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“ Statistical analysis of the FOMC’s reaction function offers insights in what influences policy decisions. However, the responsiveness of the Committee fluctuates over time -every tightening or easing cycle is different-, which implies that Fed watchers should continue to pay close attention to the speeches of FOMC members as well as Chair Powell’s press conferences. ”



ECONOMIC RESEARCH



BNP PARIBAS

The bank
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world

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UNDER THE BONNET: THE FEDERAL RESERVE'S REACTION FUNCTION

Having a good understanding of a central bank's reaction function is important. It influences inflation and interest rate expectations, the level of bond yields, investor risk appetite and economic confidence in general. In the US, different types of information help to improve our understanding of the Federal Reserve's reaction function: monetary policy rules -which play a prominent role in the material prepared by the Fed staff for the FOMC meetings-, the relationship between inflation, growth, unemployment and the federal funds rate in the Summary of Economic Projections of FOMC members as well as speeches and press conferences. The latter continue to play a central role considering that the responsiveness of the FOMC to economic data (inflation, unemployment, output gap) fluctuates over time.

Having a good understanding of a central bank's reaction function is important. It influences expectations in terms of inflation and official interest rates and, by extension, the level of bond yields, investor risk appetite and economic confidence in general¹. This is even more important as far as the Federal Reserve is concerned, given the international spillovers of its policy decisions. Fortunately, Fed watchers have a wealth of information available to improve their understanding of what the central bank may do next. Admittedly, at the end of the day the decision to hike, cut or leave the federal funds rate unchanged will depend on the data - Jerome Powell and his colleagues have insisted on this repeatedly-, but these data should not be looked at in isolation. What matters is what they tell us about the outlook for inflation and, given the Fed's dual mandate, the unemployment rate. For the central bank watcher, this analysis forms a basis for formulating policy rate expectations. A formalised approach of this process consists of using monetary policy rules, in which a small number of macroeconomic factors are used to describe the reaction function of policy makers. In the US there is a long tradition of monetary policy rules, going back to the early 1990s with the work by John B. Taylor and the rule called after him². They also play a prominent role in the inputs prepared by the Federal Reserve staff for the FOMC meetings³. Key variables are the neutral rate of interest, target inflation, the inflation gap, the output gap, the unemployment gap, assumed weights of the respective variables and an inertia coefficient, which reflects the gradualism in the implementation of monetary policy⁴. Although the limited number of variables focuses the attention on what really matters, the recommended policy rate varies a lot depending on the model specification. To illustrate this point, at the December 2018 FOMC meeting the target range for the federal funds rate was raised to

2.25-2.50% whereas this rate based on the various monetary policy rules ranged between 2.03% and 4.66%⁵. With this in mind, it may make more sense to focus on the recommended change instead of the absolute level. A recent paper by Athanasios Orphanides⁶ presents a rule whereby the quarterly change in the federal funds rate is equal to 0.5 times the difference between the expected nominal GDP growth and the natural rate of growth. This rule closely tracks the observed evolution of the federal funds rate and can be useful for the Fed watcher to conduct scenario analyses based on different economic forecasts (chart 1)⁷.

The Summary of Economic Projections (SEP) of the FOMC members also sheds light on their reaction function. Chart 2 shows the projections for nominal GDP growth⁸ and the upper end of the target range of the federal funds rate. Chart 3 shows the projection for personal consumption expenditures (PCE) inflation. The nominal growth projections for 2022 have been revised upwards during 2022 on the back of a significant upward revision of the inflation projection, so it seems that the latter has been the key driver of the monetary tightening that started that year. Until June 2023, the nominal growth projection for 2023 and 2024 showed no clear trend. However, it remained elevated, thereby justifying the restrictive monetary stance, even more so considering that in the second half of 2023 the nominal growth projections increased, driven by stronger real growth expectations. Clearly, visual analysis of a single monetary tightening cycle does not allow to make general conclusions. A statistically rigorous approach has been followed in a recent Federal Reserve paper in which the authors analyse the reaction function of the median FOMC participant: how does the median projection for the federal funds rate respond to changes in the median projection

1 For an analysis of the ECB's reaction function, see [Under the bonnet: the ECB's reaction function, EcoWeek 19 June 2024](#).

