchases (June 2016 - June 2017) by looking at yield spreads on bonds actually purchased, bonds which were eligible but were not purchased and non-eligible bonds. We focus on bond placements since we argue that the financing conditions of firms are determined in the first instance on the primary market.

[1] There has been even less research assessing the impact of ECB nonstandard measures on firms before the CSPP. The most notable exceptions are Acharya et al. (2017) and Ferrando et al. (2018), which analyze the impact of the OMT programme on the credit access by small and medium enterprises.

In addition to a large signalling effect of 36 basis points, we find that the effect of the actual CSPP purchases on bond yields evolved over time. Under the *ceteris paribus* condition, eligible bonds (regardless of being purchased or not on the primary market) enjoyed in the first six months of the programme a significantly lower yield spread than non-eligible bonds (around 70 basis points), which in turn recorded a slight deterioration of the financing conditions. However, the difference between the two sets of bonds vanished in 2017 since in the first two quarters of the year also non-eligible bonds recorded a reduction in the yield spread of around 50 basis points.

By coupling the findings on price dynamics with the changes in the equilibrium quantity, we have a consistent evidence of the timing and working of the portfolio rebalancing channel. While in the first six months of purchases the contemporaneous increase in the price of eligible bonds and the quantity issued is clearly due to the ECB increased demand, the contemporaneous increase in the price and the bond placement of non-eligible bond after six months of CSPP purchases suggests a different demand shift, which in turn was most likely due to the scarcity generated by the CSPP programme in the eligible bonds segment, which crowded out other investors pushing them towards the non-eligible segment.

The paper is organized as follows. Section 2 describes the euro-area primary bond market and the features of the CSPP programme; Section 3 introduces the econometric approach; Section 4 assesses the impact of the CSPP on bond yields; Section 5 disentangles demand and supply shifts and offers evidence supporting the timing and working of the portfolio rebalancing channel; Section 6 draws the conclusions.

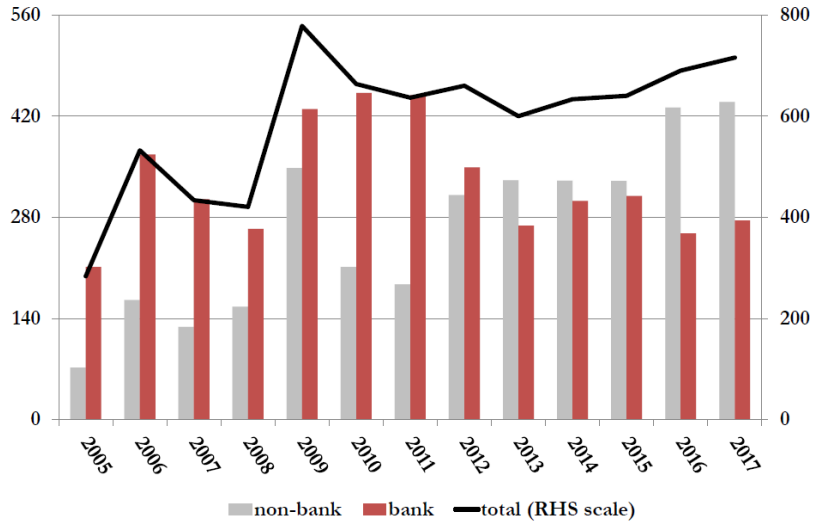
2 The CSPP and the primary bond market

Over the two waves of the financial crisis the bond pricing mechanism in the euro-area suffered a significant stress, in particular during the sovereign debt crisis in 2010-2012 (Battistini et al. 2014, Durrè et al. 2014). Government bonds spreads spiked in several countries (Ireland, Italy, Portugal and Spain notably) and the Greek debt had to be restructured to avoid the outright default and the exit of Greece from the monetary union. The integration of the financial market achieved since the early year of the monetary union and even the existence of the euro were challenged for the first time. The stress in the sovereign debt market spilled over to the corporate segment via the "transfer risk" phenomenon (Diaz et al. 2013, Bedendo and Colla 2015). Eventually, both banks and firms were involved in the crisis, experiencing a deterioration of their funding abilities. However, the deterioration was unequal across countries and led to an increasing market segmentation along national borders (Zaghini 2017, De Santis 2018, Horny et al. 2018). This market evolution, together with diverging banks' lending rates, was conflicting with the smooth transmission of the common monetary policy. In particular, such developments were the consequences of self-fulfilling expectations, multiple equilibria and contagion (Calvo 1988; Kehoe and Cole 2000, Giordano et al. 2013, Corsetti and Dedola 2016). Indeed, several works suggested that a significant part of the increase in bond spreads in that period did not

reflect the underlying fundamentals (De Grauwe and Ji 2012, Di Cesare et al. 2012, Klose and Weigert 2014, Dewachter, et al. 2015).

Even though the global financial crisis and the sovereign debt crisis halted the market expansion, the volume of bonds issued on the primary market was close to 700 billion euros in 2016, from an average of 300 billions in the 2005-2007 period, a performance second only to the 2009 peak (Figure 1).[2] In addition, the first six months of 2017 recorded the largest issuance ever (532 billions).

Figure 1. Primary bond market issuance[1]



Source: Dealogic DCM Analytics. 1) Total volume issued by euro-area corporations. Billion euros. Bond issuance by banks and non-bank corporations is reported on the main scale, total issuance is reporter on the right hand scale.

While before and during the financial crisis banks were tapping the bond market to a larger extent than non banks, since 2013 it is the other way around. A true boom of non-bank placements is recorded in 2016, in particular in the second half of the year. Bond issuers increased from an average of 252 per year in the pre-crisis period to 459 in 2013, thereafter they constantly declined to reach 404 in 2016. However, corporations other than banks outnumbered banks by a ratio 4:1.

The surge in bond placements recorded in 2016 and 2017 is clearly influenced by the announcement and the later implementation of the CSPP. As already mentioned, in March 2016,

[2] In this Section, consistently with the dataset employed in the baseline model estimation (Section 4), we rely on bonds issued on international markets by non-bank corporations registered in 12 countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain), uniquely identified by an ISIN code and for which the ASW spread at origination is available. However, for the ease of exposition, in Figure 1 we also report the performance of banks in the primary bond market.

in a context in which the heterogeneity in the euro-area bond market had not yet returned to pre-crisis levels, the ECB announced the direct purchase of corporate bonds on both the primary and the secondary market.[3] The idea under the deployment of the CSPP was that the outright purchase of bonds would have reinforced the link between the financial and real sector of the economy. In particular, the CSPP would have further strengthen the pass-through of the already accommodative monetary policy stance to the financing conditions of (non-bank) corporations: directly, via the outright purchases of eligible bonds and indirectly, via the working over time of the portfolio rebalancing channel (ECB 2017).

