

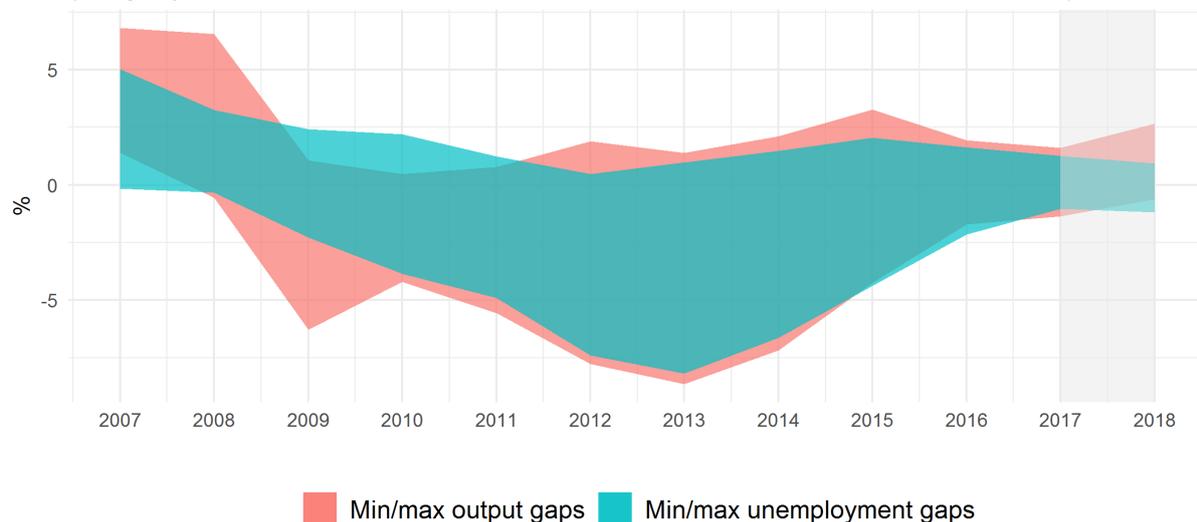
Business cycles and Taylor rules in the euro area

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The Taylor rules provide guideline recommendations for policy interest rates based on the deviation between macroeconomic variables and their target or potential levels. They can be calculated for each of the euro area countries. Although significantly divergent at the height of the sovereign debt crisis, there has been a clear convergence since 2014, reflecting the resynchronisation of business cycles in the euro area.

Chart 1: Reduction in output gaps and unemployment gaps in the euro area

(Ranges plotted between minimal and maximal values within the euro area, excl. Greece)



Sources: Eurostat, Ameco
Shaded area: European Commission projections for 2017-2018

The Taylor rules provide a benchmark that can be used to assess the future direction of monetary policy. The rules are neither normative nor necessarily optimal. They describe in simplified terms an approximation of the reaction function of a central bank, i.e. the way in which the bank would set its rates in response to economic conditions. They apply simple formulae to calculate a policy rate recommendation based on the deviation between certain macroeconomic variables and their potential or target levels. Various forms of Taylor rule calculations exist, but the majority factor in the deviation between the actual rate of inflation and the central bank target rate on the one hand, and the output gap (the deviation between growth and potential growth) or the unemployment gap (the deviation of the non-accelerating inflation rate of unemployment – NAIRU – from the actual unemployment rate) on the other.

A convergence of business cycles in the euro area since 2014

The Taylor rates are calculated in this blog for each of the euro area countries by applying the assumption that every country pursues a monetary policy based solely on its own national economic conditions. The dispersion of these rates between member countries, and consequently the dispersion of Taylor rate recommended monetary policies, reflects the degree of business cycle synchronisation and provides an assessment of the level of monetary heterogeneity across the euro area.

We are thus adopting the approach of [Nechio \(see the Federal Reserve Bank of San Francisco blog, 2011\)](#) and [Darvas and Merler \(Bruegel, 2013\)](#) who highlighted in their work the significant economic desynchronisation and Taylor rate divergences across the euro area countries during the sovereign debt crisis (2010-2013). However, since 2014 there has been a clear business cycle resynchronisation within the euro area in terms of growth, unemployment and inflation.

Chart 1 illustrates this reduction in output gaps and unemployment gaps. In a recent *Note de Conjoncture*, INSEE considered that this convergence has accelerated since the beginning of 2017 ([INSEE, 2017](#)).