2 For an overview see: John B. Taylor, *Monetary Policy Rules*, University of Chicago Press, 1999.

3 See in this respect the Tealbook, a document officially titled "Report to the FOMC on Economic Conditions and Monetary Policy" which is produced by the staff at the Board of Governors. It is "distributed to the Committee prior to each regularly scheduled FOMC meeting, contain in-depth analysis of current economic and financial conditions and projections, along with background and context on monetary policy alternatives." It is released to the public with a lag of 5 years. The latest available is December 2018. Source: Federal Reserve.

4 The exact variables and weights differ depending on the formulation of the policy rule.

5 Source: *Report to the FOMC on Economic Conditions and Monetary Policy*, Book A. Prepared for the Federal Open Market Committee by the staff of the Board of Governors of the Federal Reserve System, December 7, 2018. As mentioned in footnote 5, this is the latest meeting for which the data have been made public.

6 Athanasios Orphanides, *Enhancing resilience with natural growth targeting*, CEPR Discussion Paper DP18862, February 2024.

7 Orphanides defines the natural rate of growth as the sum of the Fed's inflation goal (2.0%) and the growth rate of real potential GDP. For the latter, he uses as an estimate the median response for the 10-year annual-average real GDP growth in the Survey of Professional Forecasters of the Federal Reserve of Philadelphia. For expected nominal GDP growth, he uses from the same survey, the median response for nominal income growth over four quarters.

8 The SEP does not provide information for nominal GDP growth. In chart 2 this has been proxied by adding the projection for real GDP growth and PCE inflation.

Statistical analysis of the FOMC's reaction function offers insights in what influences policy decisions. However, the responsiveness of the Committee fluctuates over time -every tightening or easing cycle is different-, which implies that Fed watchers should continue to pay close attention to the speeches of FOMC members as well as Chair Powell's press conferences.



for inflation and the unemployment rate⁹? The results indicate that the responsiveness to inflation and the output gap fluctuates over time and that in the post-pandemic world the reaction to inflation has significantly increased. Clearly, such an outcome isn't surprising given the recent inflation experience.

To conclude, the monetary policy rule proposed by Orphanides-, the analysis of the latest tightening cycle and an econometric estimation of what drives changes in the interest rate projections of FOMC members -the 'dot plot'- show the key role played by inflation (versus target), nominal GDP growth and the difference between the latter and its long-term forecast in the policy decisions of the FOMC. However, the responsiveness of the Committee fluctuates over time -every tightening or easing cycle is different-, which implies that Fed watchers should complement the analysis of the variables mentioned above with close attention to the speeches of FOMC members as well as Chair Powell's press conferences. In this respect, it is good to keep in mind that simple analytical approaches also may offer value. As shown in chart 4, between the early eighties and the global financial crisis, there was a close relationship between observed nominal GDP growth and the federal funds rate. Given the resilience of US growth and the slow disinflation in the current cycle, there is a good chance that this relationship might be re-established.

William De Vijlder

⁹ The period covered is June 2012-March 2023. Source: Gonzalez-Astudillo, Manuel, and Rakeen Tanvir, *Hawkish or Dovish Fed? Estimating a Time-Varying Reaction Function of the Federal Open Market Committee's Median Participant*, Finance and Economics Discussion Series 2023-070, Board of Governors of the Federal Reserve System, 2023.

