ROUILLARD Pierre

ENSAE 2ère année

Stage long

Année scolaire 2022-2023

Rapport Stage d'Application

Allianz Trade

Maître de stage : **Françoise HUANG**

Paris, France

3 Janvier - 26 Juin 2023

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Acknowledgement

Introduction

During the second part of my gap year, I interned at Allianz Trade within the Economic Research department of the Paris team. Following my internship at AEW I was interested in joining a research department where I could be involved in publication work on a wide range of economic subjects. The Economic Research department is split between Paris (Allianz Trade) and Munich (Allianz SE) and produces weekly publications on high-profile topics. It ranges from reaction to events, analysis of certain data releases, updates on the teams' view ahead of Central Banks meetings etc. . . These publications are usually composed of 3 short reactionary or forward-looking *'stories'* (1 page long) and one longer *'feature'* (2/3 pages long). In addition to the weekly release the team also produces longer-term pieces. One or two a month are usually published. In the six months I spent within the team I had the chance to work on many different releases, including the annual Trade Survey report with my tutor, and I decided to focus on two specific ones.

Firstly, I chose to present the work I did with Mr. Maxime Darmet that led to a feature tackling the issue of accrued savings since the pandemic in advanced economies (namely France, Germany, Spain, Italy, the UK, and the US). As the Covid crisis was disrupting most sectors of every economy, macroeconomic variables broke from their pre-pandemic trend. Incentives to consume were heavily curbed and governments launched support programs to assist their economy, especially with social transfers addressed to households. It is this disruption introduced in the data that we leveraged to compute the excess in disposable income relative to the shortfall in consumption. From the excess savings stock estimate for the whole economy, we also derived a per household stock in late 2022 that highlights which strata of the population potentially benefited the most from this period. We also gave a shot at estimating the form in which these stocks of excess savings were held in in the different countries of our study. Our work ended up being part of a publication[1], but we also kept it as a monitoring file that we would update monthly during my time in the team. It is does not replace other models that economists have for the countries they monitor but rather comes as a secondary source with a different approach that could easily be updated by interns (should the methodology be changed to accomodate future changes).

Secondly, the larger piece of my report, relates to the work I did with Mrs. Roberta Fortes PhD and Mr. Darmet. It was in the team's agenda to publish a report on the European labour markets[2] at the end of the first semester of 2023, and they were two of the five economists involved in the process. I then had the chance to work on the wage part of the study where we assess wage development and inflationary pressures in the context of questioning a potential risk of wage-price loop. We evaluate to what extent macroeconomic variables such as labour market slack, inflation, and productivity growth account for wage dynamics, which consistent with economic theory should concur with demand-side drivers of inflation. We also evaluate different proxies for labour market slack since supply-side and demand-side indicators seem to have been diverging recently and imply different degrees of tightness for the labour market. In addition, we broaden our study by trying-out several slack measures as the unemployment rate alone may not adequately capture all constraints in the labour market leading to wage inflation. We assess recent drivers of wage developments using- from the estimated models- its variable decomposition which we also build on to produce forecast and an outlook for the different markets. Lastly, we provide a labour productivity breakdown of different European countries that highlights, as of late 2022, lasting structural differences after the Covid-19 pandemic.

1   *Accrued savings since the Covid-19 pandemic*

The origin of our project lies in a FEDs note dated October 2022[3]. Their work aimed at estimating the *'excess savings'* - savings accrued during the pandemic as spending opportunities in either goods or services were severely curtailed – accumulated through 2020 and the first semester of 2021 by American households compared to what would have happened if income and spending components had growth at pre-pandemic trends, in short, compared to a no Covid-19 crisis counterfactual. The computation of excess savings is done following a detailed accounting approach. We build on their work and extend their methodology to European households, precisely we estimate excess savings for the European Big 4 (France, Germany, Spain and Italy), the UK and also the US for our purposes. Regarding the latter, comparing with the Fed's work allows us to see that we are in line when it comes to variable choices and methodology.

The subject of excess savings has received a lot of attention for multiple reasons. It is a high-profile news topic as it concerns any household but more importantly, the outlook for economic growth, inflation, household welfare and consumption heavily depends on the amount of savings to consider and especially who holds it. Thus, after displaying the methodology and different variables used for the 6 countries of our study, we assess the recent drivers that led to the soaring of the personal saving rate and estimate the different contributions. In addition to the raw aggregate excess saving number for the whole economy, we were also interested in estimating a distribution of the latter across the population and assessing in what asset form these savings were held.

1.1   Methodology and Variable choices

We aim at estimating the aggregate amount of excess savings. As a reminder, we worked on this project in early Q1 2023 and as we still lacked data for Q4 2022 results are up until Q3. The 'Flow of savings' can be written as:

Flow of savings = Disposable Personal Income - Personal Consumption Expenditures - other outlays

We compute the disposable personal income (DPI) -the income available to households- as the compensation of employees (which takes into account not only wages and salaries in cash or in kind paid to the employee but also the employer's imputed social contributions) **plus** received income from social transfers in kind and property **less** taxes on income, paid property income and other current transfers paid. We get data from multiple different sources: Eurostat and national sources for European countries; the Office for National Statistics for the UK; and the Federal Reserve database for the US. These different sources led us to different ways to compute the Disposable Personal Income. The details for every country can be found in the annexe (Figure 15). We checked with every regional economist if we had chosen the correct variables or had missed anything. To calculate the quarterly flows of excess savings we look at the difference between 'excess' disposable income and the 'shortfall' of consumption both relative to their pre-pandemic (2015-19) log-linear trend from Q1 2020 onwards (see Figure 16 for an illustrative example with the compensation of employees in France). Similarly to the Fed's original paper, every component of the personal income is measured in Nominal national currency, this assumes that both nominal and real values move along their pre-pandemic trends. Thus, for every DPI component and personal consumption (PCE), we compute the difference (deviation) between the observed value and the counterfactual pre-pandemic trend (Figure 16).

1.2   Total stock of excess savings estimation

For every country of the study, the left panels of Figure 1 & 2 show the flows of excess savings, and the different components' contribution, over time and the right panels show the accrued stock.

Figure 1: *Flows of Excess Savings' breakdown & Cumulated Stock.*
In order: France, Germany, Spain, Italy. Y-axis is in Billion Euros (EUR).
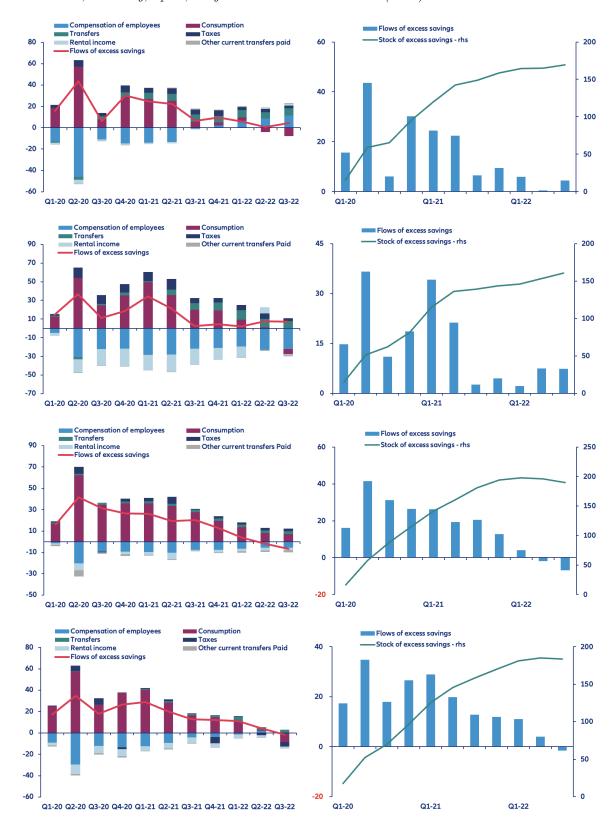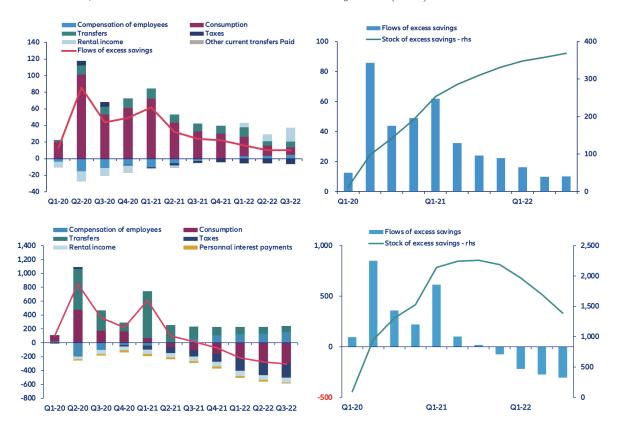
Figure 2: *Flows of Excess Savings' breakdown & Cumulated Stock.*
In order: the UK, the US. Y-axis is in Billion Local Currency Units (LCU).

The result of this exercise clearly shows that households have accumulated large savings throughout the pandemic in 2020 as incentives to consume were deeply curbed, especially during the different lockdowns. In addition to reduced expenditures in personal consumption, households' disposable income has been boosted by fiscal transfers, particularly in the US. Disruptions in the different labour markets led to below pre-pandemic trend compensation of employees. As the markets normalised and tightened, increasing pressures on nominal wages drove up nominal compensation. Only the compensation of employees in Germany seems to remain below the pre-pandemic trend in level, while it returned to the trend in growth terms (see Figure 17). According to our computations, the stock of excess savings made up close to 25% of annual consumption in the UK and Spain towards the end of 2022, i.e. GBP 370bn in the UK and EUR 190bn in Spain. Excess savings are lower as a share of consumption in France and Italy, but still large, at EUR 175bn and 185bn, respectively. In the US and Germany, however, the stock of excess savings ended 2022 at around 8% of annual consumption, ie USD 1390bn in the US and EUR 160bn in Germany.
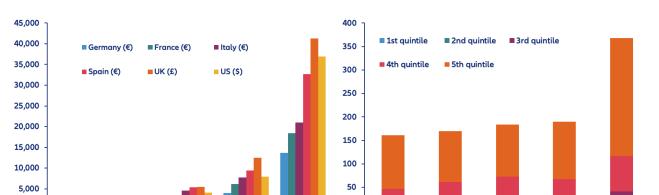
Excess savings shot up in 2020 and early 2021, despite lower aggregate compensation of employees compared to the pre-pandemic trend, mainly through heavily reduced personal expenditures for European countries (the UK included) and strong state support in the US, as huge fiscal transfers bolstered households' balance sheet. According to our computations, between Q1 2020 and Q4 2021 the stock of households reduced spendings amounts to EUR 173Bn in France, 251Bn in Germany, 246Bn in Italy, 267Bn in Spain and GBP 414Bn. In the US, it peaked at US 971Bn in late Q1 2021 before starting depleting onwards, down to US 647Bn in Q4 of that year. We estimate that in the span of two years (2020-2021), the state fiscal support buoyed US household

income up to 2 trillion dollars[1], which represents a surplus compared to the pre-pandemic suggested trend in transfers of around USD 17,000 per household. As of Q3 2022, quarterly transfer receipts remain above what the pre-pandemic trend would have suggested. However, since Q3 2021, excess savings in the US have been rapidly depleting (negative flows), while other countries at most showed lowering flows but still positive around that time. It appears that, amid consumption recovery, the strength of households' consumption grew above the pre-pandemic trend (negative flows of consumption in the breakdown of excess savings Figure 2 chart 2) and they have been digging into their pandemic excess savings to, on the one hand, fund their expenditures after the lockdown periods, but on the other hand also face rising inflation, which started picking from 1.2% in Q4 2020 to almost 7% in Q4 2021. Still, households continued purchasing more *volumes* of goods and services despite elevated inflation. This explains the fast depletion of excess savings and with the savings rate settling around 3% in Q3 and Q4 2022, much below the pre-pandemic trend, the stock of excess savings could be fully depleted by the end of the year. With the fear of recession for the US, households disposable income could be under further stress despite falling inflation and steep up the dig up of remaining excess savings.