The presence of regional disparities within monetary areas is common. It can be seen, for example, within the United States or across the regions of France. They are therefore not, in themselves, an alarming symptom of malfunction in a monetary area and do not indicate the absence of otherwise positive repercussions for the monetary union. Capital and labour mobility or fiscal transfers can compensate the economic disparities. These instruments are not fully established in the euro area, but the Investment Plan for Europe and the plans for a banking union and a capital markets union pursue this objective.

A measurement of cyclical heterogeneity through the Taylor rules

We have calculated the Taylor rates for each of the member countries of the euro area (based on varying membership: 11 countries in 1999 and 19 in 2017) using data from the [European Commission](#), including its projections for 2017 and 2018. The same calculation performed for the smaller number of countries monitored by the OECD also gives very similar results.

$$\text{Taylor rate} = \text{Neutral rate} + 1.5 \times (\text{inflation} - \text{target inflation}) \\ + \text{coefficient} \times (\text{output gap or unemployment gap})$$

Inflation is measured by the change in the harmonised index of consumer prices (HICP). Target inflation is set at 2%, consistent with the European Central Bank's target inflation rate of below, but close to, 2%.

The neutral rate, sometimes referred to as the natural rate, is the equilibrium real rate that would occur in the absence of friction (see [Penalver, 2017](#), for a definition and demonstration of the uncertainty associated with this measurement) and is assumed to be consistent between countries. This is certainly a strong assumption to make but it appears reasonable in light of the results of [Fries et al. \(2016\)](#), which demonstrate that the real

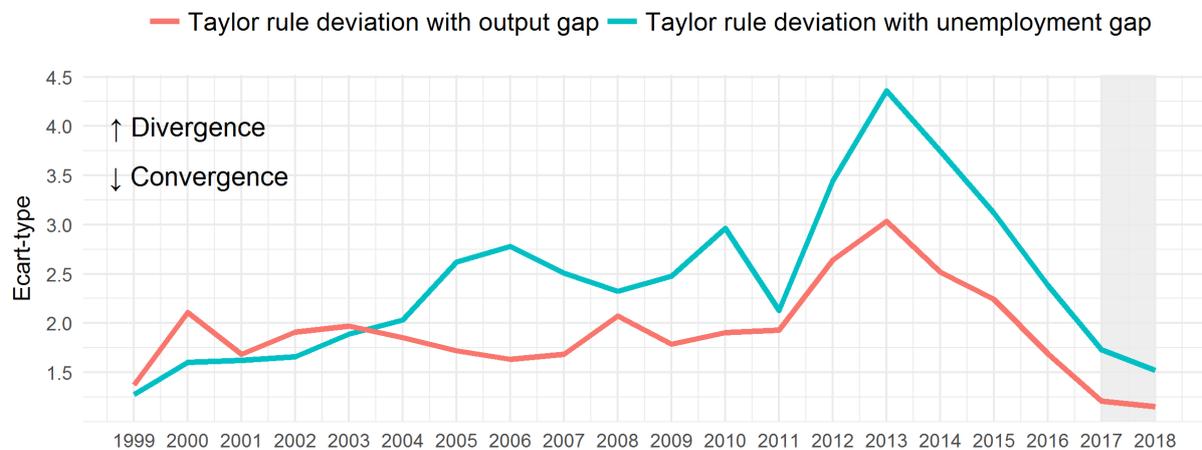
neutral rates of the four largest countries of the euro area have been very close since 1999. There levels are expected to come out at approximately -1% in 2017.

We then used two alternative forms of Taylor rule calculations based on the output gap and the unemployment gap, and parameters identical to those of Nechio (2011) and Darvas and Merler (2013), by applying a weighting of 1.5 to the nominal inflation deviation and 0.5 to the output gap or 1 to the unemployment gap.

Chart 2 shows the Taylor rate deviations for the two calculations since 1999. The standard deviations, calculated between member countries of the euro area at each date, can be interpreted as measurements of the dispersion of recommended monetary policies for each of the euro area countries.