ESTIMATED FEDERAL FUNDS RATE BASED ON THE ORPHANIDES RULE

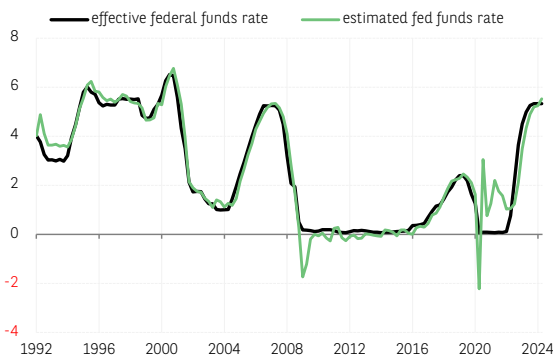


CHART 1

SOURCE: FEDERAL RESERVE, BNP PARIBAS

FEDERAL FUNDS RATE AND SUMMARY OF ECONOMIC PROJECTIONS FOR NOMINAL GROWTH

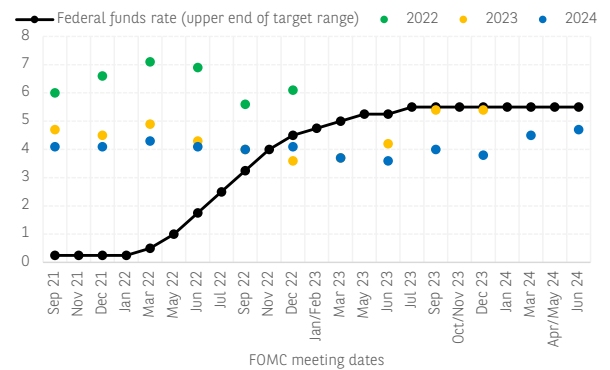


CHART 2

SOURCE: FEDERAL RESERVE, FEDERAL RESERVE OF ST LOUIS, BNP PARIBAS

FEDERAL FUNDS RATE AND SUMMARY OF ECONOMIC PROJECTIONS FOR PCE INFLATION

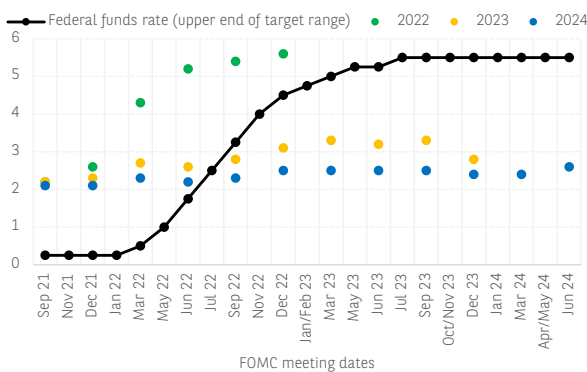


CHART 3

SOURCE: FEDERAL RESERVE, FEDERAL RESERVE OF ST LOUIS, BNP PARIBAS

NOMINAL GDP GROWTH AND EFFECTIVE FEDERAL FUNDS RATE

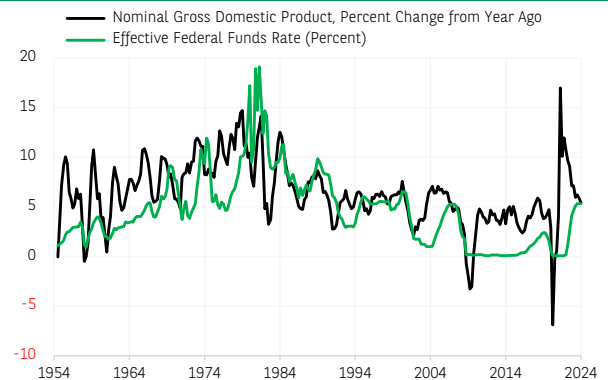


CHART 4

SOURCE: FEDERAL RESERVE OF ST LOUIS, BNP PARIBAS

MARKETS OVERVIEW

5

OVERVIEW

Week 21-6-24 to 28-6-24

▼ CAC 40	7.629	▶ 7.479	-2.0 %	
▼ S&P 500	5.465	▶ 5.460	-0.1 %	
▼ Volatility (VIX)	13.2	▶ 12.4	-0.8 pb	
↗ Euribor 3M (%)	3.69	▶ 3.71	+2.5 bp	
▼ Libor \$ 3M (%)	5.61	▶ 5.59	-2.0 bp	
↗ OAT 10y (%)	3.15	▶ 3.26	+10.7 bp	
↗ Bund 10y (%)	2.39	▶ 2.46	+7.2 bp	
↗ US Tr. 10y (%)	4.26	▶ 4.37	+11.6 bp	
↗ Euro vs dollar	1.07	▶ 1.07	+0.3 %	
▼ Gold (ounce, \$)	2.332	▶ 2.326	-0.3 %	
↗ Oil (Brent, \$)	85.9	▶ 86.3	+0.4 %	

Interest Rates

		highest 24	lowest 24	
€ ECB	4.25	4.50 at 01/01	4.25 at 12/06	
Eonia	-0.51	-0.51 at 01/01	-0.51 at 01/01	
Euribor 3M	3.71	3.97 at 18/01	3.68 at 24/06	
Euribor 12M	3.58	3.76 at 19/03	3.51 at 01/02	
\$ FED	5.50	5.50 at 01/01	5.50 at 01/01	
Libor 3M	5.59	5.61 at 20/06	5.53 at 01/02	
Libor 12M	6.04	6.04 at 01/01	6.04 at 01/01	
£ BoE	5.25	5.25 at 01/01	5.25 at 01/01	
Libor 3M	5.30	5.33 at 06/03	5.30 at 22/03	
Libor 12M	0.81	0.81 at 01/01	0.81 at 01/01	

