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Macroeconomic Dynamics and Financial Stability: Insights from Albania's Response to Crisis, Migration, and Exchange Rate Volatility

Doctoral Dissertation

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Declaration of Authorship

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Prague, October 10, 2025 Lorena Skufi

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Abstract

This thesis consists of three interrelated studies that examine critical economic phenomena in Albania, each contributing to a deeper understanding of the challenges posed by macroeconomic uncertainty, migration, and exchange rate fluctuations. The articles explore the application of macrofinancial models in turbulent times, the feedback loop between migration and inflation, and the role of FX hedging in mitigating the impact of exchange rate changes on credit risk. Collectively, these studies contribute to the literature on economic stability, offering insights that are relevant to policymakers, financial institutions, and researchers in small open economies.

The first article develops a linear macrofinancial model for the Albanian economy to analyze the macroeconomic and financial impacts of the COVID-19 pandemic during 2020-2021. The study addresses the challenge of forecasting economic developments in times of increased uncertainty by using quantile regression to construct uncertainty bands. The results show that the linear model is sufficiently flexible to capture the effects of non-linear events like the pandemic, demonstrating its applicability for analyzing economic shocks in abnormal times.

The second article investigates the relationship between migration, remittances, and wage-inflation pressures in Albania. By constructing a dynamic model, the study reveals a feedback loop between migration and inflation, where permanent decline in population leads to inflationary pressure in the medium term. The paper also highlights how remittances exacerbate inflationary pressures and discusses potential mitigation strategies, such as increasing labor force participation and raising the retirement age.

The third article examines the impact of exchange rate fluctuations on credit risk, focusing on non-performing loans in Albania. Using a bank-level dataset, the study differentiates between hedged and unhedged borrowers and analyzes their respective sensitivities to exchange rate changes. The findings suggest that unhedged non-financial corporations are more vulnerable to exchange rate fluctuations, while the opposite holds for households. This study provides valuable insights into the role of FX hedging in managing credit risk in a small open economy.

JEL Classification	C23, C32, C53, E66, G3, J11
Keywords	COVID-19 pandemic, macro-financial modeling, quantile regression, demographics, inflation, wage, remittances, NPls, hedging
Title	Macroeconomic Dynamics and Financial Stability: Insights from Albania's Response to Crisis, Migration, and Exchange Rate Volatility

Abstrakt

Tato disertace se skládá ze tří vzájemně propojených studií, které zkoumají klíčové ekonomické jevy v Albánii, přičemž každá studie přispívá k hlubšímu porozumění výzvám, které vyplývají z makroekonomické nejistoty, migrace a kolísání měnových kurzů. Články se zaměřují na aplikaci makrofinančních modelů v turbulentních obdobích, zpětnou vazbu mezi migrací a inflací a roli měnového zajištění (FX hedging) při zmírňování dopadů změn měnových kurzů na kreditní riziko. Tyto studie společně přispívají k literatuře o ekonomické stabilitě a poskytují poznatky, které jsou relevantní pro tvůrce politik, finanční instituce a výzkumníky v malých otevřených ekonomikách.

První článek používá nově zkonstruovaný lineární makrofinanční model pro albánskou ekonomiku a analyzuje makroekonomické a finanční dopady pandemie COVID-19 v letech 2020-2021. Studie řeší problém spolehlivého předpovídání ekonomického vývoje v období zvýšené nejistoty použitím kvantilové regrese. Výsledky ukazují, že lineární model je dostatečně flexibilní na to, aby zachytil dopady nelineárních událostí jako je pandemie, čímž prokazuje svou použitelnost při analýze ekonomických šoků v abnormálních obdobích.

Druhý článek zkoumá vztah mezi migrací, remitencemi (tranfery výdělku ze zahraničí) a tlakem na inflaci v Albánii. Článek používá dynamický model, který zachycuje zpětnou vazbu mezi migrací a inflací, kdy trvalý pokles populace vede ke střednědobému inflačnímu tlaku. Studie rovněž zdůrazňuje, jak příliv peněz ze zahraničí formou remitencí zhoršují inflační tlaky, a diskutuje možné strategie zmírnění, jako je zvýšení účasti na trhu práce a zvýšení věku odchodu do důchodu.

Třetí článek zkoumá dopad kolísání měnového kurzu na kreditní riziko se zaměřením na nesplácené úvěry v Albánii. Využívány jsou jedinečná data jednotlivých bank, která rozlišují mezi zajištěnými a nezajištěnými dlužníky s úvěry v cizí měně. Studie analyzuje jejich citlivost na změnu měnového kurzu. Zjištění naznačují, že nezajištěné nefinanční korporace jsou více zranitelné vůči kolísání měnových kurzů, zatímco opačný efekt platí pro domácnosti. Tato studie poskytuje cenné poznatky o roli měnového zajištění při řízení kreditního rizika v malé otevřené ekonomice.

Klasifikace	C23, C32, C53, E66, G3, J11
Klíčová slova	pandemie COVID-19, makrofinanční modelování, kvantilová regrese, demografie, inflace, mzdy, remitence, nesplácené úvěry, FX hedging
Název práce	Makroekonomická dynamika a finanční stabilita: Poznatky z reakce Albánie na krizi, migraci a volatilitu měnového kurzu

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Acronyms

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
BoA	Bank of Albania
CPI	Consumer Price Index
ECB	European Central Bank
ECM	Error Correction Models
DC	Domestic Currency
DSGE	Dynamic Stochastic General Equilibrium
EU	European Union
FC	Foreign Currency
FE	Fixed Effect
FX	Loans Denominated In Foreign Currency
GDP	Gross Domestic Product
HQ	Hannan-Quinn Information Criterion
INSTAT	Albanian National Institute of Statistics
OLS	Ordinary Least Squares
MoF	Ministry of Finance
NAIRU	Non Accelerating Inflation Rate of Unemployment
NPL	Non-Performing Loans
NPLs	Non-Performing Loans ratio
NFCs	Non-Financial Corporations
OLS	Ordinary Least Squares
QR	Quantile Regression
RE	Random Effect

RMSE	Root Mean Square Error
SC	Schwarz Information Criterion
TFP	Total Factor Productivity
ULC	Unit Labor Costs

Chapter 1

Introduction

The global economy has faced unprecedented challenges in recent years, with the COVID-19 pandemic acting as a profound shock that impacts macroeconomic stability, financial systems, and labor markets worldwide. For emerging economies such as Albania, the pandemic introduced exceptional volatility, exposing critical vulnerabilities in macrofinancial structures, monetary policy frameworks, labor dynamics, and external economic dependencies. At the same time, structural factors such as migration and remittance inflows have played a key role in shaping the economic trajectory of Albania, influencing inflation, labor markets, and financial stability. The three articles in this dissertation provide complementary perspectives and collectively examine Albania's macroeconomic responses to these shocks. Using semi-structural modeling and simulation techniques, dynamic wage-inflation frameworks, and quantile regression, we examine the short- and long-term effects of economic shocks stemming from the pandemic, migration and exchange rate fluctuations.

The overarching research question guiding this dissertation is: How do exogenous shocks such as the COVID-19 pandemic, migration outflows, and exchange rate volatility interact with Albania's macrofinancial system, the labor market, and financial stability? More specifically, the research aims to (i) assess the ability of macrofinancial models to forecast economic developments during times of extreme shocks, (ii) investigate the inflationary effects of Albania's demographic decline and the high dependence of remittances, and (iii) assess the impact of exchange rate

fluctuations on credit risk exposure among different economic agents and hedging strategies. Each article contributes to this broader agenda, offering distinct insights while maintaining thematic cohesion in examining Albania's economic resilience in the face of systemic disruptions.

The first article, "*Using Macrofinancial Models to Simulate Macroeconomic Developments During the COVID-19 Pandemic: The Case of Albania*" co-authored with Adam Geršl and published in *Eastern European Economics*, evaluates the efficacy of a macrofinancial forecasting model in predicting economic outcomes under the severe disruptions caused by the COVID-19 pandemic. Traditional macroeconomic forecasting tools, such as dynamic stochastic general equilibrium (DSGE) models and semi-structural equilibrium models, rely on stable and predictable relationships among macroeconomic variables. However, extreme shocks, particularly those accompanied by aggressive policy interventions, generate conditions that may disrupt these fundamental relationships. In response, we develop a semi-structural multi-equation model tailored to Albania's small open economy and assess its predictive power by contrasting prepandemic and pandemic-era forecasts. To account for increased uncertainty, we also incorporate quantile regressions to construct uncertainty bands around the predictions.

Key findings of this study indicate that while the model performed well in simulating broad economic trends, it struggled to account for the policymaker-driven distortions unique to the COVID-19 period. Government interventions, such as loan repayment moratoria, fiscal relief measures, and central bank liquidity provisions, altered financial variables, reducing the accuracy of the model's forecasting for key indicators such as non-performing loans and credit growth. This underscores the need for flexible modeling approaches that can incorporate real-time adjustments for policy

shocks and behavioral changes in times of crisis. The study contributes to the central theme of the dissertation by demonstrating how rigid macroeconomic frameworks may require adaptation to effectively capture extreme shocks, an insight that extends to subsequent analyses of labor markets and financial risks.

The second paper, *"Migration, Remittances, and Wage-Inflation Spillovers: The Case of Albania",* co-authored with Meri Papavangjeli and Adam Geršl and published in *Economic System*, shifts focus to the long-term impacts of Albania's population decline, driven by sustained migration trends and remittance inflows. Albania ranks among the European countries with the highest migration rates and remittances represent a substantial part of its economic inflows, accounting for about 10% of GDP in recent years. This article examines how migration coupled with remittance inflows influence aggregate price levels by affecting labor market tightness and wages.

Using a dynamic wage-inflation feedback model, the study demonstrates that population decline exerts upward pressure on wages due to labor market tightening, leading to persistent inflationary effects. Furthermore, remittance inflows amplify inflation. Empirical simulations highlight migration as both a constraint on the labor market and a channel for inflationary externalities, suggesting that a permanent population decline leads to increased inflation, thus underscoring the significant macroeconomic implications of demographic changes.

This article extends the findings of the first study by adding another layer of complexity to Albania's post-pandemic macroeconomic challenges. While the first article identifies the limitations of macrofinancial models in times of unprecedented shocks, this analysis reveals a long-term structural challenge that models must incorporate, migration and demographic shrinkage as persistent inflationary forces.

These findings reinforce the need for dynamic policymaking and structural reforms of the labor market to counteract inflationary pressures caused by demographic shifts.

The third article, *"Does FX Hedge Mitigate the Impact of Exchange Rate Changes on Credit Risk? Evidence from a Small Open Economy"* co-authored with Adam Geršl examines the risks of financial stability associated with exchange rate volatility, particularly in the highly euroized banking sector of Albania. Unlike advanced economies, where financial systems operate primarily in domestic currency, Albania maintains a substantial share of foreign currency (FX) lending, exposing borrowers to exchange rate fluctuations.

Using a bank-level dataset, the study differentiates between hedged and unhedged borrowers and analyzes their respective sensitivities to exchange rate changes. The study finds that unhedged non-financial corporations (NFCs) face significantly higher risks from exchange rate depreciation due to FX-denominated loan servicing costs. However, an unexpected finding emerges in the case of households, where borrowers using FX hedging instruments exhibited higher credit risk compared to unhedged borrowers. This suggests that certain hedging mechanisms may not be equally effective across borrower segments or that household-level financial literacy on hedging strategies may be inadequate.

By linking this article with the previous two, a broader picture emerges: while macroeconomic models must adapt to capture the dynamics of the crisis period (as shown in the first study) and structural trends of the labor market exert long-term inflation pressures (as highlighted in the second study), financial vulnerabilities remain a critical concern in Albania's economic stability. The persistence of foreign currency (FC) lending risk suggests that macroeconomic stability efforts must go beyond

traditional monetary policy and include more robust risk management frameworks to protect borrowers from FX volatility.

Together, these articles provide a holistic understanding of how Albania, as a small emerging market, experiences macroeconomic volatility induced by exogenous shocks such as the pandemic and migration. We analyze the economic vulnerabilities of Albania in multiple dimensions: macroeconomic volatility, long-term demographic changes, and financial risks. Each paper contributes uniquely to the central theme of the dissertation of understanding and modeling economic resilience in a small, open, and highly euroized economy. The first article showcases the limitations of economic forecasting in times of crisis, the second article highlights the structural inflationary consequences of population decline and remittance inflows, and the third article exposes the persistent risks of financial stability associated with the exposure of Albania's FX.

From a policy perspective, the findings suggest that: Macroeconomic models should be flexible to account for extreme policy shocks and behavioral changes in crisis periods. Public and labor policies must address the risks of structural inflation stemming from migration-induced labor shortages. Financial sector stability requires better hedging and risk management frameworks to mitigate the effects of exchange rate volatility. By advancing our understanding of the macrofinancial resilience of Albania, these studies contribute to broader discourses on emerging market vulnerabilities, central banking adaptation, and the evolving nature of macroeconomic modeling in response to global shocks.

Chapter 2

Using Macrofinancial Models to Simulate Macroeconomic Developments During the COVID-19 Pandemic: The Case of Albania

Abstract

The COVID-19 pandemic and its impact on the economy tested the capacity of current macroeconomic models to forecast economic developments in turbulent times. In this article, we develop a linear macrofinancial model for Albania and examine whether it can project the developments of key macroeconomic and financial variables during 2020-2021. To address the increased uncertainty of the forecast, we constructed uncertainty bands with quantile regressions. The results indicate that, in general, a linear model is flexible enough to analyze non-linear events and may thus be used in abnormal times.

JEL Classification	C32, C53, E66
Keywords	COVID-19 pandemic, macro-financial modeling, quantile regression, uncertainty bands

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2.1 Introduction

Macrofinancial models are important tools for analyzing the economy. Their main use is to produce short- to mid-term macroeconomic forecasts (Angelini et al. 2019), but they can also help to design counterfactual scenarios to analyze the quantitative impact of various factors, including policies. Central banks use macrofinancial models as the main analytical instrument to underpin monetary policy decisions (Brázdik et al. 2020; ECB 2021).

The COVID-19 pandemic and accompanying government measures such as lockdowns, business restrictions, and temporary changes in regulation represent an excellent example of such a large shock and provide an opportunity to test the ability of traditional macrofinancial models to capture such developments and to provide reliable forecasts in times of challenging economic conditions. Given that there is always a certain degree of uncertainty, model projections are typically reported with confidence intervals or uncertainty bands. In addition, if macroeconomic conditions experience large shocks, the uncertainty about the model projections further increases because agent behavior might change, making it more complex to model (McKibbin & Stoeckel 2018).

The COVID-19 pandemic is an exogenous shock originating in the real economy and spreading quickly in the nominal and financial sectors. The pandemic hit the actual and expected outlook of the economic agents and caused sharp deviation of real indicators and prices, although following unprecedented monetary, fiscal and financial sector policies helped the financial sector remain to some extent insulated from this shock. Obviously, the COVID-19 shock and the accompanying policy measures provide a challenge for the model and may severely affect its usefulness.

Our main goal is to check to what extent a preconstrained macrofinancial model based on a system of linear equations captures relevant empirical regularities in the COVID-19 data. While this research objective has been recently attempted by several papers (Bartocci, Notarpietro & Pisani 2020; Gomme 2021; Primiceri & Tambalotti 2020; Garcia et al. 2021), they exclusively focus on advanced countries, with almost no studies on emerging markets. Thus, we contribute to the literature by focusing on a small open economy of an emerging market status.

In particular, we aim to answer the following questions. First, does on average a macromodel preconstrained and estimated on prepandemic data in an emerging market act as a good quantifier for COVID-19 pandemic dynamics? Second, did the significant deviation of the COVID-19 path of key variables during 2020-2021 lie in the conditional distribution of the pre-COVID-19 pandemic forecast? Third, did the financial regulatory measures fit into the model flexibility or did they break the modeled links? Fourth, is a linear model accurate enough in its structure to analyze non-linear events and be used in abnormal times?

To answer these questions, we construct a macrofinancial model for Albania that is consistent with neoclassical growth models for small open economies and test its ability to forecast macrofinancial developments during the COVID-19 pandemic. Albania is a small open emerging market economy in southeastern Europe that, similar to other countries, has been hit hard by the pandemic, with a large level of excessive deaths, strict lockdowns, and government measures targeting the sectors mostly hit by the pandemic, such as tourism (MoF 2020). Albania serves as a very good case study for our type of analysis for several reasons. First, it is a free-market small open economy with a strong macroeconomic link to the Western European core countries (euro area), its own monetary and fiscal policy, floating exchange rate, reasonably

sized and sound financial sector, and liberalized financial flows. Thus, economic forces are left to play out freely and can be nicely captured by a well-behaved macrofinancial model that can properly differentiate between external factors (drop in foreign demand and tourism, changes in external interest rates, shocks to exchange rate *via* changes in general market sentiment) and internal shocks (driven by domestic measures such as lockdowns, fiscal shocks, or changes in financial regulation). Second, the pandemic evolution and the reaction of authorities (lockdowns, regulatory forbearance on loan repayment, fiscal support) have been very similar to those of other countries in the world, so the results of our analysis can be to a large extent generalized to most emerging markets. Third, to construct model-based scenarios for pandemic times, we can use the fact that lockdowns were only imposed in 2020. This gives us an opportunity to use the information from 2020 to quantify the effects of such measures for the next year within the model and to construct a "pandemic" forecast for 2020-2021 that uses not only the observed levels of the exogenous variables (such as euro area GDP, foreign interest rates, etc.) but also takes into account the measures implemented in 2020, including their potentially persistent effect as captured by the lag structure of the individual model equations. This "*quasi-real*" forecast tests the model's forecasting power in times of large shocks.

We analyze the COVID-19 pandemic data quarterly over 2020-2021 and test the model's performance by comparing two forecasts (a prepandemic forecast and a pandemic forecast) with actual data. We also provide conditional distribution of the forecasts to show whether the outturns have been within the confidence bands using a percentile regression approach. We make use of the 10th and 90th percentiles to estimate forecast uncertainty.

Our results reveal that a model estimated on prepandemic data is in general flexible enough to be used in abnormal times. However, even if we are able to control for the shocks in our simulations (pandemic forecast), there is still a large gap between such a forecast and the outturn in 2021-2022, which goes even beyond the conditional distribution of most macroeconomic variables. We interpret this as supporting the view that during pandemics, the behavior of agents changes, mostly reflecting the increase in uncertainty and adjustments in expectations, deviating from the prepandemic elasticities. Thus, macrofinancial models – if they reflect in their design even in an imperfect way the extraordinary government measures and extreme shocks from the economy – can serve to provide a picture of the possible evolution of the economy during pandemic times even in emerging markets, which are in general more volatile.

Compared to other studies, our estimations allow us to examine the potential flexibility of a given semistructure framework across a prolonged abnormal situation (four pandemic waves over two years) and provide unique insight into the relationship between indicators in terms of transmission channels and magnitude.

The remainder of this paper is organized as follows. Section 2.2 discusses the literature review. Sections 2.3 and 2.4 describe the data and methodology. We present our main results in Section 2.5 and provide their diagnostics to different extensions. Section 2.6 provides a discussion.

2.2 Literature review

A growing body of literature investigates the macroeconomic and financial implications of the COVID-19 pandemic. Several studies compare the COVID-19 pandemic with past pandemics such as the “Spanish Flu” or the “Black Death”. Barro, Ursua & Weng (2020) provide analogies with the Great Influenza pandemic based on

a dataset for 43 countries with annual frequency. They highlight potential outcomes for the COVID-19 pandemic in terms of mortality and economic activity by employing regressions on flu deaths from 1918-1920 and war deaths during WWI. Overall, their estimates reveal a decline for GDP by 6% and for consumption by 8% in the short-term.

Velde (2020) and Correia, Stephan & Emil (2020) contrast with Barro, Ursua & Weng (2020), who analyze a longer timespan (medium- and long-run) and use a high-frequency dataset of the US economy. Velde (2020) runs impulse response functions from the local projection technique and employs the SIR model to estimate the development of the pandemic. He acknowledges that the COVID-19 pandemic can be an economic disaster but also points out that the differences between 1918 and 2020 in monetary policy, fiscal policy and mobility measures tend to smooth the effect of the COVID-19 pandemic in the short-term. Additionally, Correia, Stephan & Emil (2020) confirm that nonpharmaceutical interventions reduce disease transmission without further depressing US economic activity.

Jordà, Singh & Taylor (2020) draw lessons from the "Black Death". They find that significant macroeconomic after-effects of pandemics persist for about decades. This result is consistent with the neoclassical growth model, as pandemics may induce relative labor scarcity and/or a shift to greater precautionary savings. The long-lasting after-effects concern is also shared by Croitorov et al. (2021) and Grömling (2021). They claim potential subsequent damages to potential GDP through capital, technology and labor market channels.

Another strand of literature explores the impact of the event on certain sectors of the economy. The foreign sector, one of the first and most impacted sectors from the COVID-19 pandemic, has been the focus of several materials. For example, Coutinho,

Vukšić & Zeugner (2021) prove that the decline in international tourism exacerbated external sector imbalances within the euro area, at least in the short-term. A much further timespan implication is given by Streimikiene et al. (2021). They row scientific literature for sustainable tourism forms and drivers and conclude that the COVID-19 outbreak has risen new challenges for sustainable tourism development and for future pandemics. Afesorgbor, Van Bergeijk & Demena (2022) analyze the globalization dimension and trade openness. They confess the presence of deglobalization and foresee a lower globalization level for the future. However, trade openness is estimated far better than in the 1930s due to the high level of globalization.

Quite the opposite statement is revealed by Bieszk-Stolorz & Dmytrów (2022) about the spillovers of globalization during the COVID-19 pandemic. They state that the challenges from the COVID-19 pandemic are sharper compared to previous crises given the high level of globalization. While assessing the similarity of EU labor markets before and during the COVID-19 pandemic, they find that the composition of the clusters in the prepandemic and pandemic periods is different mainly due to the different degree of development of labor markets. Additionally, labor market inequalities are reported by Cerqua & Letta (2022) for the Italian labor market. Italy was one of the first countries in Europe to be hit by the COVID-19 pandemic. According to Duval et al. (2022), even two years after the beginning of the COVID-19 pandemic for several advanced economies, employment has yet to fully recover. They highlight barriers to returning to work, changing worker preferences, and sectoral and occupational job mismatches.

Sectoral exposure to the COVID-19 pandemic accordingly imposes sectoral exposure of the financial market. Fahlenbrach, Rageth & Stulz (2021) document significant heterogeneity in firms' resilience during the COVID-19 pandemic. They

find that firms that are more financially flexible performed significantly better during the market collapse. Moreover, they conclude that the worst-performing industries are those with much higher measures of COVID-19 exposure based on social distancing needs.

Aiyar et al. (2021) estimate the impact of the crisis on European banks' capital given the riskiness of sectoral exposures under several macroeconomic scenarios. They suggest regulatory measures for banks and supported measures for businesses and households to protect the financial sector from the real sector shock. Boissay, Patel & Shin (2020) emphasize the vulnerabilities borne from international trade by the participating firms themselves and through interfirm credit and highlight the need for international financial measures. Additionally, Goldstein, Koijen & Mueller (2021) acknowledge the quick recovery of the financial sector in the US due to regulatory measures. Consequently, they discuss a possible disconnection between financial markets and the real economy.

A final strand of literature attempts to amend existing macromodels or design new approaches to better quantify pandemic implications. Among the first steps to understand COVID-19 is understanding pandemic evolution and macroeconomic implications (Eichenbaum, Rebelo & Trabandt 2021; Jones, Philippon & Venkateswaran 2021; Hong, Wang & Yang 2021; Chan 2022).

Eichenbaum, Rebelo & Trabandt (2021) incorporate the SIR (susceptible, infected, and recovered) model (Kermack & McKendrick 1927) into a DSGE (dynamic stochastic general equilibrium) macroeconomic model. According to their analysis, households decide to reduce consumption and work to decrease the probability of becoming infected. This behavior of households reduces epidemic severity but increases economic recession. They evaluate a drop of consumption by 22% during the

first year if no health measures are undertaken. With containment policies (i.e., vaccination), consumption is estimated to decline by 7%. Chan (2022) illustrates how the pandemic could result in consumption and output loss for the Chinese economy. Likewise, Eichenbaum, Rebelo & Trabandt (2021) evaluated a more substantial decrease in output under policy measures (i.e., quarantine and random testing of the uninfected).

Jones, Philippon & Venkateswaran (2021) extend the canonical SIR into a DSGE model with 'the ability to work from home'. They conclude that the risk taken by firms to mitigate infection spread is costly today, but by doing so raises future expected earnings. Additionally, Hong, Wang & Yang (2021) make use of an epidemic model. They show that the stochastic model outperforms the deterministic models at longer horizons, indicating the time when the development of the vaccine is further out.

Epidemiological projections are subject to considerable uncertainty given the sensitivity they feature on epidemiological assumptions. Boissay, Rees & Rungcharoenkitkul (2020) illustrate the sensitivity of the SIR macromodel to COVID-19 development assumptions by simulating three alternative paths on infected people and deaths. They estimate a drop in output from 6% to 36% in the second quarter of infections.

Therefore, some other studies have employed existing macromodels to conduct alternative scenarios to project macroeconomic developments during 2020-2021. Mckibbin & Fernando (2020) explore seven different scenarios of how COVID-19 might evolve in the coming year using a global hybrid DSGE/CGE general equilibrium model. They demonstrate that the costs might be reduced by greater investment in public health systems in all economies but particularly in less developed economies.

Mihailov (2020) simulates three scenarios with alternative assumptions on lockdown length and labor force shocks in the United States, Germany, France, Italy and Spain. The results of the simulations reveal that even in the most optimistic scenario, consumption declines by 6% to 7% in annualized terms and output per capita by 3% to 4%. In the most pessimistic scenario, the results are more devastating.

Additionally, Bordo, Levin & Levy (2020) run a set of scenarios using key historical episodes from the Spanish flu, the Great Depression, the end of World War II, and the global financial crisis. They identify key challenges for monetary policy and emergency credit facilities under each of these alternative scenarios. However, this approach has been challenged by other authors arguing that past epidemic scenarios are not suitable to estimate the macroeconomic impact of the COVID-19 pandemic given its totally different intensity and unprecedented government interventions (Donadelli, et al. 2021). The loss of efficiency resulting from ignoring true sample information is of such a scale to distort conclusions (McAdam & Mestre, 2007).

Thus, some studies have tried to make use of early 2020 information about shocks to construct projections for the subsequent COVID-19 pandemic horizon (Bartocci, Notarpietro & Pisani 2020; Primiceri & Tambalotti 2020; Gomme 2021). These papers simulate the COVID-19 pandemic shock as a combination of existing structural shocks. Garcia et al. (2021) adopt a similar approach for the implication of the COVID-19 pandemic in the euro area. They suggest that when households have finite lifetimes, the responses of output and inflation are amplified compared to the case with infinitely lived households.

Many efforts have been made to provide the impact of the COVID-19 pandemic implications. Altogether, the literature recognizes the presence of large shocks and the change in agents' behavior. Pellegrino, Ravenna & Züllig (2021) illustrate through an

interacted-VAR model for the euro area that the uncertainty shock experienced during pessimistic times is three and a half times much larger compared to normal times. Among others, some studies have changed the model calibration to address the outlook of the COVID-19 pandemic (Eichenbaum, Rebelo & Trabandt 2021; Jones, Philippon & Venkateswaran 2021; Mckibbin & Fernando 2020).

Evidence of the COVID-19 challenge to time series and models is also documented by Bobeica & Hartwig (2021). They find that parameters change notably with the pandemic to provide the model with the ability to better deal with the COVID-19 shock.

Engelke, Heinisch & Schult (2019) testimony that macrofinancial models' ability to provide reliable macrofinancial forecasts crucially relies on the model structure, the estimated or calibrated elasticities among the model variables, and reliable assumptions about the "exogenously determined" variables and shocks that enter the model. Earlier, Clements & Hendry (1998, 1999) claimed that unforecastable breaks, known in the forecasting literature as 'deterministic shifts', account for most systematic forecast failures. Recently, Kucharcukova, Bruha, Kral, & Motl (2022) highlight the significance of clearly identifying the nature of assumptions underlying the output decline during COVID-19 pandemic. Specifically, they examine whether the shock should be interpreted as a demand or supply shock, and whether it affects the fundamentals or the cyclical component of the economy. Their analysis suggests that the economic contraction during COVID-19 pandemic largely attributable to lockdown measures and can be understood primarily as a negative, anti-inflationary demand shock. Also, they quantify the proportion of the observed GDP decline that can be attributed to negative supply shock.

Thus, residual adjustment is obviously a useful device when dealing with information missing in the model (McAdam & Mestre 2007). This was considered by Garcia et al. (2021) in designing the COVID-19 shock. However, instead of COVID-19 data, they derive the shock as the difference between two forecasts with and without COVID-19 knowledge (to release COVID-19 shock implications from other sources of model shocks).

Despite the insights that these studies have provided, the COVID-19 pandemic has uncovered large gaps. There is a need for further research to explore the implications by incorporating more knowledge from the COVID-19 datasets and a wider country base, especially for less studied countries such as emerging market countries.

2.3 Data used and the main features of the macrofinancial model

2.3.1 Data

Our dataset is based on data from the Albanian National Institute of Statistics (INSTAT 2022), the Bank of Albania (BoA 2022), the Ministry of Finance (MoF 2022), and Eurostat (Eurostat 2022). Additional indicators were generated out of the received data by the formulas described in the next section on the model setup.

The dataset consists of quarterly frequency data between 2010 and 2021. Although most of the data are originally available at this frequency, some were received at a monthly or annual frequency, and thus, selected frequency conversion methods were applied as follows: (i) the average-of-observations method is applied over monthly flow rate indicators (i.e., exchange rate, inflation rate), (ii) the sum-of-observations method is applied over monthly flow indicators (i.e., compensation for employment, fiscal expenditures), and (iii) the last-observation method is applied over

monthly stock indicators (i.e., credit stock, nonperforming loans). We used the Denton method (Chollette 1984) to convert yearly observations into quarterly frequency (i.e., population).

Afterward, the data were seasonally adjusted with the Tramo/Seats technique. Indicators that are constructed by us (using a formula) are seasonally adjusted in an indirect way, as they use seasonally adjusted variables as inputs. For example, the disposable income series is indirectly seasonally adjusted because all its components are seasonally adjusted before the series was generated (Table 2.A1 in Appendix 2.A provides more detail about the source of the data and adjustments for individual variables used in the model).

The unobservable indicators (i.e., potential GDP, output gap, NAIRU) and additional variables (i.e., capital stock, disposable income, competitiveness term, and real terms) are estimated following the same methodology as described in Skufi, et al. (2024).

In the case of methodological breaks in variables' time series, dummy variables are used. The series of capital stock and output gap do not reflect the losses of the November 2019 earthquake in Albania (European Commission 2021). This event was intentionally left out. Given the backward nature and the transmission mechanism of the model the event would not fit our simulation.

2.3.2 The macrofinancial model

The macrofinancial model we employ is a semistructural model consistent with neoclassical growth models for small open economies and provides a rich environment to assess shocks and their impacts on the economy. The model covers all crucial aspects of a country's macroeconomic development and is similar in spirit to other semistructural models, such as the Area Wide Model (AWM) for the Euro Area (Fagan,

Henry & Mestre 2001) and the single country macromodel as by Bulligan et al. (2017) and Budnik et al. (2009). The model has four sectors (the real economy, the nominal side with prices, the labor market, and the credit market) and distinguishes between the long-run and the short-run. The long-run properties of the model follow neoclassical features (i.e., potential GDP estimated *via* Cobb–Douglas production function with constant returns to scale). Expectations are assumed to be adaptive (backward looking). Money is neutral in the long-run. Prices are set by monopolistically competitive firms as a mark-up over the average minimum cost. Price rigidities are present in the short-run, causing fluctuations of the output around the potential GDP following a Keynesian approach. All the markets are assumed to operate in monopolistic competition.

The real economy

On the supply side, potential output is determined by a production function that combines total factor productivity (TFP), capital stock, and labor supply. TFP reflects the exogenously predefined level of technical progress. Capital stock moves gradually according to the level of fixed capital formation (private and public investments) and depreciation rate. Labor supply moves in line with labor force development and the structural unemployment rate. The Cobb-Douglass production function with constant returns to scale is represented in *Eq. (2.1)*.

$$\bar{Y} = AC^{\alpha}\bar{L}^{1-\alpha} \tag{2.1}$$

where, $\bar{Y}$ is the potential output, A is total factor productivity and consists of the so-called Solow residuals, C is capital stock is divided into private capital stock and public capital stock with differing depreciations rates as calculated by (Gupta, et al. 2011), $\bar{L}$ is effective labor supply represents the labor force corrected by the NAIRU

indicator, which is estimated exogenously as in Ceka & Skufi (2018), and α is the capital share in the production function.

On the demand side, the model describes the economy in a way that reflects macro processes from a national account point of view. Economic agents are aggregated in households, firms, foreign countries, fiscal authority, and monetary authority. Aggregate demand *(GDP)* splits into household consumption, public consumption, private investment, public investments, exports, and imports.

Households receive income as well as pay taxes. They spend a part of their disposable income to purchase domestically produced goods or imported goods. The level of household expenditures also reflects the intertemporal choice. Household consumption is consistent with life-cycle hypothesis. Empirically, household expenditures are determined by disposable income and a real interest rate that captures intertemporal choices in *Eq. (2.2)*.

$$\Delta YC_t = -\alpha_0(YC_{t-1} - \alpha_1 YDI_{t-1} - \alpha_2) + \alpha_3 \Delta i_t + \varepsilon_t \quad (2.2)$$

where, *YC* is real household consumption, *YDI* is real disposable income, *i* is the real interest rate, α are parameters, and ε is error term.

Firms produce goods that are sold in the domestic market or to foreigners. When setting the level of investments, enterprises consider the level of economic activity and the real user cost of capital. Private investments are specified by the level of economic activity, the user cost of capital, and demographic trends in *Eq. (2.3)*.

$$\Delta YIP_t = -\beta_0(YIP_{t-1} - \beta_1 Y_{t-1} - \beta_2 M2P_{t-1} - \beta_3 ic_{t-1} - \beta_4) + \varepsilon_t \quad (2.3)$$

where, *YIP* is private gross fixed capital formation, *Y* is real gross domestic product, M2*P* represents inhabited square meters per capita (as a variable capturing the

demographic factors), *ic* denotes capital costs, β are parameters, and ε is error term. *M2* stands for residential square meters and was estimated using Census data and construction permit for residential buildings in meter squares. The indicator is latter divided by the population to obtain *M2P*, as detailed in (Skufi, et al. 2024).

