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Central Bank of Ireland

Eurosystem

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Introduction

This is the 17th edition of the Research Bulletin of the Central Bank of Ireland and its aim is to highlight economic research and associated activities conducted by Bank staff during 2023. Analytical work at the Bank in 2023 has been influenced by higher inflation witnessed in last couple of years, in the wake of the Covid-19 pandemic and the war in Ukraine, with analytical work examining its impact on various elements of the economy as well as on wage and price setting. In addition, the impact of the tightening of interest rates as a result of higher inflation and its impact on the economy has been carefully examined. An increasing amount of analytical work has focused on climate-related issues and how it affects the macroeconomic and financial system.

Our Research Technical Paper Series seeks to publish original high quality research that is academically rigorous and is suitable for publication in well regarded external peer reviewed economic and finance journals. 11 Research Technical Papers were released in 2023. The non-technical summaries for each of these papers are included in this bulletin while the full papers are available for download from the Central Bank website. Some of the recent topics explored include: assessing the impact of monetary policy communication; how monetary policy effectiveness is influenced by heterogenity in the labour market; how non-bank lenders respond to a credit supply shock; the macroeconomic impact of a carbon tax on the euro area; the macroeconomic effects of reshoring of production along national borders; and the impact of home equity subsidies on house buyers' behaviour.

Both our Economic Letters and Financial Stability Notes Series' are aimed at a general readership and seek to provide economic analysis and insight into policy related issues, data or new indicators developed in a concise fashion. The latter series examines issues germane to financial stability such as the macroprudential tools, arrears, and shadow banking issues while the former series focuses more on real economy, credit and monetary policy issues.

There were 11 Financial Stability Notes published on a range of topics including a series of notes examining the impact of higher inflation on households and firms; the interest rate exposure of mortgage holders, climate- related transition for mortgage lenders; the growth of green mortgage financing in Ireland; non-bank lending to SMEs as a source of financial stability; and the effect of 2022 Gilt Market crisis in the UK on Irish resident liability driven investment funds amongst others. All of these notes are available for download here.

There were 4 Economic Letters released in 2023 and a listing is included in this Bulletin while the actual Letters are available for download. Topics examined included, inheritance and wealth in Ireland; the interest rate pass-through of higher ECB rates to domestic customers; the decomposition of higher inflation into supply and demand components; a comparison of the evolution of inflation between the euro area and the US.

In addition, a number of signed articles featuring economic and statistical analysis were published in the Quarterly Bulletin throughout the year including articles on earning growth in a time of higher inflation; the role of the ITC services sector in the Irish economy; public finance developments and issues facing the state. These can be accessed from our website here. The Bank also publishes a number of notes on data and statistics related issues via the Behind the Data series which examine data released by the institution in greater detail. There were 8 Behind the Data releases covering topics such as carbon intensity of financial sector securities holdings; the landscape for green lending to households and firms; do Special-purpose entities hide domestic exposures of investment funds; holdings of sovereign debt by the insurance and pension sector; and the distribution of interest rates charged by non-mortgage lenders amongst others.

Also included in this edition are recent and forthcoming publications by Bank staff in peer reviewed academic journals. The Bank's visiting speaker programme fosters engagement and the sharing of knowledge between staff and a diverse range of researchers and policy makers in other domestic and international institutions. A full listing of the speakers who presented in 2023 is provided on page 18 of this Bulletin. Central Bank staff have also presented externally at a number of domestic and international conferences and institutions including: American Real Estate and Urban Economics Association, Bank of England, Central Bank Research Association, Dublin Economic Workshop, ECB, ESCB research cluster, International Banking & Finance Society, Irish Economic Association, International Conference of Macroeconomic Analysis and International Finance, International Network of Economic Research, European Economic Association, National University of Galway, Royal Economics Society, Society for Computational Economics, Society for Nonlinear Dynamics & Econometrics amongst others.

The bank hosted a number of conferences in 2023. These included a 2-day conference entitled *Financial Stability Policies in a Changing Lending Landscape* and the programme is available here. Papers focussed on the growing importance of non-bank financial intermediation, the changed higher interest rate environment, and a range of other topics related to banking systems, housing cycles, and macro-finance. The Bank also hosted its inaugural winter conference in December. The papers explored topics closely linked to the Bank's research agenda and the programme for the conference is available here. In addition, the Bank hosted the annual conference of International Journal of Central Banking in June entitled *Global Supply Chain Shocks, Trade Frictions and Inflation* and the programme is available here.

The Bank has increased its focus on research activities in 2023. We have a new website called Research Exchange where many of our activities are highlighted here. We have also increased and formalised our approach to engagement with outside stakeholders in academia and policy institutions including our various visitor programmes which can be seen here. In addition, we have also added staff profiles of our research economists to the website. The plan is to continue to enhance our research output as well as continue to foster engagment with outside audiences and foster collaboration between bank staff and outside researchers.