At 28-6-24

MONEY & BOND MARKETS

		highest 24	lowest 24	
€ AVG 5-7y	2.64	2.64 at 01/01	2.64 at 01/01	
Bund 2y	2.99	3.23 at 10/06	2.53 at 01/02	
Bund 10y	2.46	2.66 at 29/05	2.02 at 03/01	
OAT 10y	3.26	3.26 at 28/06	2.47 at 01/01	
Corp. BBB	4.02	4.14 at 10/06	3.75 at 01/01	
\$ Treas. 2y	4.77	5.10 at 30/04	4.22 at 15/01	
Treas. 10y	4.37	4.70 at 25/04	3.86 at 01/02	
High Yield	7.85	8.24 at 16/04	7.73 at 13/03	
£ gilt. 2y	4.77	4.96 at 29/05	3.98 at 01/01	
gilt. 10y	4.17	4.41 at 29/05	3.60 at 01/01	

At 28-6-24

EXCHANGE RATES

1€ =		highest 24	lowest 24	2024
USD	1.07	1.10 at 01/01	1.06 at 15/04	-3.0%
GBP	0.85	0.87 at 02/01	0.84 at 11/06	-2.2%
CHF	0.96	0.99 at 27/05	0.93 at 08/01	+3.6%
JPY	172.40	172.40 at 28/06	155.33 at 02/01	+10.7%
AUD	1.60	1.67 at 28/02	1.60 at 28/06	-0.9%
CNY	7.79	7.88 at 06/06	7.69 at 15/04	-0.6%
BRL	5.95	5.95 at 28/06	5.31 at 13/02	+10.9%
RUB	92.44	102.67 at 23/02	89.75 at 19/06	-6.4%
INR	89.37	91.92 at 01/01	88.68 at 12/04	-2.8%

At 28-6-24

Change

COMMODITIES

Spot price, \$		highest 24	lowest 24	2024	2024(€)
Oil, Brent	86.3	91.6 at 12/04	75.8 at 08/01	+11.0%	+14.4%
Gold (ounce)	2.326	2.432 at 21/05	1.989 at 14/02	+12.6%	+16.1%
Metals, LME	4.164	4.652 at 21/05	3.558 at 09/02	+10.7%	+14.1%
Copper (ton)	9.456	10.801 at 20/05	8.065 at 09/02	+11.7%	+15.2%
wheat (ton)	204	2.5 at 28/05	191 at 15/03	-12.3%	-9.6%
Corn (ton)	148	1.7 at 13/05	148 at 23/02	-1.5%	-12.3%

At 28-6-24

Change

EQUITY INDICES

Index	highest 24	lowest 24	2024	
World				
MSCI World	3.512	3.524 at 19/06	3.114 at 04/01	+10.8%
North America				
S&P500	5.460	5.487 at 18/06	4.689 at 04/01	+14.5%
Europe				
EuroStoxx50	4.894	5.101 at 15/05	4.403 at 17/01	+8.2%
CAC 40	7.479	8.240 at 15/05	7.319 at 17/01	-0.1%
DAX 30	18.235	18.869 at 15/05	16.432 at 17/01	+8.9%
IBEX 35	10.944	11.444 at 06/06	9.858 at 19/01	+0.8%
FTSE100	8.164	8.446 at 15/05	7.446 at 17/01	+0.6%
Asia				
MSCI, loc.	1.414	1.415 at 22/03	1.242 at 03/01	+1.3%
Nikkei	39.583	40.888 at 22/03	33.288 at 04/01	+18.3%
Emerging				
MSCI Emerging (\$)	1.086	1.102 at 20/05	958 at 17/01	+0.6%
China	57	64 at 20/05	49 at 22/01	+3.9%
India	1.073	1.073 at 28/06	915 at 03/01	+16.7%
Brazil	1.408	1.800 at 01/01	1.387 at 19/06	-10.5%

At 28-6-24

Change

PERFORMANCE BY SECTOR (Eurostoxx50 & S&P500)

Year 2024 to 28-6, €	Year 2024 to 28-6, \$
+16.9%	+32.1%
+15.2%	+22.5%
+14.4%	+17.0%
+13.7%	+16.6%
+8.7%	+15.9%
+8.1%	+14.3%
+6.8%	+13.2%
+5.0%	+12.6%
+4.3%	+11.5%
+3.3%	+10.7%
+0.6%	+9.7%
+0.0%	+7.8%
-0.4%	+6.8%
-0.4%	+5.9%
-2.9%	+3.9%
-3.4%	+3.3%
-3.9%	+1.1%
-5.4%	+0.6%
-6.1%	-13.4%

