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Operational targets and the yield curve: The euro area and Switzerland

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Abstract

When setting monetary policy, central banks seek to affect the entire term structure of interest rates. Most central banks with a price stability or inflation mandate do this by targeting a very short-term market rate. This Letter presents a comparative analysis of the correlation between policy rate changes and bond yields in the euro area, where the implicit target of monetary policy is the overnight rate, and Switzerland, where the target is a three-month rate. The analysis indicates that unanticipated policy rate changes by the European Central Bank and Swiss National Bank are significantly and positively correlated with changes in German and Swiss government bond yields out to 6 years and 20 years, respectively

1 Introduction

In order to achieve price stability, a central bank must be able to influence nominal variables that affect inflation, such as interest rates. By setting a very short-term policy rate, central banks are able to impact the longer end of the yield curve via the expectations hypothesis of the term structure of interest rates. The key policy rate of most price stability and inflation-targeting central banks is an overnight rate. The European Central Bank (ECB), for example, implicitly steers the Euro OverNight Index Average (EONIA) by setting interest rates for the main refinancing operation and standing facilities. The Swiss National Bank (SNB), on the other hand, is unique in that it targets the 3-month Swiss franc Libor.

Given the importance of longer-term interest rates for the real economy, an interesting question is whether monetary policy could be more effective if it targeted a longer-term interest rate, especially when the functioning of financial markets is impaired. Under such conditions, the transmission mechanism of monetary policy is weakened and reductions in policy rates may not result in lower long-term yields. In a recent IMF discussion paper on monetary policy, Bayoumi *et al.* (2014) note that in addition to focusing on rates that are most relevant for spending decisions, targeting longer-term interest rates can offset the economic impact

[1]The views expressed in this paper are those of the authors and do not necessarily reflect those of the Central Bank of Ireland or the ESCB. The authors would like to thank Paul Johnston for research assistance and Stefan Gerlach, Gerard O'Reilly, colleagues in the Financial Markets Division and, particularly, Eimear Curtin and Mary Masterson for comments - any remaining errors are the responsibility of the authors.

[2]Following the financial crisis of 2008, many central banks in developed economies reduced policy rates towards the zero lower bound. At this time, impairment in the transmission mechanism reduced the impact of lower (short-term) policy rates on longer-term interest rates. By targeting longer-term rates, central banks would be less constrained by impairments in the transmission mechanism and given that longer-term interest rates include positive term premia, targeting them could reduce

of shocks to the term premium and would reduce the risk of hitting the zero lower bound.[2]

As noted by Amstad and Martin (2011), longer-term money market rates are more challenging to target directly, in part because market participants determine the supply and demand for such funds.[3] However, a potential benefit of targeting further out the yield curve is that it can allow the central bank to stabilise more economically-relevant interest rates while letting shorter-term rates fluctuate to absorb changes in credit and liquidity risk.

This Letter analyses the relationship between policy rate changes and bond yields in the euro area and Switzerland. The results indicate that unanticipated changes in policy rates by the ECB and SNB are positively and significantly correlated with changes in government bond yields, with effects further out the yield curve in the case of Switzerland. Section 2 outlines the key features of the operational frameworks of the ECB and SNB. Section 3 reviews the literature on targeting different parts of the yield cuve. The methodological approach and results are discussed in Sections 4 and 5, respectively. Section 6 concludes.

2 Operational frameworks of the ECB and SNB

Both the ECB and SNB have a mandate to ensure price stability. Like most other price stability and inflation-targeting central banks, the ECB implements monetary policy by setting official policy rates and conducting open market operations. The key policy rates are the main refinancing rate and the rates on the deposit and marginal lending facilities.[4] Although the ECB does not have an official operational target, it closely monitors EONIA and can steer this through its key policy rates and open market operations. EONIA is therefore viewed by market participants as the implicit operational target of monetary policy in the euro area.