Conversely, it appears that consumption recovery in Europe remained subdued with decreasing but positive sizeable contribution of consumption throughout 2021 in the breakdown Figure 1. As of Q3 2022 personal consumption expenditures still remain below the pre-pandemic trend in Spain and the UK, which explains why households in these countries have accumulated a large stock of excess savings. In other countries of the region consumption growth only returned to the levels suggested by the pre-pandemic trend around Q2 2022, long past the lockdown periods. Italian and Spanish households digging into their savings, despite what we have said regarding consumption, probably also reflects quickly rising inflation rates and increasing pressures on households' finances. European households income were also buyoed by social transfers, but in a lesser extent compared to their American counterparts. Following our methodology it is estimated that between Q1 2020 and Q1 2022, the increase in state support amounts to EUR 36Bn in France, 38Bn in Germany, 16Bn in Spain, 10Bn in Italy and GBP 86Bn in the UK. Overall this represents a surplus per household of EUR 1,187 in France, 937 in Germany, 851 in Spain, 383 in Italy and GBP 2,922 in the UK. Despite these differences between countries, it appears that as of Q3 2022 social transfers for each country remain well above what is suggested by the pre-pandemic trend. It is worth noting the taxes reduction bolstered households' savings in European countries in both 2020 and 2021, while in the US increasing taxation from early 2021 onwards has been strengthening the dig up of savings to fund living expenses and increasing consumption.

With the aggregate figures estimated we assumed the country-specific excess savings distribution followed the total assets distribution across households (annexe Figure 18). Through this we were able to give, for each quintile, an amount per household left as of Q3 2022 (see Figure 3). Unexpectedly, it is very unevenly distributed, and we estimate the bulk of excess savings is held by the 20% of households with higher income. On average, the top 20% holds 65% of excess savings vs. around 5% for the bottom 40% (and below 1% for the bottom 20% alone). The average high-income household has, on average, excess savings ranging from EUR 13,650 in Germany to GBP 41,600 in the UK. At the opposite end of the spectrum, the bottom 20% of households have essentially no more excess savings left, except in the US where the average household has around USD 1,800 remaining.

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[1]For reference President Biden's infrastructure plan unveiled in early 2021 was about the same amount

Figure 3: *Amount per household of excess savings remaining as of Q3 2023 (left panel, LCU) & Total stock by quintile (right panel, LCU Bn)*

1.3   Excess savings' allocation towards asset classes

After estimating the aggregate stock of excess savings, and then an amount per household, we also attempted to work on a breakdown of the said stock per country across asset classes. In essence, we were interested in figuring out in what form these savings were held or if they were used towards paying off debt. To do so we had to come up with a methodology and formulate hypotheses. In hindsight, it may give some interesting elements to work with but it would need further work to be that effective. We used the household balance sheet from Eurostat for European countries, the Flow of Funds Financial Accounts from the National Office of Statistics for the UK and the households balance sheet from the Federal Reserve for the US. Assets held by households are mainly composed of Currency & deposits; Equity & IF shares; Insurance, pension & stand guar; other account receivable; debt securities and Gross fixed capital Formation. We assume households' liabilities are only made of loans (accounts for 93.5% of total households' financial liabilities in 2021 according to Eurostat). Below are the following rules we use to calculate the investments made by households. We agree they are quite harsh (probably erratic to some extent) and would need further discussion, but we had already figured out most of what we were looking for and just went on for some exploratory work that I still wished to include here as it was part of my learning.

   - Assets: every quarter we only account for positive flows; meaning we assume that for any given variable if the quarterly flow is negative households did not allocate part of their excess savings towards that asset class (rather they cashed out).

   - Loans: we only account for negative flows here; if loan flows are positive for a given quarter, then on average households contracted more debt than they paid back and we assume no share of excess savings were allocated to the reimbursement of debt. And conversely, if the flow is negative we assume on average households decided to invest towards the reimbursement of their debt: we take this flow into account. The investment made by households towards paying back their debt thus equals minus the negative flow.

   Thus, for any given quarter we assume that households' total investment is made of the assets positive flows

and the liabilities negative flows: we are then able to derive a share of the total investment (%) for each class. We assume that the allocation of excess savings in asset classes follows the same distribution as investment in these very own classes. We get households' excess savings distribution across asset classes at a given quarter by multiplying the flow of saving for that very own quarter by the corresponding previously computed share. We derive the savings stock breakdown by adding up the quarterly flows. According to our estimations, the most of excess savings (for European countries) is held in non-liquid forms, such as residential investment and equity: for instance, in Spain, currency and deposits account for 30% of total excess savings, i.e. around EUR 60bn out EUR 195 bn (see Figure 4).
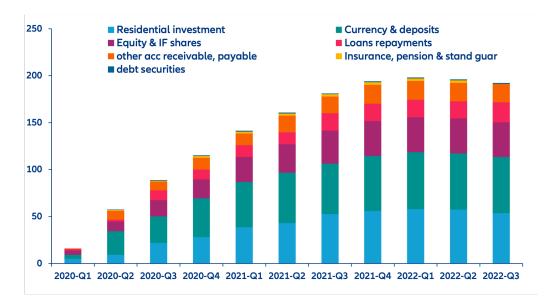
Figure 4: *Estimated breakdown of Spanish stock of excess savings (EUR bn) into asset classes*

Furthermore, the data shows that only Spain and the US show some negative quarters of net investment in loans repayments. Thus, according to our methodology, only these two countries show overall tendency of households to actively direct these excess savings towards repaying their debt. It Spain net loans repayments happened in Q1 and Q3 of both 2020 and 2021 but also in Q3 2022, while in the US it was in the first semester of 2020 and in Q1 2021. Our computation suggest that between 2020 and late 2022, 15% of excess savings have been invested towards loan repayments in Spain and only 2% in the US.

In hindsight, the methodology still lacks efficiency and is probably too rough in several aspects (for instance negative saving flows are hard to account for). It does not appear to best the best decision to consider that when saving flows are negative households dig in their savings to fund investments, but rather direct these funds towards consumption. However, it was really interesting to work on this topic and to propose a methodology of our own. As there was a lot of national accounts topics that I had to learn about and finding the data sometimes being a challenge in itself, I still wanted to include these results with room for improvement.

1.4   Summary of key findings

- The stock of household excess savings is still large in European countries and the US in absolute terms. This huge stock of savings has barely started to come down in European countries while American households have started depleting savings as early as Q4 2021.

- Excess savings are unevenly distributed across income groups, with the bottom 40% of the spectrum having little to no excess savings left as of early 2023 and in the current economic situation higher income households are less likely to spend their excess savings which they consider more as assets rather than extra income to be spent.

- Fiscal support buyoed household income during the pandemic (especially in the US) and as of Q3 2022 with countries tackling the issue of high inflation, social transfers have remained well above the pre-pandemic trend.

- US consumption spending has outpaced European's in the aftermath of the pandemic but this means that the US stock of excess savings is now depleting fast. Increasing strains on US households' finances mean that excess savings are to remain under heavy pressure and potentially fully deplete throughout the year.

2   *Wage growth drivers across European markets*

2.1   Literature review

After the post-pandemic recovery phase inflation rose from disturbances on the supply side, first with supply-chain disruptions and then with the energy crisis from the war in Ukraine, GDP growth has slowed to a standstill, and business confidence remained below its long-term average. Yet, the different labour markets across Europe are not showing strong signs of weakening, and record low unemployment levels conversely point to highly tight markets. If inflationary pressures were to strongly pass-through to wages, once the energy crisis and induced effects (rising prices for commodities, food, transportation costs...) fade, wage growth could play a key role in inflation not returning to normal levels, especially if the pass-through is slow. We could see inflation going down before rising due to increasing consumer spending power through delayed wage increases. Thus, the keen interest in inflation and the interaction with wages being a key challenge for monetary policy motivated our study of wage dynamics, especially regarding the Eurozone labour market outlook for this publication.

The primary basis for our study was to extend a Goldman Sachs study on the drivers of wage growth in the UK to the Eurozone Big 4, namely France, Germany, Spain, and Italy. Through a large range of model specifications, they assessed the extent to which the labour market needs to cool down to bring down wage growth and thus possibly inflation. From the estimated Phillips curve the drivers of recent wage growth strength are derived, highlighting a strong effect of a tight labor market and high inflation expectations mix. Coefficients estimates also allow the authors to evaluate what it would take to bring down wage inflation to levels usually considered compatible with the BoE inflation target.

Phillips curve models have longed been studied from the original 1958 paper *"The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957"*[4] to most recent studies on its possible weakening explainability power due to flattening during the pandemic (Hartwig, Nickel & Bobeica (2021)[5]). In their 2017 chapter of the IMF World Outlook on drivers of wage growth Nabar & al.[6] consider the Phillips curve framework proposed by Gali in 2011[7] and illustrate the expected weights of inflation expectations and productivity growth on wage growth. While in the original paper from Williams Phillips the link is drawn between nominal wage growth and unemployment in Great Britain, it appears from their results that despite slack being a known key driver of wage development, the unemployment rate alone may not adequately capture all constraints in the labor market leading to wage inflation, and thus other measures of slack should be considered.