Foreign countries provide goods purchased by domestic economic agents, and at the same time, they purchase domestically produced goods. The foreign sector is modelled in terms of an activation variable and prices ratio. Export of goods and services are a function of foreign demand and competitiveness *Eq. (2.4)*, while import of goods and services reflects the need for imports and the level of relative prices *Eq. (2.5)*.

$$\Delta YE_t = -\delta_0(YE_{t-1} - \delta_1 YF_{t-1} - \delta_2) + \delta_3 \Delta CT_{t-1} + \varepsilon_t \quad (2.4)$$

where, *YE* is exports of goods and services, *YF* is foreign demand, *CT* is competitiveness term, δ are parameters, and ε is error term.

$$\Delta YM_t = -\zeta_0(YM_{t-1} - \zeta_1 DM_{t-1} - \zeta_2) + \zeta_3 RP_{t-1} + \varepsilon_t \quad (2.5)$$

where, *YM* is real imports of goods and services, *DM* is absorption variable, *RP* are relative prices, ζ are parameters, and ε is error term.

Fiscal authorities obtain revenues from taxes, which they redistribute to households, purchase consumer goods, and finance investments. As the level of fiscal expenditure might be higher than the collected revenues, part of the financing is borrowed in the domestic economy. The public sector, which in our model comprises public consumption and public investment is exogenous. For simplicity, we handle the fiscal sector exogenously. The fiscal rule broke with the earthquake of 2019, as did its links to macroeconomic conditions. Furthermore, fiscal policy is introduced in the model through a wide set of fiscal indicators in the model, such as public consumption,

public expenditures, transfers, and so on. The fiscal impulse is transmitted *via* several channels, each having a distinct impact (see Table 2.A8 in Appendix 2.A for more details). In the same spirit Arigoni, et al. (2021) keep the fiscal sector exogenous and run shock analysis while analyzing the impact of COVID-19 pandemic on the economy.

The nominal side

The prices are distinguished into supply and demand prices. Domestic supply prices are set by monopolistically competitive firms as a mark-up over the average minimum cost. Unit labor costs proxy the marginal costs, while markups are influenced by cyclical conditions and commodity prices *(Eq. (2.6))*. The import prices follow a pricing-to-market approach, reflecting the developments of costs and exchange rates *(Eq. (2.7))*.

$$\Delta PD_t = -\psi_0(PD_{t-1} - \psi_1 ULC_{t-1} - \psi_2) + \psi_3 PO_t + \psi_4 \tilde{Y}_t + \varepsilon_t \quad (2.6)$$

where, *PD* is the domestic supply prices, *ULC* is unit labor costs, $\tilde{Y}$ is output gap, *PO* is the oil price, ψ are parameters, and ε is error term.

$$\Delta PM_t = -\varsigma_0(PM_{t-1} - \varsigma_1 PF_{t-1} - \varsigma_2 EX_{t-1} - \varsigma_3) + \varepsilon_t \quad (2.7)$$

where, *PM* is the import deflator, *PF* is the foreign price, *EX* is the exchange rate in unit of foreign currency, ς are parameters, and ε is error term.

All demand prices are homogeneous of degree one in supply prices and imported prices equation reflecting the different import content of each aggregate. For the components of gross domestic product, nominal developments are related to the development of price deflators *(Eq. (2.8))*.

$$\Delta PDD_t^i = \Omega^i\left(\lambda^i PD_{t-1} + \left(1-\lambda^i\right)PM_{t-1} - \phi^i\right) + \varepsilon_t \qquad (2.8)$$

where, *PDD* is the domestic deflator index and *'i'* represents the component of aggregate demand, *PD* is the domestic supply prices, *PM* is the import deflator, λ the weight of the domestic content for each component, the rest are parameters, and *ε* is error term. It is important to note consumer price index inflation is related to household deflator with a time-varying coefficient.

Labor Market

The labor market consists of labor demand and labor supply, as well as its price, which is approximated by the nominal average wage. Exogenous labor supply is assumed. Labor demand is determined by real activity developments, the real cost of employment approximated with the real wage, and the capital productivity in *Eq. (2.9)*. The average wage follows the Philips curve specification. We assume that inflation dynamics are fully transmitted to wages within a year and let the other parameters to be estimated stochastically *(Eq. (2.10))*.

$$\Delta LD_t = -\eta_0(LD_{t-1} - \eta_1 N_{t-1} - \eta_2 Y_{t-1} - \eta_3(Y/C)_{t-1} - \eta_4) + \varepsilon_t \qquad (2.9)$$

where, *LD* is labor demand, *N* is real wage, *Y* is real gross domestic product, *Y/C* is capital productivity, *η* are parameters, and *ε* is error term.

$$\Delta PN_t = -\vartheta_0 \Delta PN_{t-1} + (1-\vartheta_0)\pi_{t-1} + \vartheta_1 \Delta LP_{t-1} + \vartheta_2 \Delta\widetilde{LD}_{t-1} + \varepsilon_t \qquad (2.10)$$

where, *PN* is the nominal average wage, *π* is inflation, *LP* is labor productivity, $\widetilde{LD}$ is the unemployment rate gap, ϑ are parameters, and *ε* is error term.

UIP and Monetary policy reaction

Monetary authority controls the base interest rate level in a way that inflation target is achieved. Monetary policy reacts to changes in inflation and cyclical conditions as shown in *Eq. (2.11)*.

$$\Delta ir_t = \theta_0 + \theta_1 \Delta ir_{t-1} + \theta_2 \tilde{\pi}_{t-1} + \theta_3 \Delta \tilde{Y}_{t-1} + \varepsilon_t \quad (2.11)$$

where, *ir* is monetary policy rate, $\tilde{\pi}$ is the inflation rate deviation from target, $\tilde{Y}$ is the output gap, Θ are parameters, and ε is error term.

The exchange rate is consistent with uncovered interest rate parity. Exchange rate deviations are determined by the difference in price levels and interest rates between the domestic and foreign economies, as well as the risk premium *Eq. (2.12)*.

$$\Delta EX_t = \varpi_0 + \varpi_1 \Delta EX_{t-1} + \varpi_2 \Delta(\pi_{t-1} - \pi f_{t-1}) + \varpi_3 (i_{t-1} - if_{t-1}) + \varepsilon_t \quad (2.12)$$

where, *EX* is the exchange rate in unit of foreign currency units, π is inflation rate, πf is the foreign inflation rate, *i* is the domestic interest rate, *if* is the foreign interest rate, ϖ are parameters, and ε is error term, which also represent the risk premium.

Credit market

Credit market covers credit stock, loan interest rate, and nonperforming loans. On the credit market, monetary impulse is completely transmitted to the yield of domestic government papers equation *(Eq. (2.13))*. Government papers represent the risk-free asset, which altogether with a risk premium (approximated by the non-performing loan ratio) determine the bank lending rate equation *(Eq. (2.14))*. The risk-free asset is a weighted average between the Albanian treasury bills and Euribor, which represent the funding costs for loans denominated in foreign currency. The risk premium is determined by the cyclical condition, lending rate, and the solvency equation *(Eq.*

(2.15)). The loan stock specification assumes that the share of economic activity financed by bank intermediation remains largely unchanged. Additionally, during the borrowing decision investors consider the lending rate developments *Eq. (2.16)*.

$$\Delta i_t = -\tau_1(i_{t-1} - ir_{t-1}) + \tau_2 \Delta i_{t-1} + \tau_3 \Delta ir_{t-1} + \tau_0 + \varepsilon_t \qquad (2.\ 13)$$

where, *i* is the interest rate of government papers, *ir* is the monetary policy rate, τ are the parameters, and ε is the error term.

$$il_t = \kappa_0 + \kappa_1 il_{t-1} + \kappa_2 rp_{t-1} + \kappa_3[k_t i_t + (1 - k_t) if_t] + \varepsilon_t \qquad (2.\ 14)$$

where, *il* is lending rate, *rp* is risk premium, *i* is domestic interest rate, *if* is foreign interest rate, *k* is the share of loan denominated in domestic currency, κ are parameters, and ε is error term.

$$rp_t = \chi_0 + \chi_1 rp_{t-1} + \chi_2 \tilde{Y}_{t-1} + \chi_3 S_{t-1} + \varepsilon_t \qquad (2.\ 15)$$

where, *rp* is risk premium, $\tilde{Y}$ is the output gap, *S* is solvency, χ are parameters, and ε is error term.

$$L_t = (\rho_0 + \rho_1 L_{t-1}/Y_{t-1} + \rho_2 il_{t-1}) Y_t + \varepsilon_t \qquad (2.\ 16)$$

where, *L* is the stock of loans, *Y* is real gross domestic product, *il* is lending rate, ρ are parameters, and ε is error term.

The feedback loop between financial system and real sector

Financial intermediaries finance the real economy and play a crucial role in the transmission of central bank interest rates into loan rates. Figure 2.1 illustrates a simplified diagram of interdependencies in the model among sectors and economic agents.

The model includes a feedback loop between the financial system and the real sector. Financial intermediaries finance the real economy by setting the loan interest rate, which is an aggregate of the costs faced by the financial intermediaries with a mark-up containing a risk premium capturing the risk that the borrower will default in

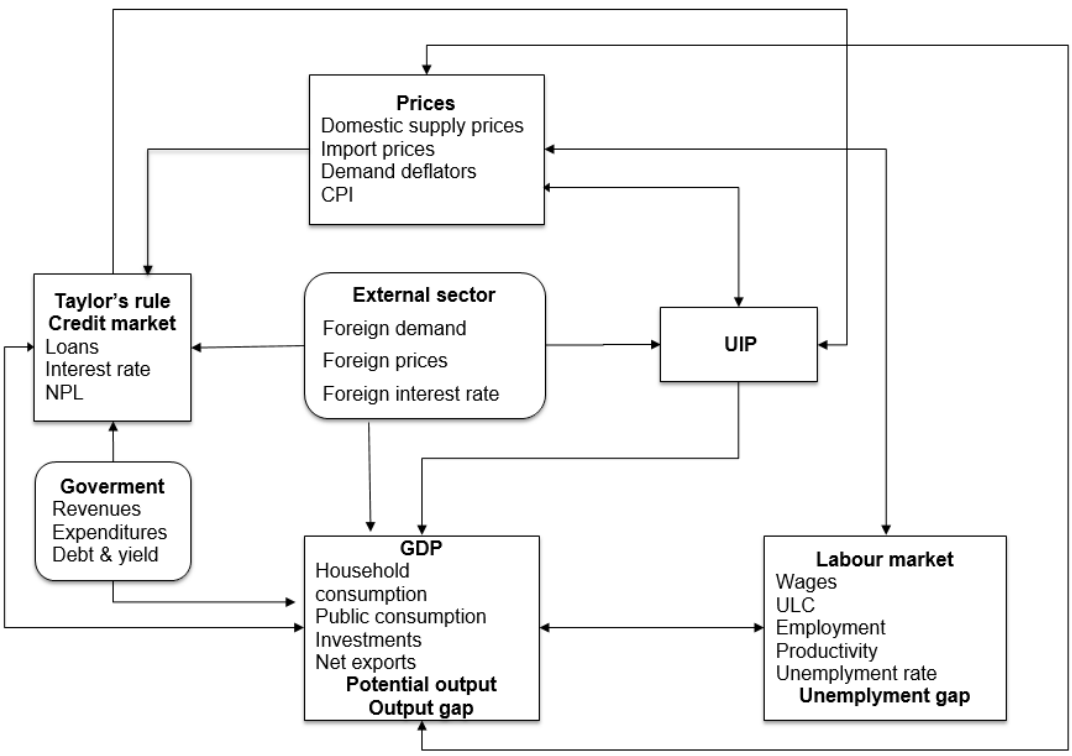

Figure 2.1 Model interdependencies

Source: Authors' calculations.
Note: Macroeconomic variables are framed with rectangles and connected with straight lines to show their interdependence, round rectangle indicates exogenous variables.

repaying the loan. The borrower has a higher chance of nonrepayment during negative cyclical conditions and whenever its solvency deteriorates. An increase in financial burden, a decrease in income, or both increase the probability of default of borrowers (nonperforming loan rate). A higher default probability leads (*via* an increased risk premium) to higher interest rates, which result in higher capital costs, subsequently lower investments by the private sector, and therefore a worsening of cyclical conditions. With default probability depending on real and financial indicators, a

feedback mechanism between the real economy and financial market thus builds in, as shown by Figure 2.2.

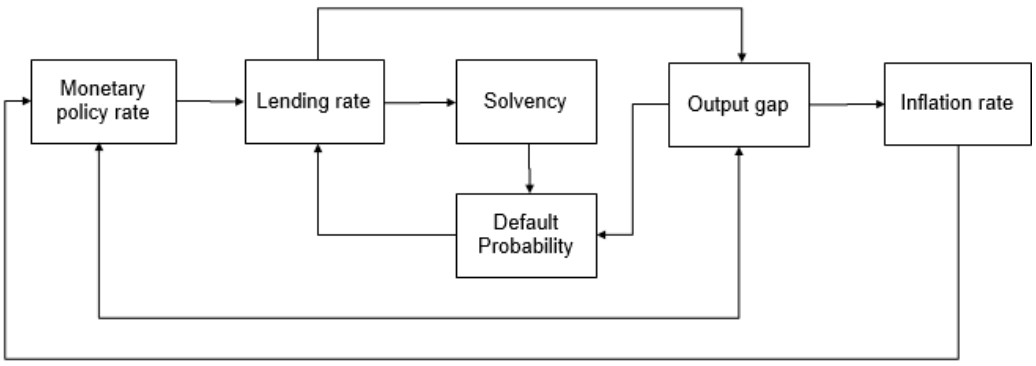

Figure 2.2 The feedback loop between the financial market and the real sector

Source: Authors' calculations.
Note: Macroeconomic variables are framed with circles and linked with lines to depict the feedback loop.

Empirical issues

Behavioral equations were estimated as error-correction models (ECM) or ordinary least squares (OLS) depending on whether a cointegration relationship among variables was found. The long-run parameters of all equations are calibrated according to Skufi, et al. (2024), while the short-run dynamics are estimated on the basis of historical data for the period 2010-2019. Table 2.A4 in the Appendix 2.A provides the parameter values and whether they are derived from an estimation or a calibration process.

The set of estimated behavioral equations and identities is solved for the unique solution through the linear approximation by the Gauss-Siedel algorithm. At this stage, we obtain the in-sample solution for the endogenous indicators, whose paths differ from the historical trajectories by means of misspecification, estimation, calibration, breaks, and shocks (see Clements & Hendry 1999 on introducing shocks). The difference between the estimated and historical values represents the residuals. Each

equation is then assigned an explicit error term (add-factor) to ensure that the endogenous variable solution overlaps with historical paths and is solved again. As the set of equations is solved simultaneously, the model ensures that the in-sample add-factors in individual equations can be associated with a specific economic interpretation.

Figure 2.3 illustrates the path of add-factors for selected indicators during 2010-2021. Most add-factors, during 2010-2019, feature zero mean, but the variance statistics show notable volatility in the series.[1] Thus, it is worth extrapolating the paths of add-factors out of sample when preparing forecasts. Add-factors' statistics are notably different during the period 2020-2021. They feature higher volatility, peaking and troughing much higher and lower than their extreme pre-pandemic values.

[1] Figure 2.A1 in Appendix 2.A shows the descriptive statistics of selected add-factors over 2010-2019.

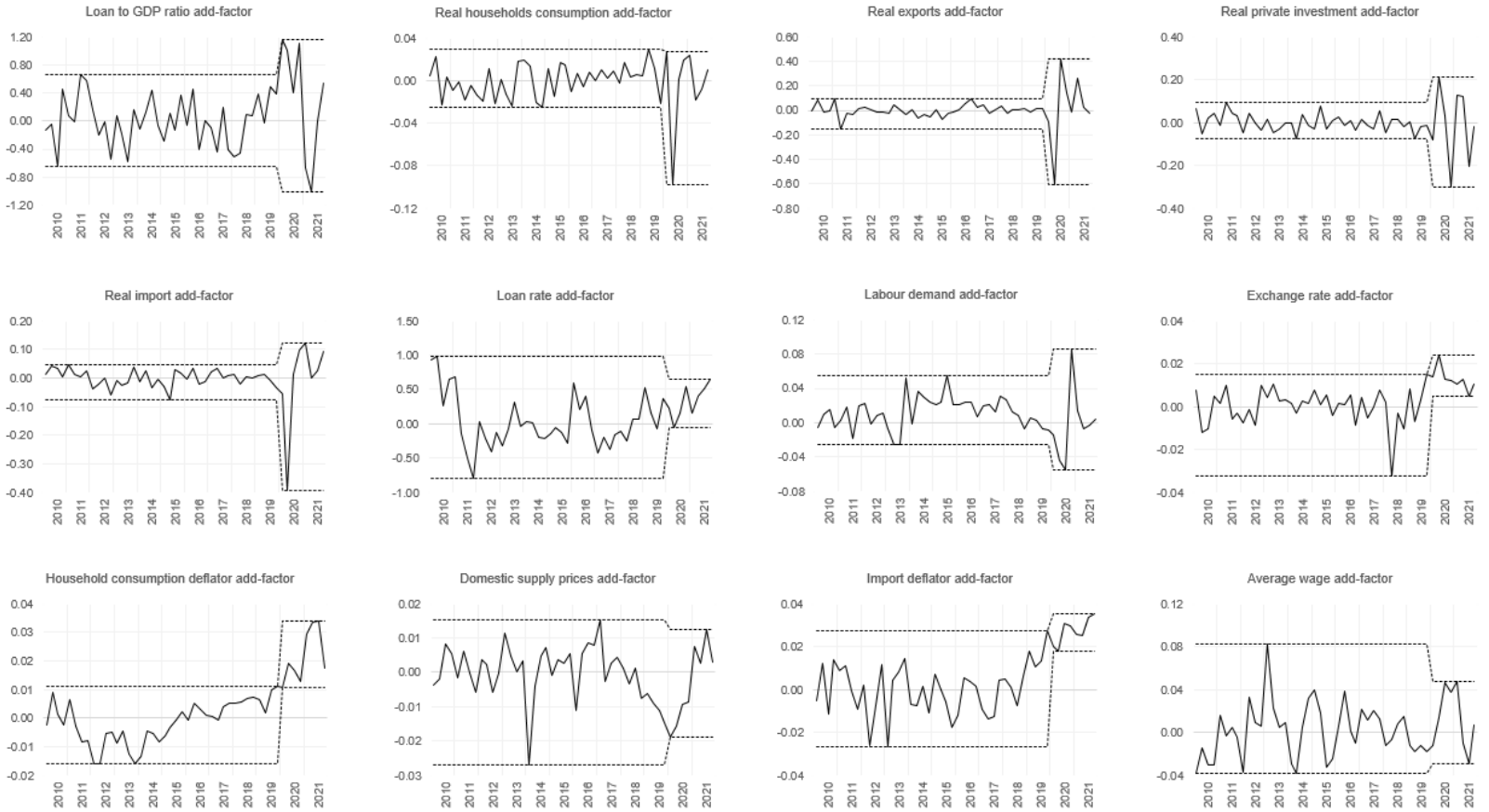

Figure 2.3 In-sample (2010-2019) and (2020-2021) add-factors

Source: Authors' calculations.
Note: Add-factors trajectories feature low volatility during 2010-2019 and notable higher volatility during 2020-2021. Black line add-factors and black dotted line minimal and maximal values.

2.4 Constructing prepandemic and pandemic forecasts

We construct two distinct forecasts for 2020-2021, a prepandemic forecast (with no considerations of pandemic knowledge) and a pandemic forecast (which takes into consideration the pandemics' developments, especially from the first year of the pandemic). We follow an approach by Garcia et al. (2021) to construct projections but differ from them by generating pandemic shocks using actual data rather than propagandizing pandemic development.

The prepandemic forecast is generated using the model with the following assumptions about the exogenous variables for 2020-2021:

- foreign sector variables are assumed to grow according to the Consensus Forecast projections from January 2020 (Consensus Economics 2020);
- fiscal variables' growth rates are based on the Ministry of Finance Budget Plan 2020-2021 (MoF 2021), including the reconstruction plan of the November 2019 earthquake[2];
- demographic developments are assumed unchanged;
- square meters are assumed to grow by its average over 2010-2019, after accounting for capital losses and depreciation;
- NAIRU is estimated using a methodology described in Ceka and Skufi (2018);
- TFP is assumed to grow by its average over 2010-2019.

Prepandemic forecast does not include any information about the COVID-19 pandemic and serves as the starting point to assess the observed developments during

[2] Although, we let untouched the supply side indicators from the impact of earthquake in last quarter of 2019, here we have included the reconstruction plan due to the spill-overs on the demand side, the implications in the simulation, and the impacts of the lockdown in the reconstruction plan.

2020-2021. The projection can be interpreted as the most likely macrofinancial development that would have been observed over 2020-2021 if the pandemic had not come.

In this forecast, endogenous variables are not only driven by the evolution of explanatory variables and the elasticities in the individual behavioral equations but are also assigned the add-factors for each of the 8 quarters of 2020-2021.[3] These are based on the add-factors (error terms) in individual equations estimated during the simulation process when estimating the model (OECD 2014). Apart from fine-tuning the historical paths of the indicators, add-factors play a key role in the forecasting process capturing expert judgment (Mestre & McAdam 2008; Giannoni 2016; Roberts 2019). We impose our judgment in the prepandemic forecast only for a set of indicators.

With respect to the real economy sector, the corresponding add-factors of household consumption, exports and imports are assigned to one standard deviation[4], reflecting the spillover of reconstructing plans in the real economy.[5] For the same reason, the private investment add-factor is subtracted by one standard deviation, as some private capacities would be oriented toward the government reconstruction plan. The private investment add-factor path reflects the scheduled fiscal expenditures for

[3] The add-factors are assigned with values to selected indicators to provide the missing information is the set of exogenous variables i.e. the nature of the reconstruction plan for the earthquake of November 2019. The reconstruction plan was identified as a unique item in the fiscal balance sheets, with a different nature from the fiscal variables captured by our macromodel. For this reason, we treated the reconstruction plan as a separate shock.

[4] Since detailed information on the distribution and timing of this plan was not available, we considered it more appropriate to model it as an exogenous shock. Thus, by applying +/-1 standard deviation to the variables of interest allowed us to capture the expected impact and provide additional information not reflected in the variables of the model.

[5] The plan was not limited to rebuilding houses; it also included financial aid to households and businesses, effectively increasing disposable income and liquidity. Since the earthquake caused significant damage in the Durres area, home to the largest port in the Balkans, many exporting firms were affected and subsequently received aid.

reconstruction. On the nominal side, prices are assigned one standard deviation to capture a possible increase in energy prices. The monetary policy rate is fine-tuned to reflect monetary policy forward guidance. To remove the pressures of the monetary policy rate and inflation on the exchange rate, we added two standard deviations to the exchange rate add-factor. Finally, we set one standard deviation to the nonperforming loan rate, as the improved cyclical conditions were born as a fiscal stimulus rather than private sector acceleration.

The pandemic forecast represents a forecast that combines knowledge about the COVID-19 pandemic impact (both on the exogenous variables and on the endogenous variables *via* add-factors) and the power of the macrofinancial model with the elasticities estimated up to 2019. This forecast serves to illustrate whether – if we perfectly knew the path of exogenous variables and were able to quantify the impact of COVID-19-related measures such as lockdowns by factors – the model would be able to predict the evolution of key macrofinancial variables during 2020-2021.[6]

The pandemic forecast's assumptions about exogenous variables reflect the observed developments in 2020-2021 as follows:[7]

- a worsening of the foreign economy (euro area GDP growth) and a higher implicit deflator;
- lower oil prices;

[6] By providing the observed path of exogenous variables, we free the model from errors stemming from incorrect assumptions and to examine how the model would perform if the underlying information were indeed accurate. The exercise thus evaluates whether the estimated parameters and the transmission channels are sufficiently robust for the model to remain informative during periods of high uncertainty. For the same reason, we assign add-factors to selected indicators to capture both the increased uncertainty and the lack of reliable information in the data.

[7] See Table 2.A3 in Appendix for a comparison of exogenous variables assumptions between the prepandemic and pandemic forecasts.

- lower remittances related to the worsening foreign economic outlook;
- a negative fiscal impulse reflected in the interruption of the after-earthquake reconstruction plan and lower fiscal consumption due to lower government income, although the government increased transfers to households and provided guarantee schemes to businesses. Contemporaneously, construction free capacity reoriented toward the private sector, resulting in 2020Q2 having a positive shock on private investment;
- a decrease in population and labor supply reflects the direct health impacts of the COVID-19 pandemic and the acceleration of migration once lockdown restrictions ended.

For variables that enter the model as directly seasonally adjusted, we apply the following procedure. First, we calculate year-on-year growth rates from historical data for the period of interest 2020Q1-2021Q4 and use them to prolong the direct seasonally adjusted series over 2020Q1-2021Q4; indirect seasonally adjusted series are generated according to their specifications.

Additionally, we include add-factors into the behavioral equations that go beyond their levels in the prepandemic forecast[8], capturing the loosening of monetary policy by 50 basis points, a decrease of household consumption due the high uncertainty and lockdowns, a decrease of exports and imports in 2020 due to the lockdown policy and the travel restriction as well as a decrease of nonperforming loans rate and an increase of credit stock due to the financial sector measures (moratoria etc.). However, in order to let the model "speak for itself", we only impose these "additional"

[8] The pandemic add-factors were derived from the in-sample forecast errors of the selected variables over the first four quarters. This approach allowed us to anchor the judgmental adjustments to historically observed deviations rather than arbitrary assumptions. The trajectory of these add-factors is reported in Figure 2.A2 in the Appendix 2.A.

add-factors (compared to the prepandemic forecast) in the four quarters of 2020 (even if the exogenous variables trajectory is defined over 8-quarters ahead) and only for selected behavioral equation (see Clements & Hendry 1998, for the assignment of add-factors during unforecastable breaks). Garcia et al. (2021) follow a similar technique to generate the COVID-19 pandemic shock. We limited the add-factors for 2020 to reflect that the lockdowns were imposed only in 2020 (and not in 2021) and to reflect the fact that the endogenous variables are able to propagate the shocks imposed in 2020 further down into the future due to the estimated persistence. Anyway, if we imposed the add-factors to bring all variables to the observed levels across the whole 8-quarter horizon, we would not be able to assess the forecasting performance of our model at all!

We are aware of the fact that during the pandemic, some of the elasticities reflecting agents' behavior might have also changed. Several studies adapt macroeconomic transmission channels under nonstandard measures (Coenen, Montes-Galdón & Smets 2020; Pariès, M. & Papadopoulou 2020). We approach this issue in the following way: we keep our original macrofinancial model as designed but provide uncertainty bands for both prepandemic and pandemic forecasts using a quantile regression. This approach allows for changing elasticities across different quantiles of distribution of the dependent variable. We use the period 2010-2019 to generate these uncertainty bands to test whether this approach is sufficient to accommodate the large shock observed during 2020-2021 within the bands.

Quantile regression has recently become popular in investigating the COVID-19 pandemic (De Santis & Van der Veken 2020; Barajas et al. 2021; Mishra & Mishra 2021; Kipriyanov 2022). We follow the quantile regression approach introduced by

Roger & Bassett (1978) and updated by Koenker (2005). A quantile regression methodology overview is briefly presented below.

Let *Y* be an indicator with an *F(y)* probability distribution function *(Eq. (2.17))*. For $\tau \in]\ 0;\ 1[$, the τ^{th} quantile of *Y* is defined as the inverse cumulative distribution function of *Y* satisfying $F(y) \geq \tau$ *(Eq. (2.18))*. Given *n* observations of *Y*, the sample quantile 'Q_τ' is obtained by sorting the series in ascending order or by optimizing for the smallest deviation *(Eq. (2.19))*, where $\rho_\tau(u)=u(\tau-1(u<0))$, is the so-called check function that weights positive and negative values asymmetrically.

$$F(y) = P(Y \leq y) \tag{2.17}$$

$$Q(\tau) = inf\{y: F(y) \geq \tau\} \tag{2.18}$$

$$Q_n(\tau) = argmin_\xi\{\sum_i \rho_\tau(Y_i - \xi)\} \tag{2.19}$$

The quantile regression allows for explanatory indicators X, where the conditional quantile of Y is linearly related to X. Therefore, the quantile minimization is the conditional quantile regression estimator *(Eq. (2.20))*

$$\hat{\beta}_n(\tau) = argmin_{\beta(\tau)}\{\sum_i \rho_\tau(Y_i - X_i'\beta(\tau))\} \tag{2.20}$$

Uncertainty bands are generated by the upper and lower conditional quantile regression estimator. We estimate τ=10 for the lower band and τ=90 for the upper band. The results are smoothed by the 2-term centered moving average technique. Following the described methodology, we re-estimate the equations of interest. The details are in Appendix 2.A.

2.5 Results

The results of our analysis are based on two distinct forecasts, a prepandemic forecast and a pandemic forecast, and their respective uncertainty bands. We acknowledge that it is impossible to forecast perfect paths of exogenous variables, as we do in our pandemic forecast. Nevertheless, we follow this approach for two main reasons.

First, we focus on the extent to which the model captures relevant empirical regularities in the data, given its system of equations entirely. Thus, we make use of all available information in the data (McAdam & Mestre (2007) follow a similar approach to test model prediction accuracy). As we focus on the flexibility of parameters, it is necessary to have the set of exogenous indicators as known to release the model from the "forecast error of assumptions".

Second, the uncertainty bands generated by the quantile regressions provide higher output variability compared to alternative paths of explanatory indicators, for instance, +/-1%, +/-100 basis points, or +/-1 standard deviation. Figure 2.A6 in the Appendix 2.A illustrates the reaction of exports to +/-1 standard deviation of foreign demand. Other endogenous indicators featured similar results for alternative paths of exogenous indicators. Considering that we employ a log-linear system of equations, a permanent unit deviation of exogenous indicators results in the respective estimated parameter printed in Table 2.A4 in Appendix 2.A *"Model selected estimated and calibrated parameters"* in the long-run. Thus, imperfect paths of exogenous indicators lead to a deviation of results in line with the magnitude of deviation and the respective elasticity by default.

2.5.1 The prepandemic simulation

Starting before the pandemic outbreak, the prepandemic macroeconomic scenario for 2020-2021 is based on the following external assumptions:

- a positive growth of the foreign economy with moderate inflation;
- a moderate increase in oil prices;
- a positive inflow of remittances in line with foreign economic developments;
- a positive fiscal impulse due to the reconstruction plan;
- an unchanged demographic development and therefore a stable labor force.

Based on these assumptions and the latest data from 2019, the prepandemic simulation estimates that economic growth would accelerate during the first year and gradually stabilize in the second year of the horizon. Economic activity is supported by domestic demand and accommodative monetary policy. Household consumption accelerates due to positive developments in disposable income and government support schemes. Disposable income evolves in line with increasing economic activity and higher remittances. Government support schemes are related to the compensation of earthquake damage. Low interest rates lower household saving behavior. Employment increase reflects an expanded economic level. As labor supply is assumed to be unchanged, the unemployment rate declines.

Investments increase significantly, driven by public investment. Private investments are simulated by the positive spillover of the reconstruction plan and the favorable lending conditions (capital costs). Capital accumulation also benefits from the high level of public expenditures for reconstruction. Investments provide the main driver of economic acceleration. Exports of goods and services grow in line with foreign demand development. Despite the increase in domestic prices and a slight appreciation of the exchange rate, the overall price level in Albania remains significantly lower compared to foreign price levels. This relative advantage ensures that competitiveness continues to support exports.

Imports are expected to grow high to sustain the high domestic demand. Thus, the trade balance deteriorates and provides a negative contribution to economic growth. Inflation, calculated on the basis of domestic and foreign components, rises gradually. The increase in inflation mainly reflects the trend of the domestic component. Domestic supply prices are stimulated by the acceleration of ULC. High ULC is driven by a higher level of average wages and better cyclical conditions. The foreign component is attenuated by foreign price developments and the stable exchange rate.

The monetary policy rate is estimated to ease in the beginning of the simulation as the inflation rate fluctuates under the target. Improved cyclical conditions and the accelerated inflation rate require the tightening of monetary policy. Inflationary pressures lead to a slight depreciation of domestic currency. The deprecation is partly attenuated by the monetary policy reaction.

In the credit market, the financial conditions are eased in line with the accommodative monetary policy and low government bond yields. The lending rate remains below the average levels recorded in 2018-2019. The decline also reflects the fall in private sector risk premia. The default probability is estimated to decrease as cyclical conditions improve, leading to better borrower solvency. The stock of loans evolves according to economic activity, reflecting financing needs.

The overall economic outlook is illustrated in Figure 2.4 and compared with the outturn, which was greatly influenced by COVID-19. The differences show how large the COVID-19 shock actually was.

Figure 2.4 Prepandemic simulation *versus* the outturn for 2020-2021

Source: Bank of Albania, Consensus Forecast, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: Simulation before pandemic predicts stable economy in 2020-2021, but actual results show large macroeconomic changes. Prepandemic simulation in black dotted line and the outturn in black. Predictions are constructed as 2-term-centered moving averages.

2.5.2 The pandemic simulation

In this simulation, the external environment as captured by the development of exogenous variables such as external demand is much worse than in the previous scenario, reflecting the global nature of the pandemic. Selected endogenous variables are complemented with added factors during the first 4 quarters of the forecast to capture the COVID-19 factors. This assignment technique of adding factors is known as the 'outlier projection method' (McAdam & Mestre 2007) and is used to indicate the start of a deterministic shift, in our case, the start of the pandemic.

We illustrate the assignment of added factors by the discussion of two variables: household consumption and exports of services. Households decreased their expenditures on consumption. On the one hand, they faced a decrease in revenues due to lower economic activity. On the other hand, supporting schemes attenuated the decline in disposable income. Moreover, households decreased their consumption due to both lockdowns and high uncertainty surrounding the COVID-19 pandemic. The uncertainty/lockdown shock experienced by the households is not captured by the explanatory variables entering the household equations. Hence, to properly simulate the behavior of households, the model requires to impose this missing information. We thus finetune the add-factor to account for this negative shock.