Chart 2: Monetary convergence within the euro area

(Standard deviation of national Taylor rates)



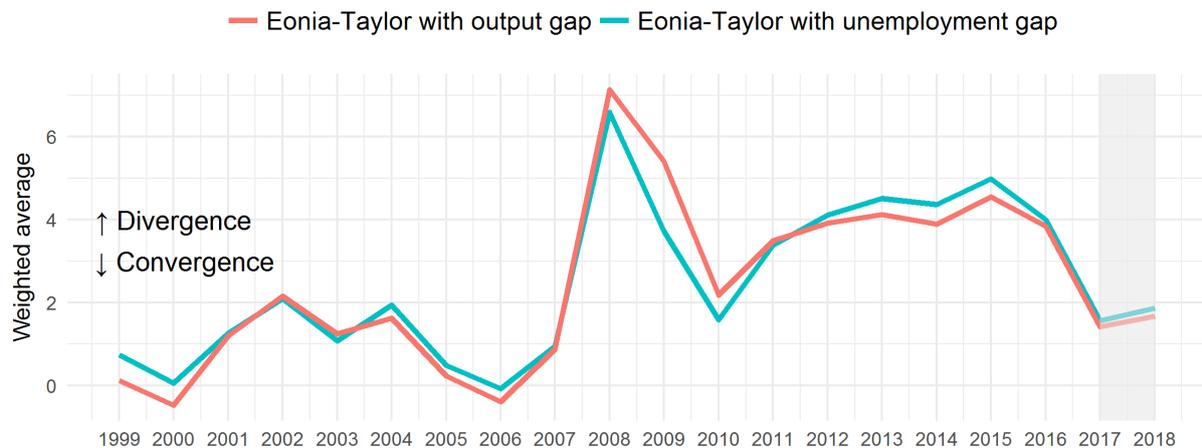
The standard deviations are calculated between member countries of the euro area at each date (annual data)
Shaded area: data including European Commission projections

Sources: Eurostat, Ameco, Banque de France

This first measurement gives the same weighting to each euro area country, which is reasonable if we consider that one country, even small, that diverges from the area average, poses a problem. If however, we consider that the weighting thereby assigned to small countries is excessive, we can calculate the deviation between these Taylor rules and the Eonia short-term interbank interest rate (which here represents the future direction of monetary policy) for each country then the average, weighted by the GDP of each country, to obtain an indicator for the euro area as a whole (see Chart 3).

Chart 3: Reduction in divergences compared with Eonia

(Weighted average by GDP of deviations between national Taylor rates and Eonia)



Note: 1999-2016 – the short-term rate is taken to approximate the future direction of monetary policy
 2017 and 2018: Eonia rates as provided by the OIS curve at year end at 21 February 2017
 Shaded area: data including European Commission projections
 Euro area, varying membership – Sources: Eurostat, Ameco, Banque de France

The two indicators demonstrate the relative cyclical convergence of the euro area economies from 1996 to 2006, interrupted between 2007 (just before the Great Recession) and 2015 (following the European public debt crisis), but since re-established.

Significant reductions in Taylor rate divergences

Divergences in Taylor rule recommendations have declined since 2013 in Chart 2, and 2015 in Chart 3, and are expected to return to their pre-crisis levels during the 2017-2018 period, and even to a historical low for the non-weighted output gap. In 2017, the intra-euro area Taylor rates calculated using these methods are expected to range from -2.7% to +0.5%, compared with a range of -10% to +1.4% in 2013 (excluding Greece).

Accordingly, the Taylor rates in 2017 for the majority of the countries in the euro area are expected to be negative and lower than Eonia. This tends to support the implementation of non-standard measures that can be used, when the policy rate is already close to zero, to provide an additional stimulus, such as the purchase of private and government securities, forward guidance and targeted longer-term refinancing operations (TLTROs) pursued by the Eurosystem since 2014.

As there is a unique interest rate policy by definition in the euro area, non-standard measures have also supported the realignment of macroeconomic conditions between countries. For example, thanks to the announcement of the Outright Monetary Transactions (OMT) programme, risk premiums caused by redenomination between euro area countries were significantly reduced. A further example is the long-term refinancing associated with a common collateral policy, which has contributed to reducing fragmentation in the credit markets.

[Kojien et al. \(2016\)](#) also show that the Eurosystem's securities purchases (sometimes referred to as Quantitative Easing, or QE) have contributed more to lowering market risk

premiums in "peripheral" countries than to lowering rate premiums in the "core" countries, thereby reducing longer-term intra-European rate differentials: thanks to this purchase programme announced in January 2015, market rates have fallen on average from -13 basis points to -60 basis points in peripheral countries.