This is consistent with a broader literature as measures regarding slack have largely been discussed. Recently, Domash & H. Summers (2022)[8] from the Centre for Economic Policy Research (CEPR) provided an in-depth analysis of a wide range of alternative measures of slack in the US, particularly measures that include a demand dimension, to assess labor market tightness. They also highlighted the changes, amid the pandemic, in these measures that used to move together but started behaving differently. This induces a growing interest to consider them separately and not as interchangeable measures. Moreover, they point out the instability of estimated relationships between wage developments and the slack measures -whether it is due to stationary properties of some variables or structural changes- and raise caution when one attempts to predict future wage growth. Both Saez & Michaillat (2022)[9] and Furman & Powell (2021)[10] also illustrated the better fit of job vacancy rate

and quit rate as demand-side slack measures in the US.

In the ECB Economic Bulletin of January 2023, Bodnár & al.[11] shed light on measures' differences but this time regarding wage growth as the latter also started showing some divergence during the pandemic. Namely, the annual growth of compensation per employee (consisting of total wages and salaries paid by employers but also of imputed social contributions, expressed per employee) decreased while the compensation per hour and the Labor cost index from Eurostat both rose during the same period. Despite moderating over time some differences still remain. As the goal of our analysis is not to highlight these differences we chose not to focus on this issue but it is still worth mentioning. We give more precision regarding the selection of our variables in the dedicated data section.

More recently, and in line with our study, Domash & H. Summers (2023)[12] assessed the recent wage development in the US and argue that the traditional Phillips Curve framework still performs relatively well when predicting wage inflation. Moreover, they underline the factors that would bring down wage growth to levels compatible with the Federal Reserve's 2% inflation target.

We build on this literature and make the following main contributions: investigating broader slack measures for European countries and estimating Phillips curves with a rich dynamic structure following our own methodology. Our model sheds light, both quantitatively and qualitatively, on the relative importance of the key wage drivers, all the more highlighted over time by the contribution breakdown charts, while performing fairly well. We are thus able to strengthen the Eurozone Labour market outlook for Allianz Trade's quarterly outlook. In hindsight even though we were satisfied with the results we also point out limits and overall reflections we have on the methodology throughout the report.

2.2 Data and Methodology

2.2.1 Data

Wage. As our study did not focus on the different possible measures of wage and the inherent differences mentioned in particular by Bodnár & al.[11] we decided to construct a simple measure that would be comparable across countries. Our wage variable $Wage$ is more of a labour cost variable than a, strictly speaking, wage measure. We take the logarithm of the Hourly earn in 2015 basis (2015=100).

Inflation. The standard Phillips curve relies on an inflation expectation variable. However, as we not only aimed to study the drivers of inflation through the Phillips curve framework but also to produce some forecasts and a forward-looking assessment of the different labour markets we decided to switch the inflation expectation variable to realised inflation. With the team making inflation forecast scenarios every quarter we are then confident in the data and we do not rely on some external source for this specific variable. It also makes it really easy to consider different inflation pathways if need be. Thus, our inflation variable CPI is simply measured by the logarithm of the Consumer Price Index (2015=100) of all items.

Productivity. We measure labour productivity, or just productivity, as the logarithm of the four-quarter moving average of the Gross Domestic Product (produced at each quarter) to employment ratio. We take a moving average rather than the direct ratio for two reasons: to smoothen the overall curve and remove possible

base effects and as productivity changes may not instantly translate into wages, but rather productivity trend changes affect wage growth, we decided that the trend of productivity growth would be deemed more appropriate.

Labour underutilisation. As discussed in the introduction we consider several different slack measures. Our first variable of labour underutil is the Unemployment (U) measured the country-specific unemployment rate. We then also considered the following measures: the Job-Worker Gap as a share of the labour force ($JW\text{-}LF$) measured by the ratio between the job-worker gap (labour demand [employment + job vacancies/openings] minus labour supply [employment + unemployment]) and the labour supply in percentage; the Vacancies to Unemployment ratio (V/U) and the Labour force Participation rate ($LF\text{-}part$) measured by the logarithm of the ratio between the Labour supply and the Population in working age. Some variables remained missing for some countries though, see Figure 5.

We start by running some unit root tests on our variables to assess their level of stationarity. Find below a result table summarising the key results from the different tests.

Figure 5: *Unit root test results by country and variable, in level and first difference.*

		LEVEL				FIRST DIFFERENCE						
		ADF		PP		ADF		PP		KPSS		Integration
		Drift & Trend	Drift	Drift & Trend	Drift	Drift & Trend	Drift	Drift & Trend	Drift	Drift & Trend	Drift	order
Critical values at 5%		**-3.45**	**-2.89**	**-20.7**	**-13.7**	**-3.45**	**-2.89**	**-20.7**	**-13.7**	**0.463**	**0.146**	
France	Wage	-1.334	-1.407	-3.58	-0.391	-7.640	-7.525	-129	-131	0.106	0.279	I (1)
	CPI	-1.359	0.768	-6.1	0.295	-5.640	-5.614	-97.4	-96.4	0.119	0.135	I (1)
	U	-1.355	-1.304	-6.9	-6.49	-6.140	-6.168	-139	-139	0.113	0.117	I (1)
	JW_LF	-1.195	-1.136	-5.79	-5.3	-5.227	-5.252	-148	-148	0.135	0.137	I (1)
	V/U	-1.705	-1.704	-10.4	-10.3	-6.494	-6.519	-133	-133	0.112	0.115	I (1)
	LF_part	-0.855	0.628	-6.69	0.581	-8.967	-8.882	-142	-142	0.111	0.222	I (1)
	Productivity	-2.356	-2.126	-7.5	-3.2	-5.503	-5.338	-61.5	-60.4	0.032	0.254	I (1)
Spain	Wage	-1.253	-4.1	-1.56	-1.3	-6.702	-5.665	-134	-130	0.124	0.749	I (1)
	CPI	-1.180	-1.005	-4.58	-0.617	-4.127	-4.134	-194	-195	0.117	0.167	I (1)
	U	-1.960	-1.836	-4.32	-4	-3.318	-3.321	-35.8	-35.5	0.125	0.134	I (1)
	LF_part	1.620	-3.604	-2.13	-2.6	-7.555	-6.551	-109	-108	0.141	0.672	I (1)
	Productivity	-1.935	-2.027	-5.61	-6.31	-5.262	-5.186	-57	-56.2	0.077	0.165	I (1)
Germany	Wage	-1.151	1.544	-22.7	0.653	-9.668	-9.395	-149	-151	0.092	0.404	I (1)
	CPI	-0.232	1.703	-2.01	1.09	-5.863	-5.575	-80.9	-77.8	0.122	0.265	I (1)
	U	-2.843	-0.74	-12.2	-0.987	-5.488	-5.518	-66.4	-66.4	0.068	0.076	I (1)
	JW_LF	-2.853	-0.964	-10.4	-1.16	-4.813	-4.847	-48.8	-48.5	0.061	0.068	I (1)
	V/U	-3.037	-1.255	-11	-1.73	-4.722	-4.755	-52.4	-52.1	0.041	0.061	I (1)
	LF_part	-2.688	-0.319	-12.2	-0.194	-4.831	-4.851	-70.5	-70.5	0.069	0.069	I (1)
	Productivity	-3.654	-1.975	-14.6	-3.55	-4.531	-4.494	-47.1	-46.4	0.029	0.083	I (1)
Italy	Wage	-1.015	-1.945	-3.52	-0.922	-10.515	-10.118	-132	-135	0.081	0.487	I (1)
	CPI	-1.272	0.981	-5.84	0.02	-1.14	-1.28	-15	-17.1	0.149	0.231	I (1)
	U	-1.257	-1.237	-3.56	-3.48	-4.618	-4.641	-87.8	-87.8	0.171	0.172	I (1)
	LF_part	-4.325	-4.341	-40.4	-39.8	-9.419	-9.463	-110	-110	0.046	0.055	I (1)
	Productivity	-4.741	-3.557	-12.8	-7.28	-5.375	-5.355	-33	-32.3	0.069	0.097	I (1)

We use the standard Augmented Dickey-Fuller (ADF) and Perron-Phillips (PP) tests to asses the different series showing signs of a unit root in level. As a reminder the null hypothesis for both the ADF and PP test is the presence of a unitary root and thus non-stationary. We run the ADF test with Drift (1) & Trend and with Drift only (2). Likewise for the other tests. To check that the stationary hypothsis is not incorrect for the first difference series we use the KPSS test, where the null hypothesis is stationarity.

$$\Delta y_t = \gamma y_{t-1} + a_0 + a_1 t + \sum_{i=2}^{p} \beta_i \Delta y_{t-i+1} + \epsilon_t \quad \longmapsto \quad \text{H}(0)\colon \gamma = 0 \tag{1}$$

$$\Delta y_t = \gamma y_{t-1} + a_0 + \sum_{i=2}^{p} \beta_i \Delta y_{t-i+1} + \epsilon_t \quad \longmapsto \quad \text{H}(0)\colon \gamma = 0 \tag{2}$$

After computing the first difference counterpart for each series we interpret the comparison of either the Drift & Trend or Drift statistics to its corresponding critical value depending on the differentiated series looks. Overall all series are not level-stationary as the t-statistics for the ADF and PP are below the critical values, we thus can't reject the presence of a unit root. Running the same test on the differentiated series establishes the series as first-difference-stationary. Using the KPSS test the hypothesis of stationarity cannot be rejected at the 5% level, thus reinforcing our conclusion of the variables being integrated of order one I(1).

2.2.2 Methodology and Model selection

As we highlighted in the previous section, our variables are I(1) and we thus consider a model ran in first difference. Namely, we run country-specific Autoregressive Distributed Lag (ARDL) models of the following form, for $t = 1, \ldots, T$:

$$\Delta wage_t = c + \sum_{k=1}^{W} \alpha_k \Delta wage_{t-k} + \sum_{k=0}^{Q} \beta_k^{(CPI)} \Delta CPI_{t-k} + \sum_{k=0}^{S} \beta_k^{(slack)} \Delta slack_{t-k} + \sum_{k=0}^{P} \beta_k^{(prod)} \Delta prod_{t-k} + \theta^T \gamma + \epsilon_t$$

With respective maximum lags $\{Q, S, P\} \in [0; 6]^3$ and $\{W\} \in [1; 6]$ (*prod* refers to the Productivity variable). $\gamma = (\mathbb{1}_{covid}, \mathbb{1}_{GFC})^T$ is a vector of dummy variables for the periods detailed below and $\theta = (\theta_{covid}, \theta_{GFC})^T$.