SOURCE: REFINITIV, BNP PARIBAS

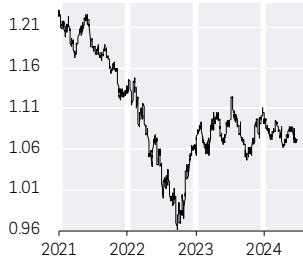


BNP PARIBAS

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MARKETS OVERVIEW

EURO-DOLLAR



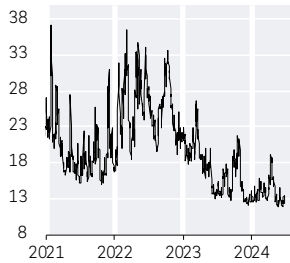
EUROSTOXX50



S&P500



VOLATILITY (VIX, S&P500)



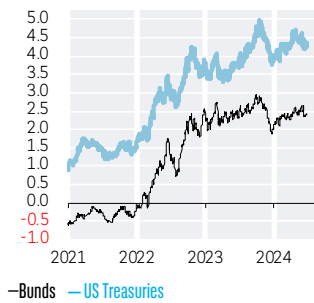
MSCI WORLD (USD)



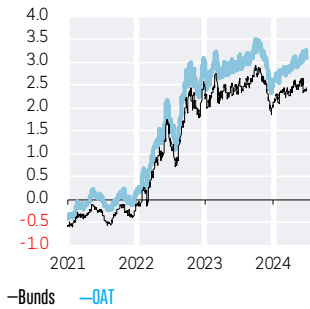
MSCI EMERGING (USD)



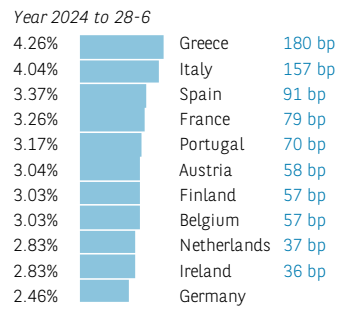
10Y BOND YIELD, TREASURIES VS BUND



10Y BOND YIELD



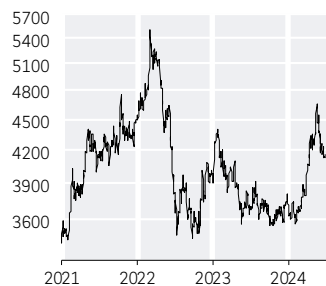
10Y BOND YIELD & SPREADS



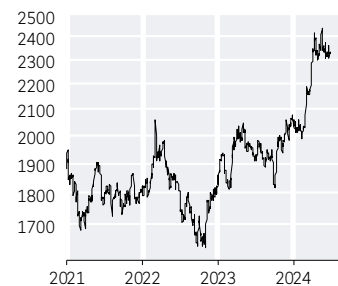
OIL (BRENT, USD)



METALS (LMEX, USD)



GOLD (OUNCE, USD)



SOURCE: REFINITIV, BNP PARIBAS



ECONOMIC PULSE

INTERNATIONAL TRADE: BUSINESS ACTIVITY IS WITHSTANDING LOGISTICAL PRESSURES FOR THE TIME BEING

The increase in global shipping flows, and the resulting logistical problems, continue to push up freight rates and container ship prices, but are not, at this stage, causing a significant slowdown in business activity or a major rise in import prices. The increase in prices gained momentum in June: the Freightos Index (chart 5) climbed by 43% m/m last month, compared with an increase of almost 15% in May. At the end of June, the index was 30% above the previous peak seen in mid-February, but still 60% below the record levels reached in autumn 2021.

Nevertheless, the increase in freight is concentrated on the flow of goods to and from China using container ships. Transport prices for dry bulk, as measured by the Baltic Exchange Dry Index (chart 4), are, overall, in an upward phase, but their rise is more contained. The cost of transporting crude oil (dirty tanker) or refined oil (clean tanker) even stabilised in the first half of 2024.

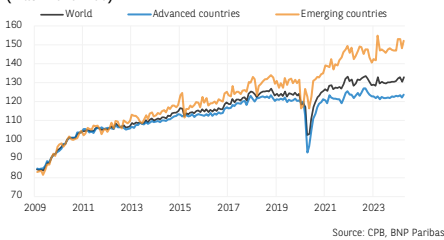
These supply disruptions are likely to have a more limited impact on global activity than when lockdown ended, as demand is now less sustained than in 2021/2022. The Global Supply Chain Pressure Index, published by the New York Federal Reserve, rebounded as expected in May, but remains at a historically low level (chart 3).