Unlike the ECB and most other central banks in developed economies, which target (either implicitly or explicitly) an overnight interest rate, the SNB targets the 3-month Swiss franc Libor. The SNB sets a target range for 3-month Libor[5] and like the ECB, conducts open market operations to impact liquidity conditions in the money market. There are a number of reasons why the SNB chose Libor as its operating target: it is the main rate at which Swiss franc credit is priced, it is closely linked to Swiss final domestic demand and at the time of the introduction of the SNB's current monetary policy framework in 1999, there were no suitable alternatives as the domestic interbank money market was still under development (Ross 2008). Furthermore, as a small open economy, the SNB chose to target a range for 3-month Libor rather than a point for the overnight rate as this allows more flexibility in reacting to exchange rate and other shocks in the short-run without having to change monetary policy (Jordan and Kugler 2004).

3 Literature review

The literature on longer-term interest rates as operational targets of monetary policy is limited. In terms of theoretical papers, Kulish (2004), McGough *et al.* (2004) and Carlstrom *et al.* (2014) consider the use of a long-term interest rate as the monetary policy instrument in New Keynesian models. Kulish concludes that long-term rates are better instruments when monetary authorities are concerned about inflation volatility. McGough *et al.* propose the use of a longer-term interest rate as the policy instrument at the zero bound. Carlstrom *et al.* find that there are welfare gains from a central bank responding to the term premium.[6]

In an historical analysis of the Federal Reserve's

the likelihood of hitting the zero bound in the first place.

[3] Central banks have more direct influence on overnight market rates as they supply reserves to the banking system and can estimate the demand for overnight funds, which are largely driven by reserve requirements and changes in autonomous factors (which are outside of the central bank's control but influence commercial banks' reserves, *e.g.* government deposits and banknotes in circulation).

[4] Since October 2008, a fixed-rate full allotment policy has been in place, allowing counterparties to borrow any amount in the main refinancing operations (MROs), against adequate collateral, at the main refinancing rate. Prior to this, liquidity in the MROs was alloted through variable rate tenders, with the main refinancing rate serving as a minimum bid rate.

[5] The width of the target range has usually been 100 bps, with the SNB aiming to keep Libor close to the centre of the range. Since August 2011, a target range of 0-0.25% has applied.

[6] As noted by former Chairmain of the Governing Board of the SNB, Jean-Pierre Roth (2009), targeting 3-month Libor rather than an overnight rate allowed the central bank to actively neutralise the sudden increase in risk premia across markets during the financial crisis of 2008.

(Fed) policy, Kuttner (2006) assesses the 1942-1951 period when the central bank and Treasury jointly imposed caps on interest rates. The Fed's experience demonstrates that central banks can, for a time, directly affect long-term rates by offering to buy and sell securities at fixed prices, provided these prices are consistent with the expected path of future short-term rates.

Abbassi *et al.* (2010) investigate the extent to which the ECB's monetary policy implementation became equivalent to the SNB's 3-month rate-targeting approach in light of the increased use of longer-term refinancing operations and conclude that the introduction of fixed-rate tenders with full-allotment by the ECB significantly improved its control over longer-term money market rates.

4 Methodology

We apply the methodology of Kuttner (2001) to the euro area and Switzerland, adapting the analysis to account for the idiosyncrasies of measuring market expectations of central bank policy action.[7] For the euro area we use the 1-month EONIA swap rate to measure anticipated and unanticipated changes in the policy rate.[8] One-month EONIA swaps are spot contracts which involve the exchange of a fixed rate for a floating rate, where the latter equals the average of EONIA over the contract period.[9] Any expected change in the ECB's policy rate should therefore be reflected in EONIA swap rates. For Switzerland, we use 3-month Euroswiss futures contracts to measure anticipated and unanticipated changes in the SNB's policy rate. As the SNB holds quarterly policy meetings, the 3-month Euroswiss futures contracts are ideal for measuring expectations.

For the euro area, we adapt Kuttner's computation of the 1-day surprise as follows:

$$\Delta r^{u}_{\tau,EA} = \frac{m_s}{m_s - \theta}(ESwap_{\tau} - ESwap_{\tau-1}) \quad (1)$$