The model is estimated via Conditional Maximum Likelihood (*using the ARDL framework from the statsmodel python package*) on a quarterly basis from Q2 1997 to Q4 2022 for Germany, France and Spain. For Italy, the sample only starts in Q1 1998. As our goal is to assess recent wage developments and produce monitoring models for our outlook it is mandatory we include as much data as possible. Thus, $\mathbb{1}_{covid}$ is a dummy variable over the Covid-19 period (2020Q1 – 2022Q2) included to alleviate to a certain extent the disruption in the data associated with the crisis but external to the explanatory variables included. There is also a dummy variable for the Global Financial Crisis (2007Q2 – 2009Q1). Since the economic theory does not provide guidance regarding the number of lags to include we decided to restrict the equation to include lags up to 6 quarters, i.e up to a year and a half, as we assumed there could be some links with the previous year for some variables but going up to 8 quarters might go overboard and introduce too much variance.

For the wage (*Wage*), inflation (*CPI*) and labour productivity (*prod.*) variables the interpretation of the first difference series is straightforward as it produces quarter-on-quarter growth rates (%QoQ) of the said series. Then, we have several country-specific equations depending on the slack measure chosen (slack). As for the latter, the interpretation of the first difference varies across measures but it is either a QoQ growth rate for the labour force participation (*LF-part*) or QoQ differences for the other three (*U, JW-LF, V/U*). The model includes both some autoregressive momentum, with the lag wage components, and the dynamic of predictor variables. The rationale behind the inclusion of more than one lag compared to the theoretical framework and a simple regression model is more or less the following. Firstly, a richer structure could perform better in a purely statistical perspective and would thus allow building up a better outlook with stronger confidence. But as we track multiple countries the maximum lag selection could also corroborate or at least provide further information on particular features of individual context. It could be the dragging or quick adjustment of wage growth changes across time, the extent of inflation pass-through to wages (especially if only recent quarters in inflation changes matter or if the changes from the past year still carry heavy weights), with the latter being a central issue in policy discussion when it comes to tackling high inflation and taking into account the labour

market situation. These are some of the many questions that we attempt to address using our model framework complementary to assessing the differences in the choice of slack measures.

Thus, with the two-fold objective of investigating broader slack measures and producing country-specific labour market outlooks, our model selection is composed of multiple steps. First, we run all possible model combinations of maximum lags included for each variable. Then, as we investigate this broad range of models we are able to select the *'best'* ones from a statistical perspective (one per slack measure variable) with the minimisation of the Akaike Information Criterion (AIC). Moreover, the pool of models is beforehand reduced as we only consider structures, where every maximum lag included, is significant at the 10% level. This first step combines the classical tools which are information criterion and statistical tests.

However statistically good the models described above might be, the selection of one as the best still lacks some economic fundamentals. More than just including lags of explanatory variables, the ARDL framework provides a feature that we tried to leverage to a certain extent to control our pool of possible models and make sense of their statistical features in an economic sense. Using the regression equation we can compute the dynamic marginal effect of each variable lag included, known as short-run effects $\frac{\mathrm{d}y_t}{\mathrm{d}x_{t_i}}$. If we consider a permanent unitary shock in X_t so that $E(X_t)$ changes, the effect in $E(Y_t)$ is (3), known as the long-run multiplier (LRM). The latter is also the accumulation of short-run effects. With stationary series and white noise ϵ_t we have, using $\theta(L) = 1 - \theta_1 L - \theta_2 L^2 - \cdots - \theta_p L^p$ and $\phi(L) = \phi_0 + \phi_1 L + \phi_2 L^2 + \cdots + \phi_q L^q$:

$$\theta(L)y_t = \delta + \phi(L)x_t + \epsilon_t$$

$$y_t = \theta^{-1}(L)\delta + \theta^{-1}(L)\phi(L)x_t + \theta^{-1}(L)\epsilon_t$$

$$\frac{\mathrm{d}E(y_t)}{\mathrm{d}E(x_t)} = \theta^{-1}(L)\phi(L).1 = \theta^{-1}(1)\phi(1)$$

$$\frac{\mathrm{d}E(y_t)}{\mathrm{d}E(x_t)} = \frac{\phi_0 + \phi_1 + \phi_2 + \cdots + \phi_q}{1 - \theta_1 - \theta_2 - \cdots - \theta_p} \tag{3}$$

We utilise this long-run multiplier as a constraint in our model selection process. We argue that a one per cent permanent increase in ΔCPI and $\Delta prod.$ variables, namely a one per cent permanent increase in QoQ inflation and productivity growth should be associated with a positive long-run multiplier for wage growth. We thus add another step in our model selection with an expected sign constraint on the LRM for each computed model. On the other hand for the different slack measures, we do not impose any constraint on the LRM sign. Through the Okun law, which links changes in unemployment and GDP growth, we argue that it is best to let LRM associated with the chosen slack measure unconstrained, despite the expectation we could have on its sign.

$$\frac{\Delta Y}{Y} = k - c\Delta U \xrightarrow[\text{unitary shock on U}]{} \qquad \frac{\Delta Y}{Y} = k - c(\Delta U + 1)$$

$$\frac{\Delta Y}{Y} \geqslant 0 \Leftrightarrow k - c\Delta U \geqslant c$$

$$\frac{\Delta Y}{Y} \geqslant 0 \Leftrightarrow \frac{k}{c} \geqslant \Delta U + 1$$

Thus, the last line shows that the effect of a unitary shock to ΔU on GDP growth is not straightforwardly clear, as it depends on the state of ΔU compared to the constant $\frac{k}{c} - 1$. If we are in a situation where the effect of a shock on the unemployment rate would be positive on GDP growth we would thus expect a rise in wage

growth (assuming all the increase in GDP does not only go to profits...). However, most of the time shocks in the unemployment rate do tend to be followed by downward pressures on wages([6],[13]). For the ratio of vacancies to unemployment, an increase can either be due to an increase in vacancies (increase in labour demand - for the same number of unemployed there are more positions) or a decrease in the number of unemployed, both tightening the labour market and we would then expect increasing pressures on wage growth. For the job-worker gap (labour demand – supply), an increase signals higher demand for labour, thus again we would expect pressures on wages. Therefore, our model selection does not impose any constraint on the sign of the long-run multiplier for any of the slack measure variables but we would still expect the following signs from the different slack measures: (LRM.$U < 0$), (LRM.$V/U > 0$), (LRM.JW-$LF > 0$), and (LRM.LF-$part > 0$) -depending on the degree of labour market tightness (or looseness) they point to. With the combination of every step presented above, we argue that we select models with good performance and with features that can be either backed by economic theory or where an argument can be made in favour of such choice of model.

We should acknowledge that wages, prices, and all the other variables in our analysis are a result of their interactions with each other in the economy, which may call for more elaborate estimation methods with an interaction mechanism, inherent to the VAR framework for example. However, our goal is more limited. Our main focus is to assess the main drivers of the recent wage growth dynamic. We argue that with the VAR framework, despite the theoretical gains we would have thanks to its interaction mechanism, we don't have the same freedom as with the methodology presented above. First, it does not allow for different maximum lag order per variable, which we thought could be an interesting feature. There are also fewer coefficients to estimate with our method, reducing the estimation complexity, resulting in an estimated 26 coefficients ARDL with full 6 lags for each variable compared to a 96 coefficients VAR(6). Another notable difference is that our ARDL framework allows for contemporaneous effects or explanatory variables, something not possible with VAR models. We also tried running some VAR models but due to time constraints, we could not work fully dive into this approach where we could leverage the estimated wage equation and -as we did here- come up with a rule of thumb to select a good model. In hindsight, I think such model would be interesting as a baseline -despite the differences mentioned above- as the framework has been deeply acknowledged in economic research with numerous performing models (*Key drivers of labour market developments: an SVAR analysis*, C. Foroni and M. Mohr) and I felt like we lacked a point of comparison during our research phase and especially when we started estimating models.

Ultimately, this process allows us to assess the broader slack measures as explanatory variables and to what extent they can bring marginal gain in explaining wage developments. Again, the country-specific nature of our study may prove useful as some measures may not be the best fitted for some countries due to market features, regulations, structural differences in the employment pool etc... With this in mind, find below a table (Figure 6) summarising the results of the selected models. We compare the different slack measures, try to interpret the long-run effect estimates and assess possible discrepancies among countries. For the sake of concision, we decided to only highlight the coefficients of the labour underutilisation variables. (Actual plots can be found in the annexe Figure 19 to Figure 22).

Figure 6: Best model selected for each slack variable

		lag=0	lag=1	lag=2	lag=3	lag=4	lag=5	lag=6	Adj-R^2	LRM-CPI	LRM-Slack	LRM-Prod
France	U	-0.8479(***)	-0.2266	0.4948(***)	0.333(**)				67%	0.51	-0.53	-1.11
		(0.163)	(0.177)	(0.108)	(0.152)							
	JW_LF	1.1029(***)	0.2077	-0.5192(***)	-0.4332(**)	-0.1376	0.2424(*)		58%	0.25	0.70	0.07
		(0.148)	(0.181)	(0.134)	(0.202)	(0.17)	(0.143)					
	V/U	0.2284(***)	0.0195	-0.0909	-0.1109(*)				65%	0.16	0.06	0.02
		(0.038)	(0.067)	(0.069)	(0.063)							
	LF_part	-0.6829(***)	-0.013	0.2179(**)	0.1649	0.3149(**)			62%	0.04	0.01	0.07
		(0.129)	(0.089)	(0.097)	(0.131)	(0.154)						
Spain	U	-0.0185	-0.0515	-0.0398	0.0427	0.0327	-0.1793(**)		60%	0.78	-0.36	0.08
		(0.095)	(0.088)	(0.169)	(0.092)	(0.079)	(0.074)					
	LF_part	-0.2799(***)	0.1058	0.1172	0.2308(**)	0.3144(**)			68%	0.69	0.60	0.08
		(0.097)	(0.094)	(0.097)	(0.1)	(0.119)						
Germany	U	-0.3653	0.5366	-0.0971	-0.9207(**)				62%	0.09	-0.37	0.08
		(0.34)	(0.481)	(0.253)	(0.352)							
	JW_LF	0.4013	-0.802	-0.0511	1.2799(***)				62%	0.11	0.40	0.01
		(0.474)	(0.547)	(0.284)	(0.332)							
	V/U	0.0417	-0.2473(***)	0.208(***)	0.3403(***)	0.0621	-0.2072(*)		65%	0.14	0.08	0.03
		(0.087)	(0.088)	(0.077)	(0.088)	(0.091)	(0.106)					
	LF_part	0.5875(*)	-0.502	-0.3875	-0.0951	0.529(*)			61%	0.13	-0.05	0.07
		(0.333)	(0.309)	(0.396)	(0.24)	(0.295)						
Italy	U	-1.6769(***)	-0.2585	1.8497(***)	-0.9574(*)				55%	0.96	-0.51	0.29
		(0.543)	(0.358)	(0.445)	(0.498)							
	LF_part	-0.5046(***)	-0.144(**)	0.0815	0.0343	0.0905	0.0004	-0.0824(***)	78%	0.71	-0.46	0.15
		(0.044)	(0.071)	(0.079)	(0.084)	(0.084)	(0.055)	(0.03)				