A similar situation is the case of exports of goods and services. Especially for the export of services (mostly related to tourism), the impact cannot be captured only by the decline in foreign demand. The lockdown policy and travel restrictions require further adjustments in the model. Thus, this kind of information is added to the model through the add-factors. Detailed information about the size of the shocks/add-factors is provided in Figure 2.A2 in the Appendix 2.A.

The pandemic simulation results together with the outturn in 2020-2021 are shown in Figure 2.5. The variables are expressed in terms of annual growth. As anticipated, real sector indicators feature a sharp reaction during the first year and a fast improvement during the second year, reflecting the base effect (starting from a lower level). The pandemic simulation trajectories fluctuate around the actual values except for the financial market indicators. While the real economy experienced a negative shock during 2020, the financial market was supported by regulatory forbearance schemes that resulted in an even improved condition. Evidence of a possible disconnection between financial markets and the real economy is also documented by Goldstein, Koijen & Mueller (2021) and Aiyar et al. (2021). For a direct comparison of the pandemic versus prepandemic forecasts, see Figure 2.A3 in the Appendix 2.A.

In the pandemic simulations, output and household consumption are estimated to decline on average by 5.1% and 6.3% in annual growth terms, respectively. These estimations, for the impact of the pandemic in the Albanian economy, are similar to those in other economies (Barro, Ursua & Weng 2020; Mihailov 2020). Economic activity and household consumption start to recover gradually as fiscal schemes and policy measures take place, as early anticipated by Velde (2020) and Correia, Stephan & Emil (2020); contemporaneously, uncertainty starts to fade out.

In the pandemic simulation, inflation exhibits a pronounced decline, consistent with the sharp contraction in GDP and the negative cyclical conditions.[9] The drop in domestic demand reduces the domestic inflation pressures *via* the negative output gap, which outweighs any upward pressure from ULC. The foreign pressures are also

[9] See Kucharcukova, Bruha, Kral, & Motl (2022) for a detailed discussion on the importance of implications for inflation of output decline (trend or cycle) during COVID-19 pandemic.

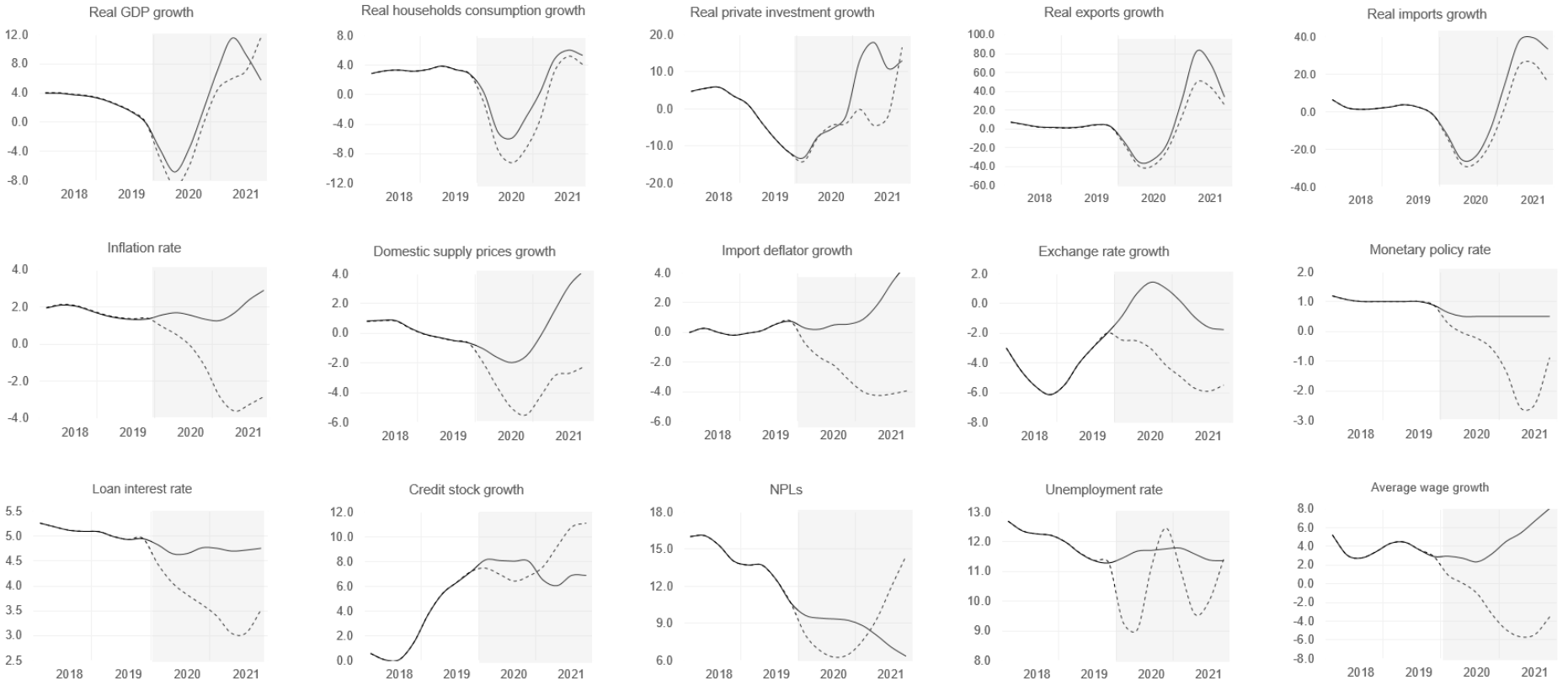

Figure 2.5 Pandemic simulations *versus* the outturn for 2020-2021

Source: Bank of Albania, Consensus Forecast, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: Pandemic simulation trajectories fluctuate around the actual values except for the financial market indicators. Pandemic simulations in black dotted line and the outturn in black. Predictions are constructed as 2-term-centered moving averages.

subdued, reflecting developments in foreign prices and the appreciation of the exchange rate. The nominal wages decline in line with the deflationary environment and the rigidities in the labor market. The appreciation of domestic currency reflects the positive interest rate differentials as the cut in foreign rates exceeds the reduction in domestic interest rates.

The model's ability to track prices during the pandemic remains limited. In the pandemic simulation, no additional judgment was imposed to counteract the strong disinflationary impulse stemming from the negative output gap. As a result, the model tends to amplify the downward pressures on prices, leading to a sharper deflationary path than the observed one. This highlights the weakness of the model in reflecting the non-linearities and frictions that can dominate in the COVID-19 pandemic. Acknowledging this shortcoming, we interpret the simulated price dynamics as an indication of the model's bias under extreme cyclical conditions, rather than as a precise prediction of observed inflation.

The NPL ratio shows a continuous decline in the risk premium of the private sector until the first half of 2020. With the deterioration of the cyclical economic conditions during 2020-2021, the default probability on loans starts to increase. Given the significant support of borrowers based on repayment holidays, introduced in the model by large values of add-factors across indicators on one hand, and the vast persistence of financial indicators on the other hand, the simulation reveals a smoothed shock absorption.

According to the model specification, the default probability on loans increases in economic downturns whenever the financial burden related to the loan is too high compared with the borrower's resources. Decreased economic activity lowers private sector revenues, deteriorating their solvency. This leads to a higher risk premium and

therefore to a higher interest rate, further increasing the financial burden and weakening solvency. This would normally be seen in higher NPL ratios. Moreover, low economic activity requires less financing, leading to a lower credit stock. However, due to repayment moratoria, the delayed payments of principal yield an improvement in NPL rates *via* a 'base effect'. As the model logic was violated *via* several channels, the model could not replicate the observed evolution of financial market indicators such as NPLs or credit stocks.

Thus, we constructed an alternative model specification, changing the transmission channels and elasticities in the financial market equations to temporarily mute the link between the overall economy and loan quality. This follows Bobeica & Hartwig (2021), who, implementing such a change, provide a better accommodation of COVID-19 pandemic developments in the financial sector. Indeed, 'switching off' the feedback loop between the financial system and the real sector provides a closer approximation for the NPL ratio, as illustrated in Figure 2.6.

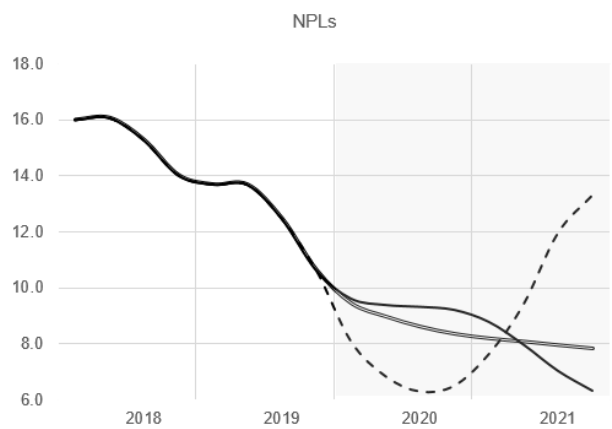

Figure 2.6 Pandemic simulations, pandemic simulations without DF channel *versus* the outturn for 2020-2021

Source: Bank of Albania, Consensus Forecast, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: In comparison to pandemic simulation with default probability channel, pandemic simulation without default probability channel provides a closer estimate for the NPL ratio trajectory with the outturn. Pandemic simulations in black dotted line, pandemic simulations without DF channel in black two lined, and the outturn in black. Predictions are constructed as 2-term-centered moving averages.

In general, tailoring the model according to pandemic conditions should lead to a better capture of macrofinancial evolution. However, doing this change had little effect on the real and nominal indicators. Figure 2.A5 in the Appendix 2.A shows the pandemic simulation results without the feedback loop between the financial system and the real sector together with the outturn in 2020-2021. Although there is a better approximation of the NPL ratio, real sector indicators have improved only very marginally compared to the original pandemic forecast.

2.5.3 Quantile regression-based uncertainty bands

Figure 2.7 shows the add-factors for both forecasts, illustrating that if we want to capture at least part of the shock *via* add-factors in the pandemic scenario for 2020-2021, we need to use a much larger magnitude of add-factors compared to the average historical values in 2010-2019.

As every forecast has a certain level of uncertainty around it, a natural question arises whether the actual outturn in 2020-2021 would at least be within the confidence bands of our forecasts. We construct these bands using quantile regression as described in Section 2.4 for both prepandemic and pandemic simulations. Table 2.A7 in Appendix 2.A shows the estimates of the quantile regression for the upper, median and lower percentiles. Most parameters are statistically significant with correct signs, and the pseudo-R^2 takes values from 20% to 95%. However, some parameters apart from not being statistically significant also feature a different sign or do not affect at all the dependent indicator in the tails of the distribution. Such results are expected given the short sample.

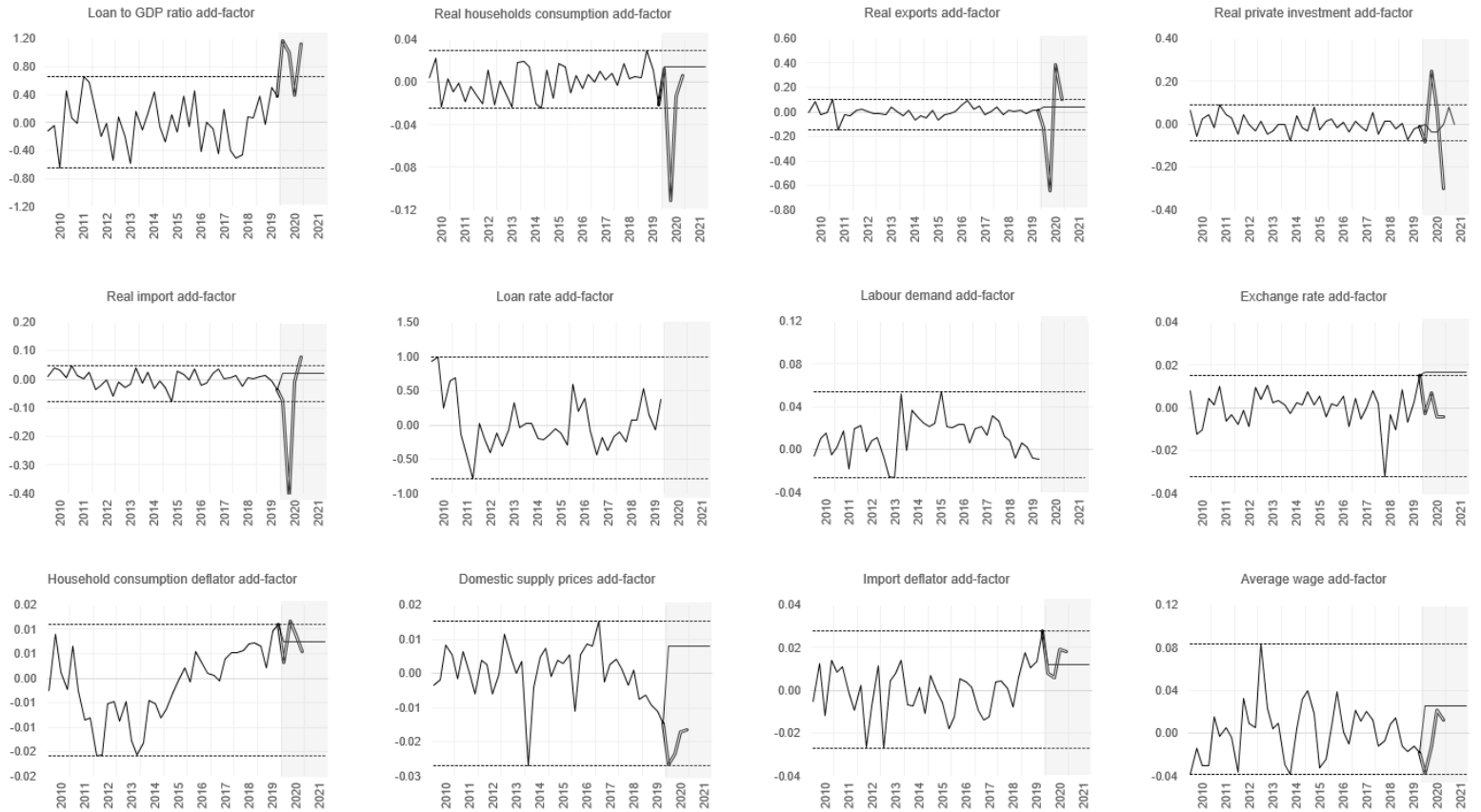

Figure 2.7 In-sample and prepandemic forecast add-factors *versus* pandemic forecast add-factors

Source: Bank of Albania, Consensus Forecast, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: The prepandemic add-factors trajectory falls between the historical minimal and maximal values, whereas the pandemic add-factors trajectory surpasses the historical extremes mainly for macroeconomic variables. Add-factors for in-sample and prepandemic in black line, pandemic in black two lined, and minimal and maximal values (2010-2019) in black dotted line.

Figure 2.8 shows that for some variables, namely, private investments, inflation, loan rate and NPL ratio, the actual trajectories are even within the prepandemic forecast uncertainty bands. This is understandable for the NPL ratio (which has been kept at a low level given the repayment moratoria) but more surprising for the other two variables. For the main components of GDP, household consumption went even temporarily above the upper band of the prepandemic forecast to return during 2022 to the area within the bands, suggesting that households quickly absorbed the uncertainty shock that they experienced at the beginning of the pandemic.

Additionally, the recovery of economic activity during the second year helped to restore the prepandemic consumption-GDP share. Given their volatile nature, private investments result in wide uncertainty bands even in normal times. Thus, their actual trajectory lies in the prepandemic uncertainty band. Exports and imports, on the other hand, experienced a large decline, which was way out of the uncertainty bands of our prepandemic forecast. As a result, GDP growth moves in and out of the bands, making it difficult to make a prediction.

Government measures such as loan repayment moratoria and direct support for the private sector stabilized the banking sector situation but broke the links in the model, which is partly the reason for the poor forecasting performance even in the case of pandemic forecasting. During the pandemic, the credit stock to GDP ratio increased, interest rates continued to fall, and the NPL ratio declined. This goes against the built-in linkages in the model. A decrease in economic activity would normally lead to lower credit and worse cyclical conditions would increase the default probability and thus also the loan interest rates. Higher borrowing costs would put additional negative pressures on credit.

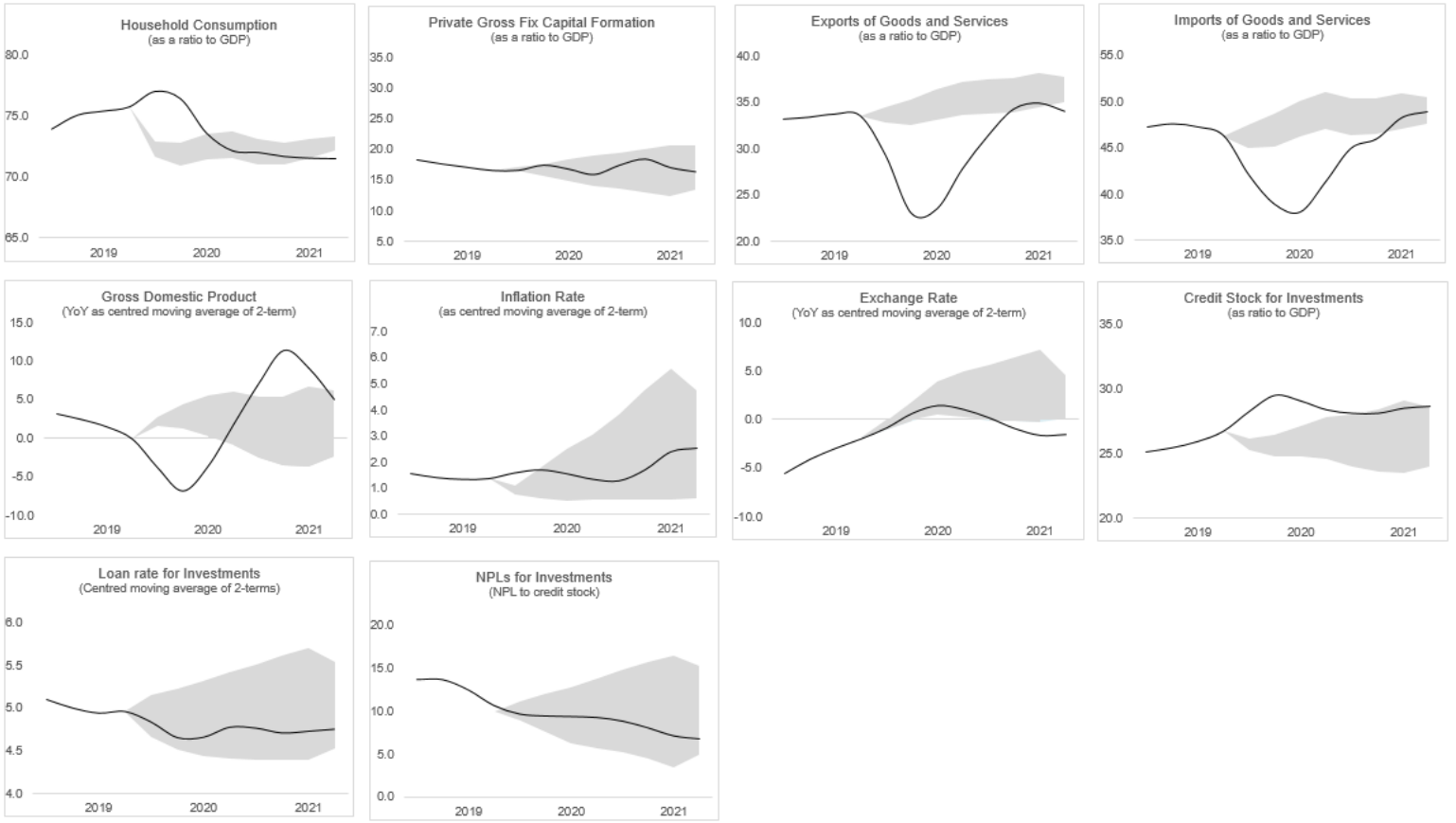

Figure 2.8 Prepandemic forecast uncertainty bands 2020-2021

Source: Bank of Albania, Consensus Forecast, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: Actual trajectories for private investments, inflation, loan rate, and NPL ratio fall within the prepandemic forecast uncertainty bands, while the remainder of the variables fall outside the prepandemic forecast uncertainty bands. Actual data in black line and gray-shaded area 10-90 uncertainty bands. Predictions are constructed as 2-term-centered moving averages.

When looking at uncertainty bands for the pandemic scenario, illustrated in Figure 2.9, most of the actual trajectories lie in the borders of the distributions or stay close. This result is expected given the materialization of the COVID-19 pandemic shock. However, fueling the percentile regressions simply with the pandemic forecast data would not be enough to generate such pandemic uncertainty bands that would reflect the uncertainty that all the sectors experienced. That would be the case for the foreign sector. Figure 2.A4 in the Appendix 2.A shows the pandemic uncertainty bands relying simply on the pandemic forecast data, without any added uncertainty from the pandemic add-factors.

Again, the opposite behavior is featured by the financial market indicators, namely, credit stock, loan rate and NPL. In fact, these variables reached a good performance during the pandemic, which was never experienced during the 2010-2019 period. Moreover, breaking the transmission link of the real sector to the banking sector remains against model rationality.

Finally, we also calculate the forecast errors of both forecasts. Table 2.1 shows the root mean square error (RMSE) for the prepandemic simulation and the pandemic simulation. The errors that enter RMSE represent the difference between the outturn and simulated values under logarithm. By means of illustration, an RMSE of 0.08 in the prepandemic for real GDP simulation means that over 8 quarters, the real GDP was mis-estimated on average by 8%. Table 2.A5 in the Appendix 2.A provides RMSE values calculated over year-on-year growth rates of variables (rather than log-level values). While, Table 2.A6 in Appendix 2.A provides the RMSE values for 2020 and 2021 to assess the contribution of the assumptions employed for 2020 to the improvement in forecasting performance and to evaluate the model's ability to track the adjustment of the economy after the shock.

Figure 2.9 Pandemic forecast uncertainty bands 2020-2021 *versus* actual data

Source: Bank of Albania, Consensus Forecast, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: Actual trajectories mostly follow pandemic forecast uncertainty bands, credit stock, loan rate and NPL behave oppositely. Added uncertainty at the 10th percentile for GDP components and at the 90th percentile for financial market variables according to the add-factors as in the pandemic scenario. Actual data in black line actual data and 10-90 uncertainty bands in gray-shaded area. Figure 2.A4 in Appendix shows the pandemic forecast uncertainty bands without the added uncertainty. Predictions are constructed as 2-term-centered moving averages.

Indicator	Pre-pandemic simulation	Pandemic simulation
Real GDP	0.08	0.05 *
Real household consumption	0.08	0.04 *
Real private investment	0.14	0.13 *
Real exports	0.36	0.16 *
Real imports	0.22	0.12 *
Inflation rate	0.01	0.05
Domestic supply prices	0.07	0.06 *
Import deflator	0.03	0.07
Exchange rate	0.01	0.07
Monetary policy rate	0.52	0.9
Loan interest rate	0.03	0.32
Credit stock	0.05	0.02 *
NPL rate	0.29	0.45
Unemployment rate	0.30	0.22 *
Average wage	0.15	0.11 *

Table 2.1 RMSE of prepandemic and pandemic simulations for 2020-2021

Source: Authors' calculations.
Note: RMSE values are calculated over the logarithms. The asterisk indicates the lower RMSE between the two forecasts.

On average, the predicted errors are higher in the prepandemic simulation. As already discussed, financial market indicators feature the opposite performance given the regulatory measures.

2.6 Conclusions

This paper investigates the ability of a linear macrofinancial model to provide reasonable macroeconomic forecasts in times of large shocks such as the COVID-19 pandemic in an emerging market country. We construct a semistructural multiequation model for Albania, a small open and well-behaving economy in South-Eastern Europe, and estimate its parameters using data for 2010-2019. Using the model, we construct two forecasts – a prepandemic forecast (without any information about the future

pandemic) and a pandemic forecast (which uses some information about the impact of the pandemic in the first year) – and compare the forecast performance by comparing the projections with reality. To capture the uncertainty around both forecasts, we construct uncertainty bands using quantile regression, a suitable approach for pandemic simulations, as it allows for changing model elasticities depending on the quantile of the distribution.

Our analysis suggests that the model is able to capture most of the turning points of indicator trajectories in the pandemic forecast. Simulated trajectories fluctuate around the actual values except for the financial market indicators, which differ due to the government interventions that prevented the increase in NPLs.

The shocks experienced during the COVID-19 pandemic are significantly different from the shocks that occurred in the historical setup of the model. This interpretation is also consistent with the evidence that the simulated trajectories of the pandemic forecast do not fall in the prepandemic conditional distribution. However, if we run the pandemic forecast, prepare uncertainty bands based on quantile regression, and adjust them with add-factors, we are able to include the outturn.

The model's ability to track the nominal side during the pandemic is limited. Without judgment to offset the strong disinflationary impulse from the negative cyclical conditions, it amplifies downward pressures on prices, producing a sharper deflationary path than observed. This reveals a structural limitation of the model, as it captures cyclical drivers of activity but misses non-linearities and frictions in abnormal times like the pandemic.

Also, financial market indicators deviate from the actual paths in the pandemic simulation due to the regulatory measures. The offered option to delay the repayment of principal provided a prolonged freeze of default probability channel together with

an artificial improvement of private sector solvency. Regulatory measures broke the links in the model, which is partly the reason for the poor forecasting performance in the case of the pandemic forecast. Extending the model to mute the feedback loop between the real and financial sectors helps to obtain a better approximation of the outturn values, especially for NPLs, but it only provides a marginal improvement in the real economy forecast.

Overall, our results have several policy implications. Our analysis points out that a model estimated on prepandemic data can be flexibly used even in abnormal times, as most economic forces remain working even in pandemic times but need to be adjusted to reflect the policy measures. In particular, our exercise implies that a linear model may act as a quantifier for approximating the crisis evolution of economic and financial variables. However, its flexibility should not be taken for granted, as it is heavily affected by regulations. Indeed, running an adequate simulation requires a proper expert judgment.

These findings point to avenues for future research. For example, further analyses may explore the direct impact of various government and regulatory measures (such as repayment moratoria or direct subsidies to the private sector) on agents' behavior either in Albania or in other countries with similar experience.

Reference

AAB. (2024). *Albanian Association of Banks* . Statictics. Retrieved from https://aab.al/en/rreth-nesh/statistika/

Abdymomunov, A., Elul, R., Ruffino, D., & Wang, J. (2025). Examining the Relationship Between Loan Pricing and Credit Risk. *FED*. doi: https://doi.org/10.17016/2380-7172.3876

Afesorgbor, S., Van Bergeijk, P., & Demena, B. (2022). COVID-19 and the Threat to Globalization: An Optimistic Note. *COVID-19 and International Development*, 29–44.

Aiyar, M. S., Mitra, M. S., Mineshima, M. A., Jobst, M. A., Dao, M. C., & Pradhan, M. (2021). COVID-19: How Will European Banks Fare? *International Monetary Fund*, IMF Departmental Papers / Policy Papers 2021/008.

Alvarez, S. P., Briod, P., & Ferrari, O. (2015). Remittances: How reliable are the data? *Migration Policy Practice, 2*, 42-46.

Anderson, T. W., & Hsiao, C. (1981). Estimation of Dynamic Models with Error Components. *Journal of the American Statistical Association, 76*(375), 598-606. doi: https://doi.org/10.1080/01621459.1981.10477621

Angelini, E., Bokan, N., Christoffel, K., Ciccarelli, M., & Zimic, S. (2019). Introducing ECB-BASE: The blueprint of the new ECB semi-structural model for the euro area. *European Central Bank, Working Paper Series, No 2315* . Retrieved from https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2315~73e5b1c3cd.en.pdf

Ari, A., Chen, S., & Ratnovski, L. (2021). The dynamics of non-performing loans during banking crises: A new database with post-COVID-19 implications.

Journal of Banking & Finance, 133.

doi:https://doi.org/10.1016/j.jbankfin.2021.106140

Ari, A., Garcia-Macia, D., & Mishra, S. (2023). *Has the Phillips Curve Become Steeper?* Working Paper, IMF, European Department.

Arigoni, F., Breznikar, M., Lenarčič, Č., & Maletič, M. (2021). Impact of Fiscal Measures in Response to the COVID-19 Pandemic on Small-Open Economies: Lessons from Slovenia. *SSRN Electronic Journal*.

Aydemir, R., Atik, Z., & Guloglu, B. (2023). Macro Stress Testing the Credit Risk of Conventional and Participation Banks in Turkey: A Nonparametric Quantile Regression Approach. *Eastern European Economics*, 1–35. doi:https://doi.org/10.1080/00128775.2023.2253226

Baba, C., Duval, R. A., Lan, T., & Topalova, P. (2023). *The 2020-2022 Inflation Surge Across Europe: A Phillips-Curve-Based Dissection.* International Monetary Fund.

Ball, C. P., Zuniga, M. C., Lopez, C., & Reyes, J. A. (2013). Remittances, Inflation and Exchange Rate Regimes in Small Open Economies. *The World Economy, 36*(4).

Ball, L., Leigh, D., & Mishra, P. (2022). Understanding US Inflation during the COVID-19 Era. *Brookings Papers on Economic Activity, 2022*(2), 1-80.

Barajas, A., Choi, W. G., Gan, K. Z., Guérin, P., Mann, S., Wang, M., & Xu, Y. (2021). Loose Financial Conditions, Rising Leverage, and Risks to Macro-Financial Stability. *IMF Working Papers*, WP/21/222.

Bartocci, A., Notarpietro, A., & Pisani, M. (2020). The COVID-19 shock and a fiscal-monetary policy mix in a monetary union. *Temi di discussione*

(Economic working papers) 1313, Bank of Italy, Economic Research and International Relations Area.

Barro, R. J., Ursua, J. F., & Weng, J. (2020). The coronavirus and the Great Influenza epidemic:: Lessons from the "Spanish Flu" for the coronavirus' potential effects on mortality and economic activity. *American Enterprise Institute, AEI Economics Working Paper 2020-02*.

Beck, R., Jakubik, P., & Piloiu, A. (2013). Non-performing loans: What matters in addition to the economic cycle? *ECB Working Paper, 1515*. Retrieved from http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1515.pdf

Beck, R., Jakubik, P., & Piloiu, A. (2015). Key determinants of non-performing loans: New evidence from a global sample. *Open Economies Review, 26*(3), 525–550.

Bergholt, D., Furlanetto, F., & Vaccaro-Grange, E. (2022). Did Monetary Policy Kill The Phillips Curve? Some Simple Arithmetics. *The Phillips Curve: Dead, Alive, or Resurrected?* European Economic Association.

Bernanke, B., & Blanchard, O. (2023). What Caused the U.S. Pandemic-Era Inflation? *Working Papers 23-4*.

Bethlendi, A. (2011). Policy measures and failures on foreign currency household lending in central and eastern Europe. *Acta Oeconomica, 61*(2), 193-223. Retrieved from https://www.jstor.org/stable/41318103

Bieszk-Stolorz, B., & Dmytrów, K. (2022). "Assessment of the Similarity of the Situation in the EU Labour Markets and Their Changes in the Face of the COVID-19 Pandemic. *Sustainability, MDPI*, vol. 14(6), pages 1-20.

Binder, C., & Kamdar, R. (2022). Expected and Realized Inflation in Historical Perspective. *The Journal of Economic Perspectives, 36*(3), 131-156.

Blanchard, O. (2016). The Phillips Curve: Back to the '60s? *The American Economic Review, 106*(5), 31-34.

Bleakley, H., & Cowan, K. (2008). Corporate Dollar Debt and Depreciations: Much Ado about nothing? *Review of Economics and Statistics, 90*(4), 612–26.

BoA. (2015). *Bank of Albania*. Retrieved from Supervision: https://www.bankofalbania.org/Supervision/Action_plan_for_non-performing_loans/

BoA. (2022). *Bank of Albania*. Retrieved from https://www.bankofalbania.org/Statistikat/Statistikat_Monetare_Financiare_dhe_Bankare/

BoA. (2023). *Banka e Shqipërisë*. Retrieved from https://www.bankofalbania.org/Statistikat/Seri_Kohore/

BoA. (2024). *Bank of Albania*. Retrieved from https://www.bankofalbania.org/Statistikat/Seri_Kohore/

Bobeica, H., & Hartwig, B. (2021). The COVID-19 shock and challenges for time series models. *European Central Bank, ECB working paper NO 2558*.

Bodnár, K. (2009). Exchange rate exposure of Hungarian enterprises – results of a survey. *MNB Occasional Papers*.

Boissay, F., Patel, N., & Shin, H. S. (2020, June). Trade credit, trade finance, and the Covid-19 Crisis. *Bank for International Settlements, BIS Bulletin No 24*.

Boissay, F., Rees, D., & Rungcharoenkitkul, P. (2020). *Dealing with Covid-19: Understanding the policy choices.* BIS. BIS.

Boissay, F., Rees, D., & Rungcharoenkitkul, P. (2020). *Dealing with Covid-19: Understanding the policy choices.* BIS. BIS.

Bordo, M. D., Levin, A. T., & Levy, M. D. (2020). Incorporating Scenario Analysis into the Federal Reserve's Policy Strategy and Communications. *NBER Working Paper No. 27369*.

Boumparis, P., Milas, C., & Panagiotidis, T. (2019). Non-performing loans and sovereign credit ratings. *International Review of Financial Analysis, 64*, 301-314. doi:https://doi.org/10.1016/j.irfa.2019.06.002

Brázdik, F., Hlédik, T., Humplová, Z., Martonosi, I., Musil, K., Ryšánek, J., . . . Žáček, J. (2020). The g3+ Model: An Upgrade of the Czech National Bank's Core Forecasting Framework. *Working paper series, No 1/2020*.

Brown, M., Haas, R. D., Tille, C., & Halpern, L. (2012). Foreign banks and foreign currency lending in emerging Europe. *Economic Policy, 69*(57), 59-98. Retrieved from https://www.jstor.org/stable/41428846

Budnik, K. B., Greszta, M., Hulej, M., Kolasa, M., Murawski, K., Rot, M., . . . Tarnicka, M. (2011). The new macroeconometric model of the Polish economy. *National Bank of Poland Working Paper, 62*.

Budnik, K., Greszta, M., Hulej, M., Krzesicki, O., Lewińska, R., Murawski, K., . . . Rybaczyk, B. (2009). An update of the macroeconometric model of the Polish economy NECMOD. *National Bank of Poland Working Papers*, NO. 64.

Bulligan, G., Busetti, F., Caivano, M., Cova, P., Fantino, D., Locarno, A., & Rodano, L. (2017). The Bank of Italy econometric model: an update of the main equations and model elasticities. *Banca d'Italia, Temi di Discussione*, No 1130.