where τ is the day of an interest rate announcement, m_s is the number of days in the relevant policy-setting month s, θ is an adjustment factor that captures the lag between the announcement and implementation days of an interest rate change and the spot settlement period, and $ESwap$ is the 1-month EONIA swap rate for close of business. This measure of the policy surprise takes into account the fact that the 1-day change in the EONIA swap rate will not fully capture the extent of the unexpected component of the change. The full expectation equals the 1-day change in the swap rate, multiplied by a scaling factor to account for differences in the number of days over which the swap contract will reflect the new policy rate. For example, if the ECB announces a policy rate change on Thursday to take effect at the start of the maintenance period the following Wednesday, the quoted EONIA swap rates for close of business Thursday will reflect the expectation of the average EONIA over a 30-day period starting the following Monday. This implies that for Monday and Tuesday, the EONIA fixing will reflect the old policy rate and only from Wednesday will the swap rate reflect the new policy rate. The change in the swap rate on the date of the announcement therefore does not fully capture the extent of the policy surprise. For this, the change in the swap rate must be multiplied by $\frac{30}{30-28}$ (assuming a 30-day month).[10]

For Switzerland, we follow Abbassi *et al.* (2010) in defining the policy surprise as:

$$\Delta r^{u}_{\tau,CH} = (f^{3m^g}_{\tau} - f^{3m^g}_{\tau-1}) \quad (2)$$

which simply takes the difference between the price of the first generic 3-month Euroswiss futures contract between the day of a policy-setting meeting, τ, and the previous day. The calculation of the unexpected component of a policy change is more straight-forward for Switzerland as any change in the target range for 3-month Libor takes effect immediately and the futures contract delivery price equals the 3-month Libor rate at a future point in time, rather than an average over a period.

[7] Kuttner builds on the work of Cook and Hahn (1989), who considered the 1-day response of government bond yields to changes in the target federal funds rate during the 1970s.

[8] Euribor futures contracts or EONIA itself could also be used. However, Euribor futures contracts have a 3-month maturity and therefore do not match the *circa* 1-month time-horizon over which the ECB sets monetary policy. EONIA, which is an unsecured overnight rate, is only implicitly targeted by the ECB; the ECB policy rate is a minimum bid rate in 1-week collateralised repo operations and EONIA can vary from this day-to-day depending on liquidity conditions in the market.

[9] A spot contract settles two business days after the trade date. For a 1-month EONIA swap contract entered into on day *t*, the floating rate will equal the average of EONIA from day *t*+2 through day *t*+32 (for a 30-day month).

[10] Were EONIA to react immediately and in full to a policy rate change, the scaling factor would be equal to 1. This would not materially change the results of the analysis.

After defining the surprise component of a central bank interest rate decision, we follow Kuttner (2001) in calculating the expected component as the difference between the actual change in the policy rate, Δr_τ,and the unexpected element:[11]

$$\Delta r_\tau^e = \Delta r_\tau - \Delta r_\tau^u. \quad (3)$$

We then assess the extent to which anticipated and unanticipated changes in the policy rate impact bill and bond yields across the term structure. We test whether the SNB, with a 3-month interest rate target, exerts more influence over longer-term yields than the ECB, which effectively targets an overnight rate. To examine this question, we regress the change in bond yields of different maturities on the two components of a change in the central bank policy rate:

$$\Delta R_t^i = \alpha^i + \beta_1^i \Delta r_t^e + \beta_2^i \Delta r_t^u + \epsilon_t^i \quad (4)$$

where R^i are German and Swiss government bill and bond yields.[12] For the euro area and Switzerland, we run the regressions for a dataset encompassing all days on which there were interest-rate-setting meetings, as well as for a narrower subsample including only days on which there was a change in the policy rate. The wider sample takes into account the fact that policy inaction may itself be a surprise. We use a dummy variable to account for the fact that the crisis may have impacted the relationship between changes in the policy rate and changes in government bond yields, for example due to safe-haven flows into highly-rated government bonds.[13]

The euro area dataset includes policy meetings from 1999 to November 2013 and the Swiss dataset covers policy meetings from 2000 to September 2013. Tables 1 and 2 in the Annex summarise the expected and unexpected components of policy rate changes for the euro area and Switzerland. The ECB held 212 interest-rate-setting meetings over the sample period, changing rates 38 times. On two occasions (September 2001 and October 2008), interest rates were changed at unscheduled meetings (yellow rows in Table 1). The SNB held 63 policy meetings, of which 8 were unscheduled (yellow rows in Table 2). It changed interest rates 25 times during the sample period. The market has largely anticipated policy rate changes by the ECB and SNB. On average, the ECB's policy surprise has been 2.8 bps and the SNB's has been 6.4 bps.