NB: *Note that the lack of complete job vacancies series for Italy and Spain forced us to disregard the V/U and JW-LF slack measures for these countries.*

The first thing to note is that no model is completely left-out performance-wise, as almost all show adjusted R^2 above 60%. Considering the unemployment rate estimate as the baseline the results show that for Germany the job-worker gap and labour force participation measure up to it. We estimate that the vacancy-to-unemployment ratio even has a slight edge over other slack measures, with its adjusted R^2 reaching 65%. Moreover, there does not seem to be a discrepancy in the estimated long-run effect of either CPI or labour productivity. We estimate that a permanent increase of 10bps in the QoQ difference of the unemployment rate would lead to a decrease of around 3.7bps in QoQ wage growth. The estimated long-run multiplier is close to zero and slightly negative for growth in labour force participation. Looking at the data the latter has kept increasing steadily over the past 30 years, almost following a linear trend, from 76% to as high as 91%. This unstoppable-like upward trend, combined with rising labour force participation even during crises, could explain the estimation of no long-term effect on wage growth. Moreover, the threefold combination of effects from changes in unemployment, employment and population might blur the link with wage growth changes. See for example Figure 7 for the different drivers in the recent changes in the labour force participation rate, compared to Q4 2019, among our 4-country dataset. Finally, both the vacancies to unemployment ratio and the job worker gap show expected positive signs for the LRM estimate.
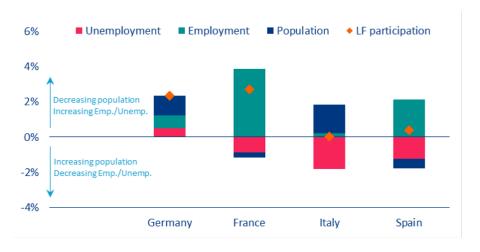
Figure 7: Labour force participation breakdown, 2022Q4 against 2019Q4

Regarding France, the models with unemployment, V/U and labour force participation are the best performing with adjusted R^2 between 62% and 67%, though no additional slack measure seems to outperform the model using the first. The strong negative estimate for the long-run multiplier of productivity is surprising. Compared to an estimation with a sample lasting until Q3 2019, it seems the pool of estimated models deeply embedded the trend rupture in productivity since the break that happened during the Covid crisis and the recent decoupling between wage developments and productivity changes. Other slack measures also point to a really low long-run effect (positive but close to zero). Similarly to its German counterpart, a decrease of around 5.3bps in QoQ wage growth is estimated from a permanent increase of 10bps in the QoQ difference of the unemployment rate. Again, the JW-LF and the V/U ratio both show expected positive signs and estimates are within the same range as for Germany. The job-worker gap seems to impact more the French economy than its German counterpart while it is the other way around for the V/U ratio, which probably reflects structural differences between the two countries' labour market.

Regarding Spain and Italy, both show improvements when using labour force participation in terms of adjusted R^2. However, compared to France and Germany, the amplitude of estimated long-run effects is on a totally different scale, especially for Italy where it is surprisingly negative. For Spain, the estimate is large and positive. We guess that for the Italian labour force participation, as it has remained in the same range across the sample, the model overshoots its recurrent slow negative trends during crises and the break during Covid only amplified that. As for Spain, the early 2000s' increase could be overestimated and this past trend would be over-embedded within the model.

Overall, the different models suggest (again through the long-run multiplier) that -on average- higher inflationary pressures affect the peripheral countries -i.e. Italy and Spain – than the core countries – i.e. France and Germany. For the latter, a 1% increase in QoQ% inflation would lead to respectively a 12bps increase in wage growth in Germany, and twice as big in France at 24bps. In peripheral countries, it reaches 74bps in Spain and up to 84bps in Italy. Roberta's take is that this probably reflects the influence of unions in wage bargaining in peripheral countries, where negotiations take time and gradual wage increases (lower than current inflation) are often preferred in exchange for job security, particularly the case for Spain in 2022. However, this also suggests that the contribution of inflation to wage growth in 2023-24 is likely to be more pronounced in Spain and Italy

than in the core countries -even though headline inflation has slowed down- as lagged inflationary effects kick in.

We find that labour productivity is the hardest variable whose long-run effect we have to interpret, as a more structural variable and not as easy to grasp as inflation or unemployment. We note that there is again a discrepancy between the peripheral and core countries. Both Germany and France show a weak to even negative long-term trend in labour productivity effect on wage growth while for Spain and Italy, the estimates are larger and positive. Compared to France it seems the recent dip in Spanish labour productivity has not (yet) changed the positive relationship between productivity and wage growth, despite the two countries showing similar breaks and no recovery, probably because for France the decrease in productivity was stronger despite strongly rising labour cost.

Then, to select the 'best' model for our analysis, we not only rely on the adjusted R^2 value but also on the availability of forecasts for the different series. As we do not have forecasts of vacancies, despite the marginal gains in explaining wage developments, we had to drop the *V/U* and *JW-LF* models if we were to use them to compute forecasts. With the unemployment rate being a key variable in the team's labour market outlook, each economist has to produce quarterly forecasts which are then debated and confirmed for the scenario. The general interest in a forecasting model using this specific variable, the confidence in the forecasted series and the overall results' performance motivated the selection of the estimated models using the unemployment rate.

2.3 Wage growth models results

The table below displays the full estimates for each country. Charts plotting the selected model estimate and the top 25% of R^2-models against actual values can be found in the annexe (Figure 23 to 26).

Figure 8: Best model selected for each slack variable

		lag=0	lag=1	lag=2	lag=3	lag=4	lag=5	lag=6	Adj-R^2	LRM-CPI	LRM-Slack	LRM-Prod
France	Lagged wage	-	-0.1055	0.0554	0.1937(*)	0.1805(**)	0.2117(***)					
		-	(0.075)	(0.061)	(0.103)	(0.084)	(0.07)					
	Inflation	0.0272	0.2832(**)	0.1317(*)	0.2136(**)	-0.1282	-0.2864(**)					
		(0.091)	(0.108)	(0.079)	(0.102)	(0.11)	(0.123)					
	Unemployment	-0.8479(***)	-0.2266	0.4948(***)	0.333(**)				67%	0.51	-0.53	-1.11
		(0.163)	(0.177)	(0.108)	(0.152)							
	Productivity	-0.5682(***)	-0.0195	-0.0539	0.3241(***)	-0.2(***)						
		(0.104)	(0.1)	(0.076)	(0.055)	(0.063)						
	Intercept	0.3371(***)										
		(0.119)										
Spain	Lagged wage	-	-0.0682	0.0945	0.016	0.3686(***)						
		-	(0.076)	(0.069)	(0.068)	(0.114)						
	Inflation	-0.0641	0.1159(**)	-0.0385	0.0888	0.355(***)						
		(0.077)	(0.057)	(0.071)	(0.064)	(0.083)						
	Unemployment	-0.0185	-0.0515	-0.0398	0.0427	0.0327	-0.1793(**)		60%	0.78	-0.36	0.08
		(0.095)	(0.088)	(0.169)	(0.092)	(0.079)	(0.074)					
	Productivity	-0.7418(***)	0.8126(***)	0.2938(***)	-0.3174(**)							
		(0.226)	(0.162)	(0.101)	(0.132)							
	Intercept	0.0831										
		(0.109)										
Germany	Lagged wage	-	-0.7632(***)	-0.4318(***)	-0.296(**)	0.0789	0.1498(*)					
		-	(0.093)	(0.123)	(0.115)	(0.103)	(0.086)					
	Inflation	-0.0296	0.31(*)	0.4371(**)	0.2363	-0.1567	0.1385	-0.7389(***)				
		(0.183)	(0.18)	(0.199)	(0.17)	(0.231)	(0.192)	(0.215)				
	Unemployment	-0.3653	0.5366	-0.0971	-0.9207(**)				62%	0.09	-0.37	0.08
		(0.34)	(0.481)	(0.253)	(0.352)							
	Productivity	-0.3158	0.0079	0.1898	-0.1374	0.4366(**)						
		(0.208)	(0.222)	(0.147)	(0.195)	(0.173)						
	Intercept	1.1594(***)										
		(0.268)										
Italy	Lagged wage	-	-0.5032(***)	-0.2443(*)	-0.3048(*)							
		-	(0.087)	(0.131)	(0.163)							
	Inflation	-0.4661	-0.2271	0.4569(*)	0.7588(*)	0.4833	0.9737(***)					
		(0.335)	(0.29)	(0.266)	(0.449)	(0.402)	(0.336)					
	Unemployment	-1.6769(***)	-0.2585	1.8497(***)	-0.9574(*)				55%	0.96	-0.51	0.29
		(0.543)	(0.358)	(0.445)	(0.498)							
	Productivity	1.2897	-0.2738	-0.3434	-0.8983(*)	0.8221(*)						
		(1.092)	(1.141)	(0.742)	(0.524)	(0.451)						
	Intercept	0.0808										
		(0.191)										

As we have mostly gone over the parameters' interpretation before, we focus on decomposing wage growth using these models (Beta-variation figures 9 to 12) and assess both recent drivers and expectations for 2023 and the first semester of 2024. Note that as we worked on this project around March/April 2023, for a publication and the Q2 scenario around the same date, the first two quarters of the year are included in the forecast timeframe. We first look at the results for the core countries.
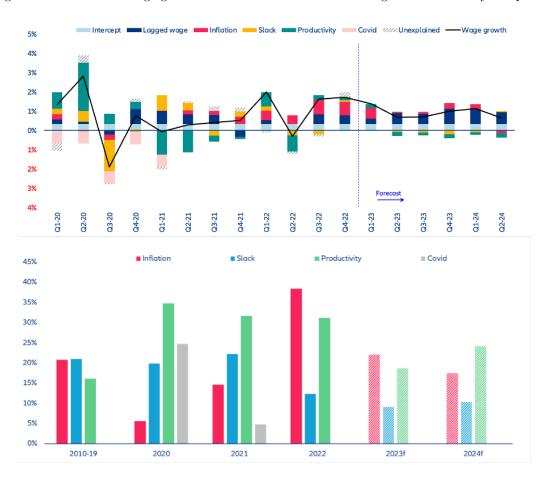
Figure 9: Model-based wage growth breakdown for France & average contribution by component.