Non-Technical Summaries of Research Technical Papers 2023

01/RT/23: The Central Bank Crystal Ball: Temporal Information in Central Bank Communication

David Byrne, Robert Goodhead, Michael McMahon & Conor Parle

An expanding literature has documented high-frequency movements in asset prices around central bank communication events. This is taken as evidence for central banks being able to influence market expectations through their communication, causing the market reactions. For markets to respond in this way, they must have had an "information deficit" relative to the policymakers. They were unable to anticipate fully what would be said and they learned something from it that was useful for them in forming their expectations. The source of the information deficit is less clear, but is highly important for thinking about what and how central banks should communicate.

This paper contributes to the literature by showing that central bank communication about how they assess the state of the economy can be a source of the information deficit. We commonly understand central banks as setting interest rates in response to changing macroeconomic data, according to their preferences. These preferences are often referred to as the central bank reaction function. In our study we introduce the idea of an additional central bank assessment function. We begin by developing a framework for how central banks use their assessment function to process data into beliefs about the state of the economy. Having formed their beliefs, central banks apply their reaction function to make a monetary policy decision. We also model the central bank's assessment function as incorporating two distinct steps: evaluation of the data they observe and projection for the future state of the economy. These assessment steps are highly important for the practice of monetary policymaking in central banks but have been little studied in the literature before now. Standard models for the analysis of monetary policy, such as Eggertsson and Woodford (2003), see the role for communication as limited to description of the reaction function, and additional forward guidance. In these models, there is full knowledge of the structure of the economy, so it would not be useful for the central bank to communicate its assessments. Work on real-time monetary policymaking has shown that the assessment role is important, however (Orphanides, 2001). In this paper, we highlight the role of economic assessments in how communication affects asset prices. We make four main contributions. First, we provide a decomposition of market reactions that shows that they come from four channels: changes in the central bank's preferences (the reaction function), a new evaluation of the state, new projections, and release of new private information. Second, we develop an algorithm to quantify the temporal dimension in text. Evaluation looks backward and projection forward. To capture these steps, we adapt new tools from the Natural Language Processing literature for an economics context and apply them to the communications of the Federal Reserve and the European Central Bank.

Third, we show empirically that assessments are important for explaining market reactions to both the Fed and ECB. Markets react to information about the future, which includes projections and forward guidance. Backward-looking data is also extremely informative, contrary to a view that markets would only wish to learn about the future. This cap-

tures important contextualisation of data in the central bank's assessments to which markets react. Fourth, we use the press conferences that take place at the ECB to directly measure the "information deficit". Journalists'questions are important signals of the topics on which markets would like more information. We show that the more closely subsequent speeches are related to the questions in press conferences, the stronger the market reactions.

Our work indicates what is important for central banks to communicate. Even though markets may be solely interested in the outlook for monetary policy, their interest will be more than just forward guidance. Policymakers should try to communicate how they are assessing incoming data, and how this affects their thinking about both the current and future state of the economy. This goes beyond the recommendations from standard models used in the analysis of monetary policy.

02/RT/23: Measuring the Temporal Dimension of Text: An Application to Policymaker Speeches

David Byrne, Robert Goodhead, Michael McMahon & Conor Parle

When tackling economic questions, an important source of progress is the ability to bring new sources of data to bear on important issues. Thanks to advances in the Natural Language Processing (NLP) literature, recent decades have seen great increases in our ability to handle unstructured data, which are any data that do not conform to regular standards of presentation: the textual data generated by human speech is an important example.

It is likely that the impact of the use of unstructured data in economics is only just beginning to manifest itself. To date, economists have largely focussed on quantifying "two Ts" of textual data, Topic and Tone, and mapping their measures to outcomes of interest. For example, NLP tools have been used to quantify the tone of text derived from firm statements (Tetlock, 2007), to isolate references to uncertainty (Baker et al., 2016), and to study how both the topic and tone of central bank communication impacts the macroeconomy (Hansen and McMahon, 2016).

In this study we show how one can quantify a third T: Time. We synthesise two existing methods from the NLP literature, and we also make adjustments to reflect the nature of text relating to discussions of economics. By following this approach, we are able to take text relating to economics and tag individual occurrences of references to time. We tag three forms of time reference: numerical (e.g. "June 2018", "next year"), categorical ("presently", "in the future"), and grammatical (i.e. the past, present, or future tenses).

The ability to quantify how and where discussions of economics make reference to time is a very important one. Practical economic questions inevitably relate to distributions of resources over time, in some fashion. The relevant time horizon is hugely important for any discussion of risk, asset pricing, economic or financial cycles, growth, the rate at which we can discount the future, and any evaluation of policy change. By using the methods of NLP, we show how it is possible to extract the time dimension of these discussions from text in a systematic manner.

The present document is a companion paper to Byrne et al. (2022), "The Central Bank Crystal Ball: Temporal information in monetary policy communication". In this latter paper, we use our temporal indicators to summarise the ways in which monetary policymakers both evaluate data that they have access to presently (that was released in the recent past), and project into the future. We distinguish between the evaluation and projection

steps of policymaking by quantifying the time orientation of central bank communications, and we show that market participants respond to both evaluation and projection. This is important for the design of effective communication strategies. The present data is designed as a more thorough discussion of the algorithms employed. It is designed to form a useful resource for researchers who wish to quantify time in text. We hope that future research will extend, adapt, or even overhaul wholesale the approach in this study, to further extend our ability to quantify the time dimension of text.