The bond and issuer eligibility conditions set forth by the ECB were as follows:

- the bond must be eligible as collateral for Eurosystem credit operations;
- the bond must be denominated in euro;
- the bond must have a minimum first-best credit assessment of at least BBB- or equivalent (obtained from an external credit assessment institution);
- the bond must have a minimum (remaining) maturity of six months and a maximum (remaining) maturity of less than 31 years;
- the issuer must be a corporation established in the euro area, defined as the location of incorporation of the issuer;
- the issuer must not be a credit institution nor have any parent undertaking which is a credit institution.

In order to ensure that debt instruments with small issuance volumes (often those issued by small firms) could also be purchased, there is no minimum issuance volume for debt instruments eligible for purchase under the CSPP. The Eurosystem applies a maximum issue share limit of 70% per security identification number (ISIN) on the basis of the outstanding amount. In addition, there are also limits per issuer group, following a pre-defined benchmark, to ensure a diversified allocation of purchases across issuers while allowing for sufficient leeway to build up the portfolio. Finally, to sustain market liquidity, CSPP holdings are also made available for securities lending by the Eurosystem.[4]

Bond purchases are conducted by central banks from six euro-area countries (Belgium Finland, France, Germany, Italy and Spain), under the coordination of the ECB. The transparency of the programme relies on the ex-post disclosure of the monthly holdings (total, primary market and secondary market) and on the weekly publishing of a list of all the bonds purchased and made available for security lending.

[3] In December 2016, the ECB decided to extend the programme after the initial deadline of March 2017 to December 2017 and to reduce to 60 billion euros the amount purchased from April 2017. Later on (October 2017), it was further extended to September 2018 and reduced to 30 billion euros per month.

[4] For further the details see the ECB press releases:
https://www.ecb.europa.eu/press/pr/date/2016/html/pr160421_1.en.html,
https://www.ecb.europa.eu/mopo/implement/omt/html/cspp-qa.en.html.

Focusing on the bonds issued by non-bank corporations, which are the target of the CSPP, Table 1 shows the evolution of the primary market from 2015Q1 to 2017Q2, distinguishing between bonds that fulfill the CSPP eligibility conditions and those which do not. It turns out that over the period following the announcement of the CSPP, (i.e. from 2016Q2 onwards) both segments experienced in each quarter a year-on-year increase in bond placements (i.e., with respect to the corresponding quarter of the year before), with non-eligible bonds outperforming eligible bonds, especially in the first half of 2017.[5] The overall volume issued over the first year of actual CSPP purchases (2016Q3-2017Q2) amounts to 211 billion euros for eligible bonds and 285 for non-eligible bonds.

Table 1. Bond issuance by type of bond[1]

	Bonds fulfilling CSPP criteria				Bonds not fulfilling CSPP criteria			
	Volume	YoY	CA(4)	Issues	Volume	YoY	CA(4)	Issues
2015Q1	44,524	2,110	142,356	93	63,547	19,260	199,860	128
2015Q2	31,131	-1,747	140,609	81	56,408	-15,499	184,360	120
2015Q3	34,117	4,432	145,041	80	23,983	-8,211	176,150	64
2015Q4	37,571	2,302	147,344	95	29,273	-2,939	173,211	67
2016Q1	48,005	3,481	150,824	82	57,232	-6,314	166,896	45
2016Q2	61,727	30,595	181,420	118	57,678	1,270	168,166	90
2016Q3	43,941	9,823	191,243	77	77,744	53,761	221,927	112
2016Q4	46,534	8,962	200,205	98	33,355	4,082	226,010	82
2017Q1	58,400	10,395	210,601	106	94,792	37,560	263,570	182
2017Q2	62,402	675	211,276	114	78,818	21,140	284,710	162

Source: Dealogic DCM Analytics. 1) Volume is the total amount issued in million euros; YoY is the absolute change in volume in each quarter with respect to the corresponding quarter of the year before; CA(4) is the cumulated amount issued in the 4-quarter period ending with the quarter of reference, Issues is the number of bonds issued.

In parallel with the development in bond volumes, also bond prices were significantly affected by the CSPP. After the announcement of the programme in March 2016, all bond yields significantly declined in the secondary market, yet eligible bonds benefited the most from the news (Abidi and Miquel-Flores 2018). However, while the performance on the secondary market can be thought of as the market assessment of a possible trade in that moment, it does not change the face value of the already issued bonds, in other words it does not change the actual cost for the issuing corporation. Instead, the originating trade on the primary market exactly defines the actual funding cost for the firm.

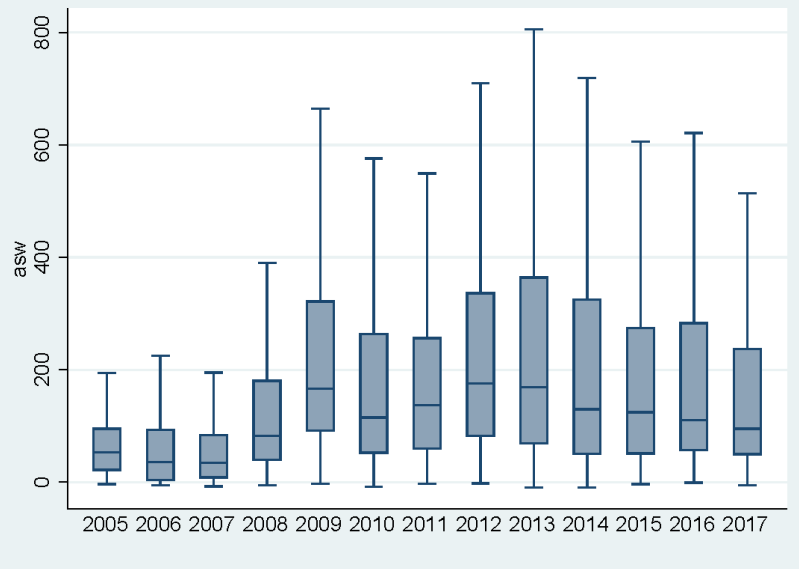
In order to assess the effect of the CSPP on the cost of funding in the primary bond market for issuing firms, we rely on the asset swap (ASW) spread, which is the difference between the

[5] Given the strong seasonality in the corporate bond market, we report under the CA(4) columns in Table 1 also the cumulated amount issued in the four quarters ending with the quarter of interest.

bond yield and the yield of an asset swap contract of similar characteristics. In particular, an asset swap contract is a synthetic instrument which allows an investor to swap the payments on a bond (i.e. coupons) to a floating rate payments (risk free rate plus the ASW spread), while maintaining the original credit exposure to the fixed rate bond.

The evolution over time of the ASW spread on the primary market was greatly influenced by the two waves of the crisis (Figure 2). The interquartile range (IQR) increased from an average of 79 basis points in the pre-crisis period to values above 200 in almost every year since 2008 (2011 is the only exception). Even though the ASW spread distribution narrowed somewhat after the sovereign debt crisis and the introduction of unconventional monetary policy measures by the ECB, both the dimension of the IQR and the high level of the top whisker in the box-plot representation in 2016 and 2017 suggest the persistence of large heterogeneity.