Calem, P., & Rob, R. (1999). The Impact of Capital-Based Regulation on Bank Risk-Taking. *Journal of Financial Intermediation, 8*(4), 317-352. doi:https://doi.org/10.1006/jfin.1999.0276

Carpenter, S. B., Harris, E. S., Hooper, P., & West, K. D. (2022). *Some Benefits and Risks of a Hot Economy.* U.S. Monetary Policy Forum.

Carstens, A. (2022). *The return of inflation.* International Center for Monetary and Banking Studies . Bank for International Settlements.

Castaldo, A., & Reilly, B. (2007). Do migrant remittances affect the consumption patterns of albanian households? *South-Eastern Europe Journal of Economics, 1*, 25-54.

Cecchetti, S. G., Feroli, M. E., Hooper, P., Mishkin, F. S., & Schoenholtz, K. L. (2023). DP18068 Managing Disinflations. *CEPR Press Discussion Paper No. 18068.*

Cela, E., & Skufi, L. (2018). Natural rate of unemployment – Reduced form approach. *Bank of Albania*, Working paper series No 40-(79). Retrieved from https://www.bankofalbania.org/Publications/All_publications/Natural_rate_of_unemployment_Reduced_form_approach.html

Cerqua, A., & Letta, M. (2022). Local inequalities of the COVID-19 crisis. *Regional Science and Urban Economics*, Elsevier, vol. 92(C).

Chan, Y. T. (2022). The macroeconomic impacts of the COVID-19 pandemic: A SIR-DSGE model approach. *China Economic Review*, Elsevier, vol. 71(C).

Chollette, P. (1984). Adjusting sub-annual series to yearly benchmarks. *Survey Methodology, 10*, 35-49.

Clements, M. P., & Hendry, D. F. (1998). Forecasting Economic Processes. *International Journal of Forecasting, 14*((1)), 111-131.

Clements, M. P., & Hendry, D. F. (1999). *Forecasting Non-Stationary Economic Time.* Cambridge, Mass.: MIT Press.

Coenen, G., Montes-Galdón, C., & Smets, F. (2020). Effects of state-dependent forward guidance, large-scale asset purchases and fiscal stimulus in a low-interest-rate envrionment. *ECB*, Working Paper Series, No 2352.

Coibion, O., & Gorodnichenko, Y. (2015). Is the Phillips Curve Alive and Well after All? Inflation Expectations and the Missing Disinflation. *American Economic Journal: Macroeconomics, 27*(1), 197-232.

Conrad, D., Ramkissoon, B., & Mohammed, S. (2018). Back to Basics: Remittances in the Keynesian Macroeconomic Framework. *International Advances in Economic Research* , 233–238. doi:https://doi.org/10.1007/s11294-018-9703-y

Consensus Economics. (2020). *Consensus Forecasts.* London: Phillip M. Hubband. Retrieved from www.consensuseconomics.com

Correia, S., Stephan, L., & Emil, V. (2020). Pandemics Depress the Economy, Public Health Interventions Do Not: Evidence from the 1918 Flu. *SSRN Electronic Journal*.

Coutinho, L., Vukšić, G., & Zeugner, S. (2021). *International tourism decline and its impact on external balances in the euro area.* Quarterly Report on the Euro Area (QREA), European Commission, Directorate General Economic and Financial Affairs (DG ECFIN).

Croitorov, O., Filippeschi, G., Licchetta, M., Pfeiffer, P., Reut, A., Simons, W., . . . Vogel, L. (2021). The macroeconomic impact of the COVID-19 pandemic in the euro area. *European Commission*, Quarterly Report on the Euro Area (QREA), Directorate General Economic and Financial Affairs (DG ECFIN), vol. 20(2), pages 7-16, July.

Crump, R. K., Eusepi, S., Giannoni, M., & Şahin, A. (2019). A Unified Approach to Measuring u. *Brookings Papers on Economic Activity, Spring*(2019), 143-214.

De Santis, R. A., & Van der Veken, W. (2020). Forecasting macroeconomic risk in real time: Great and Covid-19 Recessions. *European Central Bank*, Working Paper Series 2436.

Demirguc-Kunt, A., & Huizinga, H. (2000). Financial structure and bank profitability. *Policy Research Working Paper Series, 2430*.

Docquier, F., Ozden, Ç., & Peri, G. (2014). The Labour Market Effects of Immigration and Emigration in OECD Countries. *The Economic Journal, 124*(579), 1106–1145. doi:https://doi.org/10.1111/ecoj.12077

Donadelli, M., Ferranna, L., Gufler, I., & Paradiso, A. (2021, June). Using past epidemics to estimate the macroeconomic implications of COVID-19: A bad idea! *Structural Change and Economic Dynamics, 57*, 214-224.

Dowlah, C. (2020). Cross-Border Labor Mobility: Theoretical Perspectives and Empirical Findings. In *Cross-Border Labor Mobility.* Palgrave Macmillan, Cham. doi:https://doi.org/10.1007/978-3-030-36506-6_11

Duval, L., & Wolff, F.-C. (2009). *Remittances matter: Longitudinal evidence from Albania.* HAL.

Duval, M. R., Shibata, M. I., Ji, Y., Pizzinelli, C., Tavares, M. M., Li, L., . . . Sozzi, A. (2022). Labor Market Tightness in Advanced Economies. *International Monetary Fund*, IMF Staff Discussion Notes 2022/001.

ECB. (2011). Empirical determinants of non-performing loans. *ECB Financial Stability*, 132-139.

ECB. (2021). *Review of macroeconomic modelling in the Eurosystem: current practices and scope for improvement.* Frankfurt: European Central Bank. Retrieved 2022, from https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op267~63c1f094d6.en.pdf

Eichenbaum, M. S., Rebelo, S., & Trabandt, M. (2021). The Macroeconomics of Epidemics. *NBER, w26882*.

Engelke, C., Heinisch, K., & Schult, C. (2019). How forecast accuracy depends on conditioning assumptions. *Leibniz-Institut für Wirtschaftsforschung Halle, IWH Discussion Papers No. 18/2019*. Retrieved from http://hdl.handle.net/10419/201837

European Commission. (2021). Albania post-disaster needs assesssment. Retrieved from https://ec.europa.eu/fpi/system/files/2021-05/10_Albania%202020%20Post-Disaster%20Needs%20Assessment.pdf

European Commission. (2022). Labour Market and Wage Developments in Europe. *Annual review 2022*.

Eurostat. (2022). *European Commission*. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/namq_10_gdp/default/table?lang=en

Fagan, G., Henry, J., & Mestre, R. (2001). An Area-wide Model (AWM) for the euro area. *ECB, WORKING PAPER NO. 42*.

Fahlenbrach, R., Rageth, K., & Stulz, R. M. (2021). How valuable is financial flexibility when revenue stops? Evidence from the COVID-19 crisis. *Review of Financial Studies*.

Fahlenbrach., R., Rageth, K., & Stulz, R. M. (2021). How valuable is financial flexibility when revenue stops? Evidence from the COVID-19 crisis. *Review of Financial Studies*.

Festić, M., & Bekő, J. (2008). The Banking Sector and Macroeconomic Performance in Central European Economies. *Czech Journal of Economics and Finance, 58*(3-4), 131–151.

Fink, G., Rainer, W., & Haiss, P. R. (2016). The euro as international currency: Euro-loans in central and south-east european countries. In M. Guderzo, & A. Bosco (Eds.), *A Monetary hope for Europe: the Euro and the Struggle for the Creation of a New Global Currency.* Studi e Saggi.

Foroni, C., Marcellino, M., & Stevanovic, D. (2019). Mixed frequency models with MA components. *Journal of Applied Econometrics, 34*. doi:10.1002/jae.2701

Gagliardone, L., & Gertler, M. (2023). *Oil Prices, Monetary Policy and Inflation Surges.* National Bureau of Economic Research.

Garcia, P., Jacquinot, P., Lenarcic, C., Lozej, M., & Mavromatis, K. (2021, October). Global models for a global pandemic: the impact of COVID-19 on small euro area economies. *ECB WP*, No 2603. Retrieved 2021, from European Central Bank: https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2603~95e887c0db.en.pdf

Gerlach, S., Peng, W., & Shu, C. (2005). *Macroeconomic conditions and banking performance in Hong Kong SAR: a panel data study.* Working Paper, BIS.

Gëdeshi, I., & King, R. (2018). *New trends in potential migration from Albania.* Tirana: Friedrich-Ebert-Stiftung.

Ghosh, S., & Weinstein, A. (2021). The Impact of Emigration on Source Countries. In K. Kourtit, B. Newbold, P. Nijkamp, & M. Partridge, *The Economic*

Geography of Cross-Border Migration (pp. 421–448). Springer, Cham. doi:https://doi.org/10.1007/978-3-030-48291-6_19

Giannoni, M. (2016). The Federal Reserve in the 21st century. Models for Forecasting and Policy Analysis. *Federal Reserve Bank of New York*. Retrieved from https://www.newyorkfed.org/medialibrary/media/outreach-andeducation/Giannoni-ModelsforForecasting-Fed21-2016.pdf

Giovanni, J. d., Kalemli-Özcan, Ş., Silva, A., & Yildirim, M. A. (2022). Global Supply Chain Pressures, International Trade, and Inflation. *Challenges for monetary policy in a rapidly changing world.* ECB Forum on Central Banking.

Goldstein, I., Koijen, R., & Mueller, H. M. (2021). COVID-19 and Its Impact on Financial Markets and the Real Economy. *The Review of Financial Studies*.

Gomme, P. (2021). Labor Market and Fiscal Policy During and After the Coronavirus. *Working Papers 21003, Concordia University, Department of Economics*.

Grömling, M. (2021). COVID-19 and the Growth Potential. *Intereconomics: Review of European Economic Policy*, Springer;ZBW - Leibniz Information Centre for Economics;Centre for European Policy Studies (CEPS), vol. 56(1), pages 45-49.

Gupta, S., Kangur, A., & C. Papageorgiou, A. W. (2011). *Efficiency-adjusted public capital and growth.* Washington: International Monetary Fund.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251-1271. doi:https://doi.org/10.2307/1913827

Hazell, J., Herreno, J., Nakamura, E., & Steinsson, J. (2022). The slope of the Phillips Curve: evidence from US states. *The Quarterly Journal of Economics, 137*(3), 1299–1344.

Hobijn, B., Miles, R., Royal, J., & Zhang, J. (2023). The recent steepening of Phillips curves. *Chicago Fed Letter, 475*.

Hong, H., Wang, N., & Yang, J. (2021). Implications of stochastic transmission rates for managing pandemic risks. *Review of Financial Studies*.

Hudecz, A. (2013). Parallel Stories: Fx Lending To Households In Poland, Romania And Hungary, 1997—2011. *Acta Oeconomica, 63*(3), 257-286. Retrieved from https://www.jstor.org/stable/23526175

Inoue, A., Rossi, B., & Wang, Y. (2022). *Has the Phillips Curve Flattened and Why?* Federal Reserve Bank of Cleveland.

INSTAT. (2022). *Instituti i Statistikave*. Retrieved from http://databaza.instat.gov.al/pxweb/sq/DST/?rxid=b5069c81-9c75-4560-905a-2cb719af3ada

INSTAT. (2023). *Instituti i Statistikave*. Retrieved from https://www.instat.gov.al

INSTAT. (2024). Retrieved from INSTAT: https://databaza.instat.gov.al:8083/pxweb/sq/DST

INSTAT. (2024). *Instituti i Statistikave*. Retrieved from https://www.instat.gov.al

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica, 59*, 1551–1580.

Jones, C. J., Philippon, T., & Venkateswaran, V. (2021). Optimal mitigation policies in a pandemic: Social distancing and working from home. *Review of Financial Studies*.

Jorda, O., & Nechio, F. (2020). Inflation Globally. *Changing Inflation Dynamics,Evolving Monetary Policy, 27*, 269-316.

Jordà, Ò., Singh, S. R., & Taylor, A. M. (2020). Longer-run economic consequences of pandemics. *National Bureau Of Economic Research, Working Paper No. 26934*.

Kalaj, E. (2015, April). Hidden Consequences of Migration and Remittances in Albania. *European Journal of Social Sciences Education and Research, 2*(1).

Kanas, A., & Molyneux, P. (2018). Macro stress testing the U.S. banking system. *Journal of International Financial Markets, Institutions and Money*, 204-227. doi:https://doi.org/10.1016/j.intfin.2017.12.006

Karadima, M., & Louri, H. (2020). Non-performing loans in the euro area: Does bank market power matter? *International Review of Financial Analysis, 72*. doi:doi.org/10.1016/j.irfa.2020.101593

Kassab, S. (2024). The Impact of Remittance Inflows on Inflation: The Case of Lebanon. *Review of Middle East Economics and Finance, 20*(1). doi:https://doi.org/10.1515/rmeef-2024-0006

Kazinczy, E. (2013). The catching-up of the banking sector in south-eastern Europe: a fragiledevelopment model dominated by credit growth. *Society and Economy, 35*(4), 493-511. Retrieved from https://www.jstor.org/stable/43774187

Kermack, W. O., & McKendrick, A. G. (1927). A contribution to the mathematical theory of . *Proceedings of the Royal Society of London. Series A, Containing Papers of a Mathematical and Physical Character*, 115:700–721.

Khurshid, A., Kedong, Y., Călin, A. C., Meng, Z., & Nazir, N. (2018). Remittances Inflows, Gain of Foreign Exchange or Trade Loss? New Evidence from Low,

Lower-Middle and Middle-Income Groups. *Journal for Economic Forecasting, 0*(1), 20-41.

Kipriyanov, A. (2022). Comparison of Models for Growth-at-Risk Forecasting. *Russian Journal of Money and Finance*, Bank of Russia, vol. 81(1), pages 23-45.

Klein, N. (2013). Non-Performing loans in CESEE: Determinants and impact on macroeconomic performance. *IMF Working Paper, WP/13/72*. Retrieved from https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Non-Performing-Loans-in-CESEE-Determinants-and-Impact-on-Macroeconomic-Performance-40413

Kochovska, T. (2020). Interplay between Reservation wage and Unemployment Duration: Evidence from Jordan, Serbia. Montenegro, Ukraine and Moldova in 2015. *Business and Economic Research, 10*(1).

Koenker, R. (2005). Quantile Regression. *Econometric Society Monographs*.

Kucharcukova, O. B., Bruha, J., Kral, P., & Motl, M. (2022). Assessment of the Nature of the Pandemic Shock: Implications for Monetary Policy. *Research and Policy Notes 2022/01*.

Kuzucu, N., & Kuzucu, S. (2019). What Drives Non-Performing Loans? Evidence from Emerging and Advanced Economies during Pre- and Post-Global Financial Crisis. *Emerging Markets Finance and Trade, 55*(8), 1694-1708. doi:10.1080/1540496X.2018.1547877

Le, C. D., & Le, A. H. (2023). Macroeconomic determinants of non-performing loans: a quantile regression approach evidence from Vietnam's banking system. *Journal of Eastern European and Central Asian Research, 70*(5). doi: https://doi.org/10.15549/jeecar.v10i5.1255

Louzis, D. P., Vouldis, A. T., & Metaxas, V. L. (2012). Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of Banking and Finance, 36*.

Lütkepohl, H. (2005). *New Introduction to Multiple Time Series Analysis.* Berlin: Springer.

Lütkepohl, H. (2006). Forecasting with VARMA Models. *Handbook of Economic Forecasting, 1*, chapter 6, pages 287-325.

Macháček, M., Melecký, A., & Šulganová, M. (2017). Macroeconomic Drivers of Non-Performing Loans: A Meta-Regression Analysis. *Prague Economic Papers, 27*(3), 1-24.

Magkonis, G., Chortareas, G., & Zekented, K. (2019). Credit risk and the business cycle: What do we know? *International Review of Financial Analysis, 67*(4).

Manz, F. (2019). Determinants of non-performing loans: What do we know? A systematic review and avenues for future research. *Management Review Quarterly, 69*, 351–389.

Marcucci, J., & Quagliariello, M. (2008). Credit Risk and Business Cycle Over Different Regimes. *Temi di Discussione (Working Paper) 670*. Retrieved from https://ssrn.com/abstract=1160155 or http://dx.doi.org/10.2139/s

Maurya, P. K., Bansal, R., & Mishra, A. K. (2023). Russia–Ukraine conflict and its impact on global inflation: an event study-based approach. *Journal of Economic Studies*.

McAdam, P., & Mestre, R. (2002). *Evaluating Macro-Modelling Systems: An Application to the Area Wide Model.* ECB.

McAdam, P., & Mestre, R. (2007). *Evaluating Macro-Modelling Systems: An Application to the Area Wide Model.* ECB, Research Department.

McGregor, T., & Toscani, F. G. (2022). *A Bottom-Up Reduced Form Phillips Curve for the Euro Area.* International Monetary Fund.

McKibbin, W. J., & Stoeckel, A. (2018). Modelling a Complex World: Improving Macromodels. *Oxford Review of Economic Policy, vol. 34 nos. 1-2*.

Mckibbin, W., & Fernando, R. (2020, April). The global macroeconomic impacts of COVID-19: Seven scenarios. *Covid Economics, 10*, 116-156.

Mehedintu, A., Soava, G., & Sterpu, M. (2020). Remittances, Migration and Gross Domestic Product from Romania's Perspective. *Sustainability, 12*(1). doi:https://doi.org/10.3390/su12010212

Mestre, R., & McAdam, P. (2008). Is Forecasting with Large Models Informative? Assessing the Role of Judgement in Macroeconomic Forecasts. *ECB, ECB Working Paper No. 950*. doi:http://dx.do

Meyer, D., & Shera, A. (2017). The impact of remittances on economic growth: An econometric model. *EconomiA, 18*(2), 147-155.

Mihailov, A. (2020). Quantifying the Macroeconomic Effects of the COVID-19 Lockdown: Comparative Simulations of the Estimated Galí-Smets-Wouters Model. *Economics Discussion Papers em-dp2020-07, Department of Economics, University of Reading*.

Mishra, P., & Mishra, S. K. (2021). Do Banking and Financial Services Sectors Show Herding Behaviour in Indian Stock Market Amid COVID-19 Pandemic? Insights from Quantile Regression Approach. *Millennial Asia*. doi:10.1177/09763996211032356

MoF. (2020). *Ministry of Finance and Economy*. Retrieved from Covid support packages: https://financa.gov.al/masae-e-marra/

MoF. (2021). *Ministry of Finance and Economy*. Retrieved from Buxheti 2020: https://www.financa.gov.al/buxheti-2020/

MoF. (2022). *Ministry of Finance and Economy*. Retrieved from https://financa.gov.al/raporte-dhe-statistika-fiskale/

Narayan, P. K., Narayan, S., & Mishra, S. (2011). Do Remittances Induce Inflation? Fresh Evidence from Developing Countries. *Southern Economic Journal, 77*(4), 914-933.

Narayan, P. K., Narayan, S., & Mishra, S. (2011). Do Remittances Induce Inflation? Fresh Evidence from Developing Countries. *Southern Economic Journal, 44*(7), 914-933.

Negro, M. D., Lenza, M., Primiceri, G. E., & Tambalotti, A. (2020). What's Up with the Phillips Curve? *Brookings Papers on Economic Activity, SPRING 2020*, 301-357.

OECD. (2014). *Organisation for Economic Co-operation and Development* . Retrieved from The OECD Economic Outlook: Sources and Methods: https://stats.oecd.org/glossary/detail.asp?ID=44#:~:text=An%20add%2Dfactor%20is%20the,the%20forecast%20period%20as%20well

OECD. (2023). Employment Outlook 2023. *Artificial Intelligence and the Labour Market*.

Pariès, D., & M. and Papadopoulou, N. (2020). Balance Sheet Policies in a Large Currency Union: A Primer on ECB Non-Standard Measures since 2014. *Revue d'économie politique*, Vol. 130, No 2, pp. 171-230.

Pellegrino, G., Ravenna, F., & Züllig, G. (2021, August). The Impact of Pessimistic Expectations on the Effects of COVID-19-Induced Uncertainty in the Euro Area. *Oxf Bull Econ Stat, 83*(4), pp. 841-869.

Petreski, M., Oviedo, A. M., & Cancho, C. A. (2019). Expectations Set High: Understanding Reservation Wages in North Macedonia. *Comparative Political Economy: Regulation eJournal*.

Phillips, A. W. (1958). The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957. *Economica, 25*(100), 283–299.

Primiceri, G. E., & Tambalotti, A. (2020, June). Macroeconomic Forecasting in the Time of COVID-19. *Manuscript*.

Quagliariello, M. (2007). Banks' riskiness over the business cycle: a panel analysis on Italian intermediaries. *Applied Financial Economics, 17*(2), 119–138.

Raudys, A., Lenčiauskas, V., & Malčius, E. (2013). Moving Averages for Financial Data Smoothing. (T. Skersys, R. Butleris, & R. Butkiene, Eds.) *Information and Software Technologies, 403*, 34-45. doi:https://doi.org/10.1007/978-3-642-41947-8_4

Rivera, J. P., & Tullao, T. (2020). Investigating the link between remittances and inflation: evidence from the Philippines. *South East Asia Research, 28*, 1-26. doi:10.1080/0967828X.2020.1793685

Robert F. Engle, S. M. (2004). CAViaR: Conditional Autoregressive Value at Risk by Regression Quantiles. *Journal of Business & Economic Statistics, 22*(4), 367-381.

Roberts, J. M. (2019). Panel discussion: Modelling strategies and policy analysis. *Forecasting and policy analysis with semi-structural models.* Joint Bank of

Canada – Banque de France – ECB workshop. Retrieved from https://www.banque-france.fr/sites/default/files/roberts_-_bdf_september2019.pdf

Roger, K., & Bassett, G. J. (1978). Regression Quantiles. *Econometrica*, 46(1).

Roger, K., & Bassett, G. J. (1978). Regression Quantiles. *Econometrica*, 46(1).

Said, S. E., & Dickey, D. A. (1984). Testing for Unit Roots in Autoregressive Moving Average Models of Unknown Order. *Biometrika, 71*(3), 599–607. doi:https://doi.org/10.2307/2336570

Salas, M., Lamothe, P., & Delgado, E. (2024). Determinants of nonperforming loans: A global data analysis. *Computational Economics*. doi:https://doi.org/10.1007/s10614-023-10543-8

Sergi, B. S., & Morabito, G. (2016). Migration and remittances: the rise and fall of Albania and Kosovo. *Journal for Labour and Social Affairs in Eastern Europe, 19*(1), 55-66.

Skufi, L., & Geršl, A. (2023). Using Macrofinancial Models to Simulate Macroeconomic Developments During the COVID-19 Pandemic: The Case of Albania. *Eastern European Economics, 61*(5), 517-553. doi:10.1080/00128775.2023.2215229

Skufi, L., & Kika, E. (2019). The Price Formation Process in the Albanian Economy: A Macro Modelling Approach. *Bank of Albania WP, 44*(83).

Skufi, L., Kika, E., & Ceka, E. (2024). Macro econometric Albanian model (Meam): An update of the main equations and model elasticitie. *Bank of Albania Working Paper, 7*(94).

Streimikiene, D., Svagzdiene, B., Jasinskas, E., & Simanavicius, A. (2021). Sustainable tourism development and competitiveness: The systematic

literature review. *Sustainable Development*, John Wiley & Sons, Ltd., vol. 29(1), pages 259-271, January.

Shehaj, E. (2012). The Determinants of Migration and Remittances in Albania. *International Journal of Scientific & Engineering Research, 3*(4).

Theil, H. (1957). Specification Errors and the Estimation of Economic Relationships. *Review of the International Statistical Institute, 25*, 41-51. doi:https://doi.org/10.2307/1401673

United Nations. (2023). *World Population Prospects 2022.* Population Division , Department of Economic and Social Affairs.

Vacas-Soriano, C., & Kostolny, J. (2022). *Minimum Wages in 2022: Bigger Hikes this Time Around.* European Foundation for the Improvement of Living and Working.

Vazquez, F., Tabak, B. M., & Souto, M. R. (2012). A Macro Stress Test Model of Credit Risk for the Brazilian Banking Sector. *Journal of Financial Stability, 8*(2).

Velde, F. R. (2020). What Happened to the US Economy During the 1918 Influenza Pandemic? A View Through High-Frequency Data. *Federal Reserve of Chicago, WP 2020-11*.

Verner, E., & Gyöngyösi, G. (2020). Household Debt Revaluation and the Real Economy. *The American Economic Review, 110*(9), 2667-2702. Retrieved from https://www.jstor.org/stable/10.2307/26966313

World Bank . (2023). *Remittances.* World Development Indicators.

World Bank. (2017). *Review of the market for remittances in Albania.* World Bank.

2.A Appendix

Variable	Acronym	Source	Terms	Seas.adj	Frequency
Real sector					
GDP	Y	INSTAT	R/N	TS	Q
Household consumption	YC	INSTAT	R/N	TS	Q
Public consumption	YG	INSTAT	R/N	TS	Q
Gross fixed capital formation	YI	INSTAT	R/N	TS	Q
Public gross fixed capital formation	YIG	MoF	R/N	TS	Q
Private gross fixed capital formation	YIP	C	R/N	ITS	Q
Exports of goods and services	YE	INSTAT	R/N	TS	Q
Imports of goods and services	YM	INSTAT	R/N	TS	Q
Demand for imports	DM	C	R	ITS	Q
Disposable income	YDI	C	R/N	ITS	Q
Output gap	$\tilde{Y}$	C	R	ITS	Q
Potential GDP	$\tilde{Y}$	C	R	ITS	Q
Total factor productivity	A	C	R	ITS	Q
Capital stock	C	C	R	NA	QL
Public capital stock	CG	C	R	NA	QL
Private capital stock	CP	C	R	NA	QL
Potential labor supply	$\tilde{L}$	C	R	ITS	Q
Square meters inhabited per capita	M2P	C	R	NA	Q
Nominal side					
CPI index	PI	INSTAT	N	NA	QA
Oil price	PO	INSTAT	N	TS	QA
GDP deflator	PY	C	N	TS	Q
Household consumption deflator	PDDC	C	N	ITS	Q
Public consumption deflator	PDDG	C	N	ITS	Q
Gross fixed capital formation deflator	PDDI	C	N	TS	Q
Exports of goods and services deflator	PDDE	C	N	TS	Q
Import deflator	PM	C	N	TS	Q
Domestic supply prices	PD	C	N	TS	Q
Domestic deflator	PDD	C	N	ITS	Q
Competitiveness term	CT	C	N	ITS	Q
Relative prices of imports	RP	C	N	ITS	Q
Labor market					
Labor demand	LD	INSTAT	R	TS	Q
Labor supply	LS	C	R	ITS	Q
Unemployment rate	UN	INSTAT	R	NA	Q
NAIRU	NAIRU	C	R	NA	Q
Average wage	PN	INSTAT	R/N	TS	Q
Compensation per employee	PE	C	N	ITS	QS
ULC	ULC	C	N	TS	Q
Labor productivity	LP	C	R	ITS	Q
Population	P	INSTAT	R	NA	QI
Financial market and exchange rate					
Credit stock granted to business	L	BoA	N	Na	QL
Credit stock granted to business to GDP	L_Y	C	N	ITS	QL
Financial burden of borrowers	BB	C	N	Na	QL
Leverage of borrowers	S	C	N	ITS	QL
NPL for loans granted to business	rp	BoA	N	NA	QL
Loan interest rate to business	IL	BoA	R/N	NA	QA
Cost of capital rate	IC	C	R/N	NA	QA
Monetary policy rate	IR	BoA	R/N	NA	QA
Treasury bill 12-months	I	MoF	R/N	NA	QA
Exchange rate	EX	BoA	N	NA	QA
Foreign sector					
EA Inflation	PIF	EUROSTAT	N	NA	QA
Foreign demand	YF	EUROSTAT	R	NA	Q
Implicit deflator of export EU	PFE	EUROSTAT	N	NA	Q
Implicit deflator of imports EU	PFI	EUROSTAT	N	NA	Q
Foreign interest rate	IF	EUROSTAT	N	NA	QA
Remittances	R	BoA	N	TS	Q
Other transfers BoP	RO	BoA	N	TS	Q

Table 2.A1 List of Model Variables

Source: Bank of Albania, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: Acronyms: BoA - Bank of Albania; C - calculated; INSTAT - Institute of Statistics; ITS - Indirect seasonal adjustment; N - Nominal; NA - None; Q/A/I/L/S - Quarterly/ monthly average/ Interpolated/ Last month/ Monthly sum; R - Real; TS - Tramo seats.

Variable	Type	Source
Real sector		
GDP	EN	NA
Household consumption	EN	ADDF
Public consumption	EX	MoF
Gross fixed capital formation	EN	NA
Public gross fixed capital formation	EX	MoF
Private gross fixed capital formation	EN	ADDF
Exports of goods and services	EN	ADDF
Imports of goods and services	EN	ADDF
Demand for imports	EN	NA
Disposable income	EN	NA
Output gap	EN	NA
Potential GDP	EN	NA
Total factor productivity	EX	CS
Capital stock	EN	NA
Public capital stock	EN	NA
Private capital stock	EN	NA
Potential labor supply	EN	NA
Square meters inhabited per capita	EX	CS
Nominal side		
CPI index	EN	NA
Oil price	EX	CF
GDP deflator	EN	NA
Household consumption deflator	EN	ADDF
Public consumption deflator	EN	NA
Gross fixed capital formation deflator	EN	NA
Exports of goods and services deflator	EN	NA
Import deflator	EN	ADDF
Domestic supply prices	EN	ADDF
Domestic deflator	EN	NA
Competitiveness term	EN	NA
Relative prices of imports	EN	NA
Labor market		
Labor demand	EN	NA
Labor supply	EX	CL
Unemployment rate	EN	NA
NAIRU	EX	Est.
Average wage	EN	ADDF
Compensation per employee	EN	NA
ULC	EN	NA
Labor productivity	EN	NA
Population	EX	CL
Financial market and exchange rate		
Credit stock granted to business	EN	NA
Credit stock granted to business to GDP	EN	NA
Financial burden of borrowers	EN	NA
Leverage of borrowers	EN	NA
NPL for loans granted to business	EN	ADDF
Loan interest rate to business	EN	NA
Cost of capital rate	EN	NA
Monetary policy rate	EN	ADDF
Treasury bill 12-months	EN	NA
Exchange rate	EN	ADDF
Foreign sector		
EA Inflation	EX	CF
Foreign demand	EX	CF
Implicit deflator of export EU	EX	CF
Implicit deflator of imports EU	EX	CF
Foreign interest rate	EX	CF
Remittances	EX	CF
Other transfers BoP	EX	CF

Table 2.A2 List of prepandemic simulation assumptions

Source: Consensus Forecast, Ministry of Finance, authors' calculations.
Note: Acronyms: ADDF – Add-Factor; CF - Consensus Forecast; CL - Kept constant at 2019Q4; CS - Kept constant at average value 2010-2019; EN - endogenous variable; Est - Estimated; EX - Exogeneous variable; MoF - Ministry of Finance; NA – None.

Exogenous Variables	Prepandemic	Pandemic
Public consumption	Ministry of Finance Projections	Ministry of Finance Statistics
Public gross fixed capital formation	Ministry of Finance Projections	Ministry of Finance Statistics
Total factor productivity	Kept constant at avg. 2010-2019	Kept constant at avg. 2010-2019
Square meters inhabited per capita	Kept constant at avg. 2010-2019	INSTAT
Oil price	Consensus Forecast	EUROSTAT
Labor supply	Kept constant at 2019Q4	INSTAT
NAIRU	Estimated	Estimated
EA Inflation	Consensus Forecast	EUROSTAT
Foreign demand	Consensus Forecast	EUROSTAT
Implicit deflator of export EU	Consensus Forecast	EUROSTAT
Implicit deflator of imports EU	Consensus Forecast	EUROSTAT
Foreign interest rate	Consensus Forecast	EUROSTAT
Remittances	Consensus Forecast*	Banlance of Payments
Other transfers Banlance of Payments	Consensus Forecast*	Banlance of Payments

Table 2.A3 List of prepandemic and pandemic assumption of exogenous variables

Source: Balance of Payments, Consensus Forecast, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: In the pandemic forecast the exogenous variables follow the observed path. The asterisk indicates that foreign GDP projections are taken from Consensus Forecast and are employed in satellite models to estimate the indicator of interest.

Equation	Parameter value				
parameter subscription	*_0*	*_1*	*_2*	*_3*	*_4*
Real sector					
Household consumption	-0.22[c]	0.84[c]	0.01[c]	-0.23[c]	
Private gross fixed capital formation	-0.18[e]	1.00[c]	-0.83[c]	-1.00[c]	0.58[e]
Exports of goods and services	-0.12[e]	1.00[c]	6.91[e]	0.40[c]	
Imports of goods and services	-0.41[e]	1.00[c]	0.08[e]	-0.36[c]	
Potential GDP	0.30[c]				
Nominal side					
Import deflator	-0.27[c]	0.52[c]	0.91[c]	0.61[e]	
Domestic supply prices	-0.22[c]	0.16[c]	0.62[e]	0.04[e]	0.48[e]
Domestic deflator					
Labor market					
Labor demand	-0.20[c]	0.74[c]	1.58[e]	0.46[c]	-5.53[e]
Average wage	-0.27[e]	1.17[e]	-5.15[e]		
Financial market and exchange					
Credit stock granted to business	-0.57[e]	1.00[c]	-0.27[e]		
NPL for loans granted to business	-0.90[e]	0.85[e]	-0.51[e]	1.10[e]	
Loan interest rate to business	1.97[e]	0.27[e]	0.08[e]	1.00[c]	
Monetary policy rate	0.00[c]	0.88[e]	0.16[e]	0.46[e]	
Treasury bill 12-months	0.29[e]	-0.16[e]	0.20[e]	0.67[e]	
Exchange rate	-0.04[e]	-0.33[e]	0.38[e]	-0.10[e]	

Table 2.A4 Model selected estimated and calibrated parameters

Source: Skufi et al. (2024), authors' calculations.
Note: c - calibrated; e – estimated.