In an application of our approach, in this study we compare the time dimension of text across documents sourced from different forms of policymaker communication. We apply our approach to speeches by central bank policymakers: the ECB and the U.S. Federal Reserve. We also compare the way central bankers use temporal references to the way they are used in documents from the International Monetary Fund (IMF), European Council, European Commission, and the European Parliament. We document important stylised facts, relating to the use of temporal references by policymakers. Our most important finding is that the three measures of temporal reference (numerical, categorical, and grammatical) are not reducible to each other, and often send different signals as to the orientation of a given sentence. This finding motivates the construction of an overall measure of temporality, based on all three measures.

03/RT/23: A Single Monetary Policy for Heterogeneous Labour Markets: The Case of the Euro Area

Sandra Gomes, Pascal Jacquinot & Matija Lozej

Two of the world's largest central banks, the European Central Bank and the Federal Reserve have recently conducted a review of their monetary policy strategies. A common feature of both strategy reviews was the considerable attention paid to employment-related issues. Distributional issues were an important consideration and both central banks produced background documents that looked at heterogeneity, either between households or among countries in the monetary union. In the euro area, the heterogeneity dimension is not only important across households, but also across countries within the monetary union.

This is particularly the case for labour markets, which are less integrated than those of the US and are governed by country-specific legislations. Differences in labour market institutions between countries of the monetary union can give rise to different responses to shocks across countries, even when the shocks hit all monetary union regions symmetrically.

Our paper provides an analytical framework that addresses both cross-country and within-country labour market heterogeneity in a monetary union. In particular, we develop and use a new version of the Euro Area within the GLobal Economy model (the EAGLE model), a large-scale open-economy model that is augmented with an enhanced labour market, modelled using search-and-matching frictions. Each country is modelled as a two-agent New Keynesian model (a so-called TANK model) with Ricardian ("wealthy") and non-Ricardian ("poor") households. Each type of agent faces a labour market with its own particular characteristics regarding job finding and separation rates, bargaining power, and nominal wage rigidity. The latter is modelled so that it allows distinguishing wage stickiness for new hires and for existing employees. Importantly, because non-Ricardian households are constrained in terms of consumption smoothing, their consumption depends mainly on their

labour income, which in turn depends on the labour market situation for these households.
We use the model to study the implications of cross-country heterogeneity for the conduct of monetary policy in a monetary union. We first compute responses to a common expansionary demand shock, which increases inflation and reduces unemployment, across the monetary union under three different monetary policy rules: a benchmark Taylor rule that includes a response to inflation and unemployment, a Taylor rule that includes an asymmetric response to unemployment, and average inflation targeting rule. For all these three rules, we distinguish between cases where the central bank does not respond to unemployment and the cases where it does. We next compute the responses to an inflationary supply shock, which increases both inflation and unemployment. For each type of shock, we compare the performance of rules in terms of inflation and employment stabilisation, and in terms of cross-country and cross-household heterogeneity within the monetary union.
We find that when monetary policy responds to unemployment developments, then this results in stronger unemployment decrease after expansionary demand shocks and lower unemployment increase after a contractionary supply shock. While this does lead to a faster and stronger increase in inflation, it also results in a fast return of inflation to lower levels after the supply shock. Responding to unemployment tends to lower inequality between and within countries of the euro area. If monetary policy ignores unemployment and responds only to inflation, this leads to larger fluctuations of output and (un)employment. Moreover, these fluctuations increase divergence between the euro area economies as well as within-economy divergence among households. The effect on between-household consumption differences is, however, different for expansionary and contractionary shocks. When the central bank does not respond to unemployment, the difference between consumption of different types of households goes in favour of the poor households after an expansionary demand shock, while after an inflationary supply shock this difference goes in favour of richer households.

04/RT/23: Housing assistance policy for mortgage borrowers: Liquidity improvements or price

Fergal McCann & Anuj Pratap Singh

How are public subsidies absorbed in the markets to which they are targeted? Do they achieve their stated up-front aims? Do they benefit particular groups more than others? Do they have unintended adverse consequences? Given that public funds are scarce, studies that ask these questions are a critical and necessary part of the assessment of any fiscal program. In the case of housing assistance schemes, research has typically focused on broad questions, for example whether or not such schemes have added inflationary pressure to house prices, or whether they have stimulated housing supply.
In this study, we take a granular view using borrower-level data available to the Central Bank of Ireland on new mortgage lending in Ireland. We focus on the Help to Buy (HTB) scheme, which provides cash grants to support downpayments of new mortgage borrowers in a subset of the Irish mortgage market. With our detailed dataset on borrowers, we focus on the borrower-level responses, rather than macroeconomic effects, of a substantial enhancement to the scheme introduced in July 2020.
We assess three ways in which borrowers can respond to an enhanced grant payment for

house purchases: liquidity, equity, and purchase prices. Methodologically, we construct treatment and control groups, by virtue of the eligibility criteria within the scheme, to allow a difference-in-difference estimation of the causal effects of the policy change to be carried out.