Figure 2. ASW spread evolution over time[1]



Source: Dealogic DCM Analytics. 1) Total volume issued by euro-area corporations. Billion euros. Data for 2017 end on June 30, 2017.

In the first year of CSPP purchases (2016Q3-2017Q2) the ASW spread on all non-bank bonds averaged 174 basis points, whereas the ASW spread on eligible bonds was 86 basis points. The correspondent values in 2015 were 185 and 122 basis points, respectively, while over the whole after-crisis period 2013-2017 they were 186 and 129 basis points. Given that the default risk of eligible bonds is usually smaller (as certified by an "investment grade" rating), it is not surprising that the bonds with the CSPP characteristics were placed at a lower yield than non-eligible bonds. Yet, the spread on eligible bonds seems to have dropped faster than that of non-eligible bonds. Since in addition to credit risk there are several other sources of heterogeneity in the euro-area primary bond market which have a bearing on the ASW spread of a bond (Zaghini 2017, De

Santis 2018, Horny et al. 2018), in the next Section we propose a fully-fledged econometric approach to assess whether the CSPP has had an impact on bond yields and, if any, on which bonds.

3 The econometric approach

We base our analysis of the CSPP impact on bond yields on the econometric framework proposed by Sironi (2003) and Zaghini (2016) for the euro-area primary bond market.[6] Since they are the target of the programme, we focus on bonds issued by corporations other than banks registered in the euro area. The spread with respect to a risk-free asset is determined by three main sources of risk: bond features, issuer characteristics and market conditions. Analytically:

$$spread_i = \alpha_0 + \sum_k \alpha_k V_{i,k}^{bond} + \sum_l \alpha_l V_{i,l}^{issuer} + \sum_z \alpha_z V_{i,z}^{market} \quad (1)$$

where $spread_i$ is the ASW spread at origination on bond i, V_k^{bond} are the K variables tracking the bond features, V_l^{issuer} are the L variables characterizing the issuing corporation, V_z^{market} are the Z variables which take into account the market conditions.

The value of each regressor is taken at time t (the exact issuance day) with the exception of balance sheet data which are lagged by one year (i.e., they refer to the latest annual balance available at t). Thus, for each bond i, the regressors' value is fixed at time t (the day of the bond placement), even if regressors take different values over time for the same issuer. In this sense the model has a cross-section structure and the estimation procedure can be thought of as equivalent to a standard pooled OLS panel estimation in which the time dimension is taken into account by a set of time dummies.

The cross-section approach allows a much larger selection of bonds and issuing institutions than a time series analysis. Indeed, many bonds, especially from smaller issuers, are not constantly priced and traded in the secondary market and thus can not be employed in a time series approach. Even when secondary market quotes exist, prices are most of the times not coupled with actual trades. By focusing on the primary market, we then avoid the market distortions due to the scarce liquidity of many euro-area bonds in secondary trades (Bao et al. 2011, Dick-Nielsen et al. 2012, Wang and Wu 2015).

The selection of the regressors is based on the traditional drivers of the risk premium.[7] As regards the bond features $\left(V_k^{bond}\right)$, the variables taken into account are: the time to maturity at origination, the amount issued (single tranche), the currency of denomination, the bond grade. In particular, we expect a positive relation between the ASW spread and the time to maturity

[6] Other contributions analyzing the yield spread at origination are Morgan and Stiroh (2001) and Santos (2014) for the US, Zaghini (2017) for the euro area and Pianeselli and Zaghini (2014) for a set of select OECD countries.

[7] The literature on the topic is abundant, the interested reader is referred to the seminal contributions by Elton et al. (2001), Collin-Dufresne et al. (2001), Campbell and Taksler (2003). For recent empirical analyses see instead Anginer and Warburton (2014), Ahmed et al. (2015), Badoer and James (2016), Boneva and Linton (2017).

due to the roll-over risk associated to long redemption horizons. Instead, concerning the volume of the issue, there might be two effects at work going in opposite directions. While issuing corporations may face higher costs to generate a sufficiently large demand for their placements, a larger issuance volume may imply improved liquidity for secondary market trades.[8] It follows that the relation between the bond volume and the spread is a matter of empirical assessment. To take into account the riskiness of the bond we use a dummy variable which takes 1 if the bond is in the "investment grade" range (BBB- or higher) and 0 otherwise.[9]

The set V_l^{issuer} characterizing the issuer includes a measure of the creditworthiness of the corporation, an indicator of the size and whether the issuing corporation is a 1-timer or has issued more than one bond in the period under consideration. At the same time a set of dummy variables takes into account the (general) industry sector of the issuer.[10] As for the creditworthiness, we rely on the rating provided by the three most important rating agencies: Moody's, Fitch and Standard&Poors. Given the likely non linear relation between the probability of default and the rating, we use a set of dummy variables, one for each rating grade.[11] The variable size is the log of the total assets, which is expected to negatively affect the bond spread: given their diversified activities large corporations (both financial and non-financial) are better positioned to reduce risks. In addition, their prominence for the domestic economy might make them able to benefit from the too-big-to-fail (TBTF) government support (Mishkin 2006, Kroszner 2016). In the same vein as for banks, the idea is that governments would not allow large corporations to go bankrupt if their failures were to bring about significant distress to the overall economic activity or even the domestic financial stability. It is thus assumed that governments will back the debt of these firms should they face significant financial stress (Ahmed et al. 2015).

Finally, in the set V_z^{market} of variables tracking the euro-area market conditions, we have several indices at different frequencies. With a high frequency we have the daily VSTOXX index, which is a measure of the equity market volatility in the euro area (computed relying on both call- and put-implied volatilities from the DJ Euro STOXX 50 index) and the weekly CISS bond index (Composite Indicator of Systemic Stress), which is the systemic stress indicator for the euro-area financial market proposed by Hollo et al. (2012) and regularly updated by the ECB statistical data warehouse (SDW).[12] With a lower frequency we have four monthly

[8] Note that standard measures of bond-specific liquidity used when analysing secondary market spreads (e.g., the number of trades per day or the bid-ask spreads), cannot be used when dealing with the bonds issued on the primary market, since just the features concerning the originating trade are available.

[9] The investment grade dummy refers to the bond assessment by market participants, which is based on the average of all available ratings or even the worst rating. Thus not all the bonds which satisfy the CSPP rating condition (which requires just the best rating being BBB- or above) show 1 in the investment grade dummy.

[10] Non-bank corporations are classified into 12 sectors: Auto and track, Basic materials, Consumer goods, Consumer services, Financials, Healthcare, Industrials, Insurance, Oil and gas, Technology, Telecommunications and Utilities.

[11] The rating of the issuer is first linearized between 1 (CC/Ca) and 20 (AAA/Aaa), so that when the same bond receives more than one assessment from Moody's, Fitch and Standard&Poors they can be averaged. Then the average is transformed into a set of dummy variables. We rely on the rating of the parent company when the issuer's rating is not available but the parent's is. We also add a dummy tracking the firms whose rating is not available at all.