Regarding the French economy, the model suggests the pandemic affected wage growth mainly through changes in labour productivity and the unemployment rate. The Covid dummy variable coefficient estimate, which aims at estimating on average the temporary pandemic disruption not coming from the included variables, is negative (-0.64) and significant at the 5% level. We note the chosen model performs particularly well during the pandemic period. It appears labour productivity has been a statistically key variable over the past two years, with large changes. In our view, the model shows to some extent some balancing effects in labour productivity, as the largest coefficient estimates are for the contemporaneous value and the lag 3 with opposite signs (negative then positive). We believe the strong negative coefficient for the lag 0 comes from the opposite contemporaneous changes in wage growth and labour productivity observed in the data while other lags, and especially the third, could reflect the positive link with the trend of productivity growth rather than precisely one-for-one immediate changes (the topic is also addressed in these two papers: Dew-Becker and Gordon 2005; Yellen 2005). Over the past three years, changes in labour productivity have accounted for, on average, around 33% of wage growth. We expect this contribution to decrease to 22% in 2023-24, returning close to its pre-pandemic average (17%). The falling labour productivity trend suggests downward pressures on wage growth,

visible with negative contributions from Q2 2023 onwards.

In the same vein, weaker growth economic prospects point to a relative increase in the unemployment rate (remaining close to its lower historical bound) limiting once again prospects of increases in wages. The pandemic being a pretty peculiar period, our main focus for inflation is recent developments, especially since late 2021. The figure shows that rising inflationary pressures on wages started as early as Q4 2021 before quickly rising in Q3 and Q4 2022, following the Russian invasion of Ukraine in March 2022 and the economic turmoil it engendered. It is consistent with the worldwide increase in inflation that started around mid-2021, attributed in part to supply chain problems and supply shortages amid recovery in consumer demand. The country also suffered from higher imported prices, due to already rising energy prices. With inflation's contribution to QoQ wage growth rising as high as 45% and 50% in Q2 and Q3 2022, the model suggests that after Q1 2023 at the same level, inflationary pressures on wages are to significantly decrease but remain positive. Thus, this suggests there should not be disinflation passing through to wages and we could expect positive real wage growth. Overall, according to model-based forecasts, we should expect an average yearly wage growth of 4.7% in 2023 and 2.7% in 2024 (keep in mind that our measure of wage uses the logarithm of the Hourly earn, hence another reason that our figures may differ from central bank's estimates...).

Figure 10: Model-based wage growth breakdown for Germany & average contribution by component.

It appears that, during the pandemic, wage growth in Germany was not as heavily influenced by labour productivity changes as its French counterpart. However, inflationary pressures arose sooner and stronger. The surge in inflation from mid-2021 onwards accounts for 50% of the QoQ growth rate in Q3 2021 and on average

30% between Q4 2021 and Q2 2022. The model suggests the pass-through of the war in Ukraine-induced inflation (energy-induced inflation) should be more limited in Germany compared to France, with a moderate contribution (20%) in Q3 2022 and a peak in the following quarter (60%). On the other hand, the inflation pathway used in the forecast also points to possible deflationary effects in late 2023. Again, without strong unexpected changes in the unemployment rate, we do not expect it to be that strong of a driver for wage growth. The figure also shows a higher estimate for Germany than for France, which can somewhat be interpreted as the structural level around which QoQ wage growth fluctuates. Overall, the model-based estimates still appear to fall short compared to the 4.5% estimate by the Deutsche Bundesbank, with yearly wage growth estimates of 3.3% in 2023 and 2.2% in 2024. This probably reflects differences in inflation pathways, as the German bank may embed core inflation -which they expect to remain high- into their model rather than headline inflation. There are also expected inflation adjustment premiums instruments, one-off payments "inflation compensation bonuses", which will boost effective earnings.
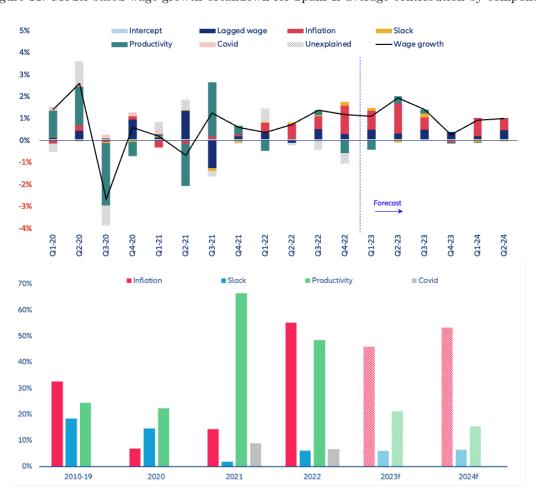
Figure 11: Model-based wage growth breakdown for Spain & average contribution by component.

Similarly to France, the Spanish model suggests labour productivity changes during the pandemic drove most of the changes in wage growth. However, the QoQ difference in the unemployment rate doesn't appear to matter as much in comparison. Our pathway projects some little increases in the unemployment rate between Q3 2023 and Q1 2024, but overall it should not be a strong driver of future wage growth. We also note the model shows some struggle during the early stages of the pandemic (Q2-Q3 2020). What is more striking is the increasing pressures of inflation on wages, not really in 2021, but from Q1 2022 and onwards. In 2022,

the contribution of inflation to QoQ wage growth increased from 45bps in Q1 to 130bps in Q4. This is well above what we have seen for the core countries but more importantly, the surge appears delayed in comparison. Looking at the coefficient estimates for the different lags of the inflation variable, the latest one included (lag 4) is positive, significant at 1% and dominates the other lags ($\beta = 0.36$ compared to -0.06, 0.12, -0.04 and 0.09).

What it tells us is that the previous year's (QoQ) inflation rate will mainly determine the inflation component of the current wage growth, and thus the with current level of inflation we can have a first intuition regarding wage growth for the year ahead. As we have already mentioned, this probably reflects lengthy and gradual wage negotiations that happen over time but it also indicates that the quarterly increases in inflation we have seen between Q2 and Q4 2022 (namely 2%, 3% and 1%) have not yet fully passed through to wages. If headline inflation is to moderate on the back of lower energy prices, the Spanish Central Bank could potentially face the challenge of rapid wage adjustment kicking in as soon as Q2 2023 -with the model suggesting a peak in QoQ wage growth at 2%- which, in addition to the 8% increase in the minimum wage (government and unions agreed on a deal in early February), could feed into higher core inflation. Overall, inflation contribution amounts to 55% in 2022 and we expect it to remain around 50% in the upcoming two years due to high past inflation. Without drastic changes in employment or GDP, we also expect the contribution of labour productivity to continue decreasing and to revert to pre-pandemic levels in 2023. Our model-based wage growth forecast for 2023 and 2024 project year-on-year increases of 4.7% and 4.2%.
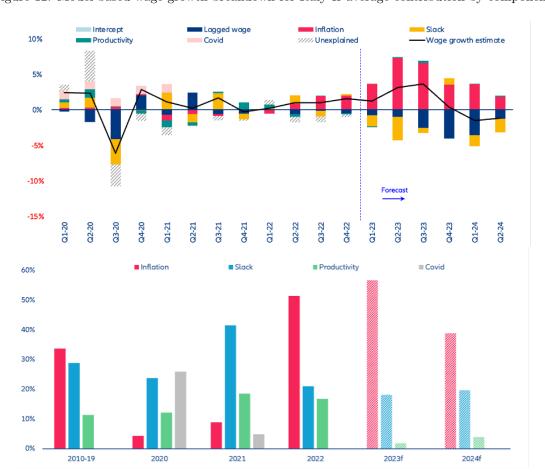
Figure 12: Model-based wage growth breakdown for Italy & average contribution by component.

Compared to the other three countries of our study quarterly changes in the unemployment rate are much more influencing wage growth in Italy. The average contribution of slack to wage developments amounts to around 30% for the 2010 to 2019 period. During the pandemic, it rose from 25% in 2020 to as high as 45% in 2021, while changes in labour productivity appear not to have affected wage growth as much as in Spain or France to some extent. In addition, our pathway expects very little changes in labour productivity, thus the low contribution. We note that Italy has the chosen model that shows the most struggle to explain wage growth at the offset of the Covid-19 crisis, the dummy variable is not enough to model a surge in Q2 2020 than a strong drop in Q3 of the same year. In hindsight, it could have been better to use two separate dummy variables for that purpose. Our forecast pathway projects the unemployment rate to increase from Q4 2022 onwards, going up from 7.8% to 8.45% by early 2024, putting downward pressure on wages. After returning to pre-pandemic levels in 2022 the overall contribution of slack should remain around 20% for 2023-2024.

Similarly to the Spanish case, inflationary pressures appear delayed around Q2-Q3 2022 and in the last semester of that year the model suggests it explains over 65% of wage growth. Looking at the breakdown details, it appears the contribution of inflation for the last semester of 2022 is mainly driven by inflation from the past 2 to 5 quarters. This is particularly relevant when assessing future wage growth for Italy as the country has recorded extremely high QoQ inflation rates throughout 2022, between 1.8% in Q2 to as high as 4.2% in Q4. The model then projects a strong pass-through of inflation to QoQ wage growth in 2023, contributing to around 60% of the whole year's changes in wages. The model-based forecast project wage growth at 6.7% for 2023 and 3.5% for 2024.

2.4   Changes in labour productivity

Labour productivity (which we defined as GDP over Employment) is a key topic when assessing the state of an economy and its outlook, as it is a driver of economic growth and it affects all players in the economy (businesses, workers and the government) through different channels whether it is output (same output with less -human resources- hours worked/workers), likely higher wages or higher tax revenues. To understand its contribution to the wage growth breakdowns above we also worked on a breakdown on its own for productivity using the number of hours worked per employee and the output produced per hour (4). The GDP per hour is also decomposed to assess the possible effect of Employment (5). We compare Q4 2022 labour productivity to pre-Covid level (Q4 2019). The two charts below and the country-specific and quarterly breakdown allow us to highlight the following points.

$$\frac{GDP}{E} = \frac{GDP}{Hours} . \frac{Hours}{E} \longmapsto Productivity\% \sim \frac{GDP}{Hours}\% - \frac{Hours}{E}\% \tag{4}$$

$$\frac{GDP}{Hours} = \frac{GDP}{\frac{Hours}{E}.E} \longmapsto GDP/Hour\% \sim GDP\% - (\frac{Hours}{E}\% + E\%) \tag{5}$$
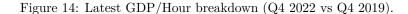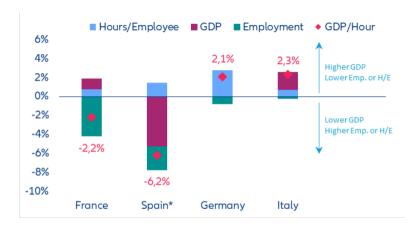
Figure 13: Latest Labour productivity breakdown (Q4 2022 vs Q4 2019).

NB: *Spain* breakdown for Q3 2022*

Figure 14: Latest GDP/Hour breakdown (Q4 2022 vs Q4 2019).