We find that liquidity enhancement is the dominant response: once borrowers can access grants that are up to €10,000 larger, they reduce the size of their posted out-of-pocket downpayment by almost exactly as much. The implication is that these funds are now available either to boost consumption, or to improve liquidity buffers for the household. Looking across the income distribution, we find stronger effects among low to middle income borrowers, suggesting that liquidity constraints are most salient for this group. We find only modest effects on either equity improvements or purchase prices. On equity, we show that only higher-income borrowers reduce their LTV ratio or loan amounts. Similarly, we find that only the highest-income borrowers increase their purchased prices in response to the more generous subsidy.

Of particular interest to policymakers is that we are studying housing assistance payments in an environment where macroprudential mortgage regulation is in place. Since 2015, these measures have restricted mortgage borrowers'maximum borrowing amount relative to income and purchase price. HTB, at the same time, boosts the resources available to potential house-buyers thereby relaxing the downpayment requirement, or in some cases, reducing the required mortgage amount. We are unaware of a previous 2 study that shows how housing grants are absorbed into the market when macroprudential regulation is imposing credit limits.

Our findings suggest that liquidity retention is the main effect of the HTB policy for these borrowers. This would be consistent with HTB easing some of the liquidity costs associated with building the downpayment for house purchase. We find no evidence of any changing composition of mortgage borrowers after the policy change, suggesting that entry of households with very different characteristics (for example, income or age) was not a consequence of the change in the scheme. Finally, our estimates suggest that borrower leverage does not noticeably change when subsidies become more generous, nor do we find any borrower-level evidence that would point to widespread inflationary effects of the changes in the HTB scheme in 2020, although the analysis - by design - is not general-equilibrium in nature.

05/RT/23: The macroeconomic effects of global supply chain reorientation

Daragh Clancy, Vilém Valenta & Donal Smith

The COVID-19 pandemic and heightened geopolitical tensions, from events such as Brexit, US/China trade tensions and beyond all the Russian invasion of Ukraine, have increased concerns over the smooth functioning and security of global supply chains. Policymakers around the world are reconsidering the trade-off between efficiency and resilience inherent in global supply chains. Many have introduced legislation seeking to encourage the local production of key inputs to reduce risks emanating from excessive dependencies on external suppliers. Despite the importance attached to achieving this policy goal, the macroeconomic implications of global supply chains reorientation remain little explored.

We analyse the macroeconomic effects of global supply chain reorientation through localisation policies, such as partially reshoring production and partially friend-shoring produc-

tion towards "trusted partners", using a global dynamic general equilibrium model. We model three regions of the global economy: the euro area, the United States, and the rest of the world. The regional economies are linked with each other through bilateral trade and participation in international financial markets, with bloc-specific calibration. To analyse reshoring, we gradually reduce, over a period of 10 years, the share of euro area imports used as inputs in domestic production and replace these imports with locally produced goods. To analyse friendshoring, we gradually reduce the share of euro area imports from the rest of the world and replace them by imports from trusted partners, in this case the U.S.

Our approach has several advantages. First, it allows for a comprehensive treatment of cross-border macroeconomic interdependences and spillovers between the different regions. Second, it permits an analysis of non-tariff mechanisms, which are so far dominating the localisation agenda. Finally, we are able to assess three key aspects of localisation policies: transition dynamics, long-run effects, and implications for resilience. The main disadvantages compared to trade models are less granularity in modelling cross-border linkages and less flexibility in delineating the trade blocks.

We find that localisation policies are inflationary and imply transition costs in the short to medium run. The long-term impacts of localisation policies on aggregate domestic output are generally negative. The size (and sign) of these impacts depends on whether these policies are implemented unilaterally or as a part of a global shift and the extent to which they lead to a reduction in domestic competition and productivity. Once domestic producers are not exposed to foreign competition, they have greater ability to increase prices. For goods where the quality of local production is not as high as the foreign competition, as is the case for chips, reshoring would also lead to lower productivity. These negative effects would likely offset any positive impact from moving production back home, resulting in permanently lower domestic aggregate output.

A key motivation for reorientating supply chains is to boost economic resilience. We analyse whether this is the case by comparing the response of the status quo and a reshored European economy to adverse regional and global shocks. We find that untargeted localisation policies do not necessarily improve macroeconomic resilience against shocks that proxy supply chain disruptions. Sensitivity of the reshored economy to regional shocks increases, while its resilience to global shocks improves only marginally.

Based on these results, we provide some recommendations for policymakers considering implementing the localisation agenda. While the Open Strategic Autonomy 2 agenda is rooted in concerns over and beyond economics, European policymakers need to consider ways to reduce the costs of this adjustment. First, free trade should remain Europe's driving economic principle and any localisation policies should focus only on essential goods. Second, maintaining effective state-aid rules may limit the negative impact of reshoring on domestic competition. Third, localisation policies should focus on goods that are not too far from the technological frontier to limit negative impacts on productivity. Finally, policymakers should seek greater ties with regions that are not potential competitors for the same type of goods.