[12] The overall CISS index comprises 15 market-based financial stress measures concerning five broad market segments (financial intermediation, money market, equity market, bond market, foreign exchange market). The

indices: the real effective exchange rate of the euro, the €-coin index by Altissimo et al. (2010), the economic policy uncertainty (EPU) index by Baker et al. (2016), and the non-financial corporation credit risk index by Gilchrist and Mojon (2018). The real effective exchange rate is computed by the ECB with respect to the 38 main trading partners of the euro area. The €-coin is an index of macroeconomic conditions summarizing in real time the "current" economic picture of the euro area. In particular, €-coin collates a large collection of statistical data (industrial production, business surveys, stock market and financial data, demand indicators) and extracts the information that is relevant to nowcast the GDP. The EPU index summarizes the geopolitical uncertainty possibly affecting the financial markets decision making process, by looking at the frequency of newspaper articles that contain a trio of terms pertaining to economy, policy and uncertainty. Finally, the index by Gilchrist and Mojon (2018) employs the information obtained from the yield on several thousands of corporate bonds issued since the launch of the euro in January 1999 to construct a credit spread at the bond-issuance level which is then aggregated at country and euro-area level. All in all, we expect that higher uncertainty and financial market stress are detrimental for corporate funding and thus leads to an increase in the ASW spread.

Table 2. Summary statistics[1]

	Bonds fulfilling CSPP criteria					Bonds not fulfilling CSPP criteria						
	Obs	Mean	Std. Dev	Min	Max	Obs	Mean	Std. Dev	Min	Max	Delta	T-test
ASW spread	3,399	128.7	117.8	-9.400	900	3,784	238.5	219.1	-9.680	1,000	109.8	26.77
Bond maturity	3,399	2,888	1,831	365	18,271	3,784	3,003	3,327	175	36,167	115.0	1.805
Bond value	3,399	19.58	1.098	14.91	22.19	3,784	19.33	1.159	12.06	23.04	-0.256	-9.614
Bond in euros	3,399	1	0	1	1	3,784	0.302	0.459	0	1	-0.698	-93.43
Bond rating	2,820	14.18	2.618	5	20	3,451	12.34	4.193	1	20	-1.832	-21.12
Issuer size	3,399	9.894	1.819	0.411	14	3,784	9.815	2.113	0.349	14	-0.079	-1.701
Issuer rating	2,786	13.87	2.526	2	20	3,168	12.40	4.030	1	20	-1.475	-17.12
1-timer	3,399	0.053	0.225	0	1	3,784	0.050	0.218	0	1	-0.003	-0.631
REER	3,399	95.57	6.504	83.90	108.7	3,784	94.91	6.095	83.90	108.7	-0.662	-4.436
Systemic stress	3,399	0.054	0.029	0.004	0.144	3,784	0.051	0.026	0.004	0.143	-0.003	-4.892
Market volatility	3,399	23.52	8.704	12.08	73.08	3,784	22.03	7.148	12.24	69.96	-1.481	-7.830
Businesss cycle	3,399	0.180	0.470	-1.268	0.937	3,784	0.252	0.395	-1.268	0.937	0.072	6.945
Uncertainty	3,399	173.6	67.34	47.69	433.3	3,784	177.4	68.05	47.69	433	3.759	2.351
Corporate risk	3,399	1.083	0.567	0.532	3.410	3,784	0.991	0.449	0.532	3.410	-0.091	-7.512

Source: Dealogic DCM Analytics, Thomson Reuters, Capital IQ, ECB. 1) ASW spread is the difference between the bond yield and the fixed-leg rate of a swap contract with the same maturity (basis points); Bond maturity is the maturity of the bond at issuance (days); Bond value is the log of the tranche value of the bond; Bond in euros is a dummy which takes 1 for euro-denominated bonds and 0 otherwise; Bond rating is the average of the bond rating by Moody's, Fitch and Standard&Poors linearized between 1 (CC/Ca) and 20 (AAA/Aaa); Issuer size is the log of the balance sheet value of all assets; Issuer rating is the average of the issuer rating by Moody's, Fitch and Standard&Poors linearized between 1 (CC/Ca) and 20 (AAA/Aaa); 1-timer is a dummy which takes 1 for corporations which issued only one bond and 0 otherwise, REER is the real effective exchange rate index computed by the ECB with respect to the 38 major euro-area trading partners; Systemic stress is the CISS bond index by Hollo et al. (2012); Market volatility is the weekly average of the VSTOXX index, Business cycle is the €-coin index by Altissimo et al. (2010), Uncertainty is the EPU index by Baker et al. (2016), Corporate risk is the index by Gilchrist and Mojon (2018), respectively. Delta is the mean difference and T-test is the value of the t-test.

sub-index of the bond market segment is based on the realised volatility of the German 10-year benchmark government bond, the yield spread between A-rated non-financial corporations and government bonds, the value of the 10-year interest rate swap spread (Hollo et al. 2012).

Table 2 shows the basic statistics of the main variables employed by distinguishing between bonds that fulfill the CSPP criteria (left hand panel) and bonds that do not (right hand panel).

As concern the bond characteristics, both the maturity and the volume are rather similar. However, non-eligible bonds issued in the euro currency are just 30% of the total number of placements and the average rating is almost two notches below that of eligible bonds (A- vs BBB). Looking at the issuer characteristics, we have that the balance sheet dimension is very similar, but again the rating is different (1.5 notches). As concerns market conditions, it seems that the placement of bond not fulfilling the CSPP criteria enjoyed, on average, a slightly better environment (less systemic stress and volatility, better macroeconomic outlook but more policy uncertainty) and a more depreciated euro. All in all is not surprising that the reported differences are reflected in a much higher ASW spread for non-eligible bonds (239 vs 129 basis points).

As for the data sources, we merged information from several providers in order to have a sample of 7,183 bonds issued by 1,066 euro-area corporations over the period from January 2005 to June 2017. In particular, the ASW spread is taken from Thomson Reuters, balance sheet variables are sourced from Capital IQ, issuance features come from DCM Analytics by Dealogic, the CISS index from ECB SDW.[13]

4 The CSPP at work

As a first step in the assessment of the CSPP, we check whether the model consistently estimate the different sources of price determination and whether the set of bonds selected by the eligibility criteria was a preferred habitat before the announcement and actual deployment of the programme. Indeed, the literature analyzing the effects of quantitative easings has shown that the rebalancing channel is most effective when there are some frictions causing imperfect substitutability between assets (Vayanos and Vila 2009, Koijen et al. 2016, Gambetti and Musso 2017) and when the financial market is under stress (Altavilla et al. 2016). We thus introduce in the baseline model a variable mimicking the eligibility criteria, i.e. a dummy which tracks all the bonds which would have been labelled "eligible" before the launch of the programme (CSPP habitat).[14]

All regressions are run with fixed effects by country of residence, issuer rating and industry sector to take into account the different sources of heterogeneity in the euro-area corporate bond market. In addition, fixed effects by time period (quarters) are estimated to take into account the different market conditions over time, which are not explained by the variables included in

[13] We excluded from the sample the top 1% and the lower 1% of bonds according to the ASW spread as reported by Thomson Reuters. We also excluded the bonds issued by corporations whose total assets were negative. Given the paucity of data, we also excluded from the sample 50 bonds issued by other euro-area countries (Cyprus, Estonia, Latvia, Slovak Republic and Slovenia) for which all the variables were available.