Indicator	Pre-pandemic simulation	Pandemic simulation
Real GDP growth	8.6	5.2 *
Real household	6.4	2.8 *
Real private investment	12.0	13.6
Real exports growth	55.6	20.5 *
Real imports growth	28.3	11.0 *
Inflation rate	0.8	4.0
Domestic supply prices	5.0	4.4 *
Import deflator growth	2.2	5.3
Exchange rate growth	1.5	4.3
Monetary policy rate	0.4	2.0
Loan interest rate	0.1	1.2
Credit stock growth	3.3	2.7 *
NPL rate	2.6	4.2
Unemployment rate	3.0	2.2 *
Average wage growth	11.2	8.5 *

Table 2.A5 Root mean square errors (RMSE) of prepandemic and pandemic simulations for 2020-2021

Source: Authors' calculations.
Note: RMSE values are calculated over year-on-year growth rates. The asterisk indicates the lower RMSE between the two forecasts.

Indicator	Pre-pandemic simulation		Pandemic simulation	
	2020	*2021*	*2020*	*2021*
Real GDP	0.10	0.04	0.02	0.05
Real household consumption	0.08	0.05	0.02	0.04
Real private investment	0.14	0.11	0.01	0.13
Real exports	0.50	0.08	0.06	0.15
Real imports	0.31	0.06	0.03	0.12
Inflation rate	0.00	0.01	0.01	0.05
Domestic supply prices	0.06	0.06	0.02	0.06
Import deflator	0.01	0.03	0.02	0.07
Exchange rate	0.00	0.01	0.03	0.06
Monetary policy rate	0.39	0.44	0.75	0.49
Loan interest rate	0.03	0.02	0.14	0.28
Credit stock	0.04	0.04	0.01	0.01
NPL rate	0.16	0.27	0.25	0.38
Unemployment rate	0.32	0.19	0.18	0.12
Average wage	0.11	0.13	0.03	0.10

Table 2.A6 Root mean square errors (RMSE) of prepandemic and pandemic simulations for 2020 and 2021

Source: Authors' calculations.
Note: RMSE values are calculated over the logarithms.

Dependend variable	Explanatories variables	τ = .10	τ = .50	τ = .90
YC				
	AR	0.6***	0.5***	0.5***
	YI	0.4***	0.5***	0.4***
	i	-1.0*	-0.3	0.0
	Pseudo-R2	0.9	0.9	0.8
YIP				
	AR	0.1	-0.1	-0.4***
	Y	2.1***	1.9***	0.2
	M2P	-0.4	-0.3	-0.7
	ic	-0.4	-0.2	-0.1
	Pseudo-R2	0.4	0.3	0.3
YE				
	AR	0.4***	0.6***	0.6***
	YF	3.3***	1.5***	1.3***
	CT	1.0***	0.9***	1.0***
	Pseudo-R2	0.8	0.8	0.8
YM				
	AR	0.2***	0.3**	0.3
	DM	0.8***	0.6***	0.5*
	RP	2.2*	3.4*	5.0**
	Pseudo-R2	0.8	0.8	0.7
PD				
	AR	0.6***	0.6***	0.4***
	ULC	0.1***	0.0	0.1**
	PO	0.1***	0.1***	0.1***
	$\tilde{Y}$	1.0	0.5*	0.6***
	Pseudo-R2	0.8	0.8	0.8
PM				
	AR	-1.6**	-0.8*	0.1
	PF	1.0	1.8**	0.9
	EX	0.6	0.8**	1.0**
	Pseudo-R2	0.3	0.2	0.3
EX				
	AR	1.0***	0.8***	1.1***
	$\Delta\pi$	0.1	0.2*	0.0
	Δi	-0.2***	-0.1**	0.2***
	Pseudo-R2	0.4	0.4	0.5
il				
	AR	0.4***	0.6***	0.4
	if	0.5***	0.4***	1.1**
	rp	0.1**	0.0	0.0
	Pseudo-R2	0.6	0.7	0.8
rp				
	AR	0.8***	0.9***	1.0***
	$\tilde{Y}$	-4.8**	-1.1	-1.1
	S	0.3**	0.2**	0.2**
	Pseudo-R2	0.8	0.8	0.8
L				
	AR	1.0***	1.0***	1.0***
	il	0.0	-0.1	0.1
	Pseudo-R2	1.0	0.9	0.9

Table 2.A7 Quantile regression estimates – 10th percentile, median, and 90th percentile over 2010-2019

Source: Authors' calculations.
Note: The asterisk indicates the p-value of parameter, statistically important * at 10%, ** at 5%, *** at 1%.

Indicator	20-I	20-II	20-III	20-IV	21-I	21-II	21-III	21-IV	**2020**	**2022**
Aggregate demand										
Public consumption	1.2	1.7	1.8	1.7	1.7	1.6	1.6	1.5	**1.6**	**1.6**
Public investments	1.3	1.8	1.8	1.6	1.5	1.4	1.3	1.2	**1.6**	**1.3**
Transfers to households	0.0	0.2	0.3	0.5	0.6	0.6	0.7	0.7	**0.2**	**0.6**
Inflation										
Public consumption	0.0	0.0	0.2	0.3	0.4	0.6	0.7	0.8	**0.1**	**0.6**
Public investments	0.0	0.0	0.2	0.3	0.4	0.5	0.6	0.7	**0.1**	**0.6**
Transfers to households	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	**0.0**	**0.1**
Public capital stock										
Public consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Public investments	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.3	**0.8**	**2.0**
Transfers to households	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**

Table 2.A8 Simulation of alternative fiscal expenditures policies over 2020-2021

Source: Authors' calculations.
Note: Public consumption, public investment and transfers to households are increased by 1 percent of GDP, respectively.

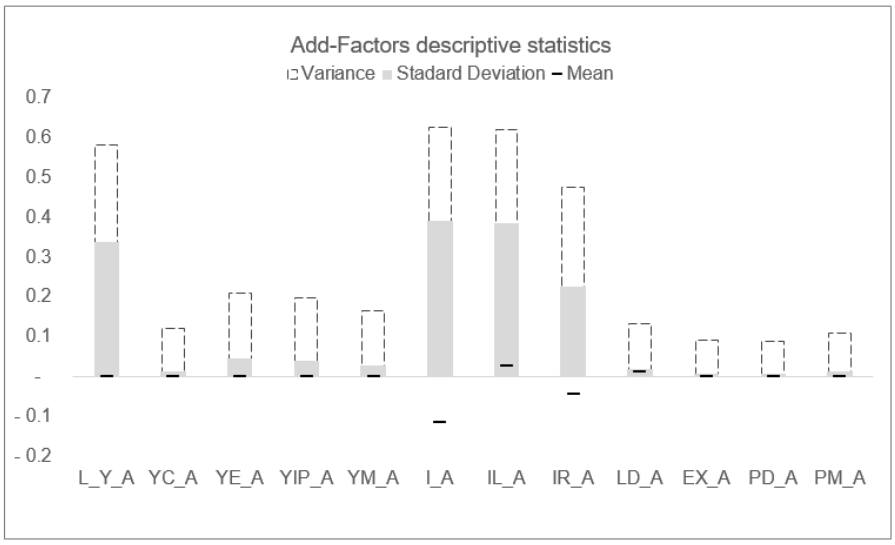

Figure 2.A1 Add-factors mean, variance and standard deviation over 2010 – 2019

Source: Authors' calculations.
Note: Columns depict add-factors, variance, standard deviation, and mean; most variables have a zero mean add-factor and a modest standard deviation; however, financial market variables have a non-zero mean. Most of the indicators feature a zero mean add-factor (error) and a small standard deviation. In contrast, financial market indicators appear with a non-zero mean. Partly, this outcome is influenced by the monetary policy rate indicator by means of being a policy tool. The monetary policy rate, which impacts financial market indicators, reflects the decision-making process rather than just the macroeconomic developments. Monetary policy behavior is reflected in the financial market indicators through the loan rate channel. Moreover, the period of interest is also characterized by increased banking market efficiency. These dynamics in financial market tend to produce un-robust estimations.

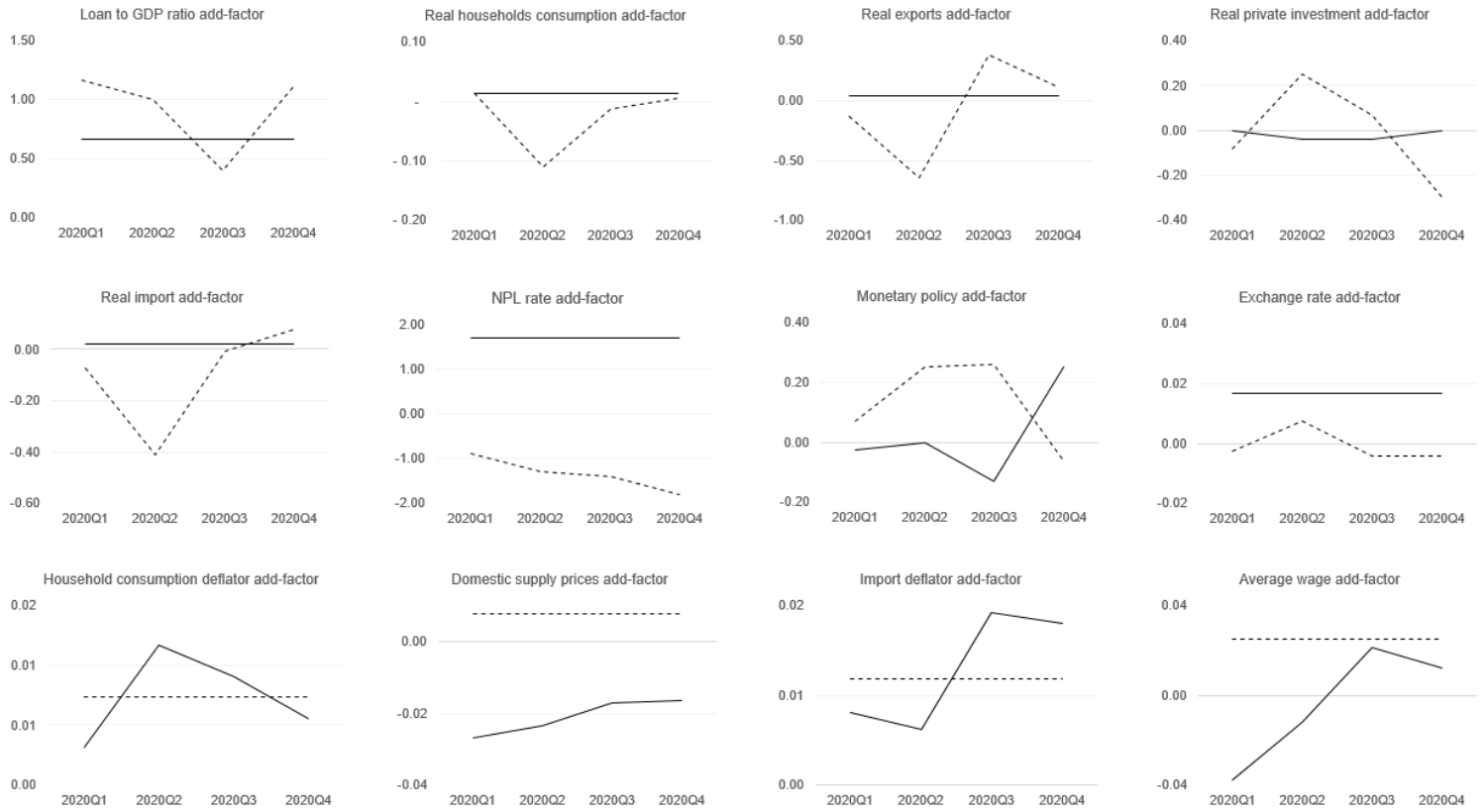

Figure 2.A2 Add-factors in prepandemic and pandemic simulations over the four quarters of 2020

Source: Authors' calculations.
Note: Add-factors in prepandemic in black line and pandemic simulations in black dotted line. Prepandemic add-factors are smoother than pandemic add-factors, particularly for real sectors variables. In the Monetary policy add-factor chart, the black line is not flat because it is fine-tuned to reflect the forward guidance policy. The pandemic add-factors were derived from the in-sample forecast errors of the selected variables over the first four quarters.

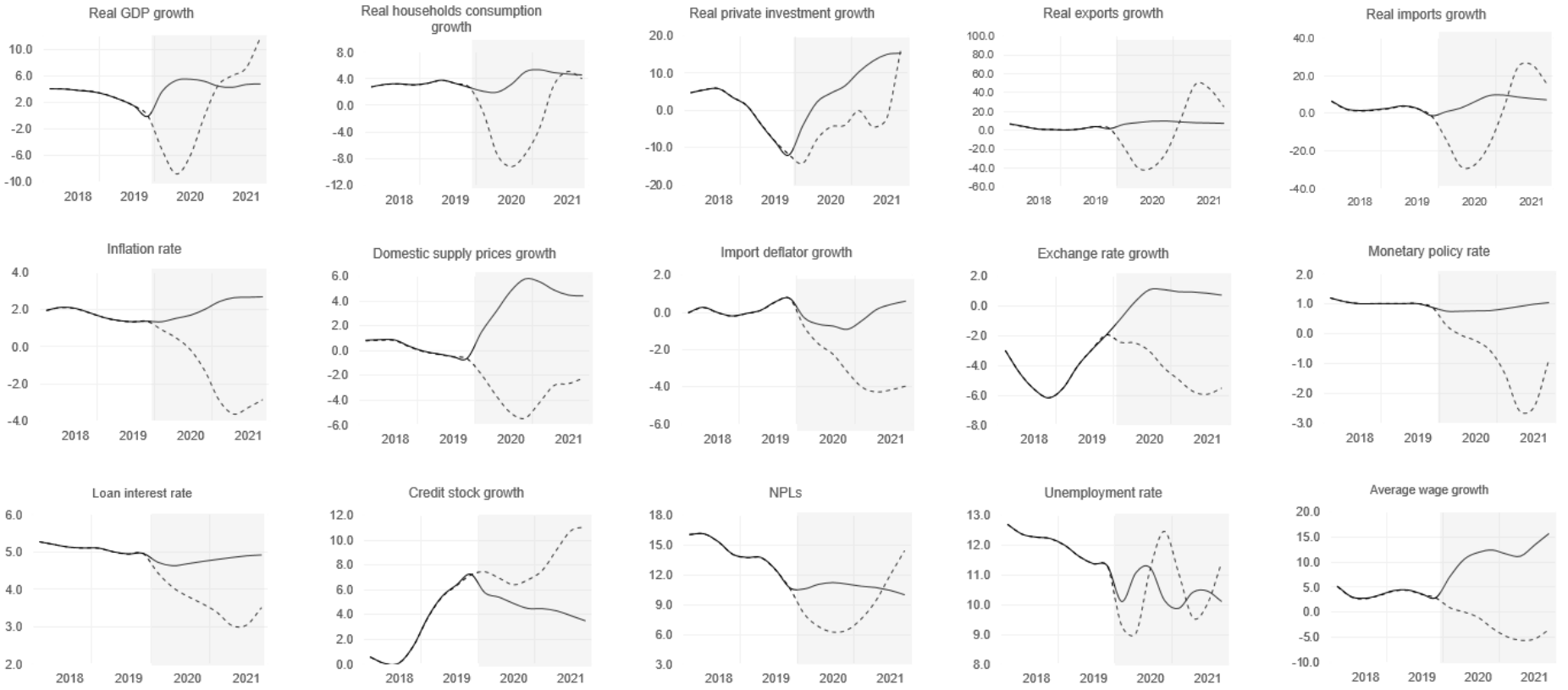

Figure 2.A3 Pre-pandemic *versus* pandemic simulations

Source: Authors' calculations.
Note: Prepandemic and pandemic simulations differ significantly and barely converge towards the end of the simulation. Pre-pandemic in black dotted line and pandemic in black line. Predictions are constructed as 2-term-centered moving averages.

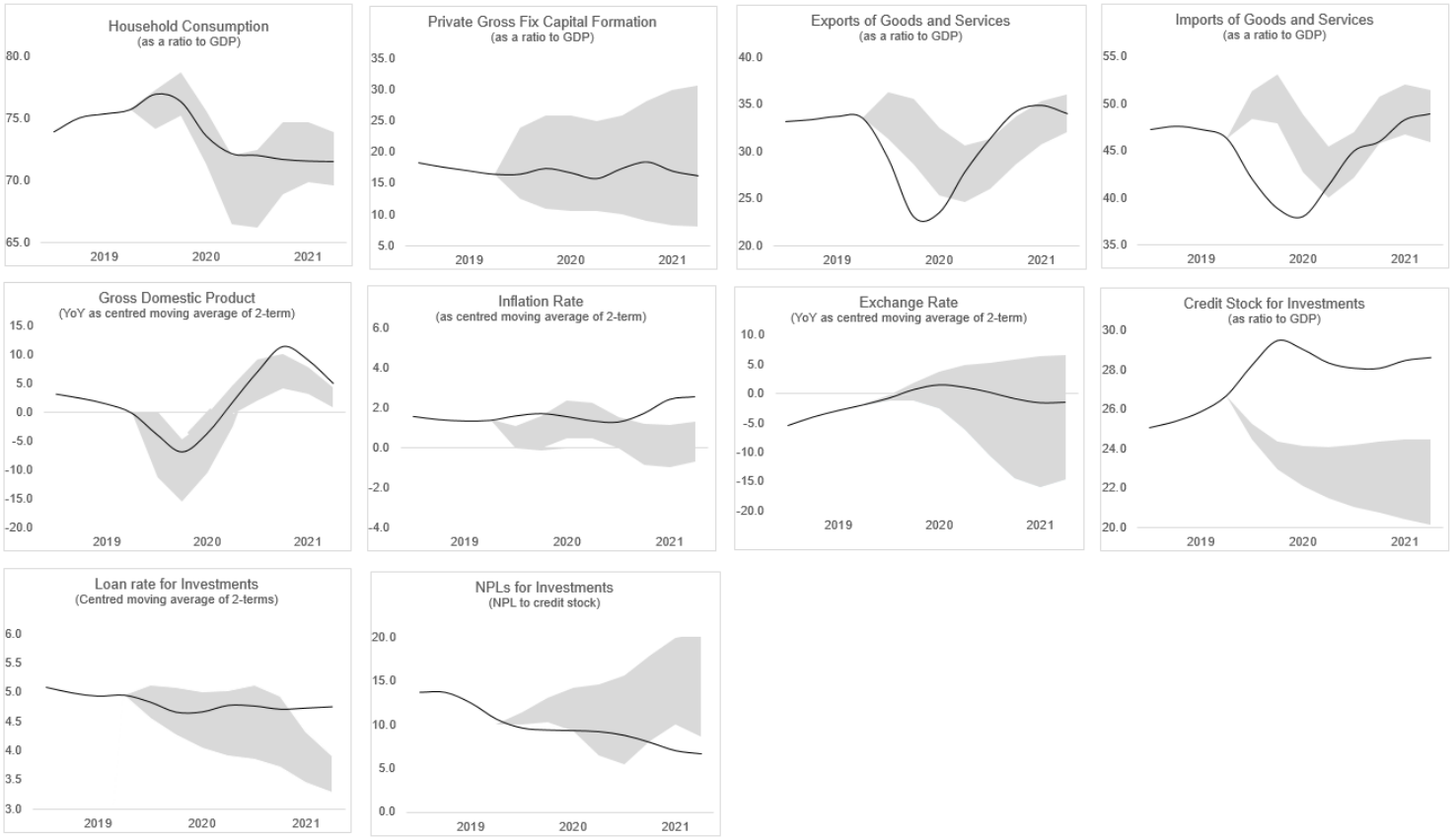

Figure 2.A4 Pandemic forecast uncertainty bands 2020-2021 and actual data

Source: Authors' calculations.
Note: The pandemic uncertainty bands are narrower when no additional uncertainty from pandemic add-factors is present and actual data is further away. Predictions are constructed as 2-term-centered moving averages.

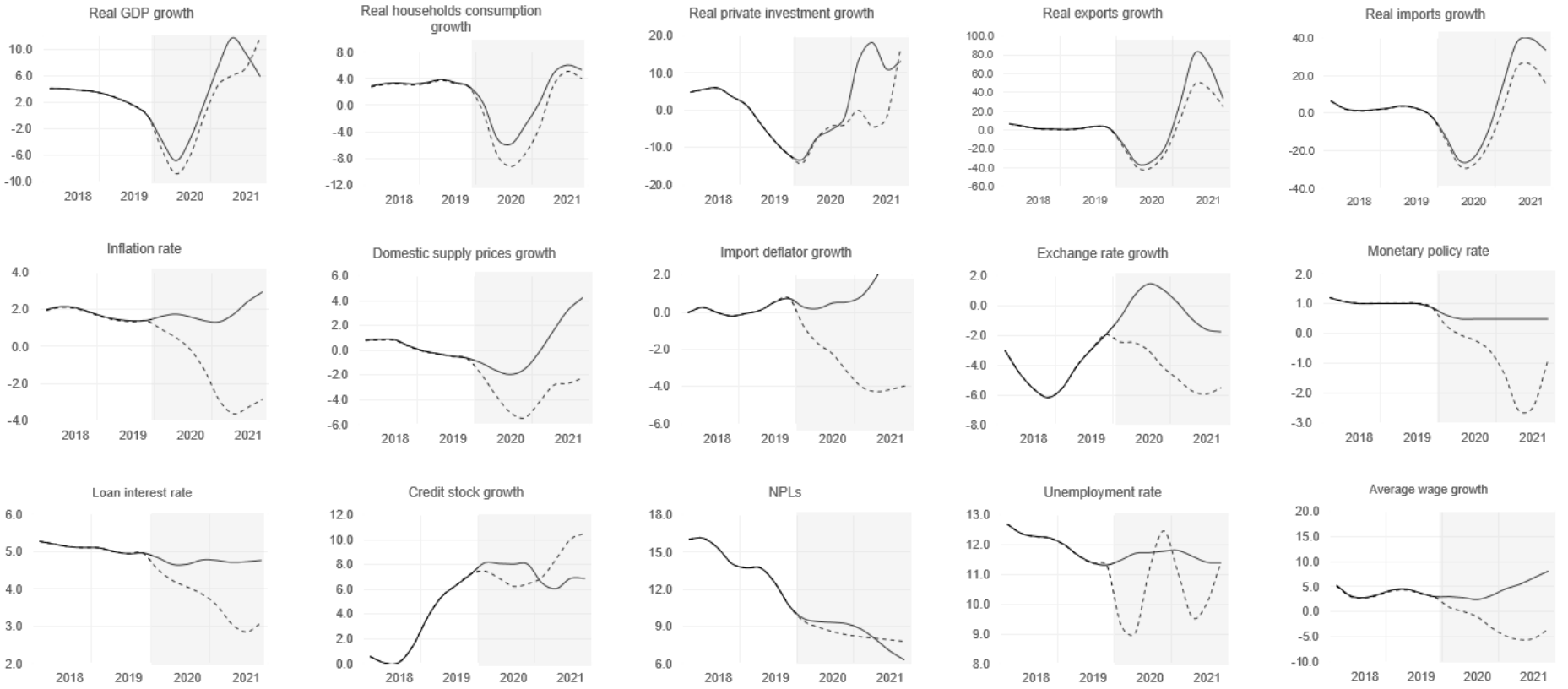

Figure 2.A5 Pandemic simulations without financial market-real sector feedback loop *versus* the outturn

Source: Bank of Albania, Consensus Forecast, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: Pandemic simulation without a feedback loop better approximates the NPL rate, while real sector variables have only modestly improved Predictions are constructed as 2-term-centered moving averages. Pandemic simulations without financial market-real sector feedback loop in black dotted line and the outturn in black line.

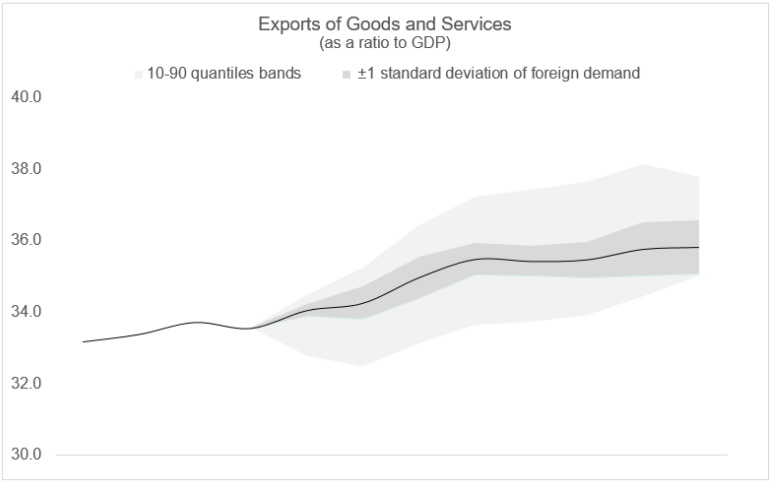

Figure 2.A6 Prepandemic forecast, uncertainty bands 2020-2021 and +/-1 standard deviation of foreign demand

Source: Bank of Albania, Consensus Forecast, Eurostat, INSTAT, Ministry of Finance, authors' calculations.
Note: The quantile regression uncertainty bands are wider than +/-1 standard deviation of foreign demand. Predictions are constructed as 2-term-centered moving averages.

Quantile regression equations

Following the quantile regression methodology, 10 behavioral equations of the model are re-estimated. Concretely, equations *Eq. (2.2), Eq. (2.3), Eq. (2.4), Eq. (2.5), Eq. (2.6), Eq. (2.7), Eq. (2.12), Eq. (2.14), Eq. (2.15)*, and *Eq. (2.16)* are specified as below:

$$Q_\tau(YC_t) = \alpha_{0(\tau)} + \alpha_{1(\tau)}YC_{t-1} + \alpha_{2(\tau)}YI_t + \alpha_{3(\tau)}i_t + \varepsilon_{\tau,t} \quad (2.A1)$$

$$Q_\tau(\Delta YIP_t) = \beta_{0(\tau)} + \beta_{1(\tau)}\Delta YIP_t + \beta_{2(\tau)}\Delta Y_t + \beta_{3(\tau)}\Delta M2P_{t+1} + \beta_{4(\tau)}\Delta ic_t + \varepsilon_{\tau,t} \quad (2.A2)$$

$$Q_\tau(YE_t) = \delta_{0(\tau)} + \delta_{1(\tau)}YE_{t-1} + \delta_{2(\tau)}YF_t + \delta_{3(\tau)}CT_t + \varepsilon_{\tau,t} \quad (2.A3)$$

$$Q_\tau(YM_t) = \zeta_{0(\tau)} + \zeta_{1(\tau)}YM_{t-1} + \zeta_{2(\tau)}DM_{t-1} + \zeta_3 RP_{t-2} + \varepsilon_{\tau,t} \quad (2.A4)$$

$$Q_\tau(PD) = \psi_{0(\tau)} + \psi_{1(\tau)}PD_{t-1} + \psi_{2(\tau)}ULC_t + \psi_{3(\tau)}PO_t + \psi_{4(\tau)}\tilde{Y}_{t-2} + \varepsilon_{\tau,t} \quad (2.A5)$$

$$Q_\tau(\Delta PM_t) = \varsigma_{0(\tau)} + \varsigma_{1(\tau)}\Delta PM_{t-1} + \varsigma_{2(\tau)}\Delta PF_{t+1} + \varsigma_{2(\tau)}\Delta EX_t + \varepsilon_{\tau,t} \quad (2.A6)$$

$$Q_\tau(\Delta EX_t) = \varpi_{0(\tau)} + \varpi_{1(\tau)}\Delta EX_{t-1} + \varpi_{2(\tau)}\Delta(\pi_{t+2} - \pi f_{t+2}) + \varpi_{3(\tau)}(i_t - if_t) + \varepsilon_{\tau,t} \quad (2.A7)$$

$$Q_\tau(il_t) = \kappa_{0(\tau)} + \kappa_{1(\tau)}il_{t-2} + \kappa_{2(\tau)}rp_t + \kappa_{3(\tau)}[k_{t-1}i_{t-1} + (1 - k_{t-1})if_{t-1}] + \varepsilon_{\tau,t} \quad (2.A8)$$

$$Q_\tau(RP_t) = \chi_{0(\tau)} + \chi_{1(\tau)}RP_{t-1} + \chi_{2(\tau)}\tilde{Y}_t + \chi_{3(\tau)}S_{t-1} + \varepsilon_{\tau,t} \quad (2.A9)$$

$$Q_\tau(L_t) = (\rho_{0(\tau)} + \rho_{1(\tau)}L_{t-1}/Y_{t-1} + \rho_{2(\tau)} * il_t)Y_t + \varepsilon_{\tau,t} \quad (2.A10)$$

The indicators enter quantile regression either level (natural logarithm) or differentiated (first difference of natural logarithm). The decision was based on

diagnostics. Lags are specified based on statistical significance. Given the empirical soundness, the other explanatory indicators may enter in lags, leads, or contemporaneously.

Furthermore, we generate uncertainty bands for gross domestic product and consumer price index indicators. These indicators are represented by an identity. Thus, their uncertainty bands are derived from estimates of the 10th and 90th quantiles of explanatory variables. Inflation and growth specifications are given in *Eq. (2.A11)* and *Eq. (2.A12)* correspondingly.

$$\pi_{\tau,t} = -\Theta_t \Omega^{hc}\left(\lambda^{hc} PD_{\tau,t-1} + (1-\lambda^{hc}) PM_{\tau,t-1} - \phi^{hc}\right) \qquad (2.A11)$$

$$Y_{\tau,t} = YC_{\tau,t} + YG_t + YIP_{\tau,t} + YIG_t + YE_{\tau,t} - YM_{\tau,t} + Y_\varepsilon \qquad (2.A12)$$

where, Θ is a time varying parameter connecting the household consumption deflator to the consumer price index, the index *'hc'* stands for household consumption deflator, *YG* stands for public consumption, *YIG* stands for public investment, and $Y\varepsilon$ stands for statistical discrepancy and change in inventories. Terms that are not subscribed with *'tao'* are assigned the values generated during the prepandemic simulation.

Chapter 3

Migration, remittances, and wage-inflation spillovers: The case of Albania

Abstract

Motivated by migration phenomena and wage-inflation spillovers, we investigate the relationship between the two and the inflationary remittances built-in pressures. We establish a feedback loop between migration and inflation, and specify a simple dynamic model to identify the pass-through. We have found that a permanent decline of population by 1.0% leads up to 0.8 percentage points of inflation pressures in the midterm. Remittances induce excessive pressures. Supportive schemes such as an older retirement age and a higher labor force participation rate can partially mitigate inflationary pressures.

JEL Classification E24, E31, J11, J21, J31

Keywords labor market, demographics, inflation, wage, remittances, feedback-loop

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3.1 Introduction

Since 2021, the global inflation surge has renewed academic interest in exploring the determinants of price level movements. Key factors driving this trend include supply chain disruptions caused by the COVID-19 pandemic, commodity and input price spikes following the invasion of Ukraine, and tight labor markets leading to higher wages (Giovanni et al., 2022; Maurya et al., 2023; European Commission, 2022; OECD, 2023; Vacas Soriano & Kostolny, 2022). The significant impact of tight labor markets on inflation is well documented. However, in emerging markets, labor market pressures may be more pronounced compared to advanced economies, especially in the context of migration phenomena.

With this in mind, the goal is to develop a straightforward wage-inflation feedback loop that connects not only to traditional factors, but also to migration characteristics, such as labor supply shortages and remittance inflows.

We employ Albania as a case study. Situated in Southeast Europe on the Balkan Peninsula, with coastlines along the Adriatic and Ionian Seas, Albania presents a unique case due to its high migration levels. It ranks among the top 20% of countries globally for migration rates (UN, 2023) and remittance inflows (World Bank, 2024), as illustrated in Figure 3.1.[10]

[10] Figure 3.1 indicates net migration rate per 1000 population and net remittances to GDP in different regions around the world, namely CESEE, WB, MENA, ASEAN-5, Latin America and Caribbean, Sub-Saharan Africa. Albania illustrated in black line have experienced the highest net migration rate in Europe. Since transitioning to a market-oriented economy in the early 1990s, it has undergone significant economic changes. Migration patterns have evolved over the decades, from young men moving to Greece and Italy in the 1990s, to family reunification and settlement in other European countries and North America in the 2000s, and more recently, highly qualified individuals migrating to Germany and other Western countries. As of 2023, Albania's population is estimated at 2.4 million (INSTAT, 2024), with a GDP per capita of approximately $6,742 (INSTAT, 2024). A significant diaspora of about 1.4 million Albanians resides abroad (Ministry for Europe and Foreign Affairs, 2024), with remittances contributing around 10% of GDP during the last years (World Bank, 2024).

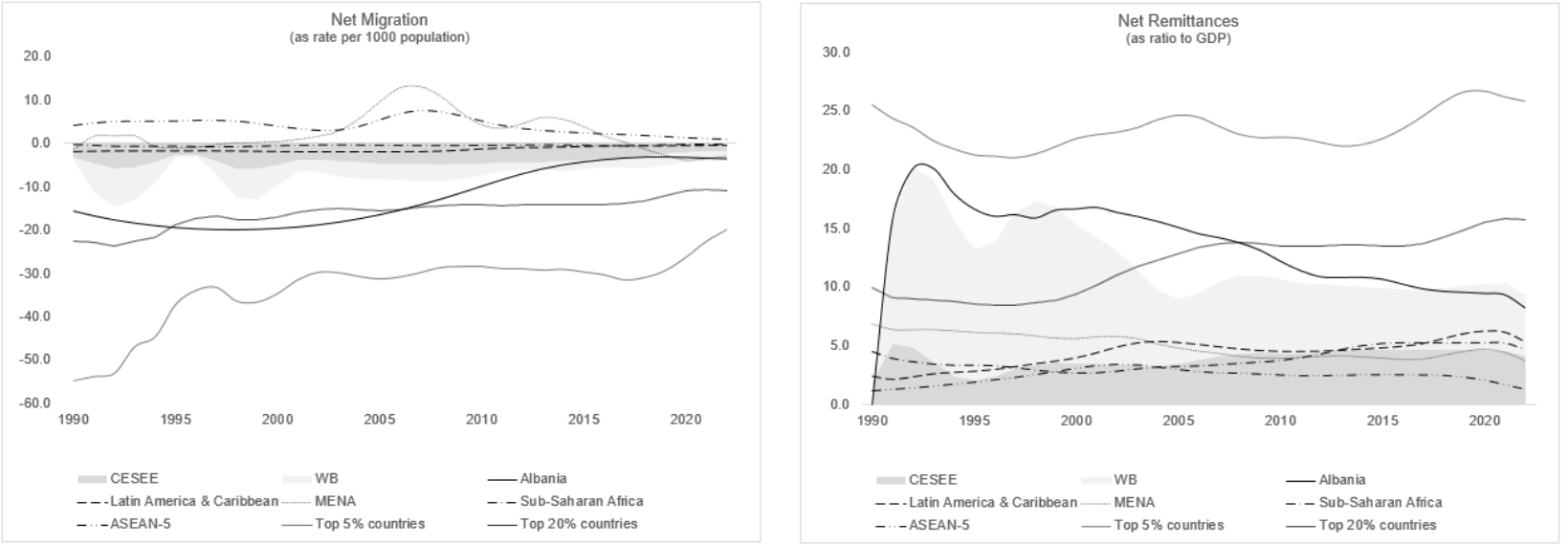

Figure 3.1 Migration and remittances

Source: UN (2023), WB (2023), and authors' calculations.
Note: Figure 3.1 illustrates net migration flows per 1000 population (left side graph) and net remittances to GDP (right side graph) for CESEE, WB, MENA, ASEAN-5, Latin America and Caribbean, Sub-Saharan Africa, and the highest migratory countries of 5% and 10% in comparison to Albania.[11]

[11] The highest migratory 5% and 20% countries are calculated on yearly basis given the full sample of 237 nations in the world. For 2021 top 20% nations in descending order includes the following: Marshall Islands, American Samoa, Saint Martin (French part), Lebanon, Venezuela (Bolivarian Republic of), Central African Republic, Qatar, Cook Islands, Kosovo (under UNSC res. 1244), Montserrat, Tonga, Northern Mariana Islands, Kuwait, Bosnia and Herzegovina, Wallis and Futuna Islands, Fiji, Bahrain, Micronesia (Fed. States of), Guyana, Nauru, Republic of Moldova, Armenia, Afghanistan, Oman, El Salvador, Saudi Arabia, Lithuania, Sri Lanka, Eritrea, Eswatini, New Caledonia, Samoa, Martinique, Albania, Latvia, Saint Vincent and the Grenadines, Sao Tome and Principe, Yemen, South, Sudan, Haiti, Croatia, Kyrgyzstan, State of Palestine, Kiribati, Liberia, Puerto Rico, United States Virgin Islands.