06/RT/23: The Last Mile of Monetary Policy: Inattention, Reminders, and the Refinancing Channel

Shane Byrne, Kenneth Devine, Michael King, Yvonne McCarthy & Christopher Palmer

Mortgages are an important financial product so any decision to impact long-term repayment levels will have significant implications on household finances. Borrowers often have the opportunity to refinance their mortgage, to change terms within their current provider, and take advantage of more favourable interest rates. However, previous research has documented a widespread "failure to refinance", where substantial savings available to mortgage holders through refinancing are not claimed. At the macroeconomic level, this suboptimal refinancing may significantly limit the power of the refinancing channel of monetary policy transmission. The impact of low levels of refinancing on monetary policy transmission is an example of the "last-mile problem" of monetary policy because it inhibits the delivery of policy to the real economy. Underrefinancing can also leave borrowers with unnecessarily elevated debt-service burdens, and as such, is an important issue for consumer protection.

In this paper, we study an intervention targeted at improving the last-mile delivery of monetary policy to the real economy. We use a field experiment combined with a model of inattentive financial decision-making to demonstrate that targeted communication can help overcome frictions that inhibit the refinancing channel of monetary policy transmission. To do this, we partnered with a large retail bank in the Irish mortgage market to analyse the results of a field experiment with a random sample of 12,000 customers, testing whether a series of behaviourally enhanced versions of an existing financial disclosure have a positive impact on the take-up of refinancing opportunities. Our results show that the best performing tested combination of redesigned disclosures and follow-up reminders increases the take-up of in-the-money refinancing opportunities by 76%, from 8.9% to 15.7%, substantially more than any previous study in the literature. The average savings achieved by refinancing borrowers in our data is €1,209 just in the first year. This demonstrates how small targeted changes to consumer disclosures can deliver substantial impacts in the real world.

A behavioural model of inattentive refinancing shows that reminders have large attention effects, increasing the share of attentive households from 24% to 39%. We use the estimated model to contrast the relative effectiveness of cutting interest rates with sending refinancing reminders. We find that the best performing communication increases refinancing by significantly more than would be achieved by a 100 basis point (bp) decrease in mortgage rates. Therefore, regulatory interventions that enhance lenders'communication to customers, such as refinancing reminders - or, in a more theoretical setup, targeted central bank communications - could have a larger effect on refinancing than a standard policy rate cut. During an expansionary monetary phase, offer letters and reminders can improve interest rate pass through and strengthen the impact of interest rate reductions on the real economy.

Our results contribute to a growing body of evidence that demonstrates the value of behaviourally informed approaches in delivering effective consumer protection in essential product markets. In particular, our results are the first to demonstrate statistically and economically meaningful improvements in the stubbornly persistent puzzle of low take up of advantageous mortgage refinancing opportunities.

07/RT/23: Foreign economic policy uncertainty shocks and real activity in the Euro area

Filippo Arigoni & rt Lenari

Do exogenous changes in economic policy uncertainty originating abroad affect real activity in the Euro area? A recent literature has shown that unexpected outcomes of policy decisions can be a key determinant of economic performance. The increase of markets and countries'interdependence has generated a strong link also in the field of cross-country economic policy decisions and related disturbance. Implications of foreign economic policy uncertainty can be in fact non-negligible for domestic real activity. The contagion scheme foreign economic uncertainty-domestic real business cycle can be of interest for policy-makers to understand whether the propagation mechanism is homogeneous despite the origin the foreign economic policy uncertainty.

In this paper, we study the effects of economic policy uncertainty shocks that originate in the US and China for the Euro area economy. Our approach allows to focus on the implications of foreign economic policy uncertainty shocks for the real business cycle in the Euro area.

Our results show a medium-term deterioration of real activity for the Euro area after both an economic policy uncertainty shock in the US and China. A comparison between domestic and foreign uncertainty testifies that foreign economic policy uncertainty is more relevant than its domestic counterpart when it comes to real business cycle fluctuations. We expand the analysis to understand whether the two sources of foreign economic policy uncertainty propagate similarly into the Euro area economy. We find that, despite comparable effects of US and Chinese economic policy uncertainty shocks, the transmission mechanism substantially vary. While US economic policy uncertainty impacts real activity exclusively via foreign-domestic uncertainty spillovers, uncertainty that originates in China transmits into the Euro area also via trade. The results about the heterogeneity of the transmission channel are confirmed also by a country-level analysis on the Netherlands.

The outcomes of this study document that, despite similar effects of economic policy uncertainty that originates in the US and China for the Euro area real activity, the transmission mechanisms of the two shocks substantially vary. This conclusion can be a key point for policy-makers in the time of managing the negative effects stemming from foreign economic policy uncertainty. The origin of the shock calls for ad hoc policy intervention since the "one fits all" approach cannot be desirable given the different channels of the propagation mechanism of foreign economic policy uncertainty into the Euro area economy.

08/RT/23: Macroeconomic Effects of Carbon Transition Policies: An Assessment Based on the ECB's New-Area-Wide Model with a Disaggregated Energy Sector

unter Coenen, Matija Lozej & Romanos Priftis

In this paper, we use scenario analysis to assess the macroeconomic effects of transition policies aimed at reducing carbon emissions in the euro area, with a focus on tax policies that raise the price of carbon emissions. To carry out the analysis, we employ a version of the ECB's New Area-Wide Model (NAWM) which has been augmented with disaggregated energy production and use, where intermediate-good firms and households demand an energy composite for production and consumption purposes. The energy composite is produced by an energy provider which aggregates "dirty" and "clean" energy inputs. These inputs are in turn produced from imported fossil resources, the use of which causes carbon emissions, and from domestic renewable resources.