In terms of *a priori* expectations, the sign of the beta coefficients in the regressions could be positive or negative. If an interest rate change is seen as the first in a rate cycle, the beta coefficient should be positive, especially at the very short-end of the yield curve. Further along the curve, however, policy rate changes in one direction could induce a change of the opposite sign in bond yields if the central bank policy is seen as credible and likely to generate the desired change in inflationary/disinflationary pressures. Given that we are looking at the immediate, 1-day impact of policy rate changes, however, this longer-term impact may not be evident in the results. We also expect the size of the beta coefficient for the unanticipated component of a policy rate change to decline as the maturity of the government bond yield on the left-hand side of the equation increases; *i.e.* we expect less correlation between changes in the central bank policy rate and market interest rates at longer horizons.

5 Results

The results are presented in Tables 3 and 4 for the euro area and Switzerland, respectively.[14] Panel A contains the results for the wide sample of data (*i.e.* all policy meetings) and panel B reflects

[11] In an alternative specification, Kuttner (2001) defines the expected component as the difference between the futures rate before the policy-setting meeting and the policy rate before the meeting. We re-ran our regressions using this alternative construction of the expected component and found no material differences in the results.

[12] For the euro area, we consider 6-month German bill yields, as well as bond yields from 1-10 years and 30-years. For Switzerland, where there is a narrower range of bonds with a complete price history, we use 2-, 5-, 10-, 15-, 20- and 30-year yields.

[13] The euro area regressions include a dummy variable for all dates after and including 8 October 2008, when the fixed-rate full-allotment tender procedure was introduced. For the SNB, we include a dummy variable for all observations after and including 15 September 2008, the first trading day following the bankruptcy of Lehman Brothers. Additonal crisis dummies to account for other phases of the crisis were included as robustness checks, but were insignifiant and did not change the results.

[14] White tests and Breusch-Pagan tests suggest heteroskedasticity in the residuals; therefore, robust standard errors are used for hypotheis testing. Durbin-Watson statistics and Q-statistics indicate no autocorrelation in the residuals with the exception of the equation for 6-month yields.

the results for the narrow sample (*i.e.* only policy meetings where the interest rate was changed). For both the euro area and Switzerland, the crisis dummy variables are mostly insignificant and are therefore not reported in the tables.

The R-squareds are low across all euro area regressions, but the coefficient for the unanticipated rate change is significant and positive out to 6 years in the wide sample (panel A) and out to 2 years in the narrow sample. For the wide sample, a one percentage point ECB policy surprise is associated with a 1-day change of 20 bps in the 6-month German government bond yield in the same direction. The coefficient is even higher for the 1-year German bond yield (49 bps) but decreases thereafter out to 6 years (20 bps). The decline in the size of the coefficient as the maturity horizon increases is in line with our expectations.

For Switzerland, the R-squareds are notably higher. The coefficient for the unanticipated component of a policy rate change is positive and significant out to 20 years in both the wide (panel A) and narrow samples (panel B). The size of the coefficient for the Swiss regressions is larger for any given maturity than the euro area coefficient, except for the 2-year maturity in the wide sample. Considering all interest-rate-setting meetings, a one percentage point SNB policy surprise is associated with 1-day Swiss government bond yield changes in the same direction of 44 bps and 40 bps for the 2- and 5-year tenors. This compares with changes of 45 bps and 23 bps for the euro area, with the difference between the 5-year coefficients significant at the 0.01 level. Even out to 20 years, the coefficient for unanticipated rate changes is highly significant and substantial, indicating a change of 22 bps for every one percentage point policy surprise.

5.1 Robustness tests

Similar studies have found that the presence of outliers in the data on yields can impact the results. We re-ran the regressions excluding an outlier observed in September 2001; there was no material difference in the results. Given safe-haven flows into German government bonds during the crisis, we replicated our analysis of the euro area by defining the dependent variable in terms of changes in the euro area yield curve.[15] The results are presented in Table 5 of the Annex and despite some differences in the size and significance of the coefficients, we draw the same broad conclusions. We also consider that monetary policy surprises could be more of a timing surprise than a levels surprise if a rate change was an advancement or postponement of an already-anticipated change. Following Bernanke and Kuttner (2005), we add a timing surprise variable to our regressions.[16] For the euro area, our results are comparable to Bernake and Kuttner, suggesting that pure policy surprises have a greater impact on bond yields than surprises related more to the timing of policy rate changes. We do not find similar evidence of a timing effect for Switzerland.