[14] In other words, to select the bonds fulfilling the CSPP criteria before the CSPP announcement, we rely on a dummy variable which takes 1 for euro-denominated bonds with (at least) an investment grade rating and a maturity between 6 months and 31 years, which are issued by a non-bank corporation established in the euro area and 0 otherwise.

the set V_z^{market} and are instead influenced by the monetary policy stance. The time horizon starts in January 2005 and ends in February 2016, just before the CSPP announcement.

Table 3. Regression results: preferred habitat[1]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bond maturity	0.0058 ***	0.0055 ***	0.0055 ***	0.0059 ***	0.0061 ***	0.0053 ***	0.0055 ***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0005)	(0.0003)	(0.0004)
Bond value	-2.3672	-1.9955	-1.4489	-3.2639	-5.2434 *	-4.3041	-4.8478
	(3.453)	(3.347)	(3.1718)	(3.4303)	(3.0556)	(2.9102)	(3.3585)
Bond IG	-242.91 ***	-231.98 ***		-57.198 **	-23.393	-166.46 ***	-173.03 ***
	(16.243)	(17.961)		(22.724)	(20.083)	(18.330)	(20.768)
Bond in euros	-6.7685	5.4295	5.6642	13.406	-0.7524	-20.615	-18.176
	(5.3400)	(10.047)	(10.371)	(14.028)	(11.85)	(14.021)	(17.470)
Issuer size	-13.575 ***	-13.583 ***	-13.539 ***	-8.7488 **	-14.786 ***	-12.141 ***	-20.688 ***
	(3.4280)	(3.3831)	(3.3133)	(3.6751)	(3.383)	(2.5371)	(2.6122)
1-timer	23.466 *	23.357 *	22.774 *	23.441	3.8682	27.980 **	24.978 *
	(13.094)	(13.038)	(12.732)	(15.190)	(16.991)	(10.778)	(13.159)
REER	-0.4518	-0.3476	-0.7658	-0.4409	-4.7003 *	-1.1159	-3.7690
	(2.0238)	(2.0291)	(2.0038)	(2.0313)	(2.4400)	(1.9181)	(2.6948)
Systemic stress	-20.564	-19.571	-1.4295	88.388	202.14	-26.854	-69.84
	(185.14)	(184.92)	(183.75)	(176.51)	(224.11)	(175.87)	(269.97)
Market volatility	-0.2380	-0.2064	-0.1079	-0.0571	-0.4602	0.1100	-0.4701
	(0.7414)	(0.7396)	(0.7448)	(0.7376)	(0.9362)	(0.6819)	(0.98)
Businesss cycle	-76.947 ***	-78.088 ***	-78.755 ***	-81.619 **	65.732	-54.684 **	27.382
	(33.200)	(33.160)	(32.818)	(33.666)	(41.046)	(27.322)	(47.598)
Uncertainty	0.0842	0.0911	0.0727	0.1050	0.0414	0.0921	0.1762
	(0.1018)	(0.1024)	(0.0972)	(0.0911)	(0.098)	(0.095)	(0.119)
Corporate credit risk	11.006	11.693	12.2643	19.9293	-8.916	-0.7094	24.738
	(23.435)	(23.473)	(22.405)	(21.6773)	(29.706)	(21.159)	(35.205)
CSPP habitat		-16.907	-17.668	-17.317	-13.170		
		(10.953)	(11.093)	(13.543)	(11.682)		
CSPP secondary						-2.270	-5.691
						(4.5547)	(6.2012)
FE by country	YES	YES	YES	YES	YES	YES	YES
FE by sector	YES	YES	YES	YES	YES	YES	YES
FE by rating	YES	YES	YES	YES	YES	YES	YES
FE by quarter	YES	YES	YES	YES	YES	YES	YES
FE quarter * Bond IG	NO	NO	YES	NO	NO	NO	NO
R^2	0.681	0.682	0.697	0.493	0.633	0.727	0.759
Observations	5,989	5,989	5,989	4,910	1,909	5,989	2,546

1) Dependent variable: ASW spread; robust standard errors are clustered by issuer (in parentheses). Bond IG is a dummy which takes 1 for bonds rated BBB- or above and 0 otherwise; CSPP habitat is a dummy which takes 1 for bonds which fulfill the CSPP eligibility criteria and were issued before March 1, 2016 and 0 otherwise; CSPP secondary is a dummy which takes 1 if the bond has been purchased under the CSPP on the secondary market after June 8, 2016 and 0 otherwise. For all other variables' definition see Table 2. The time horizon is January 2005-February 2016 in columns (1)-(4) and (6); January 2013-February 2016 in columns (5) and (7). Regressions (4)-(5) are run for the set of bonds having at least one rating of investment grade level (BBB- or equivalent). Symbols ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

The first column of Table 3 shows a broad consistency of our ex-ante expectations with the empirical results. The maturity at issuance has a positive and significant sign confirming the presence of a premium for the risk of holding a long-term security. The coefficient of the amount issued is non significantly different from zero, suggesting that the two effects stemming from the possibly improved liquidity on secondary market trades and the difficulty of placing a large

issue compensate each other. The investment grade dummy signals a large spread reduction for bonds rate BBB- or above (over 240 basis points), while the euro denomination dummy in not significantly different from zero.

As far as the issuer characteristics are concerned, the coefficient on size is significant and negative. Estimates thus confirm the existence of a bias in favour of issuers of larger dimension. As already explained, larger corporations are able to get a discount on their issues, not only because they tap more often the bond market and are able to diversify risks, but also because their absolute and relative dimension make them of (domestic) systemic relevance and beneficiary of the too-big-to-fail support. At the same time, being a 1-timer is costly: they pay an increased ASW spread of 23 basis points.

Finally, all the indicators of market sentiments have the expected sign, but only the business cycle index is significantly different from zero.

When the variable mimicking the CSPP eligibility criteria (CSPP habitat) is introduced, the estimated coefficient is not significantly different from zero (column 2), suggesting that there were no distortions concerning the pricing in that market segment. To check for the robustness of this result, the interaction between the time dummies and the investment grade dummy is introduced in column (3) to take into account the possible variation over time of the spread between investment grade and high yield bonds. Instead, columns 4 and 5 report the regressions run for a more homogenous set of bonds: those having at least one rating of investment grade level (BBB- or equivalent).[15] Column 4 shows the coefficients concerning the sample January 2005 - February 2016, whereas column 5 concerns the shorter period January 2013 - February 2016, which does not include the two waves of the financial crisis. Finally, columns 6 and 7 report, for the two time samples, the results of the regressions run when the preferred habitat segment is identified by the bonds actually purchased by the ECB under the CSPP programme in the secondary market (after June 8, 2016), but placed on the primary market before the announcement of the programme (CSPP secondary).[16] While always showing a negative sign, the coefficient tracking of the CSPP characteristics (either CSPP habitat or CSPP secondary) is never significantly different from zero.