We use the augmented version of the NAWM to conduct simulation around a central carbon tax transition scenario. The central scenario is empirically grounded in measures of Effective Carbon Rates (ECRs) provided by the OECD, which capture the price of carbon emissions at the sectoral and country level. Specifically, the scenario assumes a steady and linear increase in the average ECR for the euro area to a target rate of EUR 140 per tonne of CO2 over the period from 2022 to 2030. This target rate is broadly consistent with estimates of the International Energy Agency (IEA), according to which advanced economies need to raise the price of carbon emissions to USD 140 per tonne of CO2 in 2030 in order to meet their longer-term net-zero commitments.

Our simulation results for the central carbon tax transition scenario suggest that the assumed increase in the price of carbon emissions has a limited overall impact on the economy. Consumer price inflation rises as higher energy prices feed both directly and indirectly into the price of the aggregate consumption bundle of households. The rise in annual inflation is gradual and hump-shaped, reaching a peak of around 0.2 percentage point in the course of 2023, before slowly receding by the end of 2030. On average, inflation increases by less than one-tenth of a percentage point over the scenario period from 2022 to 2030. At the same time, higher energy prices put only modest upward pressure on inflation excluding energy via their impact on intermediate-good production costs. On the real side, aggregate consumption falls by about 0.7% over the medium to longer term. The fall in investment is stronger, with a decline of close to 2.5% at the trough. The implied decline in aggregate demand translates into a gradual but lasting fall in GDP by around 1.2%, shaving off about one-eighth of a percentage point from GDP growth per annum over the scenario period. At the sectoral level, the increase in carbon prices operates by affecting relative energy prices. Hence, the aggregate energy provider is incentivised to substitute away from utilising more costly dirty energy and into utilising clean energy. Due to the lower use of dirty energy in aggregate energy production and the overall fall in aggregate energy use, carbon emissions are reduced by roughly 7% in the medium to longer term. As the carbon tax increase in our central scenario is the only policy measure considered, this reduction must necessarily falls short of the targeted emissions levels of a comprehensive net-zero decarbonisation strategy.

Sensitivity analyses carried out around the central carbon tax transition scenario shows that the short and medium-term effects depend, inter alia, on the monetary policy reaction, on the path of the carbon tax increase and on its credibility. Expanding clean energy supply is key for containing the decline in GDP and the increase in inflation as well as accelerating the reduction in carbon emissions. Undesirable distributional effects can be addressed by redistributing the fiscal revenues from the carbon tax increase to low-income households by means of targeted transfers.

09/RT/23: Do non-bank lenders mitigate credit supply shocks? Evidence from a major bank exit

Fergal McCann, Niall McGeever & Oana Peia

Banks play a critical role in facilitating economic activity through the provision of external financing to businesses. Disruptions or shocks to banks'willingness, or ability, to provide loan financing to the real economy can therefore have knock-on implications for the wider economy. One way in which these consequences of weaker bank credit supply can be mitigated or avoided is through the substitution of financing sources to other lenders, who can fill unmet credit demand after negative shocks to credit supply. In the past decade, a growing evidence base has shown that non-bank financial intermediaries, those entities that do not take deposits and are therefore subject to a different regulatory regime to retail banks, are playing an ever-more important role in financing the economy and filling financing gaps left by retail banks.

In this paper, we provide novel evidence tracing out a negative shock to credit supply to Irish businesses, along with the role that non-bank lenders play in mitigating this shock. We study the announcement in late 2020 by Ulster Bank's parent group, Natwest Group Plc, that it was reviewing its operations in Ireland. This was followed in the spring of 2021 by the confirmation that Ulster Bank's activity was indeed being wound down in Ireland.

We first estimate the probability of a new loan drawdown, comparing the period before and after September 2020, and comparing borrowers with Ulster Bank loans in the two years before the announcement (the treatment group) with a control group of borrowers unaffected by Ulster Bank's exit. We estimate that these borrowers are 3 percentage points less likely to draw down a new loan in the period after the announcement when compared to other unaffected borrowers.

The importance of banking relationships can be inferred from these results: if bank credit was perfectly substitutable across lenders, one would expect that Ulster Bank's customers could seamlessly transition to other lending sources in the period after the announcement. Our findings that they are less likely than the control group to access new lending suggests there is indeed value within the client-bank relationship, and that transitioning to new lending relationships comes with a cost.

We then confirm that, in line with a growing international literature, non-bank lenders represent an alternate source of financing to which Ulster Bank's borrowers were at least partially able to substitute. Our results suggest that both the probability of getting a new loan and the size of loan volumes were greater among the Ulster Bank customers who switched to non-bank sources of financing in the period after the exit 2 announcement. These patterns are strongest among business lending, rather than in the asset finance and leasing segments where non-banks are typically more dominant in Ireland.