6 Conclusion

Most central banks in developed economies, including the ECB, target an overnight interest rate. However, the SNB targets the 3-month Swiss franc Libor. This Letter first outlined the contrasting operational frameworks of the ECB and the SNB, and then estimated the effect of monetary policy shocks on the yield curves in each jurisdiction. The results suggest that the SNB may have a greater effect on risk-free interest rates further out the yield curve than the ECB. The results are robust to a number of specifications and tests.

[15] Data on the euro area yield curve are from the ECB's Statistical Data Warehouse. We use the euro area yield curve that contains information on all countries. For more information, see <http://www.ecb.europa.eu/stats/money/yc/html/technical_notes.pdf>.

[16] Timing surprise is defined as the difference between the 1-day change in the 1-month-in-1-month forward EONIA rate (second generic 3-month Euroswiss futures contract) and the unanticipated component of an ECB (SNB) policy rate change (as defined in equations 1 and 2).

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Annex

Table 1: Expected and unexpected components of ECB policy rate changes since 1999 (bps)

Date of rate change announcement	Rate change	Expected	Unexpected
08/04/1999	-50	-50	0
04/11/1999	50	52	-2
03/02/2000	25	23	2
16/03/2000	25	25	0
27/04/2000	25	26	-1
08/06/2000	50	48	2
31/08/2000	25	30	-5
05/10/2000	25	18	7
10/05/2001	-25	-4	-21
30/08/2001	-25	-19	-6
17/09/2001	-50	-12	-38
08/11/2001	-50	-47	-3
05/12/2002	-50	-42	-8
06/03/2003	-25	-33	8
05/06/2003	-50	-49	-1
01/12/2005	25	23	2
02/03/2006	25	23	2
08/06/2006	25	26	-1
03/08/2006	25	21	4
05/10/2006	25	24	1
07/12/2006	25	23	2
08/03/2007	25	22	3
06/06/2007	25	25	0
03/07/2008	25	21	4
08/10/2008	-50	-20	-30
06/11/2008	-50	-47	-3
04/12/2008	-75	-68	-7
15/01/2009	-50	-36	-14
05/03/2009	-50	-49	-1
02/04/2009	-25	-31	6
07/05/2009	-25	-27	2
07/04/2011	25	20	5
07/07/2011	25	18	7
03/11/2011	-25	-12	-13
08/12/2011	-25	-24	-1
05/07/2012	-25	-16	-9
02/05/2013	-25	-25	0
07/11/2013	-25	-25	0

Notes: Shaded rows indicate unscheduled policy meetings.

Table 2: Expected and unexpected components of SNB policy rate changes since 2000 (bps)

Date of rate change announcement	Rate change	Expected	Unexpected
03/02/2000	50	39	11
23/03/2000	75	50	25
15/06/2000	50	49	1
22/03/2001	-25	-11	-14
17/09/2001	-50	-50	0
24/09/2001	-50	-40	-10
07/12/2001	-50	-44	-6
02/05/2002	-50	-26	-24
26/07/2002	-50	-35	-15
06/03/2003	-50	-32	-18
17/06/2004	25	16	9
16/09/2004	25	29	-4
15/12/2005	25	37	-12
16/03/2006	25	30	-5
15/06/2006	25	27	-2
14/09/2006	25	26	-1
14/12/2006	25	26	-1
15/03/2007	25	23	2
14/06/2007	25	28	-3
13/09/2007	25	33	-8
08/10/2008	-25	-18	-7
20/11/2008	-100	-37	-63
11/12/2008	-50	-42	-8
12/03/2009	-25	-27	2
03/08/2011	-25	-16	-9

Notes: Shaded rows indicate unscheduled policy meetings.