As a following step in the assessment of the CSPP effects, we analyze the evolution of the quarterly time dummies over the first year of ECB purchases. Indeed, time dummies are a proxy of the overall market conditions which do not depend on the explanatory variables already included in the regression (currency value, market stress, volatility, macroeconomic factors, policy uncertainty and risk appetite) and thus are directly influenced by the ECB policy measures. By looking at the dummy changes quarter by quarter we can measure the evolution over time of firms' financing conditions.

[15] The sample restricts from 5,989 to 4,910 bonds. Note that among the 2,848 bonds included in the CSPP habitat segment 35 do not have the investment grade status according to the more restrictive market assessment. This is the reason why the dummy tracking the investment grade status (Bond IG) is among the regressors also in columns 4-5.

[16] The segment of bonds with the CSPP eligibility characteristics is significantly reduced to just 738 bonds, mainly because many bonds reached maturity before the start of the CSPP (around 2,000).

Table 4. Regression results: rebalancing channel[1]

	(1)	(2)	(3)	(4)
Bond maturity	0.0059 ***	0.0059 ***	0.0059 ***	0.0058 ***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Bond value	-7.9051 **	-7.7375 **	-7.6552 **	-7.8104 **
	(3.2659)	(3.2590)	(3.2685)	(3.2654)
Bond IG	-235.71 ***	-235.00 ***	-235.19 ***	-233.75 ***
	(14.094)	(14.091)	(14.095)	(14.218)
Bond in euros	-3.9374	-2.8438	-2.8311	-1.1854
	(11.652)	(11.666)	(11.682)	(11.698)
Issuer size	-12.870 ***	-12.768 ***	-12.776 ***	-12.719 ***
	(2.8256)	(2.8276)	(2.8310)	(10.942)
1-timer	22.989 **	23.346 **	23.140 **	23.790 **
	(10.942)	(10.946)	(10.963)	(10.942)
REER	-0.1826	-0.1343	-0.1657	-0.2101
	(1.8888)	(1.8857)	(1.8907)	(1.8930)
Systemic stress	-36.240	-32.375	-26.497	-7.732
	(162.32)	(161.40)	(161.11)	(159.15)
Market volatility	-0.1962	-0.1992	-0.1715	-0.1750
	(0.6592)	(0.6592)	(0.6597)	(0.6587)
Businesss cycle	-65.987 **	-65.109 **	-64.818 **	-64.126 **
	(27.898)	(27.904)	(27.932)	(28.052)
Uncertainty	0.0772	0.0809 *	0.0719	-0.1750 *
	(0.0475)	(0.0479)	(0.0494)	(0.0511)
Corporate credit risk	6.2507	6.4921	6.4436	4.8317
	(19.888)	(19.888)	(19.855)	(19.936)
CSPP eligible purchased		-29.4765 ***		
		(7.4554)		
2016Q1	64.558 *	64.496 *	64.709 *	61.560 *
	(37.583)	(37.560)	(37.746)	(37.916)
2016Q2	28.480	29.068	28.205	25.633
	(34.547)	(34.562)	(34.738)	(34.736)
2016Q3	42.483	49.564 *	58.124 *	69.634 *
	(34.480)	(34.355)	(35.076)	(35.360)
2016Q4	41.092	48.507	55.202	70.479 *
	(35.899)	(35.829)	(36.321)	(37.273)
2017Q1	29.323	35.609	32.228	28.883
	(38.149)	(38.246)	(38.776)	(39.507)
2017Q2	12.908	18.473	17.083	14.732
	(35.088)	(35.133)	(35.979)	(37.367)
2016Q3*CSPP eligible purchased			-62.318 ***	-78.878 ***
			(14.129)	(15.621)
2016Q4*CSPP eligible purchased			-50.945 ***	-71.954 ***
			(15.377)	(19.577)
2011Q1*CSPP eligible purchased			-8.2410	-10.389
			(14.187)	(15.797)
2017Q2*CSPP eligible purchased			-17.804	-19.983
			(11.584)	(14.277)
2016Q3*CSPP eligible non-purchased				-68.989 ***
				(17.021)
2016Q4*CSPP eligible non-purchased				-60.747 ***
				(21.870)
2017Q1*CSPP eligible non-purchased				-2.4989
				(18.135)
2017Q2*CSPP eligible non-purchased				-3.0760
				(15.500)
R^2	0.698	0.699	0.700	0.700

1) Dependent variable: ASW spread; included observations: 7,183; robust standard errors (in parentheses) are clustered by issuer; regression includes FE by country, sector, issuer rating and time period. CSPP eligible purchased is a dummy which takes 1 for bonds actually purchased under the CSPP and 0 otherwise; CSPP eligible non-purchased is a dummy which takes 1 for non-purchased eligible bonds and 0 otherwise. For all other variable definitions see Table 2. Symbols ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively

Starting from the announcement of the CSPP in 2016Q1, Table 4 reports the estimated coefficients from the baseline regression (column 1) over the whole time sample (2005Q1-2017Q2).

The change in the second quarter with respect to the first one (the difference between the 2016Q2 dummy and the 2016Q1 dummy) is negative by 36 basis points and statistically significant ($p < 0.01$), confirming the large and positive effect of the CSPP announcement on market placement conditions and bonds' ASW spread.[17] Surprisingly, in the two following periods, the differences in the quarterly estimates with respect to 2016Q2 are positive, even though not statistically significant, hinting, at best, at unchanged funding conditions for the bond market as a whole, notwithstanding the CSPP purchases. The improvement seems to resume in 2017 only, for a total amount of 28 basis points ($p < 0.05$).

In order to give an interpretation to this somewhat puzzling evidence we have to delve further into the effects of the CSPP purchases. In particular, we have to assess the evolution in the corporate bond market of three segments: actually purchased bonds, non-purchased eligible bonds and non-eligible bonds.

A very intuitive and straightforward way to test the direct effect of the CSPP on the corporate financing conditions is to estimate whether being purchased on the primary market by the ECB affects the ASW spread. We thus introduce among the regressors a dummy tracking all the bonds actually purchased under the programme (CSPP eligible purchased). The coefficient is estimated at 29 basis points, hinting at a large discount in the ASW spread at issuance for the bonds selected by the Eurosystem (Table 4, column 2).[18] In addition, the deterioration in funding conditions in the second half of 2016 for non-purchased bonds is now estimated at 20 basis points and statistically significant. The return to better market conditions is instead confirmed in 2017.