Additionally, Albania's rich history of migration, transitioning from a communist to an open market economy, further underscores its uniqueness. In Albanian society, the strong role of the family means that migration remittances have significantly impacted the economy, not only by supporting consumption and construction, but also by influencing the participation of family members in the labor force (Shehaj, 2012).

Our primary research question is as follows: What are the inflationary implications of demographic decline and remittance externalities? Additionally, we examine whether supportive measures, such as extending the retirement age and increasing labor force participation rates, can partially mitigate inflationary pressures.

To address these questions, we have adopted a straightforward dynamic model strategy recently introduced by Bernanke & Blanchard (2023). Utilizing a wage-price setup within a linear system equations framework, we allow for the wage-inflation feedback loop to occur without imposing too much structure. We assess the inflationary cost of migration through a simulation strategy based on hypothetical unit assumptions, which are easy to interpret due to the linearity of the model. Starting from an equilibrium that represents the unique solution of the system of equations (baseline), we perform three alternative simulations (scenarios).

In the first scenario, we simulate a decline in population. Considering the potential for remittance-induced inflation, as suggested by Narayan et al. (2011), our second scenario simulates an increase in remittance inflows on top of the population decline. To address the challenges posed by a shrinking population, we incorporate supportive measures in the third scenario, such as increasing the labor force participation rate. It is important to note that the scenarios presented focus on short- to medium-term dynamics and assume that shocks to labor supply are long-lasting

transitory shocks. This framing is consistent with our objective of analyzing cyclical rather than structural adjustments.

Our methodology integrates established economic theory with empirical approaches. The theoretical framework is based on monopolistic competition markets, where prices are determined by normal costs plus a mark-up. We approximate normal costs with the unit labor costs and the mark-up with the cyclical conditions. The wage equation follows a Phillips curve specification. We estimate two wage Phillips curves: one excluding remittances and one including them, to facilitate our third scenario. Inflation is modeled as a composite of domestic and imported prices. Both wage and price equations are estimated using the error correction model technique to ensure long-run equilibrium.

Using a holistic method, we have found that on average, a permanent population decline results in higher inflation due to tightening labor market cyclical conditions and remittances inflows. Some inflationary costs of migration can be mitigated through the implementation of support schemes.

Compared to the existing literature, the main contribution of this paper is the construction of a reduced form model and its application to a country with strong migration and remittance phenomena. Our model effectively captures migration-wage-inflation loops, while the other available literature typically estimates the impact of migration or remittances on inflation in an econometric framework. Our approach is similar in spirit to macromodels (Budnik et al., 2011; Conrad, Ramkissoon, & Mohammed, 2018; Skufi, Kika, & Ceka, 2024). But we differ in a few areas of the construction of variables interdependence and despite having the infrastructure, they do not run this type of scenarios. The research gap we are trying to fill is to analyse the link between remittances and inflation under a permanent migration outflow leading to

a shrinking population. To our knowledge, this paper is among the first to examine the long-term inflationary costs of population decline, incorporating a wage-inflation feedback loop that connects not only to traditional factors but also to migration characteristics such as labor supply shortages and remittance inflows. By extending beyond the familiar demographic contraction-wage-inflation causation (Carstens, 2022; Bernanke & Blanchard, 2023), we highlight the spillover effects of remittance inflows within the wage Phillips curve framework.

Although numerous studies acknowledge the impact of remittances on inflation (Ball et al., 2013; Khurshid et al., 2018; Petreski et al., 2019) and the impact of migration on the labor market (Docquier et al., 2014; Ghosh & Weinstein, 2021; Dowlah, 2020), little is done to focus on these two channels simultaneously. We provide initial insights into the inflationary costs of migration through the labor market *via* two channels: labor market tightness and remittances. The methodology we employ is a novel aspect of our approach. Our paper contributes to the migration literature by enriching the discourse on wage-inflation-migration within the context of specific country cases.

The remainder of the paper is organized as follows. Section 3.2 presents a literature review Section 3.3 presents the data and methodology used, Sections 3.4 and 3.5 discuss the results, and Section 3.6 concludes.

3.2 Literature review

Inflation has remained low throughout the world for a considerable period of time (Jorda & Nechio, 2020), but has risen in recent years (Binder & Kamdar, 2022). The drivers of this trend, as well as the potential duration of inflation overshooting, brought into attention the Phillips curve and its determinates. In emerging markets, prices might

be more reactive to external developments in commodity and food prices, exchange rate volatility, and domestic pressures from the labor market compared to advanced economies. Furthermore, tight labor markets in emerging countries may play a significant role due to migration phenomena. We review the literature in two strands: first, we analyze the literature on wage-inflation and traditional factors; second, we examine the impact of remittances on wages and inflation.

3.2.1 Literature on wage-inflation

The increase in inflation during 2021 has prompted a surge in research into the drivers of this trend, as well as the potential duration of inflation overshooting. Factors contributing to this trend include supply chain disruptions caused by the COVID-19 pandemic, commodity and input price spikes resulting from the invasion of Ukraine, and tight labor markets pushing higher wages (Giovanni et al., 2022; Maurya et al., 2023; European Commission, 2022; OECD, 2023 and Vacas Soriano & Kostolny, 2022). Much of this research started with Phillips curve (Phillips, 1958) slope. The slope of the Phillips curve has been questioned over time (Coibion & Gorodnichenko, 2015; Blanchard, 2016; and Negro et al., 2020), but recent estimates suggest that it has steepened (Ari et al., 2023; Hazell et al., 2022; and Hobijn et al., 2023). A variety of approaches, such as structural or semi-structural models, time-varying parameters, and *ad hoc* sub-samples, have been employed to analyze inflation.

Gagliardone & Gertler (2023) utilize a DSGE model that allows for unemployment, real wage rigidity, oil prices, and demand shocks. They acknowledge that the model provides a good explanation of unemployment and inflation since 2010, including the recent inflation surge. Furthermore, they explain that this surge was a combination of oil price shocks, ‘easy’ monetary policy, demand shocks, and shocks to labor market tightness. The poor elasticity of substitution between oil and labor is

significant for the quantitative impact of the oil price shock. Also, Del Negro et al. (2020) rely on DSGE and SVAR. Both methodologies provide the two same conclusions. First, the slope of the Phillips curve has decreased significantly since 1990, while it has not reached zero. Second, structural changes may have affected inflation's cyclical sensitivity, but this evidence is weaker. A similar conclusion is obtained by Inoue et al. (2022) have reached a similar conclusion. They find that the weakening of the cyclical relationship between unemployment and inflation is due to a flattening of the Phillips curve over time. Using local projections and instrumental variables models with time-varying parameters, they find that during the recent pandemic, the flattening has reverted and the Phillips curve is coming back. This is likely to put pressure on goods prices and wages in the medium and long-run.

Bergholt et al. (2022) estimate structural shocks in constant-parameter VARs using sign limitations; next, they study changes in the Phillips curve over time using inflation and unemployment data purged by the relevant shocks in either subsamples or rolling windows for US economy. Furthermore, Carstens (2022) uses the rolling window technique for the euro area, concluding that the price spillovers to wages are increasing after the pandemic.

Using sectoral data from 24 advanced economies in Europe, Ari et al. (2023) highlight a steeper Phillips curve. Post-pandemic Phillips curve estimates indicate some steepening in the UK, Spain, Italy, and the euro area as a whole, but at magnitudes that are too small to explain the entire surge in inflation in 2021–22. This result for advanced and emerging European nations is also supported by McGregor & Toscani (2022) and Baba et al. (2023). They discover that Phillips curves based on historical data and energy and other commodity price dynamics can only account for around half of the increase in inflation in 2022.

Ball et al. (2022) decompose inflation into two components: core inflation (median inflation) and a residual component (the difference between headline inflation and median inflation). They discover that a significant portion of the upsurge in median inflation can be attributed to the tightness observed in the labor market. They estimate that a 150 BP increase in the unemployment rate will result in a 290 BP increase in core inflation. Furthermore, they conclude that only under the most optimistic scenario would inflation return to target.

Some studies make use of simple equations model, likewise Cecchetti et al. (2023) use datasets from 1950 for Canada, Germany, the United Kingdom, and the United States. Similarly to our approach, they construct a simplified model to comprehend the inflation process. Based on a simple three-equation model (see also Carpenter et al., 2022), namely IS curve, Taylor rule, and Phillips curve, they provide estimations for unemployment gap, monetary policy reaction, and inflation trend. The authors conclude that using data starting in the 1960s exhibits greater persistence of inflation shocks, as well as greater sensitivity of inflation to slack.

In the same spirit, Bernanke and Blanchard (2023) formulate and estimate a concise dynamic model that encompasses prices, wages, and inflation expectations. Their findings reveal that the predominant cause of the inflationary surge that emerged in 2021 was attributed to shocks related to prices in relation to wages. However, while labor market tightness has not been the primary catalyst for inflation, it is noteworthy that the enduring effects of overheated labor markets on nominal wage growth and inflation surpass the effects of shocks originating from the product market.

Overall, while these papers perform sophisticated measurements of labor market tightness and inflation and underline the role of structural changes, none of these papers allows for migration patterns over time and remittance implications,

which is instead the main contribution of our paper. Even though several studies acknowledge the contribution of migration and remittances to the labor market and inflation.

3.2.2 Literature on remittances – inflation

Remittance flows play a crucial role in numerous economies, and their causes and consequences have been extensively analyzed. The following review of the literature specifically examines the impact of remittances on inflation.

Khurshid et al. (2018) analyze data from 58 economies spanning the years 1988 to 2014. Their findings revealed that the impact of remittances on inflation depends on the specific economic context of each country. In low and lower middle income economies, remittances were found to have an inverse and significant effect on inflation, suggesting that they exerted a dampening influence on price levels. In contrast, middle-income economies exhibited a direct and significant impact of remittances on inflation, indicating that remittances contributed to higher prices in these contexts.

Petreski et al. (2019) investigate the determinants of reservation wages and the wage gap in North Macedonia. Their results indicate that in cases where households receive remittances, reservation wages are higher than the market suggests. They find that remittances can raise the reservation wage by 2.1% up to 5.6% for beneficiaries. Also, Narayan et al. (2011) find evidence that remittances induce inflation in developing countries, suggesting that the effect of remittances on inflation is more pronounced in the long-run. Additionally, Kassab (2024) finds that a one-time remittance growth shock leads to a statistically significant increase in the inflation rate in the short-run in Lebanon. Mehedintu et al. (2020) find that the continuous migration in Romania leads to an improvement in the standard of living in residents, but

contemporaneously acknowledge that the provided remittances create a dependence on money received from migrants, thus decreasing the labor supply and induce inflation.

The opposite effect is found by Kochovska (2020). She estimates that receivers of other sources' income have 32.0% lower reservation wage. Rivera & Tullao (2020) find that in the short-term, rising inflation in the Philippines prompts higher remittance flows, driven by altruistic motives to support family consumption. The study disproves the idea that remittances directly cause inflation and shows that inflation encourages more remittances, and these remittances are not necessarily inflationary.

Ball et al. (2013) investigate the impact of remittances on GDP, inflation, the real exchange rate, and money supply in 21 emerging countries, utilizing a panel VAR methodology. Their findings indicate that the effect of remittances is dependent on the exchange rate regime in place. Specifically, under a fixed exchange rate regime, an increase in remittances leads to higher inflation up to 0.8 percentage points, whereas under a flexible exchange rate regime, an increase in remittances results in lower inflation by 0.3 percentage points.

Castaldo & Reilly (2007) focusing on the Albanian economy have found that remittances only have a modest effect on consumption patterns of households. In contrast, Kalaj (2015) and Duval & Wolff (2009) based on Albanian surveys data provide statistical evidence that remittances have a positive impact on consumption. Furthermore, Shehaj (2012) has assessed that families make migration decisions for the migrant with the aim of maximizing their expected future utility by receiving remittances. A later survey conducted by the World Bank (2017) highlights that remittances represent one third of the yearly household budget in Albania. Meyer & Shera (2017) suggest that remittances have a positive effect on economic growth, with this impact strengthening at higher levels of remittances relative to GDP and

diminishing with population decline. This pattern is particularly evident in Albania, Bulgaria, Macedonia, Moldova, Romania, and Bosnia and Herzegovina during the period 1999–2013.

A study by Sergi & Morabito (2016) in Albania and Kosovo has provided evidence that migrants and remittances have had a significant impact on the economic and financial well-being of their families. However, they also questioned the perspective of this impact as a consequence of the European debt crisis. This question was later answered by Gëdeshi & King (2018) claiming that potential migration in Albania remains high, similarly to other post-communist countries in Central and Eastern Europe.

Although several studies highlight the important impact of migration and remittances on consumption and labor market, little assess the implications of permanent migration on inflation.

3.3 A simple model of migration – wage – inflation

To explore the process of price formation without imposing too much structure, we employ a wage-price set-up model. Our methodology integrates established economic theory with empirical approaches. The theoretical framework is based on monopolistic competition markets, where prices are determined by normal costs plus a mark-up. Normal costs are approximated using unit labor costs, which depend on wages. We approximate the mark-up using cyclical conditions, which are unobservable, and estimate labor market cyclical conditions using the reduced form approach[12] outlined by Crump et al. (2019). The wage equation follows a Phillips Curve specification.

[12] A method of modelling that expresses the relationship between variables taking into account the empirical information and the underlying structural relationships.

Our model comprises two primary stochastic estimates:[13] wages and inflation, together with a set of identities to facilitate the pass-through between migration and the wage-inflation feedback loop. The wage and price equations are estimated using the error correction model as a technique to ensure long-run equilibrium (Johansen, 1991). Deterministic estimates are employed for labor supply, unemployment, and unit labor cost as measurements of labor market dynamics. Our model attains dynamism by expressing stochastic estimations in terms of autoregressive components.

The equations are then integrated into a system and solved for a unique solution through linear approximation using the Gauss-Seidel algorithm, which serves as the baseline. Figure 3.2 presents a simplified diagram of interdependencies within the model concerning migration, wage, and inflation.[14] Migration influences the economy directly *via* the labor force and indirectly through remittances. Both channels affect wages, which in turn influence the inflation rate. The inflation rate impacts wages once more, creating a feedback loop that amplifies the effects of migration. These channels are typically captured by large macromodels of central banks in countries that face migration (Budnik et al., 2011; Skufi, Kika, & Ceka, 2024).

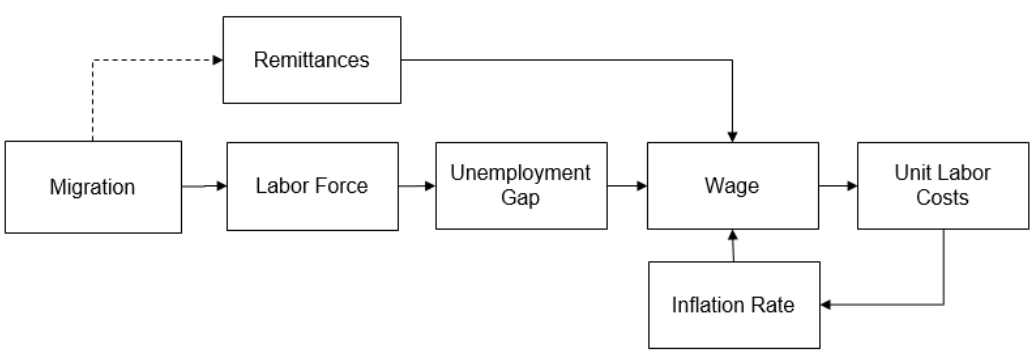

Figure 3.2 Model interdependencies

Source: Authors' calculations.
Note: The figure illustrates the transmission channels of migration in wage and inflation. The dotted line indicates an indirect effect.

[13] Estimates that incorporate random variables to account for uncertainty and variability in the data.

[14] The full transmission mechanism of our model is illustrated in Figure 3.A1 in Appendix 3.A.

In this paper, we analyze the inflationary cost of migration through a simulation strategy. Simulation is the joint solution of the equations under alternative assumptions for the variables in the model. We use hypothetical assumptions equal to the unit deviation from the baseline because they are easy to interpret due to the linearity of the model.

Starting from baseline, we conducted three scenarios. In the first scenario, we simulate a permanent 1% decline in population. Considering the potential for remittance-induced inflation, as suggested by Narayan et al. (2011), our second scenario simulates an additional 1% of GDP increase in remittance inflows on top of the population decline. To address the challenges posed by a shrinking population, we incorporate supportive measures in the third scenario, simulating a migration shock alongside policies such as raising the retirement age and increasing the labor force participation rate. Specifically, in the third scenario, we assume a 1% population decline and a 1 percentage point annual increase in the labor force participation rate compared to the baseline.

3.3.1 The stochastic estimations

We utilize the error correction method (ECM) to estimate the wage and price equations. A distinguishing aspect of this methodology is its ability to identify the joint long-term and short-term dynamics among the variables. The long-run dynamics relate to trends and the concept of economic equilibrium, whereas the short-run dynamics pertain to transitory adjustments towards long-run states. Consequently, wages and prices should adjust to absorb migration shocks and restore equilibrium.

To implement the ECM, two conditions must be satisfied. First, the variables involved in the long-term relationship must be integrated of the first order, denoted as I(1). Secondly, there must be a cointegration relationship among the variables.

Considering the stationary nature of the cyclical condition and in accordance with Lütkepohl (2005), the ECM representation that requires the endogenous variables to be cointegrated among themselves but not with the set of exogenous variables is articulated by the following equation:

$$\Delta y_t = \alpha\beta y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + \sum_{k=0}^{q} B_k z_{t-k} + u_t \quad (3.1)$$

where, y is the vector of the endogenous variables cointegrated among themselves, Δy represent the first difference of the endogenous variables, z is the set of exogenous variables, α is the correction coefficient, β, Γ and B are parameter matrices, and u is the vector of errors. Short-term dynamics incorporates *j-lags* for endogenous variables and *k-lags* for exogenous variables. To determine the optimal lag-length criteria, we employ the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC), and the Hannan-Quinn Information Criterion (HQ). Using the ECM method, we ensure that, regardless of the parameter values, both wage inflation and price inflation deviations converge to zero in the long-run. *Ceteris-paribus*, permanent migration would lead to persistent wage-inflationary pressure over the long-term.

3.3.1.1 The wage equation

In our analysis, we estimate two variants of the wage Phillips curve: one that excludes remittances and one that incorporates them. The inclusion of remittances in the wage equation enables us to explore a third scenario, allowing for a comprehensive examination of the inflationary effects induced by migration through the remittances channel.

First, we specify the wage equation as a standard one. Nominal wages grow in line with labor productivity developments, labor market cyclical conditions, and prices. Explanatory variables enter as a four-quarter moving average for two particular

reasons. First, to smooth volatility and to facilitate trending behaviour (see Raudys et al. 2013). Similarly, Bernanke & Blanchard (2023) express labor productivity as an eight-quarter moving average. Second, we can capture the dynamic relations between time series with a small number of parameters (see Lutkepohl, 2006; and Foroni et al., 2019). Furthermore, it helps to capture the rigidities in the labor market. Prices are based on the consumer price index. The ECM representation of the wage equation is expressed in *Eq. (3.2)*:

$$\Delta wn_t = \alpha_w \beta_w \begin{bmatrix} wn_{t-1} \\ cpi_{t-1} \\ lp_{t-1} \end{bmatrix} + \sum_{j=1}^{p-1} \Gamma_{w,j} \begin{bmatrix} \Delta wn_{t-j} \\ \Delta cpi_{t-j} \\ \Delta lp_{t-j} \end{bmatrix} + \sum_{k=0}^{q} B_{w,k} un_gap_{t-k} + u_{w,t} \quad (3.2)$$

where, *wn* is the monthly nominal wage, *lp* is the labor productivity, *cpi* is the consumer price index, *un_gap* is unemployment gap, u_w is the shock term derived from the stochastic estimation and refers to all other unspecified factors that affect wages. Nominal wages, consumer price index, and labor productivity are expressed in logarithmic levels. Consequently, the parameters β and Γ should be interpreted as elasticities. The unemployment gap is defined as the difference between the natural unemployment rate and the actual unemployment rate; thus, a higher unemployment gap, expressed as a percentage, indicates tighter labor market conditions. The parameters *B* represent a semi-elasticity.

Second, we define a version of the wage Phillips curve that incorporates remittances to introduce the remittance channel into the model. Receiving remittances provides additional income for households, potentially leading to a higher reservation wage (Petreski et al., 2019) and, consequently, a higher labor market wage. We posit that nominal wages are influenced by the dynamics of remittances. Specifically, we approximate this influence using the ratio of remittances to GDP, defined as rem in the ECM representation of the wage Phillips curve with remittances below:

$$\Delta wn_t = \alpha_{wr}\beta_{wr}\begin{bmatrix} wn_{t-1} \\ cpi_{t-1} \\ lp_{t-1} \\ rem_{t-1} \end{bmatrix} + \sum_{j=1}^{p-1}\Gamma_{wr,j}\begin{bmatrix} \Delta wn_{t-j} \\ \Delta cpi_{t-j} \\ \Delta lp_{t-j} \\ \Delta rem_{t-j} \end{bmatrix} + \sum_{k=0}^{q} B_{wr,k} un_gap_{t-k} + u_{wr,t} \quad (3.3)$$

3.3.1.2 The price equation

Inflation is modelled as a composite of domestic and imported prices. We assume that domestic firms operate in a monopolistic competitive market. Thus, the domestic price is a function of production costs with some mark-up. We approximate the costs by unit labor costs and the oil price as an important input in production. The mark-up is approximated with the cyclical condition. We treat foreign inflation as an exogenous behavior and approximated with import deflator, which reflects both exchange rate effects and foreign prices of trading partners and includes imported goods and services in the CPI basket. *Eq. (3.4)* presents the ECM representation of the price equation:

$$\Delta cpi_t = \alpha_c\beta_c\begin{bmatrix} cpi_{t-1} \\ ulc_{t-1} \\ f_inf_{t-1} \end{bmatrix} + \sum_{j=1}^{p-1}\Gamma_{c,j}\begin{bmatrix} \Delta cpi_{t-j} \\ \Delta ulc_{t-j} \\ \Delta f_inf_{t-j} \end{bmatrix} + \sum_{k=0}^{q} B_{c,k}\begin{bmatrix} y_gap_{t-k} \\ \Delta oil_{t-k} \end{bmatrix} + u_{c,t} \quad (3.4)$$

where, *cpi* is consumer price index, *f_inf* is import deflator, *ulc* is unit labor costs, *oil* is oil price index, *y_gap* is output gap. All variables, except the output gap, are expressed in logarithmic form.

3.3.2 The deterministic estimations

To activate the transmission channels in our simplified model, a set of identities need to be incorporated. To initiate the wage-inflation feedback loop, we introduce two deterministic estimations: unit labor costs and employee compensation *(Eq. (3.5))*. In the unit labor costs identity, labor productivity is included as an 8-quarter moving average to eliminate temporal noise, following the approach of Bernanke & Blanchard

(2023). Employee compensation is defined as three times the monthly nominal wages. This ensures that wages are transmitted to inflation through the unit labor cost channel. Since wages are defined as a function of inflation (*Eq. (3.2)* and *Eq. (3.3)*), a feedback loop is established between the labor market and inflation.

$$ulc_t = comp_t / ma(lp_t, 8) \; where: \; comp_t = 3 * wn_t \tag{3.5}$$

where, *ulc* is unit labor costs, *comp* is compensation of employees, *lp* is labor productivity, *ma* is moving average, *wn* is monthly nominal wage.

The transmission of population developments is reflected in the cyclical conditions within both the wage and the price equations. In our framework, migration influences the cyclical conditions of the economy from the supply side *via* labor supply[15]. Essentially, labor supply is determined by the product of the exogenously given population, working-age population rate, and participation rate *(Eq. (3.6))*. Labor supply and labor demand determine the unemployment rate *(Eq. (3.7))*, which is integrated into the wage equations *(Eq. (3.2)* and *Eq. (3.3))*, through the unemployment gap *(Eq. (3.8))*.

$$ls_t = p_t * wap_t * part_t \tag{3.6}$$

$$un_t = 100 * (1 - ld_t / ls_t) \tag{3.7}$$

$$un_gap_t = un_t^* - un_t \tag{3.8}$$

where, *ls* is labor supply, *p* is population, *wap* is working age population rate, *part* is participation rate, *un* is unemployment rate, *ld* is labor demand, *un_gap* is unemployment gap, *un** is natural unemployment rate.

Last, we add two auxiliary identities to facilitate the interpretation of the results: price inflation *(Eq. (3.9))* and wage inflation *(Eq. (3.10))*.

[15] For simplicity, we assume that labor supply equals labor force.

$$inf_cpi_t = 100 * cpi_t/cpi_{t-4} - 100 \quad (3.9)$$

$$inf_wn_t = 100 * wn_t/wn_{t-4} - 100 \quad (3.10)$$

where, *inf_cpi* is price inflation, *cpi* is consumer price index, *inf_wn* is wage inflation, *wn* is nominal monthly wage.

3.3.3 Dataset

The data we employ in our analysis consist of quarterly frequency data spanning from 2002 to 2022. The published data are sourced from the Albanian National Institute of Statistics (INSTAT, 2023) and from the Bank of Albania (BoA, 2023). Although most of the data are originally available at this frequency, the population is published only at annual frequency, so we used the Denton method (Chollette, 1984) to convert it into quarterly frequency. The unpublished data is either estimated or calculated.

Specifically, the output gap represents the percentage difference between the actual GDP and the potential GDP. Potential GDP is derived from the Cobb-Douglas production function, as estimated by Skufi & Geršl (2023) for the Albanian economy, assuming constant returns to scale and a labor share of 70% *(Eq. (3.11))*. This estimation of potential GDP is well-suited to our approach, as it allows us to assess the impact of labor supply on potential growth and, consequently, on cyclical conditions.

$$Y_t^* = A_t * K_t^{0.3} L_t^{0.7} \quad where: \quad L_t = ls_t * (1 - un_t^*) \quad (3.11)$$

where, Y^* is potential GDP, A is total factor productivity representing Solow residuals, K is capital stock, L is effective labor supply, ls is labor supply, un^* is natural unemployment rate.

The natural unemployment rate employs a state-space model with the Kalman Filter technique as outlined by Crump et al. (2019). This estimation comprises the measurement and the transition equations. In our estimation, the measurement equation

embodies an inflation Phillips curve that links to backward-looking inflation expectations, unemployment gap, and a set of supply shocks. Additionally, we account for the unemployment rate differential, as rapid changes in unemployment can influence inflation independently of the cyclical position of the labor market *(Eq. (3.12))*. The transition equations consist of the unemployment gap and the unemployment trend. *(Eq. (3.13))*. The unemployment gap is defined as the difference between the natural rate of unemployment and the actual unemployment rate. Here, we differ from how most other literature calculates it, as this way helps us capture better the tightness of labor market. Natural unemployment rate is defined as a first-order autoregressive process.

$$\Delta inf_cpi_t = \delta_1 \Delta inf_cpi_{t-n} + \delta_2 un_gap_t + \delta_3 \Delta un_{t-1} + \delta_4 ss_{t-k} + e_{1,t} \quad (3.12)$$

$$un_gap_t = un_t^* - un_t \quad and \quad un_t^* = \delta_5 un_{t-1}^* + e_{2,t} \quad (3.13)$$

where, *inf_cpi* is inflation deviation from the official inflation target of 3%, *un_gap* is unemployment gap, *un** is natural unemployment rate, *un* is unemployment rate, *ss* is supply shocks, namely: import prices, oil prices, and trade openness. Given that autoregressive terms and supply shocks may influence inflation at different time intervals, we designate them '*n*' and '*k*' lags, respectively. On average, we apply 4 lags for the autoregressive terms '*n*' and 2 lags for the supply shocks '*k*'. The rationale for using a higher number of lags for the autoregressive terms lies in the high persistence of inflation in the Albanian economy. In contrast, supply shocks, primarily stemming from foreign sources, impact inflation through imported goods. These goods exhibit an inelastic demand due to the limited availability of domestic substitutes, causing their price changes to be rapidly transmitted into the consumer price index basket. A similar difference in the speed of transmission is also used in the official macromodel of the Central Bank of Albania (Skufi, Kika & Ceka 2024).

The estimated output gap and the unemployment gap are shown in Figure 3.3, with the former represented by a black dotted line and the latter by a solid black line. Both indicators illustrate similar cyclical conditions within the Albanian economy. Right after the global financial crisis, the economy experienced a period of growth, which was subsequently interrupted by a recession triggered by the Greek debt crisis. This crisis had a substantial impact on the Albanian economy, given Greece's role as a major trading partner and the significant presence of Albanian migrants in Greece. Many of these migrants returned to Albania, leading to a marked increase in the unemployment rate and a prolonged deterioration in the cyclical conditions of the labor market. The economy began to recover afterward, until it was adversely affected by the November 2019 earthquake and the COVID-19 pandemic.

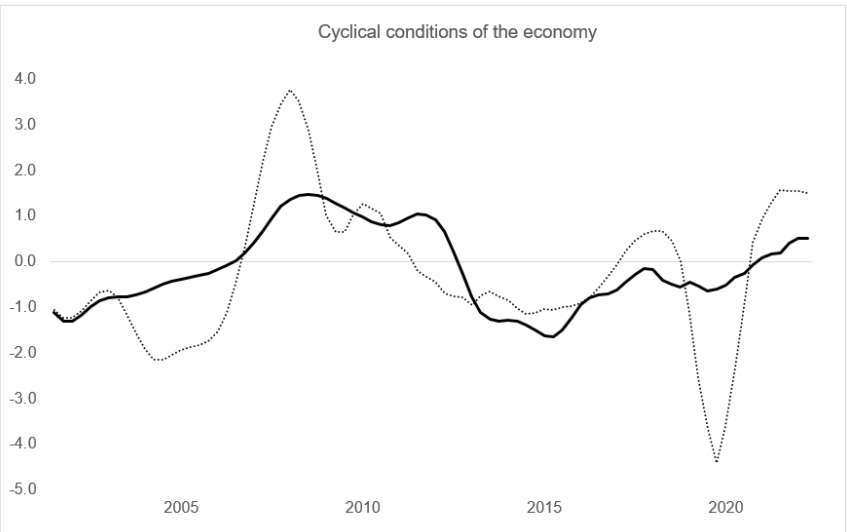

Figure 3.3 Output gap and unemployment gap

Source: INSTAT and authors' calculations.
Note: A positive value indicates positive cyclical conditions in both the labor market and production. Output gap in black dotted line and unemployment gap in black line.

Additionally, we have computed the compensation of employees and unit labor costs as outlined in *Eq. (3.5)*, labor supply from *Eq. (3.6)*, and price inflation and wage inflation from *Eq. (3.9)* and *(Eq. 3.10)*. Labor productivity is measured as real GDP divided by the number of employees, while remittances are converted to domestic

currency and then divided by nominal GDP. Table 3.1 presents a summary of the descriptive statistics for the variables incorporated in our model.

The average monthly nominal wage in Albania is 40,545 Lek (approximately 414 euros), which is roughly five times lower than the European average wage. However, in recent years, this wage gap has been narrowing, reflecting both the development of the Albanian economy and the strong appreciation of the domestic currency. Despite the relatively low wage level, unit labor costs remain high due to low productivity. Regarding inflation, the rate has generally remained stable and below the target of 3%, reflecting not only domestic conditions, but also the low and stable inflation rates in Albania's main trading partners within Europe.

The Albanian labor market is characterized by a relatively low labor force participation rate, which is on average 15 percentage points lower than that of European countries, and a relatively high unemployment rate of approximately 14%. The high standard deviation of labor force participation indicates substantial seasonality in this indicator. Although the labor force kept increasing on average by 20 basis points annually, the population continues to shrink. The minimum value of 2.8 million people is recorded in the most recent data points, compared to a maximum of 3 million people at the start of the sample. The high standard deviation is related to the fact that the population decline has been more pronounced in certain years. Similar trends are observed in remittance flows, where the ratio of remittances to GDP is among the highest, not only in Europe, but also within other emerging markets.