Global PMI indicators remained positive in the spring, above the expansion line. The index of new export orders in the manufacturing sector (chart 2) edged down slightly, from 0.1 points to 50.4, but remains at a level consistent with the momentum of export volumes published by the CPB. In April, world exports rose by 1.8% m/m and 2.5% year-on-year. The rise was mainly driven by China, which saw its exports rebound by 5.2% m/m, while the rest of Asia (excluding Japan) and the eurozone recorded a similar increase of 2.4% m/m. US exports edged up by 0.6% m/m, while Japanese exports slipped by 0.2% m/m.

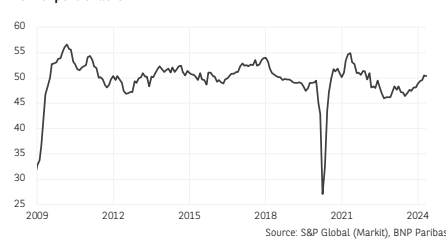
Guillaume Derrien

INDICATORS OF INTERNATIONAL TRADE

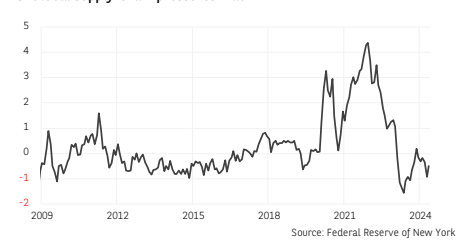
1. World exports by area, volume (index 2010=100)



2. Global manufacturing PMI, New export orders



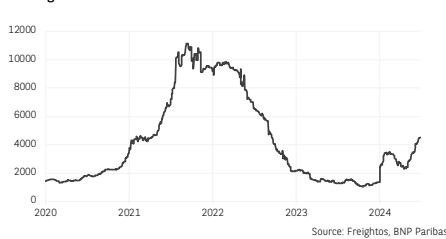
3. Global supply-chain pressures index



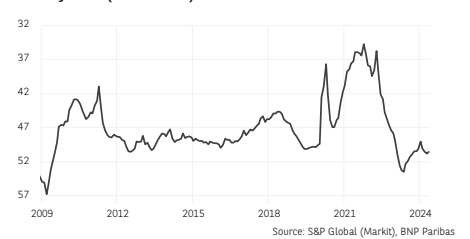
4. Baltic Exchange Dry Index



5. Freight rate index



6. Global manufacturing PMI, Delivery times (inverted line)



ECONOMIC SCENARIO

8

UNITED STATES

The US economy showed surprising vigour in 2023, illustrated by +2,5% yearly annual growth driven by the resilience of household consumption and the good figures of business investment. Thus, we have gradually ruled out the event of a recession induced by the cumulative monetary tightening. Despite a slowdown (+0.3% q/q v. +0.8% in Q4 2023), the GDP has expanded again in Q1 2024, driven by contributions from household consumption and investment. Our baseline scenario implies a +2.5% rate of growth for 2024, enabled by the very positive carryover effect from 2023 and an expected increase in real incomes. While the inflation peak was reached in mid-2022, Q1 2024 data have raised some concerns before an improvement in Q2. We forecast inflation to stand at +2.8% y/y in Q4 2024. This picture paves the way for a modest easing of its monetary policy by the Fed, which could start cutting rates progressively as the end of the year, with one rate cut in 2024.

CHINA

Economic growth was stronger than expected in Q1 2024 (+5.3% year-on-year), principally driven by the manufacturing export sector. On the contrary, domestic demand and activity in the services sector continued to lack momentum, still held back by the crisis in the property sector, regulatory uncertainties, and low confidence of consumers and private investors. To support activity, the authorities have been strengthening their industrial policy while maintaining a prudent demand policy. This economic policy mix risks amplifying the divergence in performance between sectors and the imbalance between domestic demand and supply, which have been apparent for several months. The real GDP growth target of "around 5%" set for this year is projected to be reached. Consumer price inflation is expected to remain very low; it averaged zero y/y in Q1 2024.