In order to assess whether the direct effect on CSPP purchased bonds was constant over time and whether it did spill over to other bonds (CSPP eligible non-purchased and non-eligible bonds), we interact the variable tracking the CSPP purchased bonds with the time dummies since the start of the programme (2016Q3). By looking, quarter by quarter, at the coefficient on this interaction we can follow the evolution over time of the direct effect of the programme on CSPP purchased bonds as in a diff-in-diff framework with multiple time periods (Imbens and Wooldridge 2009). At the same time, the indirect effect on other bonds can be assessed by looking at the estimated time dummies. Given that in each quarter the differential effect between the CSPP purchased and the rest of the bonds is taken into account by an ad hoc variable (the CSPP eligible purchased dummy), the changes (quarter by quarter) in the coefficient on the "pure" quarterly dummies measure the effect of the programme on non-purchased bonds only.

Results show that the direct effect on CSPP purchased bonds was entirely concentrated and very large in the first two quarters of purchases: it amounts to 62 basis points in 2016Q3 and to 51 basis points in 2016Q4. It completely disappeared in 2017 (Table 4, column 3). As concerns non-

[17] Even though the issuance procedure on the primary market takes time, the 2016Q1 coefficient may already incorporate an improvement in market conditions (the CSPP was announced on March 10, 2016). On the other hand, the direct effect of CSPP purchases (started on June 8, 2016) may be incorporated in the 2016Q2 coefficient. Altough in June 2016 just few bonds were purchased by the ECB on the primary market, the announcement effect may be somewhat overestimated.

[18] Over the period June 2016 - June 2017, the average ASW spread was 174 basis points. The estimated coefficient thus points to a 14% discount.

purchased bonds, the deterioration in market conditions in the second half of 2016 is estimated at 30 basis points, but after six months within the programme, they were involved by a positive spill-over: in 2017 the ASW spread improved by a total of 38 basis points with respect to 2016Q4.

Given that the non-purchased segment includes two distinct sets of bonds with very different characteristics (CSPP eligible non-purchased bonds and non-eligible bonds), we look at them separately to check whether the effect and the timing of the CSPP programme is different across market segments. Indeed, we know from the economic literature that large quantitative easings affect (sooner or later) also non-purchased bonds via the portfolio rebalancing channel (Krishnamurthy and Vissing-Jorgensen 2011, Hancock and Passmore 2011, Andrade et al. 2016), the effect being faster on bonds relatively similar to the purchased ones. We thus expect the CSPP spill-over to be visible first on eligible bonds and only later on to be detectable also on other market segments.

By introducing a dummy variable tracking the non-purchased eligible bonds (Table 4, column 4), we can test via the standard Wald procedure whether a difference exists between non-purchased eligible bonds and actually purchased bonds. The estimated direct effect of the CSPP on purchased and non-purchased eligible bonds is somewhat larger, averaging around 70 basis points in 2016Q3 and 2016Q4, whereas the difference with respect to non-eligible bonds is confirmed to disappear in 2017. By comparing quarter by quarter the coefficients of purchased eligible and non-purchased eligible bonds, it turns out that the difference is not significantly different from zero in any quarter since the start of the programme.

Given the similarity of bonds characteristics, this evidence is consistent with a very fast working of the portfolio rebalancing channel. Already in 2016Q3 and 2016Q4, agents which could not buy a given bond because of the increased demand from ECB (up to 30% of the issuance volume of each selected bond) switched to other bonds within the same "eligible" segment, determining a generalized reduction in the yield spreads in that segment. Non-eligible bonds instead witnessed a (statistically significant) deterioration in placement conditions, which cancelled out the gain obtained from the CSPP announcement. It is now clear that the unchanged market conditions reported in column 1 for the market as whole in the second half of 2016 mask very different behaviors among bond segments, which compensated each other.

Instead, in 2017Q1 and 2017Q2 the effect of the CSPP spilled over also to non-eligible bonds, with a cumulative drop in the spread of over 50 basis points with respect to 2016Q4.[19] Given that in the first two quarters of 2017 the coefficients on both segments of eligible bonds (purchased and non-purchased) are not significantly different from zero, we can claim that eventually the whole euro-area corporate bond market was influenced by the CSPP purchases, with eligible bonds benefiting of a smaller ASW earlier in 2016H2, and non-eligible bonds catching up in 2017H2.

[19] The 42 basis points drop in 2017Q1 with respect to 2016Q4 is statistically significant at the 10% level ($p = 0.067$), while the overall 56 basis points drop in 2017Q2 is statistically significant at the 5% level ($p = 0.012$).

5 Demand and supply shifts

A possible way to assess the channel through which the effects of the CSPP deployed can be derived from the analysis of quantity and price dynamics over time. In particular, referring to the standard demand and supply framework, we will focus on the changes in the market values of prices and quantities in 2016H2 and 2017H1 for the two sets of eligible and non-eligible bonds.[20] Such an empirical strategy allows us to shed light on the occurrence of supply and demand shifts in the corporate bond market and provide further evidence about the transmission channels of the monetary policy (Cohen et al. 2007).

Table 5 Regression with eligible bonds dummy[1]

Variable	Coef.	Std. Err.	T-test	P-value
Bond maturity	0.0058	0.0004	15.42	0.000
Bond value	-7.9607	3.3032	-2.41	0.016
Bond IG	-233.06	14.193	-16.42	0.000
Bond in euros	2.1064	11.700	0.18	0.857
Issuer size	-12.538	2.8762	-4.36	0.000
1-timer	25.177	11.002	2.29	0.022
REER	-0.7363	1.1953	-0.62	0.538
Systemic stress	67.025	152.88	0.44	0.661
Market volatility	-0.7414	0.5802	-1.28	0.202
Businesss cycle	-55.871	16.731	-3.34	0.001
Uncertainty	0.1106	0.0436	2.54	0.011
Corporate credit risk	27.520	12.907	2.13	0.033
2016H1	56.141	23.127	2.43	0.015
2016H2	76.200	23.179	3.29	0.001
2017H1	27.683	24.943	1.11	0.267
2016H1*eligible bonds	-33.000	9.4085	-3.51	0.000
2016H2*eligible bonds	-71.437	11.631	-6.14	0.000
2017H1*eligible bonds	-10.024	10.730	-0.93	0.350
		eligible bonds		
(2016H2 - 2016H1)	-18.379	7.7867	-2.36	0.018
(2017H1 - 2016H2)	12.896	9.0445	1.43	0.154
		non-eligible bonds		
(2016H2 - 2016H1)	20.058	11.944	1.68	0.093
(2017H1 - 2016H2)	-48.516	14.451	-3.36	0.001

1) Dependent variable: ASW spread; included observations: 7,183; robust standard errors (in parentheses) are clustered by issuer; regression includes FE by country, sector, issuer rating and time period. $R^2 = 0.698$. The dummy "eligible bonds" takes 1 for bonds fulfilling the CSPP eligibility criteria and 0 otherwise. For all other variable definitions see Table 2. Symbols ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

[20] Relying on the results of the previous Section we simply consider the eligible bond segment as a whole, i.e. we do not distinguish between actually purchased and non-purchased eligible bonds, and we rely on semiannual time dummies, instead of quarterly dummies.