	Observations	Min	Max	Mean	Median	InterQuartile Range	Standard Deviation	Variation Coefficient	Unit	Source
Monthly nominal wage	84	16 644	65 486	40 545	42 177	19 997	12 156	0.3	ALL	INSTAT
Wage inflation	84	-4.7	28.8	6.9	5.8	8.2	6.4	0.9	%	Calculated
Compensation of employees	84	49 932	196 457	121 634	126 530	59 990	36 467	0.3	ALL	Calculated
Unit labour costs	84	245	538	386	378	117	70	0.2	Index	Calculated
Consumer price index	84	80	135	104	106	26	15	0.1	Index	INSTAT
Price inflation	84	0.7	7.9	2.6	2.2	1.4	1.4	0.5	%	Calculated
Import deflator	84	83	117	99	103	17	9	0.1	Index	INSTAT
Oil price index	84	27	155	90	86	59	36	0.4	Index	INSTAT
Labour productivity	84	220	375	316	335	56	43	0.1	Index	Calculated
Unemployment rate	84	10.6	18.2	14.3	14.2	3.0	2.0	0.1	%	INSTAT
Unemployment gap	84	-1.7	1.5	-0.2	-0.3	1.5	0.9	-5.3	%	Calculated
Output gap	84	-4.4	3.8	-0.3	-0.7	1.8	1.6	-5.8	%	Calculated
Remittances to GDP ratio	84	9.1	23.1	14.4	13.1	5.9	3.6	0.2	%	BoA.
Population	84	2 788 682	3 048 704	2 920 835	2 902 199	113 224	70 945	0.0	People	INSTAT
Labour demand	84	873 300	1 179 758	996 829	946 600	177 140	92 444	0.1	People	INSTAT
Labour supply	84	1 043 271	1 319 640	1 162 134	1 116 582	168 935	87 666	0.1	People	Calculated
Working age population rate	84	63.3	68.8	67.1	68.3	2.9	1.8	0.0	%	INSTAT
Participation rate	84	50.8	59.6	56.5	56.3	3.7	2.3	0.0	%	INSTAT

Table 3.1 List of used variables with sources, units of measurement and descriptive summary statistics

Source: Authors' calculations.
Note: The table provides main descriptive statistics of the variables used in the mode, namely: minimum, maximum, mean, median, interquartile range, standard deviation, and variation coefficient.

Figure 3.4 illustrates the paths of net migration, remittances to GDP and labor force participation. Heighten periods of migration are accompanied with lower labor force participation rates and remittances inflows.

In accordance with the ECM protocol, to assess the stationarity of the variables, we employed the Augmented Dickey-Fuller (ADF) test (Said & Dickey, 1984). The ADF test assess if the time series has a unit root. In simpler words, it checks if times series are nonstationary or if they follow a random walk. An ADF statistic greater than the critical value indicates that the time series has a unit root and is nonstationary. The results of the ADF unit root test for each variable in the wage and price equations are presented in Table 3.2. As can be seen, the null hypothesis of a unit root cannot be rejected for variables in the long-run relationship, whether in the wage or price equation. Conversely, the variables involved in the short-run dynamics do not exhibit a unit root.

	ADF-test	standard errors	t-statistics
Monthly nominal wage	0.000	(0.010)	[0.032]
Unit labour costs	0.012	(0.019)	[0.062]
Consumer price index	0.006	(0.005)	[1.183]
Import deflator	-0.010	(0.016)	[-0.626]
Oil price index	-0.121	(0.043)	[-2.800]
Labour productivity	-0.054	(0.019)	[-2.802]
Unemployment gap	-0.054 **	(0.023)	[-2.394]
Output gap	-0.069 **	(0.021)	[-3.268]
Remittances to GDP ratio	-0.054	(0.057)	[-0.948]

Table 3.2 Results from Augmented Dickey-Fuller Test

Source: Authors' calculations.
Note: The table provides the ADF test results where the lag length has been established using the Schwarz information criterion. P-values in $***$ $p<0.01$, $**$ $p<0.05$, $*$ $p<0.1$.

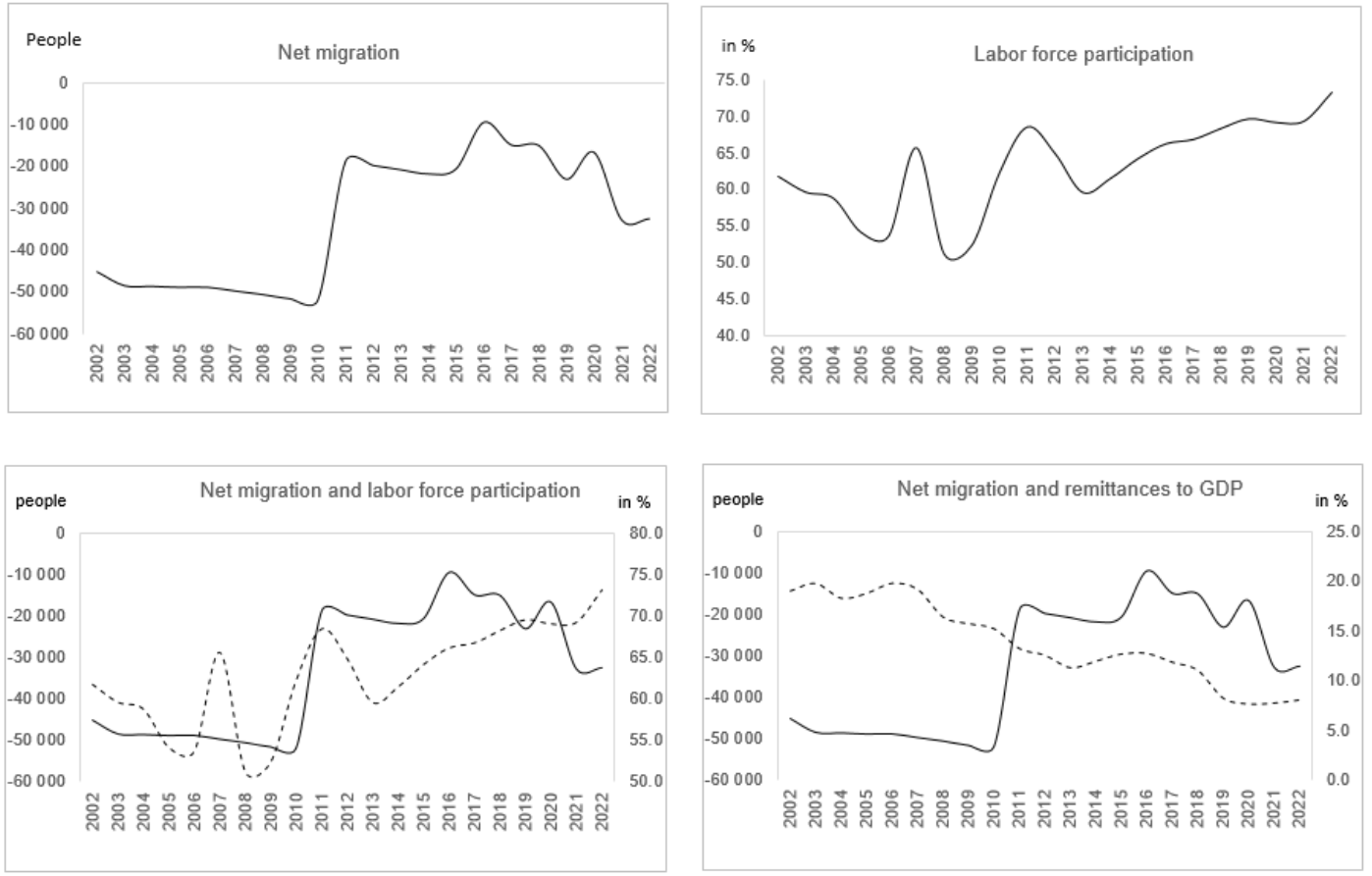

Figure 3.4 Migration, remittances to GDP and labor force participation dynamics

Source: Authors' calculations.
Note: The figure shows the historical paths of net migration, labor force participation, remittances to GDP and economic activity.

3.4 Results

The cointegration relationship among the variables in *Eq. (3.2), Eq. (3.3),* and *Eq. (3.4)* is tested by setting the lag length to 1, based on the AIC, SC, and HQ[16]. Both the Maximum Eigenvalue and Trace tests are applied to assess the rank of co-integrating relationships, as proposed by Johansen (1991). The significant Maximum Eigenvalue statistic (J_{max}) suggests at least *'r + 1'* co-integrating vectors, while the significant Trace statistic (J_{trace}) indicates more than *'r'* co-integrating relationships, where *'r'* denotes the number of existing co-integrating vectors. Table 3.3 presents the results. Both tests reject the null hypothesis of zero cointegrating vectors, confirming the presence of at least one cointegrating relationship and long-run equilibrium in the wage and price equations.

Null hypothesis	J_{trace}	J_{max}
Equation 3.1		
r = 0	60.643 ***	34.272 ***
r = 1	26.371 ***	23.748 ***
r = 2	2.624	2.624
Equation 3.2		
r = 0	28.653 ***	25.828 ***
r = 1	2.825	2.825
Equation 3.3		
r = 0	52.728 **	31.430 **
r = 1	21.299	12.675

Table 3.3 Results from Co-integration Test

Source: Authors' calculations.
Note: The table provides the results of the Johansen maximum eigenvalue and trace tests. P-values in *** p<0.01, * * p<0.05, * p<0.1.

Table 3.4 presents the ECM results for wages *(Eq. (3.2))*, wages including remittances *(Eq. (3.3))* and prices *(Eq. (3.4))* for the period 2002-2022.

[16] Lag length criteria results are detailed in Table 3.A1 in the Appendix 3.A.

	Equation 3.2			Equation 3.3			Equation 3.4		
Cointegrating Equation:									
Monthly nominal wage	1			1					
Consumer price index	-1.857 ***	(0.127)	[-14.595]	-1.869 ***	(0.107)	[-17.468]	1		
Unit labour costs							-0.582 ***	(0.062)	[-9.344]
Import deflator							-0.422 ***	(0.117)	[-3.619]
Labour productivity	-0.362 ***	(0.093)	[-10.688]	-0.583 ***	(0.078)	[-7.459]			
Remittances to GDP ratio				-0.694 **	(0.454)	[-2.528]			
Constant	0.104 ***	(0.258)	[7.306]				0.707 **	(0.290)	[2.436]
Error Correction:	-0.475 ***	(0.089)	[-5.329]	-0.433 ***	(0.092)	[-4.695]	-0.112 ***	(0.019)	[-6.037]
Unemployment gap	0.593 ***	(0.002)	[3.835]	1.489 ***	(0.004)	[3.825]			
Output gap							0.243 **	(0.159)	[2.530]
ΔOil price index							0.010	(0.007)	[-1.334]
R^2	0.388			0.317			0.161		
No. Observations	84			84			84		

Table 3.4 Results from ECM estimation.

Source: Authors' calculations.
Note: The table provides the results from the ECM estimation for the cointegrating equation, the correction coefficient and the coefficients of exogenous variables. Standard errors in ( ), t-statistics in [ ], p-values in *** p<0.01, ** p<0.05, * p<0.1.

The estimated parameters, along with their standard errors and t-statistics, show that all variables have the expected signs and are statistically significant, indicating long-term stability of wage and price inflation. The unit parameters in the cointegration equation for each specification reflect the dependent variable, suggesting that, in the long-run, wage and price inflation remain stable in the absence of shocks.

A permanent 1% increase in the CPI leads to a 1.9% increase in wages in the long-run, regardless of the inclusion of remittances. This finding reflects structural features of the Albanian economy. Inflation has averaged about 1 percentage point below target, while the minimum wage, covering nearly half of employees, has been raised almost annually above inflation. In our opinion, these adjustments, given the weight of the minimum wage in overall wages, explain the rise in real wages, even if the result appears counterintuitive from a theoretical perspective. Remittances contribute to higher wages, with a statistically significant parameter of 0.7. Comparing *Eq. (3.2)* and *Eq. (3.3)* shows that wages are more responsive to labor productivity in the long-run and to labor market tightness in the short-run when remittances are received. Specifically, labor productivity increases wages by 0.6% with remittances versus 0.4% without. Additionally, wages adjust more slowly with remittances, as indicated by a 4 basis point reduction in the error correction parameter. The elasticity to labor market tightness increases from 0.6 to 1.5. However, this disequilibrium is likely to be short-lived, given the relatively high error correction coefficient of 0.4. Overall, migration exerts inflationary pressures through remittances.

In *Eq. (3.4)* the parameter of 0.4 for the import deflator reflects the contribution of foreign inflation to headline inflation, while the 0.6 elasticity of unit labor costs represents domestic inflation. The sum of these parameters, close to 1, indicates long-

run equilibrium. The low error correction parameter suggests high persistence of inflation, consistent with the findings by Skufi & Kika (2019).

To validate our specification, we compare the actual data with the baseline solution for 2002-2022, where the baseline represents the Gauss-Seidel solution of the system. Figure 3.5 shows that the estimated values align closely with the actual data, with the remittance-inclusive model providing a better fit.

The findings of our analysis are based on three simulations, in which assumptions represent hypothetical unit measurements relative to the baseline. Simulation results are expressed as deviations from the baseline scenario[18], with results presented in Figure 3.6.

The shocks analyzed inhere should be interpreted as transitory, even though potentially long-lasting, changes in labor force participation, rather than permanent structural shifts. A permanent increase in participation would raise both the actual and natural unemployment rates equally, leaving the unemployment gap unchanged under the assumption of constant labor demand.

The first scenario simulates a population decline of 1.0% over 7 years, shown by the black line in Figure 3.6. This population decrease reduces the labor force *(Eq. (3.5))*, creating a tight labor market, *ceteris-paribus*. Consequently, wages rise gradually, and inflation increases due to higher unit labor costs. These costs are transmitted to prices, which feedback into wages.[19] Despite labor market tightness,

[18] Expressing the simulation results as deviations from the baseline implies that the outcomes are solely contingent upon the parameter matrix and the shock value. Given the model's linearity in both parameters and variables, the outcomes can be appropriately rescaled to future demographic developments to estimate their effects on wages and inflation.

[19] See Chart A1 in Appendix for a graphical illustration of transmission mechanism.

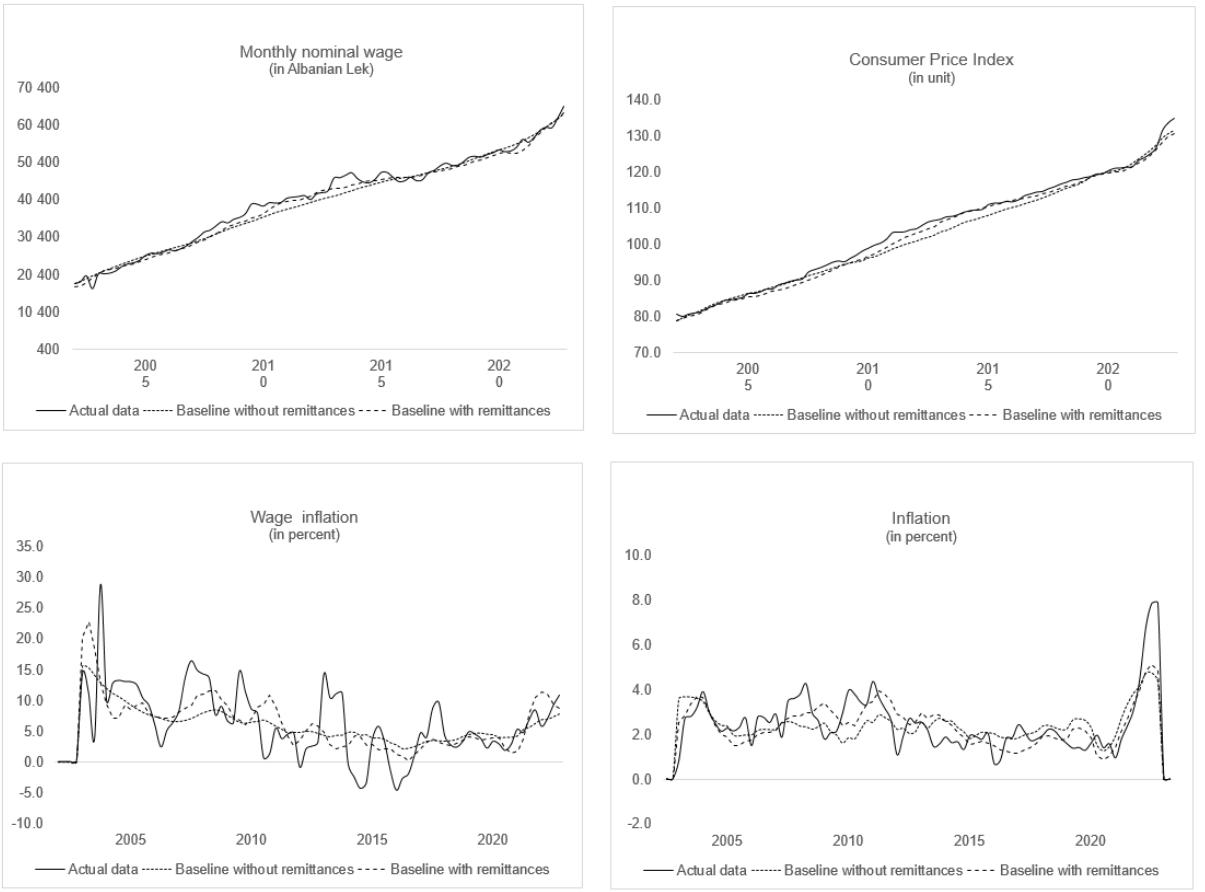

Figure 3.5 Actual data versus baseline solution

Source: Authors' calculations.
Note: Figure 3.5 shows the actual values alongside the baseline solutions of two models, one incorporating remittances and one excluding them, for wages, the Consumer Price Index (CPI), wage inflation, and overall inflation.

wages adjust to absorb inflation, with wage inflation peaking at 0.7 percentage points. At the end of the simulation, wages and prices are 1.2% and 0.6% higher than the baseline, respectively.

In the second scenario, we contemporaneously simulate a 1% increase in remittance inflows as a share of GDP, represented by the black dotted line in Figure 3.6. Wages become more responsive to labor market conditions, likely due to changes in the reservation wage driven by additional income from remittances[19]. With approximately 1.2 million Albanians abroad (INSTAT, 2024), remittance inflows increase wages by 2.8 percentage points more than in the first scenario and by 4.0% compared to the baseline. These inflows generate inflationary pressures, amplifying both wage and headline inflation, increasing inflation by 0.8 percentage points compared to no migration or remittances. Notably, the results indicate that remittances exert a stronger impact than population changes. In our model, the remittance variable captures the structural changes in the economy induced by migration, particularly through its effect on the sensitivity of the unemployment gap. In this sense, wage inflation becomes more responsive to cyclical conditions, as remittances alter household behavior and reservation wages, thereby reinforcing the transmission from labor market tightness to wages and prices. It is possible that remittances also capture other factors, such as co-movements with foreign wage and price dynamics, which could transmit to domestic inflation through alternative channels. To explore this hypothesis, we conducted a simple empirical check by estimating a participation rate as a function of remittances. The results reported in Table 3.A2 in Appendix 3.A

[19] https://rti.rtsh.al/article/diaspora-the-number-of-albanians-living-abroad.

indicate a negative relationship between remittances and labor force participation, consistent with the notion that higher remittances increase the reservation wage.

The third scenario simulates a migration shock alongside policies aimed at increasing labor force participation. We assume a 1 percentage point rise in the labor force participation rate over 7 years, offsetting 0.3 percentage points of the labor force decline. As a result, the labor supply decreases by 0.7%, compared to 1% in the first two scenarios. The simulation results, shown by the black dashed line in Figure 3.6, indicate reduced inflation pressures. Although wage inflation peaks at 2.4 percentage points and price inflation at 0.6 percentage points, inflation pressures ease after three years as the economy reaches a new equilibrium.

These long-term trends reflect the elasticities of the estimated equations. For example, in the first scenario, the 1.2% wage increase is driven by 60 basis points from the unemployment gap and 60 basis points from price-induced wage adjustments. Equilibrium is restored in nearly five years, at which point wage and price inflation stabilizes. The zero inflation value indicates the targeted inflation of 3%.

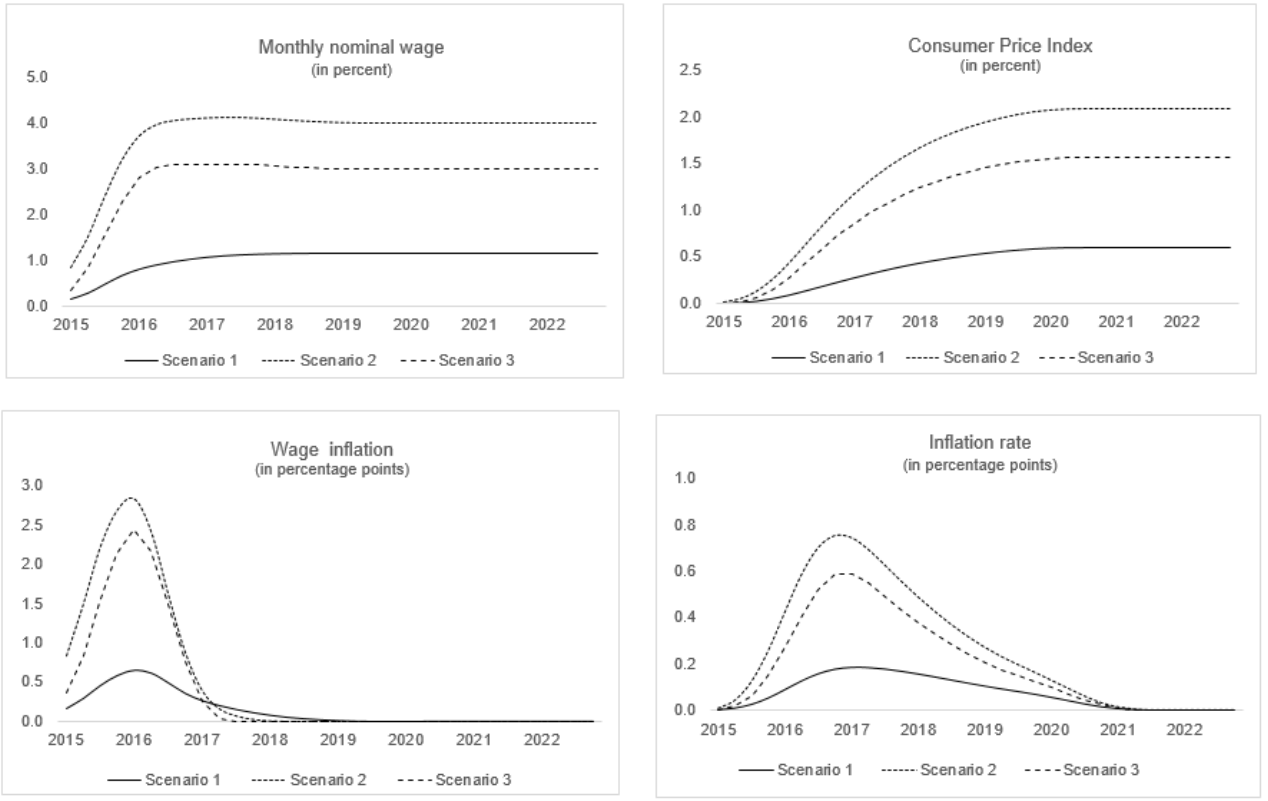

Figure 3.6 Simulation results

Source: Authors' calculations.
Note: Figure 3.6 shows the deviation of three simulations from the baseline: the decline of population in black line, the decline of population and remittances inflows in black dotted line and increase of labor force participation on top of them in black dashed line for wages, CPI, wage inflation, and overall inflation.

3.5 Discussion and limitations

3.5.1 Discussion

Our findings indicate that migration exerts inflationary pressures, primarily through labor supply shortages, tighter labor market conditions, and remittance inflows. We observe that migration induces inflationary pressures of up to 0.8 percentage points in the midterm. This conclusion aligns with the literature, including studies by Petreski et al. (2019), Narayan et al. (2011) and Mehedintu et al. (2020). While most studies focus solely on wages or inflation and often overlook the feedback mechanism between the two, our analysis reveals that accounting for remittances can increase wages by up to 4.0% and prices up to 2.1%. Our findings align within the reservation wage increase range of 2.1% to 5.6% suggested by Petreski et al. (2019) for similar economies.

Narayan et al. (2011) suggest that the impact of remittances on inflation is more pronounced in the long-run than in the short-run. Contrary to their findings, we provide evidence that the impact of migration and remittances on inflation decreases in the long-run, reaching zero within five years as the economy attains a new equilibrium. In this regard, we also disagree with Ball et al. (2013), who report a negative impact of remittances on inflation for countries with flexible exchange rate regimes. Conversely, our results align with Meyer & Shera (2017), who conclude that the impact of remittances decreases with population shrinkage, which is consistent with our primary assumption.

Furthermore, we find that wage inflation becomes more sensitive to cyclical conditions. In our interpretation, the remittance variable accounts for the structural changes in the economy imposed by migration, thereby contributing to changes in the sensitivity of the unemployment gap. As cited by Del Negro et al. (2020) and Carstens (2022), structural changes may have affected the cyclical sensitivity of inflation.

Another finding aspect of our study is the impact of policies aim to fight the shrinkage of the labor force like increase of retirement age. We find that supporting measurement pointed to an increase in the labor force participation rate offset inflation pressures, but still inflation pressures remain high. Moreover, permanent population declines are often associated with a structural demographic shift toward older age cohorts, which typically exhibit higher participation rates and lower unemployment rates. This demographic transformation could result in a lower NAIRU, thereby reducing labor market tightness over the long run.

3.5.2 Limitations

The scenarios analyzed aim to highlight key elements and factors that may drive future developments in permanent migration, rather than providing a comprehensive future projection. It is important to emphasize that our results suggest an upper inflationary risk within the *ceteris-paribus* context. Although freezing demand, the foreign economy, and monetary policy reactions may seem unrealistic, these assumptions are useful within our model framework and can be simulated as needed. By abstracting from the complexities of the macroeconomic environment and concentrating on the labor market and the interconnections between wages and inflation, we essentially narrow our focus to this feedback loop. This approach allows us to present preliminary findings from a conditional simulation analysis surrounded by a higher uncertainty over a prolonged period of times.

In our opinion, keeping the demand side unchanged best reflects the reality of the Albanian economy. Despite population shrinkage, there remains a stable or even growing demand for labor in production.[20] This is likely due to high aggregate demand

[20] The correlation coefficient for the analyzed sample (2002–2022) is -0.8, indicating a negative relationship between the two indicators and highlighting their diverging trends.

driven by factors such as increased tourist inflows, foreign students studying in Albania, and older people buying property and residing in the country. Much of this demand is concentrated in the services sector (education, hotels and restaurants, transport, etc.), which requires intensive labor input and sustains high aggregate demand. Relaxing the assumption of a fixed labor demand would alter the dynamics of wages and prices. A 1% decline in labor demand would offset the tight labor market assumed in our scenarios, as both the population and the labor force would decrease by 1%, resulting in no inflationary pressure due to stable unemployment. On the contrary, a 1% increase in labor demand would tighten the labor market. Figure 3.7 illustrates these wage and price adjustments along with the first scenario. As we use a log-linear system, deviations in exogenous indicators lead to corresponding deviations in results, based on the elasticity values in Table 3.4. Thus, wages rise by 1.2% and prices rise by 0.6%, in addition to the first scenario.

Regarding monetary policy, we chose to keep it inactive to observe the maximum inflationary pressures and to allow the economy to breathe. Tightening monetary policy to combat inflation could stifle economic growth and create financial instability.[21] Our simple equations model is not equipped to fully account for the implications of monetary policy reactions. Similarly, we kept external factors such as foreign policy, foreign prices, and demand, unchanged for simplicity.

The simplified wage and price equations with Phillips curve extensions may oversimplify complex interactions within real-world economic systems. Assumptions such as *ceteris-paribus* conditions and linear relationships might not fully capture the

[21] According to the official macroeconomic model of the Central Bank of Albania, a 1 percentage point tightening of monetary policy would result in a 20 basis point reduction in inflation and 0.3% lower economic growth (Skufi, Kika, & Ceka, 2024).

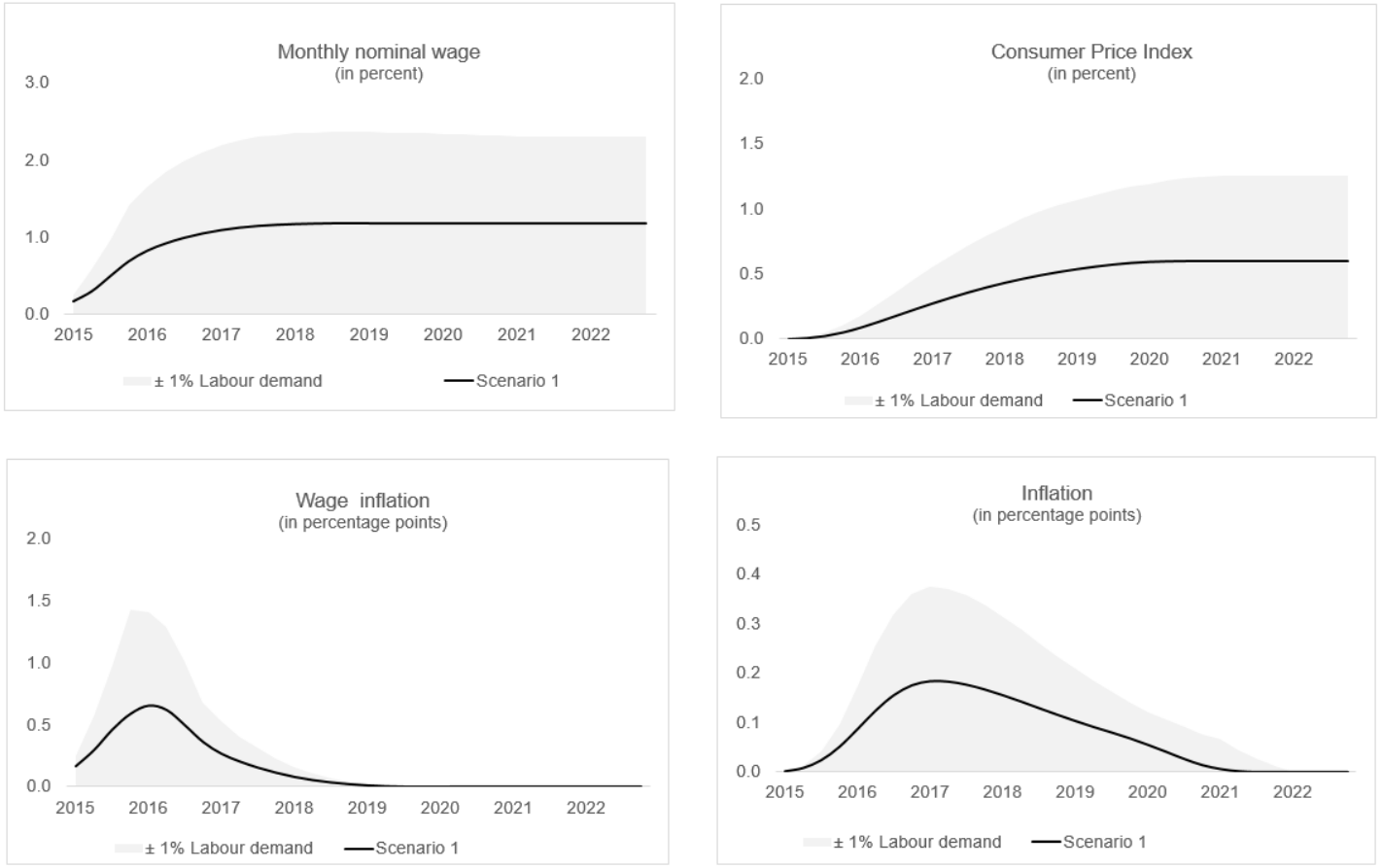

Figure 3.7 Simulation results of alternative labor demand paths

Source: Authors' calculations.
Note: The figure shows the deviation from the baseline of the first simulation and ± 1% labor demand paths: the decline of the population in black line, the decline and increase of labor demand in grey shadow for wages, CPI, wage inflation, and overall inflation.

non-linear and dynamic nature of these systems. Future research could benefit from endogenizing the domestic economy within the model. By expressing aggregate demand as a function of population and linking labor demand with aggregate demand, researchers can better capture the cyclical conditions of the labor market.

Furthermore, analyzing how various sources of business cycle fluctuations propagate price-cost-push shocks could offer further insights into macroeconomic dynamics and policy implications. Future studies should aim to incorporate a broader range of transmission channels in the context of economic transmission and policy reactions. The impact of migration should be analyzed not only on the supply side but also on the demand side to provide a more holistic understanding. Ideally, a general equilibrium model or a semistructural model can provide thorough analysis of migration phenomena, taking into account several transmission channels and interactions with the economic sectors. However given the linear nature of the model, partial analysis can be derived on the basis of assumptions in the set of exogenous variables in the model.

Additionally, employing non-linear techniques to understand how nonlinearities affect labor market dynamics would provide a comprehensive perspective on the variability across different segments of the labor market, thereby enhancing the effectiveness of policy responses.

3.6 Policy implications

Migration phenomena play a significant role in the economy of a country and may create an inflationary burden that is challenging to eliminate unless appropriate policies are implemented to address the root causes of the issue. This article provides valuable insights for policy makers in developing strategies to address the challenges posed by

demographic changes and migration flows, in Albania or other countries facing similar issues. A key recommendation is the need for targeted interventions to manage labor market tightness. Given the evidence of labor market overheating, policymakers should consider measures to moderate wage pressures while sustaining economic growth.

Policymakers should improve the skills of the workforce through training programs and promote the flexibility of the labor market, especially in sectors affected by migration. Flexible work arrangements and easing regulatory burdens can facilitate smoother economic adjustments. Incentivizing technological adoption and innovation can increase productivity and alleviate wage pressures.

Our findings also highlight the importance of considering demographic changes in policy frameworks. Policies that support increased participation in the labor force among specific groups, such as older workers or women, could mitigate inflationary pressures from population shrinkage.

Policymakers should prioritize macroeconomic stability through prudent fiscal management and effective monetary policies. Fiscal strategies could include maintaining a counter-cyclical budget, prioritizing efficient public investment in infrastructure and social services, and implementing automatic stabilizers to buffer the economy against external shocks such as pandemic-related disruptions. On the monetary side, the Bank of Albania could continue flexible inflation targeting, clear communication of policy rates, and the use of macroprudential instruments to support financial stability. Strengthening banking sector regulations, diversifying the economy beyond remittance-dependent and construction-related sectors, and accumulating foreign exchange reserves are critical to reducing vulnerability to shocks, including fluctuations in migration and remittance inflows. These targeted measures would

enhance Albania's resilience, support stable inflation, and promote sustainable economic growth even in the face of external and domestic shocks.