NB: *Spain* breakdown for Q3 2022*

Out of the four countries we considered only Italy shows remarkable growth in productivity compared to Q4 2019, with the other European economies lagging. Productivity growth is still in the red in France and especially in Spain relative to pre-pandemic levels while the decline has been relatively small in Germany. For the latter, the decline in Hours worked per worker has been compensated by a pick-up in GDP per Hour. Employment has slightly increased compared to Q4 2019 and GDP recovered to pre-pandemic levels (from the -10% drop in Q2 2020, it went back to 2019 levels in early 2022), the change in GDP/Hour is thus mostly driven by the decrease in Hours worked per Employee. Thus, the overall effect on labour productivity is only a matter of Employment, which slightly improved at constant GDP and explains the -0.8%.

In France, the situation is pretty different as the country shows a larger loss in labour productivity (-2.9%). What is striking is the strong increase in employment compared to Q4 2019, which reduces the need to increase efficiency and productivity. We have seen a rapid acceleration in job creation since 2021, especially regarding youth employment and apprentices. The employment rate for 15-24 years old has increased by +4.6pps between end-2019 and end-2022, against +2.0pps for the 25-49 age group and +3.1pps for the 50-64 cohort. The increase in GDP from the pre-pandemic level still does not fully compensate for the strong employment effect (the country recovered from the Q2 2020 -17% drop in Q3 2021).

Spain being the top productivity underperformer can be attributed to, on the one hand, a strong decline in GDP and on the other hand a strong increase in employment. Looking at the quarterly breakdown, Spanish GDP has not yet fully recovered from Q2 2020 GDP being down 21% compared to Q4 2019 as it remains in Q3 2022 at around -5%. Regarding employment, it started increasing as early as Q4 2021 and stands at +3% in Q3 2023. Spain has seen strong employment growth among the younger cohorts but also among the older cohort – +6.5% and +10.3%, respectively. At the same time, employment growth for the 24-49 age group declined.

Lastly, Italy has been the only country showing gains in labour productivity from 2020 onwards. Similarly to other European countries, the country's labour market has adjusted to the Covid-19 crisis via reduced working hours rather than layoffs. But at the same time, the Italian labour market differs from the other three as the countries have witnessed unemployment levels well above the one in Q4 2019 (thus decreases in employment) throughout 2020 and mid-2021. During this year and a half, employment has been between 7% and 20% below the levels seen in late 2019. Over the same period, GDP shrank (-15% in Q2 2020) but recovered from Q4 2021 onwards. The decline in working hours per employee was thus more than compensated by increasing GDP/Hour as the positive effect of the decrease in employment was, until Q3 2021, always higher than the negative effect of GDP. From Q4 2021 onwards, both positively contributed to changes in GDP/Hour which led overall to positive changes in labour productivity, standing at +1.8% as of Q3 2022.

2.5   Summary of key findings

- We find that other measures of slack can perform as best as (and sometimes better) the unemployment rate to explain wage growth. The different measures also all point towards discrepancies in inflationary pressures on wages in the peripheral countries than in the core countries.

- Wage growth has been strengthening over the past year, supported by robust labour markets and some catch-up in wages to compensate workers for high inflation. While this is likely to decelerate as inflation eases and the economy slows further in core countries, peripheral countries could potentially be challenged with delayed rapid wage increases which could put further pressure on core inflation.

- There has been divergent dynamics within the Eurozone regarding productivity changes due to structural factors, underscoring the need for a nuanced approach in addressing productivity disparities among member states.

Conclusion

Throughout this work we have firstly shown that, as the Covid-19 crisis unveiled, the six studied advanced economies experienced a period of accrued savings by households. While this stock of excess savings remains large in European countries it has started rapidly depleting in the US as soon as late 2021. In addition to the disparities between different countries' stock, we argued that these savings were unevenly distributed across income groups. We also proposed an estimate of the per-household transfer surplus that the Covid-19 pandemic induced.

We then assessed the developments of wage growth in European countries. Using the Autoregressive Distributed Lag framework we were able to compare different slack measures and their relative explainability power regarding wage changes. While our model-selection methodology showed better perfomance for some alternative slack measures compared to the standard unemployment rate to explain wage developments, we still had to select the model using the latter to compute forecast. The selected models provided insights on wage developments since the Covid crisis and highlighted the embedded increasing share of inflation. In an attempt to explain the changes in productivity affecting wage growth we showed that labour productivity changes are mainly driven by country-specific structural factors.

Rather than becoming a technical expert on a specific topic, this internship provided me with a broader view of economic subjects and ways to conduct research within an corporate environment. In retrospect, further diving -for each slack measure and underlying regulations- into a comparison analysis between the different countries would surely strengthen my understanding of local labour markets, wage dynamics and potentially shed light on results from our study. In addition to the two projects presented in this report, I also worked on topics such as a small global trade model[14]; an assessment of increasing inflation's effect on sovereign debt ratio (materials for Allianz Trade CEO[15]); or computing corporate profit margins and introducing a proxy for some industries[16].

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Annexe

1. Accrued savings since the Covid-19 pandemic

Figure 15: Disposable Personal Income computation details.

Country	Source
France	-
Compensation of employees	Eurostat Non-Financial Transactions (ESA2010)
Social transfers in kind (received)	Eurostat Non-Financial Transactions (ESA2010)
Property income (received)	Eurostat Non-Financial Transactions (ESA2010)
Current Taxes on Income, Wealth…	Eurostat Non-Financial Transactions (ESA2010)
Property income (paid)	Eurostat Non-Financial Transactions (ESA2010)
Other current transfers (paid)	Eurostat Non-Financial Transactions (ESA2010)
Germany	-
Compensation of employees	Eurostat Non-Financial Transactions (ESA2010)
Social transfers in kind (received)	German Federal Statistical Office
Property income (received)	Eurostat Non-Financial Transactions (ESA2010)
Current Taxes on Income, Wealth…	Eurostat Non-Financial Transactions (ESA2010)
Property income (paid)	Eurostat Non-Financial Transactions (ESA2010)
Other current transfers (paid)	Eurostat Non-Financial Transactions (ESA2010)
Italy	-
Compensation of employees	Eurostat Non-Financial Transactions (ESA2010)
Social transfers in kind (received)	Eurostat Non-Financial Transactions (ESA2010)
Property income (received)	Eurostat Non-Financial Transactions (ESA2010)
Current Taxes on Income, Wealth…	Instituto Nazionale de Statistica
Property income (paid)	Eurostat Non-Financial Transactions (ESA2010)
Other current transfers (paid)	Eurostat Non-Financial Transactions (ESA2010)
Spain	-
Compensation of employees	Eurostat Non-Financial Transactions (ESA2010)
Social transfers in kind (received)	Eurostat Non-Financial Transactions (ESA2010)
Property income (received)	Eurostat Non-Financial Transactions (ESA2010)
Current Taxes on Income, Wealth…	Eurostat Non-Financial Transactions (ESA2010)
Property income (paid)	Eurostat Non-Financial Transactions (ESA2010)
Other current transfers (paid)	Eurostat Non-Financial Transactions (ESA2010)
UK	-
Compensation of employees	Office for National Statistics
Social transfers in kind (received)	Office for National Statistics
Property income (ressources)	Office for National Statistics
Current Taxes on Income, Wealth…	Office for National Statistics
Property income (uses)	Office for National Statistics
Other current transfers (paid)	Office for National Statistics
US	-
Compensation of employees	Federal Reserve
Social benefits received	Federal Reserve
Rental income of persons	St. Louis Fed
Personal income receipts on assets	Bureau of Economic Analysis
Current Taxes on Income, Wealth…	Bureau of Economic Analysis
Personal interest payments	Bureau of Economic Analysis

Disposable Personal Income = Green - Red

Figure 16: French Compensation deviation to the pre-pandemic log-linear trend
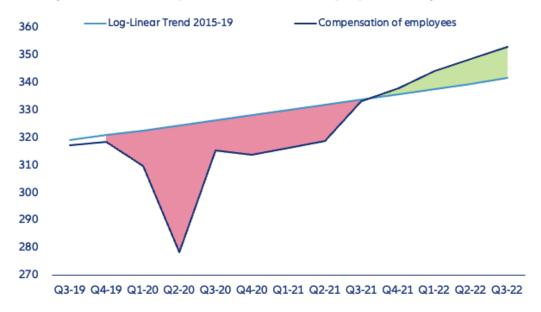

28
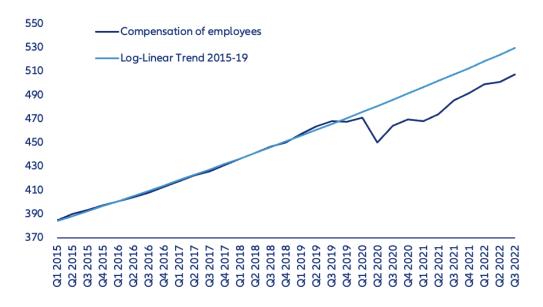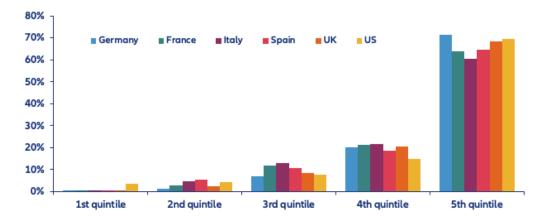
Figure 17: German Compensation of Employees

Figure 18: Total assets distribution across households

2. Wage growth drivers across European markets

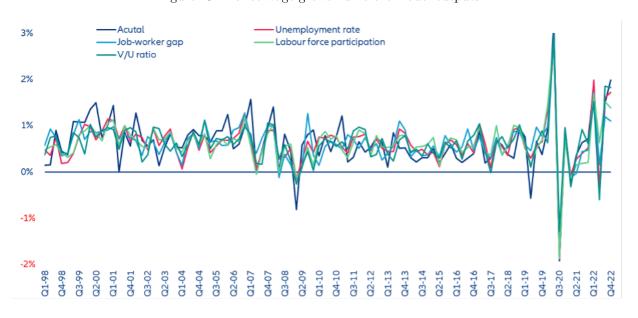Figure 19: France wage growth different model outputs

Figure 20: Germany wage growth different model outputs
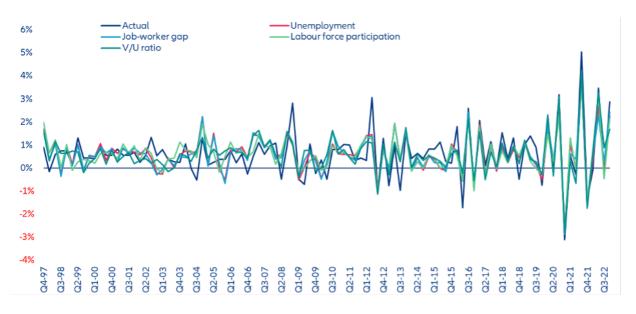
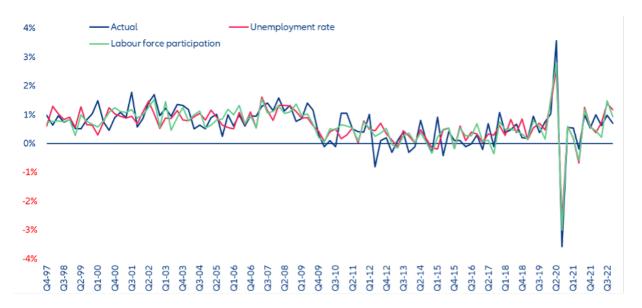Figure 21: Spain wage growth different model outputs