EUROZONE

Eurozone GDP picked up by 0.3% q/q in Q1 according to preliminary Eurostat data. The negative effects of monetary tightening on economic activity are expected to diminish in 2024. Growth would stabilise at 0.3% q/q in Q2 before strengthening at 0.4 q/q in the last two quarters of the year. This improvement would also be underpinned by the interest rate cut cycle by the ECB. After lowering its policy rates for the first time in June, we expect two more cuts in the second half of the year (one cut per quarter). This monetary easing would accompany the inflation decline, which is expected to come close to the 2% target during the third quarter. That said we expect continued stickiness in the more wage-sensitive parts of the inflation basket, like services. The disinflation process, along with the dynamism of wages, should support household purchasing power and consumption. Growth should also be boosted by NGEU disbursements and its deployment on the ground.

FRANCE

French economy benefitted from a 0.2% q/q growth in Q1 (after 0.3% q/q in Q4 2023), mainly supported by households' consumption of services and exports. As disinflation is now visible (the harmonized index grew by 2.6% y/y in May 2024, compared to 5.7% y/y in September 2023), our scenario for 2024 envisages a gradual improvement and heralds an even better 2025 (with a growth forecast of 1.4%, after 1.1% in 2024).

RATES AND EXCHANGE RATES

2024 should be the year of the start of the easing cycle by the Federal Reserve, the ECB and the Bank of England. Although the ECB proceeded with a first rate cut on June 6th, the timing of the first cut for the BoE and the Fed remains uncertain, as does the number of expected cuts for the whole year. We expect the first BoE rate cut to occur in August, whereas the Fed would start cutting at the very end of the year, in December. The Fed would thereby undertake a single rate cut in 2024, while their first move would be followed by two more for the ECB and the BoE (presumably 25 basis points cut each). On both sides of the Atlantic, policy rates in real terms and the degree of monetary restriction would remain about unchanged. The induced decline in long-term rates should be limited by the importance of bond issuance against a background of quantitative tightening.

The Bank of Japan (BoJ) was the first central bank among G7 economies to act in 2024. The BoJ jointly announced the end of its negative interest rate policy and yield curve control policy at the March meeting. As a result, the policy rate target was raised from a corridor of -0.1-0.0% to 0.0-0.1%, while the volume of JGBs will be reduced soon. We expect monetary policy to normalise very gradually in the country, with only one additional hike envisaged by the end of 2024 (probably in September).

We are fundamentally bearish regarding the US dollar, but it is so far supported by geopolitical tensions and diverging trends between the US and the Eurozone (with stronger growth and inflation and less monetary easing across the Atlantic). This leads us to push back and moderate the expected USD depreciation, especially versus the euro. The yen should also eventually strengthen versus the USD, partly as a result of the desynchronization of monetary policy, as the BoJ is tightening its monetary stance.

GDP GROWTH AND INFLATION

%	GDP Growth				Inflation			
	2022	2023	2024 e	2025 e	2022	2023	2024 e	2025 e
United States	1.9	2.5	2.5	1.8	8.0	4.1	3.1	2.3
Japan	0.9	1.8	0.3	1.0	2.5	3.3	2.6	2.5
United Kingdom	4.4	0.1	0.6	1.2	9.1	7.3	2.6	2.2
Euro Area	3.5	0.6	0.9	1.6	8.4	5.4	2.3	2.0
Germany	1.9	0.0	0.3	1.4	8.7	6.0	2.6	2.5
France	2.6	1.1	1.1	1.4	5.9	5.7	2.5	1.9
Italy	4.2	1.0	1.1	1.4	8.7	5.9	1.0	1.8
Spain	5.8	2.5	2.6	2.1	8.3	3.4	3.1	2.2
China	3.0	5.2	5.2	4.3	2.0	0.2	-0.1	1.2
India*	7.0	8.2	6.9	6.7	6.7	5.4	4.7	4.3
Brazil	2.9	2.9	2.2	2.0	9.3	4.6	4.1	4.1

Source : BNP Paribas (e: Estimates & forecasts)