Finally, we show that the size of the negative credit supply shock and the mitigating role played by non-banks were larger among smaller, more leveraged, and less liquid firms, in line with previous findings internationally and domestically that non-banks are more likely to finance riskier firms.

There are numerous policy conclusions from our work: firstly that disruptions to banks'provision of financing to the real economy do come with costs for borrowers, who cannot perfectly substitute to other sources of borrowing; secondly that nonbanks can indeed play a role in filling financing gaps that emerge when bank credit supply is restricted; thirdly that riskier firms, typically less likely to be able to access bank financing, are more likely to substitute towards non-bank sources of finance, which may bring both benefits in terms of growth as well as greater medium-to-longer term risk.

10/RT/23: Who Gets Jobs Matters: Monetary Policy and the Labour Market in HANK and SaM

Uro Herman & Matija Lozej

This paper investigates the implications of labour market heterogeneity for monetary policy. Real-world labour market is not homogeneous, and the probability that workers find or lose jobs depends on a number of factors, such as skills, industry etc. While wages are important, the main factors that determine the fluctuations in labour income of a household are the probability to find a job and the probability to lose a job. However, it is not only the levels of these probabilities that matter for labour market outcomes, but also how much they move over the business cycle. To show this, we first report a set of new empirical estimates of job finding and separation rates by educational attainment and their cyclical properties for several European countries. We find that job finding rates for the less educated workers are lower, highly procyclical, and more volatile than for the better educated workers. We also find that separation rates for less educated workers are higher, tend to be more volatile, and often acyclical compared to those for the well-educated workers. There are considerable differences across European countries, but in all cases fluctuations in job finding rates contribute the most to fluctuations in unemployment of the less educated over the business cycle, exceeding 80% in countries like Germany and France. We report similar evidence for the US. In all cases, empirical evidence suggests that workers with low educational attainment face higher employment risk over the business cycle than workers with high educational attainment. We then build a stylised model with the search and matching (SAM) framework embedded in a heterogeneous-agent New Keynesian (HANK) model that attempts to capture these empirical properties.

The labour market in the model consists of a set of separate labour markets corresponding to skill levels, and movements between these markets are rare and can be thought of as persistent changes in the desirability for a particular skill. Each labour market is different with respect to wage levels, job finding probabilities, and their cyclical properties. On each labour market the job finding probability depends on firms' incentives to create vacancies. These incentives vary with economic conditions, so that the number of vacancies posted by firms and the strength of their response to shocks differs across labour markets. Income fluctuations for households in the same labour market occur because search frictions, combined with wage rigidities, lead to an increased vacancy posting following an expansionary monetary policy shock, which increases job finding rates and therefore expected labour income within each labour market.

Because the intensity of vacancy posting differs across labour market segments, the differences between labour market segments change over the business cycle and affect the idiosyncratic labour income risk for households. In other words, the income loss/gain due to exogenous shifts from one labour market to another is changing over the business cycle. We use this framework to investigate the implications of such heterogeneous labour markets for monetary policy. Because workers with lower educational attainment have lower wages and are more likely to be unemployed (in the model and in the data), these workers tend to be poorer than highly-educated workers, whose wages are higher and who are less likely to be unemployed. Because poorer workers also have high marginal propensities to consume from additional income, changes in their employment situation matter more for aggregate consumption and therefore aggregate demand. We show in the model that when less educated (and relatively poor) work-

ers obtain more jobs than other workers after a monetary expansion, which is consistent with empirical evidence for most countries we consider, they also spend a larger proportion of the additional income. This amplifies the increase in aggregate demand after a monetary expansion, which leads to more labour demand, because firms have to hire additional workers in order to produce to meet demand. Because the labour market for workers with lower education is more sensitive to the business cycle, this leads to a relatively stronger increase in employment of these workers, which again leads to a stronger increase in consumption. This feedback loop works as an amplification mechanism that makes monetary policy effects on output more potent.

What turns out to be important for the amplification is the asymmetry of the labour market, in the sense that the labour market for the less educated (and poor) reacts more procyclically than the other labour markets. We show that this can be brought about by two mechanisms that amplify vacancy posting. One such mechanism is a relatively low and, hence, more volatile firm surplus from hiring a worker with a lower educational attainment, and the other is a higher wage rigidity for such workers.

11/RT/23: Understanding the Joint Dynamics of Inflation and Wage Growth in the Euro Area

Vahagn Galystan

This paper presents an empirical framework and analysis of the interactions among inflation, wages, employment, and output in the euro area. Results identify price shocks and demand shocks as the primary exogenous factors explaining historical variance. The wage gap emerges as a key determinant of wage dynamics in the aftermath of a price shock. In contrast, the output gap becomes dominant following demand shocks. The real wage gap acts as a corrective mechanism, ensuring that prices and wages in particular align with the broader economic landscape. Forecasts for the period starting 2023Q3 emphasise the enduring significance of the real wage gap, projecting its ongoing impact on nominal wages in tight labour markets. As for inflation expectations, the estimates emphasise their stickiness. In this context, the significant and persistent price shock that has occurred suggests a gradual decline in expectations, potentially leading to an extended period of elevated inflation