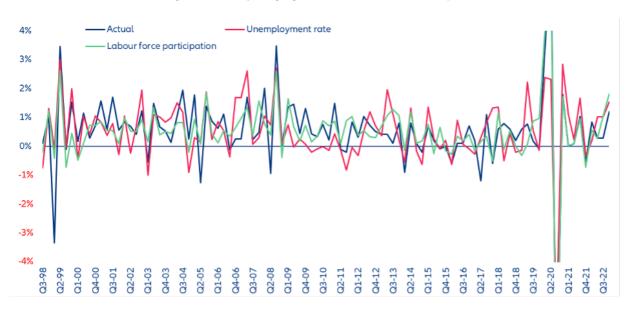Figure 22: Italy wage growth different model outputs

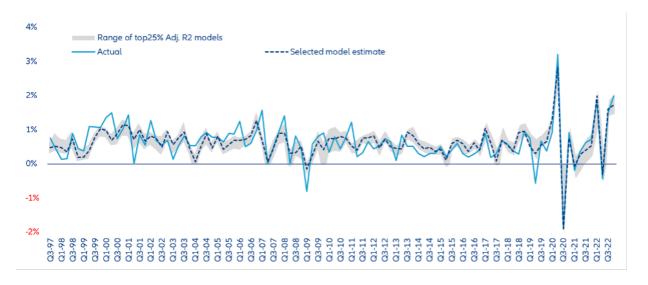Figure 23: France wage Phillips curve estimates

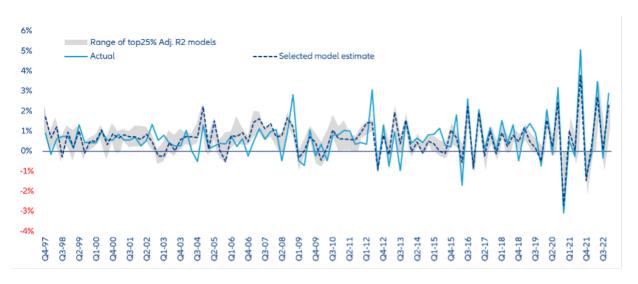Figure 24: Germany wage Phillips curve estimates
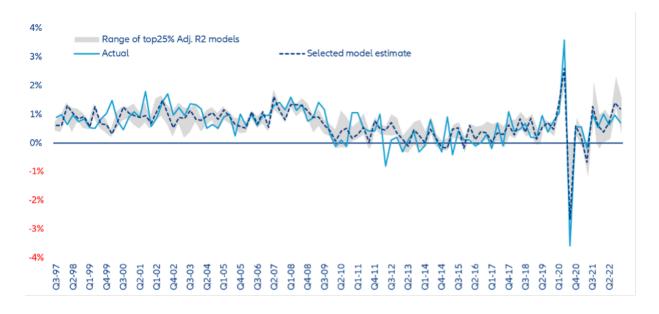

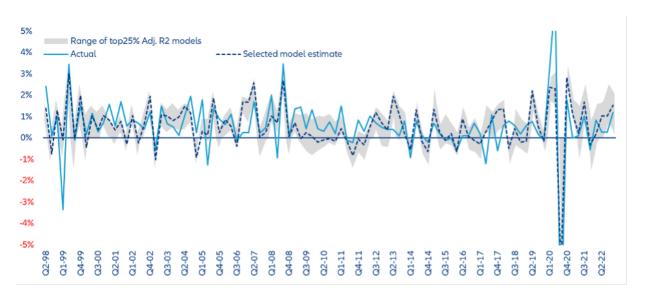Figure 25: Spain wage Phillips curve estimates

Figure 26: Italy wage Phillips curve estimates

ROUILLARD Pierre

Synthèse Stage d'Application

During the second part of my gap year, I interned at Allianz Trade within the Economic Research department of the Paris team. Following my internship at AEW I was interested in joining a research department where I could be involved in publication work on a wide range of economic subjects. In the six months I spent within the team I had the chance to work on many different releases, and I decided to focus on two specific ones.

The first part of my report sheds light on several critical aspects of the stock of household excess savings in both European countries and the United States. First and foremost, it we show that the stock of excess savings continues to be substantial in absolute terms in these regions. European countries have only recently begun to experience a slight reduction in this surplus, while American households embarked on the depletion of their savings as early as Q4 2021.

Moreover, the distribution of excess savings among income groups highlights a significant disparity. As of early 2023, the bottom 40% of the income spectrum in these regions have fully depleted their excess savings, underscoring the unequal impact of the prevailing economic conditions. Conversely, higher income households tend to view their excess savings as assets rather than immediate disposable income, resulting in a reluctance to spend, which has implications for overall economic recovery.

Furthermore, the difference in consumption patterns between the United States and European countries is noteworthy. Following the pandemic, the United States experienced a more rapid increase in consumption spending compared to European nations. However, this heightened consumption has led to a swift depletion of excess savings in the US. The increasing financial strain on American households indicates that this trend is likely to persist, potentially resulting in the complete exhaustion of excess savings throughout the year.

In light of these findings, we expect policymakers and financial institutions to closely monitor the dynamics of excess savings, as they play a pivotal role in shaping both short-term economic recovery. Addressing income disparities various income groups will be paramount in achieving a balanced and sustainable economic outlook. Additionally, a vigilant approach to managing the rapid depletion of excess savings in the United States will be crucial to ensure the resilience of households in the face of economic challenges.

The second project presented in this report shows that various alternative measures of labour market slack can perform equally well, if not better, than the traditional unemployment rate in explaining wage growth. These alternative metrics consistently reveal disparities in inflationary

pressures on wages between peripheral and core countries within the Eurozone.

Over the past year, wage growth has exhibited a notable strengthening, buoyed by robust labour markets and efforts to compensate workers for surging inflation. However, it is anticipated that this upward trajectory in wage growth may gradually decelerate, especially as inflation subsides and economic activity slows in core countries. On the contrary, peripheral countries may confront a different challenge, potentially experiencing delayed but rapid wage increases that could exert additional pressure on core inflation.

Additionally, it is crucial to acknowledge the diverse dynamics at play within the Eurozone concerning changes in productivity. These variations are largely attributable to structural factors, further underscoring the need for a nuanced approach in addressing productivity disparities among member states.

Lors de la deuxième partie de mon année de césure, j'ai effectué un stage chez Allianz Trade au sein du département de recherche économique de l'équipe parisienne. Après mon stage chez AEW, je souhaitais rejoindre un département de recherche où je pourrais participer à des travaux de publication sur un large éventail de sujets économiques. Au cours des six mois que j'ai passés au sein de l'équipe, j'ai eu l'occasion de travailler sur de nombreuses publications différentes, et j'ai décidé de me concentrer sur deux d'entre elles en particulier.

La première partie de mon rapport souligne plusieurs aspects essentiels du stock d'épargne excédentaire des ménages dans les pays européens et aux États-Unis. Tout d'abord, il apparaît clairement que ce stock d'épargne reste conséquent en termes absolus dans ces régions. Les pays européens n'ont commencé que récemment à enregistrer une légère réduction de cet excédent, tandis que les ménages américains ont commencé à réduire leur épargne dès le quatrième trimestre 2021.

En outre, la répartition de l'épargne excédentaire entre les strates de la population met en évidence une disparité importante. Début de 2023, les strate gagnant entre 0 et 40% des revenus les plus bas dans ces régions ont entièrement épuisé leur épargne excédentaire, ce qui souligne l'impact inégal des conditions économiques actuelles. À l'inverse, les ménages aux revenus plus élevés ont tendance à considérer leur épargne excédentaire comme un actif plutôt que comme un revenu disponible immédiat, ce qui se traduit par une réticence à dépenser, avec les conséquences que cela implique pour la reprise économique globale.

La différence entre les modèles de consommation des États-Unis et des pays européens est

également remarquable. Après la pandémie, les États-Unis ont connu une augmentation plus rapide des dépenses de consommation que les pays européens. Cependant, cette consommation accrue a conduit à un épuisement rapide de l'épargne excédentaire aux États-Unis. La pression croissante pesant sur les ménages américains indique que cette tendance est susceptible de persister, ce qui pourrait entraîner l'épuisement complet de l'épargne excédentaire avant la fin de l'année 2023.

À la lumière de ces résultats, nous nous attendons à ce que les décideurs politiques et les institutions financières surveillent de près la dynamique de l'épargne excédentaire, car elle joue un rôle essentiel dans l'élaboration de la reprise économique à court terme. Il sera essentiel de s'attaquer aux disparités de revenus entre les différentes strates de la population pour parvenir à des perspectives économiques équilibrées et durables. En outre, une approche vigilante relative à l'épuisement rapide de l'épargne excédentaire aux États-Unis sera cruciale pour assurer la résilience des ménages face aux défis économiques.

Le deuxième projet présenté dans ce rapport montre que diverses mesures alternatives de tensions sur le marché du travail peuvent expliquer la croissance des salaires aussi bien, voire mieux, que le taux de chômage traditionnellement utilisé. Ces mesures alternatives révèlent systématiquement des disparités dans les pressions inflationnistes sur les salaires entre les pays périphériques et les pays *core* de la zone euro.

Au cours de l'année écoulée, la croissance des salaires s'est sensiblement renforcée, grâce à la robustesse des marchés du travail et aux efforts déployés pour compenser l'inflation croissante. Toutefois, on s'attend à ce que cette trajectoire ascendante de la croissance des salaires ralentisse progressivement, en particulier à mesure que l'inflation s'atténue et que l'activité économique ralentit dans les pays *core*. Au contraire, les pays périphériques pourraient être confrontés à un défi différent, avec des augmentations salariales retardées mais rapides qui pourraient exercer une pression supplémentaire sur l'inflation sous-jacente.

Il est également essentiel de reconnaître les diverses dynamiques à l'œuvre au sein de la zone euro en ce qui concerne les changements de productivité. Ces variations sont largement attribuables à des facteurs structurels, ce qui souligne la nécessité d'une approche nuancée pour remédier aux disparités de productivité entre les États membres.

ROUILLARD Pierre

Résumé second stage