Last update: 1 July 2024

* Fiscal year from 1st April of year n to March 31st of year n+1

INTEREST AND EXCHANGE RATES

Interest rates, %		Q2 2024	Q3 2024	Q4 2024	Q2 2025	Q4 2025
End of period						
US	Fed Funds (upper limit)	5.50	5.50	5.25	4.75	4.25
	T-Note 10y	4.25	4.20	4.20	4.20	4.20
Eurozone	deposit rate	3.75	3.50	3.25	2.75	2.50
	Bund 10y	2.35	1.95	2.00	2.25	2.50
	OAT 10y	2.87	2.50	2.52	2.80	3.05
	BTP 10y	3.70	3.35	3.45	3.80	4.00
	BONO 10y	3.19	2.82	2.85	3.15	3.38
UK	Base rate	5.25	4.75	4.50	4.00	3.50
	Gilts 10y	4.00	3.80	3.70	3.55	3.65
Japan	BoJ Rate	0.10	0.25	0.25	0.50	1.00
	JGB 10y	-	1.05	1.25	1.45	1.60
Exchange Rates		Q2 2024	Q3 2024	Q4 2024	Q2 2025	Q4 2025
End of period						
USD	EUR / USD	1.05	1.05	1.06	1.08	1.10
	USD / JPY	155	154	153	150	148
	GBP / USD	1.25	1.27	1.28	1.30	1.33
EUR	EUR / GBP	0.84	0.83	0.83	0.83	0.83
	EUR / JPY	163	162	162	162	163
Brent		Q2 2024	Q3 2024	Q4 2024	Q2 2025	Q4 2025
Quarter Average						
Brent	USD/bbl	90	92	87	81	82

Sources: BNP Paribas (Market Economics, Interest Rate Strategy, FX Strategy, Commodities Desk Strategy)

Last update: 24 June 2024



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GROUP ECONOMIC RESEARCH

William De Vijlder
Chief Economist

+33 1 55 77 47 31

william.devijlder@bnpparibas.com

OECD ECONOMIES AND STATISTICS

Hélène Baudchon
Deputy chief economist, Head

+33 1 58 16 03 63

helene.baudchon@bnpparibas.com

Stéphane Colliac
France, Germany

+33 1 42 98 43 86

stephane.colliac@bnpparibas.com

Guillaume Derrien
Eurozone, United Kingdom - Global trade

+33 1 55 77 71 89

guillaume.a.derrien@bnpparibas.com

Anis Bensaidani
United States, Japan

+33 1 87 74 01 51

anis.bensaidani@bnpparibas.com

Lucie Barette
Southern Europe

+33 1 87 74 02 08

lucie.barette@bnpparibas.com

Veary Bou, Tarik Rharrab
Statistics

ECONOMIC PROJECTIONS, RELATIONSHIP WITH THE FRENCH NETWORK

Jean-Luc Proutat
Head

+33 1 58 16 73 32

jean-luc.proutat@bnpparibas.com

BANKING ECONOMICS

Laurent Quignon
Head

+33 1 42 98 56 54

laurent.quignon@bnpparibas.com

Céline Choulet

+33 1 43 16 95 54

celine.choulet@bnpparibas.com

Thomas Humblot

+33 1 40 14 30 77

thomas.humblot@bnpparibas.com

Marianne Mueller

+33 1 40 14 48 11

marianne.mueller@bnpparibas.com

EMERGING ECONOMIES AND COUNTRY RISK

François Faure
Head - Argentina, Turkey - Methodology, Modelling

+33 1 42 98 79 82

francois.faure@bnpparibas.com

Christine Peltier
Deputy Head - Greater China, Vietnam - Methodology

+33 1 42 98 56 27

christine.peltier@bnpparibas.com

Stéphane Alby
Africa (French-speaking countries)

+33 1 42 98 02 04

stephane.alby@bnpparibas.com

Pascal Devaux
Middle East, Balkan countries

+33 1 43 16 95 51

pascal.devaux@bnpparibas.com

Hélène Drouot
South Korea, Philippines, Thailand, Andean countries

+33 1 42 98 33 00

helene.drouot@bnpparibas.com

Salim Hammad
Latin America

+33 1 42 98 74 26

salim.hammad@bnpparibas.com

Cynthia Kalasopatan Antoine
Ukraine, Central European countries

+33 1 53 31 59 32

cynthia.kalasopatan.antoine@bnpparibas.com

Johanna Melka
India, South Asia, Russia, Kazakhstan

+33 1 58 16 05 84

johanna.melka@bnpparibas.com

Lucas Plé
Africa (Portuguese & English-speaking countries)

+33 1 40 14 50 18

lucas.ple@bnpparibas.com

CONTACT MEDIA

Mickaelle Fils Marie-Luce

+33 1 42 98 48 59

mickaelle.filsmarie-luce@bnpparibas.com



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Head office: 16 boulevard des Italiens - 75009 Paris France / Phone : +33 (0) 1.42.98.12.34

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