Table 3: Regression results for euro area (dependent variable defined in terms of changes in German government bond yields)

	A. All policy meetings since 1999			B. Rate changes since 1999		
Maturity	Anticipated	Unanticipated	R^2	Anticipated	Unanticipated	R^2
6mth	-0.01 (-0.29)	0.20 (1.99)**	0.0397	0.01 (0.45)	0.11 (1.06)	0.0520
1yr	-0.01 (-0.34)	0.49 (3.81)***	0.1790	0.02 (0.41)	0.33 (2.56)***	0.2352
2yr	-0.04 (-0.93)	0.45 (2.97)***	0.0988	0.00 (-0.10)	0.28 (1.78)*	0.1141
5yr	-0.02 (-0.49)	0.23 (1.83)*	0.0290	0.01 (0.19)	0.08 (0.66)	0.0144
6yr	-0.02 (-0.59)	0.20 (1.79)*	0.0241	0.01 (0.15)	0.06 (0.55)	0.0114
10yr	-0.02 (-0.52)	0.08 (0.87)	0.0070	0.01 (0.20)	-0.03 (-0.35)	0.0133
30yr	-0.02 (-0.74)	0.04 (0.51)	0.0152	-0.01 (-0.28)	-0.04 (-0.54)	0.0584

Notes: t-statistics based on robust standard errors in brackets; *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively; dummy variable included for post-fixed-rate full-allotment period but insignificant in all regressions; 212 observations for all policy meetings in the full sample, 38 observations in the narrow sample including only days on which the policy rate was changed

Table 4: Regression results for Switzerland (dependent variable defined in terms of changes in Swiss government bond yields)

	A. All policy meetings since 2000			B. Rate changes since 2000		
Maturity	Anticipated	Unanticipated	R^2	Anticipated	Unanticipated	R^2
2yr	0.03 (0.83)	0.44 (6.77)***	0.5123	0.01 (0.38)	0.44 (6.20)***	0.7720
5yr	0.00 (-0.04)	0.40 (8.92)***	0.6137	-0.03 (-1.16)	0.40 (7.21)***	0.7947
10yr	0.01 (0.44)	0.19 (3.24)***	0.1929	-0.02 (-0.68)	0.16 (2.43)**	0.4550
15yr	0.00 (-0.03)	0.25 (2.76)***	0.3206	-0.04 (-1.07)	0.25 (3.46)***	0.5356
20yr	-0.01 (-0.54)	0.22 (2.74)***	0.3229	-0.03 (-1.10)	0.23 (3.82)***	0.4606
30yr	0.05 (1.99)	0.00 (-0.24)	0.0750	0.04 (1.64)	-0.04 (-0.56)	0.2170

Notes: t-statistics based on robust standard errors in brackets; *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively; dummy variable included for the post-Lehman period but insignificant in all regressions; 63 observations for all policy meetings and 25 observations for meetings resulting in a rate change

Table 5: Regression results for euro area (dependent variable defined in terms of euro area government bond yields)

	A. All policy meetings since Oct 2004			B. Rate changes since Oct 2004		
Maturity	Anticipated	Unanticipated	R^2	Anticipated	Unanticipated	R^2
6mth	-0.01 (-0.25)	0.30 (2.94)***	0.1054	0.09 (2.40)**	0.15 (2.37)**	0.3037
1yr	-0.02 (-0.73)	0.37 (3.88)***	0.1004	0.06 (1.58)	0.31 (2.65)**	0.2933
2yr	-0.02 (-0.69)	0.38 (2.75)***	0.0762	0.04 (0.94)	0.46 (2.91)***	0.3149
5yr	-0.03 (-0.92)	0.03 (0.33)	0.0053	0.01 (0.42)	-0.02 (-0.17)	0.0390
10yr	-0.01 (-0.39)	0.02 (0.24)	0.0020	0.06 (0.90)	0.00 (0.02)	0.0692
30yr	0.00 (-0.07)	0.08 (0.46)	0.0086	0.12 (1.52)	0.16 (0.68)	0.1904

Notes: t-statistics based on robust standard errors in brackets; *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively; Dubin-Watson statistics exceed a value of 2 in all regressions; dummy variable included for post-fixed-rate full-allotment period but insignificant in all regressions; 111 observations for the full sample period, 23 observations for the narrow sample including only days on which the ECB changed policy rates; data on euro area yield curve only available from September 2004