Economic Letters

1. The Long and Short of it: Inheritance and Wealth in Ireland
   Simone Arrigoni, Laura Boyd & Tara McIndoe-Calder
2. How Different is Euro Area and US inflation?
   Dilan Aydin Yakut
3. Transmission of Monetary Policy: Bank Interest Rate Pass-through in Ireland and the Euro Area
   David Byrne and Sorcha Foster
4. Supply and Demand Determinants of Inflation in Ireland
   Daragh McLaughlin and Thomas Conefrey

Financial Stability Notes

1. An Estimate of Climate-Related-Transition Risk in Irish Mortgage Lending
   Tamanna Adhikari, James Carroll & Derek Lambert

2. The Interest Rate Exposure of Mortgaged Irish Households
   David Byrne, Fergal McCann & Edward Gaffney

3. Household Resilience to Expenditure and Debt Service Channels under Current Inflationary Conditions
   Tamanna Adhikari & Fang Yao

4. Going Green: The Growth in Green Mortgage Financing in Ireland
   Derek Lambert, Paul Lyons & James Carroll

5. New Survey Evidence for Household Resilience to Current Shocks
   Fang Yao

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   Tamanna Adhikari & Niall McGeever

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   Peter Dunne, Angelica Ghiselli, Frits Ledoux & Barra McCarthy

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   Sameer Shaikh, Paul Kilgarriff & Edward Gaffney

10. Interest Rate Sensitivity of Irish Bond Funds
    Ilaria Gianstefani, Naoise Metadjer & Kitty Moloney

11. Non-Bank Lenders to SMEs as a Source of Financial Stability Risk - A Balance Sheet Assessment
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Behind the Data

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   Brian Golden, Aisling Kerr & Arya Pillai

5. The Insurance Pension Sovereign Nexus
   Mark Mulholland

6. New enhanced Card Spending Data for Irish Households: Domestic Payment Activity and Regional Distributions
   Ciaran Meehan

7. Surveying the Green Lending Landscape to Households and Non-Financial Corporations
   Sionbhán O'Connell, Sinéad Murphy & Cecilia Sarchi

8. Understanding the Carbon Intensity of Ireland's Financial Sectors' Securities Holdings
   Bernard Kennedy & Jenny Quinn

Visitor Seminar Series

Speaker	Institution	Title
Juan Rubio Ramirez	Emory Univ	Uniform Priors for Impulse Responses
Carlos Montes-Galdon	ECB	Conditional density forecasting: a tempered importance sampling approach 11 am, in person
Antonio Marsi	Bologna	The effect of anti-fragmentation policies across the business cycle
Francesco Lucidi	Sapienza	The effects of temperature shocks on energy prices and inflation in the Euro Area
Benjamin Born	Frankfurt	A temporary VAT cut as unconventional fiscal policy
Elio Bolliger	Lausanne	Inflation Expectations, Perceptions and News Media: Regional Differences in Switzerland
Emanuele Franceschi	ECB	Inflation Persistence
Klaus Adam	Mannheim	Inflation distorts relative prices: Theory and evidence
Karel Mertens	Dallas Fed	The Returns to Government R&D: Evidence from U.S. Appropriations Shocks
Marta Karas	Wraclow	Systemic Turbulence
Pei Kuang	Birmingham	Macroprudential Policy and Housing Market Expectations
Ralph Luetticke	Tuebingen	Foreign portfolios and domestic business cycles with heterogeneous agents
Andrew Hannon	Cambridge	Housing, Rental Markets, Mortgage Policies and the Wealth Distribution
Margarita Rubio	Nottingham	The macroprudential toolkit: effectiveness and interactions
Sara Spaziani	Brown	Optimal Unemployment Insurance with Interindustry Subsidies and Labor Reallocation
Kevin Devereux	Peking	When and Where do Minimum Wage Hikes Increase Hours? Evidence from Ireland
Neeltje Van Horen	Bank of England	SME Exposure to Inflation Risk: The Role of Leverage
Tom Holden	Bundesbank	Robust Real Rate Rules
Filippo Pallotti	UCL	Who Bears the Costs of Inflation? Euro Area Households and the 2021–2022 Shock
Dmitriy Sergeyev	Bocconi	The Economics of Financial Stress

Saad Aftab	Queen Mary	Do Wealth Management Products Exacerbate Bank Systemic Risk?
Marcel Peruffo	Sydney	Distributive Effects of Banking Sector Losses
Francesco Furlanetto	Norges Bank	Did Monetary Policy Kill the Phillips Curve - Some Simple Arithmetics

External Publications

Journal Articles

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Forthcoming

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Cronin, David and Niall McInerney, "Institutional Quality and Official Budgetary Forecast Performance in EU Member States," FinanzArchiv - European Journal of Public Finance.

Gori, Etiene Lepers Filippo and Caroline Mehigan, "Capital flow deflection under the magnifying glass," International Journal of Finance & Economics.

T: +353 (0)1 224 5800
www.centralbank.ie
enquiries@centralbank.ie

Bosca PO 559, Baile Átha Cliath 1, Éire
PO Box 559, Dublin 1, Ireland