Since bonds fulfilling CSPP eligibility conditions existed even before the CSPP announcement, we use them to estimate the change between 2016H2 and 2016H1 in volumes and prices of eligible bonds. In particular, we construct a new dummy "eligible bonds" which is the merge between the "CSPP habitat" dummy used in Table 3 and the "CSPP eligible" dummy used in Table 4: over the whole 2005H1-2017H1 period, it takes 1 if the bond fulfills the CSPP eligibility conditions (regardless of the existence of the programme) and 0 otherwise.

Table 5 shows the coefficients and the statistics of the regression run using the "eligible bonds" dummy (upper panel) as well as the tests of the changes with respect to the previous period in the market conditions for the two semesters of interest (lower panel).[21] For the set of eligible bonds we have in 2016H2 an improvement of market conditions of 18 basis points and in 2017H1 unchanged market conditions. For the set of non-eligible bonds we have in 2016H2 a deterioration of market conditions of 20 basis points and in 2017H1 an improvement of 49 basis points.

From Section 2, instead, we know that the equilibrium quantity increased constantly over the period under analysis for both the eligible and the non-eligible segments (Table 1). In particular, the cumulated yearly issuance increased in 2016H2 and 2017H1 by 18,786 and 11,070 millions, respectively, for eligible bonds and by 53,761 and 4,082 for non-eligible bonds.

Now we can couple the changes with respect to the previous period in prices with those in quantities for both sets of bonds. For eligible bonds we have in 2016H2 a contemporaneous increase in bond placements (our measure of quantity) and an improvement in financing conditions (our measure of price).[22] These dynamics correspond to at least an increase in bonds' demand, as would be the case for any increase in price coupled with an increase in quantity in the standard demand and supply framework. While we are aware that this might not be the only shift that occurred, to have a new equilibrium into the North-East quadrant, at least a demand shift outward must have occurred. The demand shift which occurred in 2016H2 with respect to the previous period can be almost entirely attributed to the ECB starting the purchase of eligible bonds.

As concerns non-eligible bonds, in 2016H2 we have an increase in bond placements and a deterioration in financing conditions that can be classified as a movement into the South-East quadrant. Thus, at least a shift in supply must have occurred. The deteriorated financing conditions suggests that the increase in supply was not accommodated by an increase in bonds' demand, or it was accommodated only partially. Again, this evidence squares well with the fact that the ECB was targeting just eligible bonds and there was not enough demand for the increased volume of non-eligible bonds.

Instead, in 2017H1 we have also for non-eligible bonds a contemporaneous increase in bond placements and an improvement in financing conditions (North-East quadrant): a shift in the

[21] Note that the computation of the change in market conditions n the second semester of 2016 for non-eligible bonds is given by the difference between the following regression coefficients: (2016H2+2016H2*eligible bonds) and (2016H1+2016H1*eligible bonds); analogously for the first semester of 2017.

[22] Note that an improvement in financing conditions means that ASW spreads declined and bond prices increased.

demand of non-eligible bonds must have occurred. Where did the increased demand come from? Certainly not from the ECB which was still targeting eligible bonds only. The most likely interpretation is suggested again by the working of the portfolio rebalancing channel (Vayanos and Vila 2009). The CSPP programme, after six months of robust purchases and increasing prices, crowded out other investors in the eligible bond segment pushing them towards non-eligible bonds, which are close substitutes but have higher expected returns.

Thus, while there might be also other channels at work such as, for instance, the liquidity channel, the evidence reported on both price and quantity after the start of the CSPP is supportive of the proper timing and working of the portfolio rebalancing channel. We can think of a first phase in which the increased demand on purchased bonds (up to 30% of the volume of the placement) brought about by the start of the programme crowds out investors in the eligible bonds segment and pushes them towards other similar (non-purchased) bonds within the same segment, thus determining a widespread increase in eligible bond prices. Then, in a second phase, investors switch from the eligible to the non-eligible bond segment by further rebalancing their portfolios: the increased demand for non-eligible bonds in turn reduces their spreads. Eventually the CSPP programme affects the spread on all corporate bonds, improving the financing conditions of euro-area non-bank corporations.

6 Concluding remarks

The paper provides an assessment of the effects of the corporate arm of the ECB quantitative easing over its first year of activity. The CSPP programme, which was announced in March 2016, had an immediate effect on bond trades even before the actual start (June 2016). The decline in yield spreads was evident on both eligible and non-eligible bonds.

Since the announced aim of the programme was to sustain the pass-through of the accommodative monetary policy stance to the financing conditions of non-bank corporations, the analysis focuses on the primary bond market, which is the place where the cost of funding is set in the first instance. By looking at the ASW spread on 7,183 placements, we were able to detect: i) a large announcement effect of 36 basis points, which involved both eligible and non-eligible bonds; ii) an initial direct effect of the CSPP purchases on eligible bonds only, which were issued at a yield 70 basis point lower than non-eligible; iii) a later indirect effect which involved non-eligible bonds (50 basis points).

In addition, by exploiting the information incorporated in equilibrium "quantity-price" pairs about the shifts in demand and supply over time, we provide evidence in favour of the portfolio rebalancing channel (Vayanos and Vila 2009). In the first six months of the programme (2016H2) the volume of issued bonds (our measure of quantity) increased with respect to 2016H1 for both eligible and non-eligible bonds. At the same time, in 2016H2, the financing conditions (our measure of price) improved for eligible bonds only (prices increased and ASW spreads declined). In the standard demand and supply framework, this implies a new equilibrium in the North-East

quadrant and suggests that in that segment a demand shift occurred, which is fully consistent with the increased ECB purchases. Instead, the financing conditions of non-eligible bonds deteriorated (price declined), suggesting a supply shift not (fully) accommodated by the demand (a movement in the South-East quadrant).

Eventually, after several months of CSPP purchases, also the financing conditions of non-eligible bonds improved (2017H1). Given the contemporaneous increase in price and quantity, our empirical strategy implies that a demand shift occurred also in the non-eligible segment (North-East quadrant). Since the ECB did not target non-eligible bonds, the increased demand came from other market participants. Interpreting this evidence through the working of the portfolio rebalancing channel, we maintain that the demand shift was most likely brought about by the scarcity generated by the ECB in the eligible bonds segment, which crowded out other investors pushing them towards the non-eligible segments. As a consequence also the price on non-eligible bonds eventually increased and the difference in the ASW spread with respect to eligible bonds vanished.

All in all, focusing on the primary bond market, the paper suggests that the CSPP has exerted in the first year of purchases a positive and significant effect on the whole non-bank corporate bond market. Indeed, through different channels (announcement, direct, and portfolio rebalancing) it affected both eligible and non-eligible bonds, easing euro-area firm's financing conditions.

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