Research on Albanian migration informs policymakers about labor mobility, it can guide effective migration policies and development initiatives. Thus, Albania offers a unique context. The study's focus on Albania and its specific economic context may limit its generalizability to other regions or countries with different economic structures or migration patterns. Biases related to data availability and the criteria for including or excluding variables may skew the study findings towards certain outcomes.

3.7 Conclusions

This study explores the relationship between labor market tightness, inflation, and migration, focusing on Albania, an emerging market with a high intensity of migration. Using data from 2002 to 2022, we develop a dynamic wage-price model that incorporates the externalities of remittances. We evaluated the inflationary impacts of population decline through three simulations: a permanent population decrease, remittance inflows, and measures to increase labor force participation.

Our findings indicate that ongoing migration contributes to inflationary pressures, with remittances significantly amplifying the relationship between price and wage inflation. However, some of the inflationary costs associated with migration can be mitigated through policy interventions. For example, increasing the retirement age or increasing participation in the labor force can alleviate labor market tightness, thus reducing wage and inflationary pressures. However, some of those policies actions might not be easily implemented, e.g., an increase in retirement age would probably trigger political and social pressures.

This paper offers insights for policymakers that address migration and demographic challenges. Key recommendations include managing labor market tightness, managing wage pressure, improving workforce skills, and promoting flexibility and innovation. Additionally, fiscal prudence, effective monetary policies, and economic diversification are crucial for resilience, with lessons applicable to other countries facing similar challenges. Future research could further explore the impact of demand-side factors and external policies on migration and economic outcomes.

Reference

AAB. (2024). *Albanian Association of Banks* . Statictics. Retrieved from https://aab.al/en/rreth-nesh/statistika/

Abdymomunov, A., Elul, R., Ruffino, D., & Wang, J. (2025). Examining the Relationship Between Loan Pricing and Credit Risk. *FED*. doi: https://doi.org/10.17016/2380-7172.3876

Afesorgbor, S., Van Bergeijk, P., & Demena, B. (2022). COVID-19 and the Threat to Globalization: An Optimistic Note. *COVID-19 and International Development*, 29–44.

Aiyar, M. S., Mitra, M. S., Mineshima, M. A., Jobst, M. A., Dao, M. C., & Pradhan, M. (2021). COVID-19: How Will European Banks Fare? *International Monetary Fund*, IMF Departmental Papers / Policy Papers 2021/008.

Alvarez, S. P., Briod, P., & Ferrari, O. (2015). Remittances: How reliable are the data? *Migration Policy Practice, 2*, 42-46.

Anderson, T. W., & Hsiao, C. (1981). Estimation of Dynamic Models with Error Components. *Journal of the American Statistical Association, 76*(375), 598-606. doi: https://doi.org/10.1080/01621459.1981.10477621

Angelini, E., Bokan, N., Christoffel, K., Ciccarelli, M., & Zimic, S. (2019). Introducing ECB-BASE: The blueprint of the new ECB semi-structural model for the euro area. *European Central Bank, Working Paper Series, No 2315* . Retrieved from https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2315~73e5b1c3cd.en.pdf

Ari, A., Chen, S., & Ratnovski, L. (2021). The dynamics of non-performing loans during banking crises: A new database with post-COVID-19 implications.

Journal of Banking & Finance, 133. doi:https://doi.org/10.1016/j.jbankfin.2021.106140

Ari, A., Garcia-Macia, D., & Mishra, S. (2023). *Has the Phillips Curve Become Steeper?* Working Paper, IMF, European Department.

Arigoni, F., Breznikar, M., Lenarčič, Č., & Maletič, M. (2021). Impact of Fiscal Measures in Response to the COVID-19 Pandemic on Small-Open Economies: Lessons from Slovenia. *SSRN Electronic Journal*.

Aydemir, R., Atik, Z., & Guloglu, B. (2023). Macro Stress Testing the Credit Risk of Conventional and Participation Banks in Turkey: A Nonparametric Quantile Regression Approach. *Eastern European Economics*, 1–35. doi:https://doi.org/10.1080/00128775.2023.2253226

Baba, C., Duval, R. A., Lan, T., & Topalova, P. (2023). *The 2020-2022 Inflation Surge Across Europe: A Phillips-Curve-Based Dissection.* International Monetary Fund.

Ball, C. P., Zuniga, M. C., Lopez, C., & Reyes, J. A. (2013). Remittances, Inflation and Exchange Rate Regimes in Small Open Economies. *The World Economy, 36*(4).

Ball, L., Leigh, D., & Mishra, P. (2022). Understanding US Inflation during the COVID-19 Era. *Brookings Papers on Economic Activity, 2022*(2), 1-80.

Barajas, A., Choi, W. G., Gan, K. Z., Guérin, P., Mann, S., Wang, M., & Xu, Y. (2021). Loose Financial Conditions, Rising Leverage, and Risks to Macro-Financial Stability. *IMF Working Papers*, WP/21/222.

Bartocci, A., Notarpietro, A., & Pisani, M. (2020). The COVID-19 shock and a fiscal-monetary policy mix in a monetary union. *Temi di discussione*

(Economic working papers) 1313, Bank of Italy, Economic Research and International Relations Area.

Barro, R. J., Ursua, J. F., & Weng, J. (2020). The coronavirus and the Great Influenza epidemic:: Lessons from the "Spanish Flu" for the coronavirus' potential effects on mortality and economic activity. *American Enterprise Institute, AEI Economics Working Paper 2020-02*.

Beck, R., Jakubik, P., & Piloiu, A. (2013). Non-performing loans: What matters in addition to the economic cycle? *ECB Working Paper, 1515*. Retrieved from http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1515.pdf

Beck, R., Jakubik, P., & Piloiu, A. (2015). Key determinants of non-performing loans: New evidence from a global sample. *Open Economies Review, 26*(3), 525–550.

Bergholt, D., Furlanetto, F., & Vaccaro-Grange, E. (2022). Did Monetary Policy Kill The Phillips Curve? Some Simple Arithmetics. *The Phillips Curve: Dead, Alive, or Resurrected?* European Economic Association.

Bernanke, B., & Blanchard, O. (2023). What Caused the U.S. Pandemic-Era Inflation? *Working Papers 23-4*.

Bethlendi, A. (2011). Policy measures and failures on foreign currency household lending in central and eastern Europe. *Acta Oeconomica, 61*(2), 193-223. Retrieved from https://www.jstor.org/stable/41318103

Bieszk-Stolorz, B., & Dmytrów, K. (2022). "Assessment of the Similarity of the Situation in the EU Labour Markets and Their Changes in the Face of the COVID-19 Pandemic. *Sustainability, MDPI*, vol. 14(6), pages 1-20.

Binder, C., & Kamdar, R. (2022). Expected and Realized Inflation in Historical Perspective. *The Journal of Economic Perspectives, 36*(3), 131-156.

Blanchard, O. (2016). The Phillips Curve: Back to the '60s? *The American Economic Review, 106*(5), 31-34.

Bleakley, H., & Cowan, K. (2008). Corporate Dollar Debt and Depreciations: Much Ado about nothing? *Review of Economics and Statistics, 90*(4), 612–26.

BoA. (2015). *Bank of Albania*. Retrieved from Supervision: https://www.bankofalbania.org/Supervision/Action_plan_for_non-performing_loans/

BoA. (2022). *Bank of Albania*. Retrieved from https://www.bankofalbania.org/Statistikat/Statistikat_Monetare_Financiare_dhe_Bankare/

BoA. (2023). *Banka e Shqipërisë*. Retrieved from https://www.bankofalbania.org/Statistikat/Seri_Kohore/

BoA. (2024). *Bank of Albania*. Retrieved from https://www.bankofalbania.org/Statistikat/Seri_Kohore/

Bobeica, H., & Hartwig, B. (2021). The COVID-19 shock and challenges for time series models. *European Central Bank, ECB working paper NO 2558*.

Bodnár, K. (2009). Exchange rate exposure of Hungarian enterprises – results of a survey. *MNB Occasional Papers*.

Boissay, F., Patel, N., & Shin, H. S. (2020, June). Trade credit, trade finance, and the Covid-19 Crisis. *Bank for International Settlements, BIS Bulletin No 24*.

Boissay, F., Rees, D., & Rungcharoenkitkul, P. (2020). *Dealing with Covid-19: Understanding the policy choices.* BIS. BIS.

Boissay, F., Rees, D., & Rungcharoenkitkul, P. (2020). *Dealing with Covid-19: Understanding the policy choices.* BIS. BIS.

Bordo, M. D., Levin, A. T., & Levy, M. D. (2020). Incorporating Scenario Analysis into the Federal Reserve's Policy Strategy and Communications. *NBER Working Paper No. 27369*.

Boumparis, P., Milas, C., & Panagiotidis, T. (2019). Non-performing loans and sovereign credit ratings. *International Review of Financial Analysis, 64*, 301-314. doi:https://doi.org/10.1016/j.irfa.2019.06.002

Brázdik, F., Hlédik, T., Humplová, Z., Martonosi, I., Musil, K., Ryšánek, J., . . . Žáček, J. (2020). The g3+ Model: An Upgrade of the Czech National Bank's Core Forecasting Framework. *Working paper series, No 1/2020*.

Brown, M., Haas, R. D., Tille, C., & Halpern, L. (2012). Foreign banks and foreign currency lending in emerging Europe. *Economic Policy, 69*(57), 59-98. Retrieved from https://www.jstor.org/stable/41428846

Budnik, K. B., Greszta, M., Hulej, M., Kolasa, M., Murawski, K., Rot, M., . . . Tarnicka, M. (2011). The new macroeconometric model of the Polish economy. *National Bank of Poland Working Paper, 62*.

Budnik, K., Greszta, M., Hulej, M., Krzesicki, O., Lewińska, R., Murawski, K., . . . Rybaczyk, B. (2009). An update of the macroeconometric model of the Polish economy NECMOD. *National Bank of Poland Working Papers*, NO. 64.

Bulligan, G., Busetti, F., Caivano, M., Cova, P., Fantino, D., Locarno, A., & Rodano, L. (2017). The Bank of Italy econometric model: an update of the main equations and model elasticities. *Banca d'Italia, Temi di Discussione*, No 1130.

Calem, P., & Rob, R. (1999). The Impact of Capital-Based Regulation on Bank Risk-Taking. *Journal of Financial Intermediation, 8*(4), 317-352. doi:https://doi.org/10.1006/jfin.1999.0276

Carpenter, S. B., Harris, E. S., Hooper, P., & West, K. D. (2022). *Some Benefits and Risks of a Hot Economy.* U.S. Monetary Policy Forum.

Carstens, A. (2022). *The return of inflation.* International Center for Monetary and Banking Studies . Bank for International Settlements.

Castaldo, A., & Reilly, B. (2007). Do migrant remittances affect the consumption patterns of albanian households? *South-Eastern Europe Journal of Economics, 1*, 25-54.

Cecchetti, S. G., Feroli, M. E., Hooper, P., Mishkin, F. S., & Schoenholtz, K. L. (2023). DP18068 Managing Disinflations. *CEPR Press Discussion Paper No. 18068.*

Cela, E., & Skufi, L. (2018). Natural rate of unemployment – Reduced form approach. *Bank of Albania*, Working paper series No 40-(79). Retrieved from https://www.bankofalbania.org/Publications/All_publications/Natural_rate_of_unemployment_Reduced_form_approach.html

Cerqua, A., & Letta, M. (2022). Local inequalities of the COVID-19 crisis. *Regional Science and Urban Economics*, Elsevier, vol. 92(C).

Chan, Y. T. (2022). The macroeconomic impacts of the COVID-19 pandemic: A SIR-DSGE model approach. *China Economic Review*, Elsevier, vol. 71(C).

Chollette, P. (1984). Adjusting sub-annual series to yearly benchmarks. *Survey Methodology, 10*, 35-49.

Clements, M. P., & Hendry, D. F. (1998). Forecasting Economic Processes. *International Journal of Forecasting, 14*((1)), 111-131.

Clements, M. P., & Hendry, D. F. (1999). *Forecasting Non-Stationary Economic Time.* Cambridge, Mass.: MIT Press.

Coenen, G., Montes-Galdón, C., & Smets, F. (2020). Effects of state-dependent forward guidance, large-scale asset purchases and fiscal stimulus in a low-interest-rate envrionment. *ECB*, Working Paper Series, No 2352.

Coibion, O., & Gorodnichenko, Y. (2015). Is the Phillips Curve Alive and Well after All? Inflation Expectations and the Missing Disinflation. *American Economic Journal: Macroeconomics, 27*(1), 197-232.

Conrad, D., Ramkissoon, B., & Mohammed, S. (2018). Back to Basics: Remittances in the Keynesian Macroeconomic Framework. *International Advances in Economic Research* , 233–238. doi:https://doi.org/10.1007/s11294-018-9703-y

Consensus Economics. (2020). *Consensus Forecasts.* London: Phillip M. Hubband. Retrieved from www.consensuseconomics.com

Correia, S., Stephan, L., & Emil, V. (2020). Pandemics Depress the Economy, Public Health Interventions Do Not: Evidence from the 1918 Flu. *SSRN Electronic Journal*.

Coutinho, L., Vukšić, G., & Zeugner, S. (2021). *International tourism decline and its impact on external balances in the euro area.* Quarterly Report on the Euro Area (QREA), European Commission, Directorate General Economic and Financial Affairs (DG ECFIN).

Croitorov, O., Filippeschi, G., Licchetta, M., Pfeiffer, P., Reut, A., Simons, W., . . . Vogel, L. (2021). The macroeconomic impact of the COVID-19 pandemic in the euro area. *European Commission*, Quarterly Report on the Euro Area (QREA), Directorate General Economic and Financial Affairs (DG ECFIN), vol. 20(2), pages 7-16, July.

Crump, R. K., Eusepi, S., Giannoni, M., & Şahin, A. (2019). A Unified Approach to Measuring u. *Brookings Papers on Economic Activity, Spring*(2019), 143-214.

De Santis, R. A., & Van der Veken, W. (2020). Forecasting macroeconomic risk in real time: Great and Covid-19 Recessions. *European Central Bank*, Working Paper Series 2436.

Demirguc-Kunt, A., & Huizinga, H. (2000). Financial structure and bank profitability. *Policy Research Working Paper Series, 2430*.

Docquier, F., Ozden, Ç., & Peri, G. (2014). The Labour Market Effects of Immigration and Emigration in OECD Countries. *The Economic Journal, 124*(579), 1106–1145. doi:https://doi.org/10.1111/ecoj.12077

Donadelli, M., Ferranna, L., Gufler, I., & Paradiso, A. (2021, June). Using past epidemics to estimate the macroeconomic implications of COVID-19: A bad idea! *Structural Change and Economic Dynamics, 57*, 214-224.

Dowlah, C. (2020). Cross-Border Labor Mobility: Theoretical Perspectives and Empirical Findings. In *Cross-Border Labor Mobility.* Palgrave Macmillan, Cham. doi:https://doi.org/10.1007/978-3-030-36506-6_11

Duval, L., & Wolff, F.-C. (2009). *Remittances matter: Longitudinal evidence from Albania.* HAL.

Duval, M. R., Shibata, M. I., Ji, Y., Pizzinelli, C., Tavares, M. M., Li, L., . . . Sozzi, A. (2022). Labor Market Tightness in Advanced Economies. *International Monetary Fund*, IMF Staff Discussion Notes 2022/001.

ECB. (2011). Empirical determinants of non-performing loans. *ECB Financial Stability*, 132-139.

ECB. (2021). *Review of macroeconomic modelling in the Eurosystem: current practices and scope for improvement.* Frankfurt: European Central Bank. Retrieved 2022, from https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op267~63c1f094d6.en.pdf

Eichenbaum, M. S., Rebelo, S., & Trabandt, M. (2021). The Macroeconomics of Epidemics. *NBER, w26882*.

Engelke, C., Heinisch, K., & Schult, C. (2019). How forecast accuracy depends on conditioning assumptions. *Leibniz-Institut für Wirtschaftsforschung Halle, IWH Discussion Papers No. 18/2019*. Retrieved from http://hdl.handle.net/10419/201837

European Commission. (2021). Albania post-disaster needs assesssment. Retrieved from https://ec.europa.eu/fpi/system/files/2021-05/10_Albania%202020%20Post-Disaster%20Needs%20Assessment.pdf

European Commission. (2022). Labour Market and Wage Developments in Europe. *Annual review 2022*.

Eurostat. (2022). *European Commission*. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/namq_10_gdp/default/table?lang=en

Fagan, G., Henry, J., & Mestre, R. (2001). An Area-wide Model (AWM) for the euro area. *ECB, WORKING PAPER NO. 42*.

Fahlenbrach, R., Rageth, K., & Stulz, R. M. (2021). How valuable is financial flexibility when revenue stops? Evidence from the COVID-19 crisis. *Review of Financial Studies*.

Fahlenbrach., R., Rageth, K., & Stulz, R. M. (2021). How valuable is financial flexibility when revenue stops? Evidence from the COVID-19 crisis. *Review of Financial Studies*.

Festić, M., & Bekő, J. (2008). The Banking Sector and Macroeconomic Performance in Central European Economies. *Czech Journal of Economics and Finance, 58*(3-4), 131–151.

Fink, G., Rainer, W., & Haiss, P. R. (2016). The euro as international currency: Euro-loans in central and south-east european countries. In M. Guderzo, & A. Bosco (Eds.), *A Monetary hope for Europe: the Euro and the Struggle for the Creation of a New Global Currency.* Studi e Saggi.

Foroni, C., Marcellino, M., & Stevanovic, D. (2019). Mixed frequency models with MA components. *Journal of Applied Econometrics, 34*. doi:10.1002/jae.2701

Gagliardone, L., & Gertler, M. (2023). *Oil Prices, Monetary Policy and Inflation Surges.* National Bureau of Economic Research.

Garcia, P., Jacquinot, P., Lenarcic, C., Lozej, M., & Mavromatis, K. (2021, October). Global models for a global pandemic: the impact of COVID-19 on small euro area economies. *ECB WP*, No 2603. Retrieved 2021, from European Central Bank: https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2603~95e887c0db.en.pdf

Gerlach, S., Peng, W., & Shu, C. (2005). *Macroeconomic conditions and banking performance in Hong Kong SAR: a panel data study.* Working Paper, BIS.

Gëdeshi, I., & King, R. (2018). *New trends in potential migration from Albania.* Tirana: Friedrich-Ebert-Stiftung.

Ghosh, S., & Weinstein, A. (2021). The Impact of Emigration on Source Countries. In K. Kourtit, B. Newbold, P. Nijkamp, & M. Partridge, *The Economic*

Geography of Cross-Border Migration (pp. 421–448). Springer, Cham. doi:https://doi.org/10.1007/978-3-030-48291-6_19

Giannoni, M. (2016). The Federal Reserve in the 21st century. Models for Forecasting and Policy Analysis. *Federal Reserve Bank of New York*. Retrieved from https://www.newyorkfed.org/medialibrary/media/outreach-andeducation/Giannoni-ModelsforForecasting-Fed21-2016.pdf

Giovanni, J. d., Kalemli-Özcan, Ş., Silva, A., & Yildirim, M. A. (2022). Global Supply Chain Pressures, International Trade, and Inflation. *Challenges for monetary policy in a rapidly changing world.* ECB Forum on Central Banking.

Goldstein, I., Koijen, R., & Mueller, H. M. (2021). COVID-19 and Its Impact on Financial Markets and the Real Economy. *The Review of Financial Studies*.

Gomme, P. (2021). Labor Market and Fiscal Policy During and After the Coronavirus. *Working Papers 21003, Concordia University, Department of Economics*.

Grömling, M. (2021). COVID-19 and the Growth Potential. *Intereconomics: Review of European Economic Policy*, Springer;ZBW - Leibniz Information Centre for Economics;Centre for European Policy Studies (CEPS), vol. 56(1), pages 45-49.

Gupta, S., Kangur, A., & C. Papageorgiou, A. W. (2011). *Efficiency-adjusted public capital and growth.* Washington: International Monetary Fund.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251-1271. doi:https://doi.org/10.2307/1913827

Hazell, J., Herreno, J., Nakamura, E., & Steinsson, J. (2022). The slope of the Phillips Curve: evidence from US states. *The Quarterly Journal of Economics, 137*(3), 1299–1344.

Hobijn, B., Miles, R., Royal, J., & Zhang, J. (2023). The recent steepening of Phillips curves. *Chicago Fed Letter, 475*.

Hong, H., Wang, N., & Yang, J. (2021). Implications of stochastic transmission rates for managing pandemic risks. *Review of Financial Studies*.

Hudecz, A. (2013). Parallel Stories: Fx Lending To Households In Poland, Romania And Hungary, 1997—2011. *Acta Oeconomica, 63*(3), 257-286. Retrieved from https://www.jstor.org/stable/23526175

Inoue, A., Rossi, B., & Wang, Y. (2022). *Has the Phillips Curve Flattened and Why?* Federal Reserve Bank of Cleveland.

INSTAT. (2022). *Instituti i Statistikave*. Retrieved from http://databaza.instat.gov.al/pxweb/sq/DST/?rxid=b5069c81-9c75-4560-905a-2cb719af3ada

INSTAT. (2023). *Instituti i Statistikave*. Retrieved from https://www.instat.gov.al

INSTAT. (2024). Retrieved from INSTAT: https://databaza.instat.gov.al:8083/pxweb/sq/DST

INSTAT. (2024). *Instituti i Statistikave*. Retrieved from https://www.instat.gov.al

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica, 59*, 1551–1580.

Jones, C. J., Philippon, T., & Venkateswaran, V. (2021). Optimal mitigation policies in a pandemic: Social distancing and working from home. *Review of Financial Studies*.

Jorda, O., & Nechio, F. (2020). Inflation Globally. *Changing Inflation Dynamics,Evolving Monetary Policy, 27*, 269-316.

Jordà, Ò., Singh, S. R., & Taylor, A. M. (2020). Longer-run economic consequences of pandemics. *National Bureau Of Economic Research, Working Paper No. 26934*.

Kalaj, E. (2015, April). Hidden Consequences of Migration and Remittances in Albania. *European Journal of Social Sciences Education and Research, 2*(1).

Kanas, A., & Molyneux, P. (2018). Macro stress testing the U.S. banking system. *Journal of International Financial Markets, Institutions and Money*, 204-227. doi:https://doi.org/10.1016/j.intfin.2017.12.006

Karadima, M., & Louri, H. (2020). Non-performing loans in the euro area: Does bank market power matter? *International Review of Financial Analysis, 72*. doi:doi.org/10.1016/j.irfa.2020.101593

Kassab, S. (2024). The Impact of Remittance Inflows on Inflation: The Case of Lebanon. *Review of Middle East Economics and Finance, 20*(1). doi:https://doi.org/10.1515/rmeef-2024-0006

Kazinczy, E. (2013). The catching-up of the banking sector in south-eastern Europe: a fragiledevelopment model dominated by credit growth. *Society and Economy, 35*(4), 493-511. Retrieved from https://www.jstor.org/stable/43774187

Kermack, W. O., & McKendrick, A. G. (1927). A contribution to the mathematical theory of . *Proceedings of the Royal Society of London. Series A, Containing Papers of a Mathematical and Physical Character*, 115:700–721.

Khurshid, A., Kedong, Y., Călin, A. C., Meng, Z., & Nazir, N. (2018). Remittances Inflows, Gain of Foreign Exchange or Trade Loss? New Evidence from Low,

Lower-Middle and Middle-Income Groups. *Journal for Economic Forecasting, 0*(1), 20-41.

Kipriyanov, A. (2022). Comparison of Models for Growth-at-Risk Forecasting. *Russian Journal of Money and Finance*, Bank of Russia, vol. 81(1), pages 23-45.

Klein, N. (2013). Non-Performing loans in CESEE: Determinants and impact on macroeconomic performance. *IMF Working Paper, WP/13/72*. Retrieved from https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Non-Performing-Loans-in-CESEE-Determinants-and-Impact-on-Macroeconomic-Performance-40413

Kochovska, T. (2020). Interplay between Reservation wage and Unemployment Duration: Evidence from Jordan, Serbia. Montenegro, Ukraine and Moldova in 2015. *Business and Economic Research, 10*(1).

Koenker, R. (2005). Quantile Regression. *Econometric Society Monographs*.

Kucharcukova, O. B., Bruha, J., Kral, P., & Motl, M. (2022). Assessment of the Nature of the Pandemic Shock: Implications for Monetary Policy. *Research and Policy Notes 2022/01*.

Kuzucu, N., & Kuzucu, S. (2019). What Drives Non-Performing Loans? Evidence from Emerging and Advanced Economies during Pre- and Post-Global Financial Crisis. *Emerging Markets Finance and Trade, 55*(8), 1694-1708. doi:10.1080/1540496X.2018.1547877

Le, C. D., & Le, A. H. (2023). Macroeconomic determinants of non-performing loans: a quantile regression approach evidence from Vietnam's banking system. *Journal of Eastern European and Central Asian Research, 70*(5). doi: https://doi.org/10.15549/jeecar.v10i5.1255

Louzis, D. P., Vouldis, A. T., & Metaxas, V. L. (2012). Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of Banking and Finance, 36*.

Lütkepohl, H. (2005). *New Introduction to Multiple Time Series Analysis.* Berlin: Springer.

Lütkepohl, H. (2006). Forecasting with VARMA Models. *Handbook of Economic Forecasting, 1*, chapter 6, pages 287-325.

Macháček, M., Melecký, A., & Šulganová, M. (2017). Macroeconomic Drivers of Non-Performing Loans: A Meta-Regression Analysis. *Prague Economic Papers, 27*(3), 1-24.

Magkonis, G., Chortareas, G., & Zekented, K. (2019). Credit risk and the business cycle: What do we know? *International Review of Financial Analysis, 67*(4).

Manz, F. (2019). Determinants of non-performing loans: What do we know? A systematic review and avenues for future research. *Management Review Quarterly, 69*, 351–389.

Marcucci, J., & Quagliariello, M. (2008). Credit Risk and Business Cycle Over Different Regimes. *Temi di Discussione (Working Paper) 670*. Retrieved from https://ssrn.com/abstract=1160155 or http://dx.doi.org/10.2139/s

Maurya, P. K., Bansal, R., & Mishra, A. K. (2023). Russia–Ukraine conflict and its impact on global inflation: an event study-based approach. *Journal of Economic Studies*.

McAdam, P., & Mestre, R. (2002). *Evaluating Macro-Modelling Systems: An Application to the Area Wide Model.* ECB.

McAdam, P., & Mestre, R. (2007). *Evaluating Macro-Modelling Systems: An Application to the Area Wide Model.* ECB, Research Department.

McGregor, T., & Toscani, F. G. (2022). *A Bottom-Up Reduced Form Phillips Curve for the Euro Area.* International Monetary Fund.

McKibbin, W. J., & Stoeckel, A. (2018). Modelling a Complex World: Improving Macromodels. *Oxford Review of Economic Policy, vol. 34 nos. 1-2*.

Mckibbin, W., & Fernando, R. (2020, April). The global macroeconomic impacts of COVID-19: Seven scenarios. *Covid Economics, 10*, 116-156.

Mehedintu, A., Soava, G., & Sterpu, M. (2020). Remittances, Migration and Gross Domestic Product from Romania's Perspective. *Sustainability, 12*(1). doi:https://doi.org/10.3390/su12010212

Mestre, R., & McAdam, P. (2008). Is Forecasting with Large Models Informative? Assessing the Role of Judgement in Macroeconomic Forecasts. *ECB, ECB Working Paper No. 950*. doi:http://dx.do

Meyer, D., & Shera, A. (2017). The impact of remittances on economic growth: An econometric model. *EconomiA, 18*(2), 147-155.

Mihailov, A. (2020). Quantifying the Macroeconomic Effects of the COVID-19 Lockdown: Comparative Simulations of the Estimated Galí-Smets-Wouters Model. *Economics Discussion Papers em-dp2020-07, Department of Economics, University of Reading*.

Mishra, P., & Mishra, S. K. (2021). Do Banking and Financial Services Sectors Show Herding Behaviour in Indian Stock Market Amid COVID-19 Pandemic? Insights from Quantile Regression Approach. *Millennial Asia*. doi:10.1177/09763996211032356

MoF. (2020). *Ministry of Finance and Economy*. Retrieved from Covid support packages: https://financa.gov.al/masae-e-marra/

MoF. (2021). *Ministry of Finance and Economy*. Retrieved from Buxheti 2020: https://www.financa.gov.al/buxheti-2020/

MoF. (2022). *Ministry of Finance and Economy*. Retrieved from https://financa.gov.al/raporte-dhe-statistika-fiskale/

Narayan, P. K., Narayan, S., & Mishra, S. (2011). Do Remittances Induce Inflation? Fresh Evidence from Developing Countries. *Southern Economic Journal, 77*(4), 914-933.

Narayan, P. K., Narayan, S., & Mishra, S. (2011). Do Remittances Induce Inflation? Fresh Evidence from Developing Countries. *Southern Economic Journal, 44*(7), 914-933.

Negro, M. D., Lenza, M., Primiceri, G. E., & Tambalotti, A. (2020). What's Up with the Phillips Curve? *Brookings Papers on Economic Activity, SPRING 2020*, 301-357.

OECD. (2014). *Organisation for Economic Co-operation and Development* . Retrieved from The OECD Economic Outlook: Sources and Methods: https://stats.oecd.org/glossary/detail.asp?ID=44#:~:text=An%20add%2Dfactor%20is%20the,the%20forecast%20period%20as%20well

OECD. (2023). Employment Outlook 2023. *Artificial Intelligence and the Labour Market*.

Pariès, D., & M. and Papadopoulou, N. (2020). Balance Sheet Policies in a Large Currency Union: A Primer on ECB Non-Standard Measures since 2014. *Revue d'économie politique*, Vol. 130, No 2, pp. 171-230.

Pellegrino, G., Ravenna, F., & Züllig, G. (2021, August). The Impact of Pessimistic Expectations on the Effects of COVID-19-Induced Uncertainty in the Euro Area. *Oxf Bull Econ Stat, 83*(4), pp. 841-869.

Petreski, M., Oviedo, A. M., & Cancho, C. A. (2019). Expectations Set High: Understanding Reservation Wages in North Macedonia. *Comparative Political Economy: Regulation eJournal*.

Phillips, A. W. (1958). The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957. *Economica, 25*(100), 283–299.

Primiceri, G. E., & Tambalotti, A. (2020, June). Macroeconomic Forecasting in the Time of COVID-19. *Manuscript*.

Quagliariello, M. (2007). Banks' riskiness over the business cycle: a panel analysis on Italian intermediaries. *Applied Financial Economics, 17*(2), 119–138.

Raudys, A., Lenčiauskas, V., & Malčius, E. (2013). Moving Averages for Financial Data Smoothing. (T. Skersys, R. Butleris, & R. Butkiene, Eds.) *Information and Software Technologies, 403*, 34-45. doi:https://doi.org/10.1007/978-3-642-41947-8_4

Rivera, J. P., & Tullao, T. (2020). Investigating the link between remittances and inflation: evidence from the Philippines. *South East Asia Research, 28*, 1-26. doi:10.1080/0967828X.2020.1793685

Robert F. Engle, S. M. (2004). CAViaR: Conditional Autoregressive Value at Risk by Regression Quantiles. *Journal of Business & Economic Statistics, 22*(4), 367-381.

Roberts, J. M. (2019). Panel discussion: Modelling strategies and policy analysis. *Forecasting and policy analysis with semi-structural models.* Joint Bank of

Canada – Banque de France – ECB workshop. Retrieved from https://www.banque-france.fr/sites/default/files/roberts_-_bdf_september2019.pdf

Roger, K., & Bassett, G. J. (1978). Regression Quantiles. *Econometrica*, 46(1).

Said, S. E., & Dickey, D. A. (1984). Testing for Unit Roots in Autoregressive Moving Average Models of Unknown Order. *Biometrika, 71*(3), 599–607. doi:https://doi.org/10.2307/2336570

Salas, M., Lamothe, P., & Delgado, E. (2024). Determinants of nonperforming loans: A global data analysis. *Computational Economics*. doi:https://doi.org/10.1007/s10614-023-10543-8

Sergi, B. S., & Morabito, G. (2016). Migration and remittances: the rise and fall of Albania and Kosovo. *Journal for Labour and Social Affairs in Eastern Europe, 19*(1), 55-66.

Skufi, L., & Geršl, A. (2023). Using Macrofinancial Models to Simulate Macroeconomic Developments During the COVID-19 Pandemic: The Case of Albania. *Eastern European Economics, 61*(5), 517-553. doi:10.1080/00128775.2023.2215229

Skufi, L., & Kika, E. (2019). The Price Formation Process in the Albanian Economy: A Macro Modelling Approach. *Bank of Albania WP, 44*(83).

Skufi, L., Kika, E., & Ceka, E. (2024). Macro econometric Albanian model (Meam): An update of the main equations and model elasticitie. *Bank of Albania Working Paper, 7*(94).

Streimikiene, D., Svagzdiene, B., Jasinskas, E., & Simanavicius, A. (2021). Sustainable tourism development and competitiveness: The systematic

literature review. *Sustainable Development*, John Wiley & Sons, Ltd., vol. 29(1), pages 259-271, January.

Shehaj, E. (2012). The Determinants of Migration and Remittances in Albania. *International Journal of Scientific & Engineering Research, 3*(4).

Theil, H. (1957). Specification Errors and the Estimation of Economic Relationships. *Review of the International Statistical Institute, 25*, 41-51. doi:https://doi.org/10.2307/1401673

United Nations. (2023). *World Population Prospects 2022.* Population Division , Department of Economic and Social Affairs.

Vacas-Soriano, C., & Kostolny, J. (2022). *Minimum Wages in 2022: Bigger Hikes this Time Around.* European Foundation for the Improvement of Living and Working.

Vazquez, F., Tabak, B. M., & Souto, M. R. (2012). A Macro Stress Test Model of Credit Risk for the Brazilian Banking Sector. *Journal of Financial Stability, 8*(2).

Velde, F. R. (2020). What Happened to the US Economy During the 1918 Influenza Pandemic? A View Through High-Frequency Data. *Federal Reserve of Chicago, WP 2020-11*.

Verner, E., & Gyöngyösi, G. (2020). Household Debt Revaluation and the Real Economy. *The American Economic Review, 110*(9), 2667-2702. Retrieved from https://www.jstor.org/stable/10.2307/26966313

World Bank . (2023). *Remittances.* World Development Indicators.

World Bank. (2017). *Review of the market for remittances in Albania.* World Bank.

3.A Appendix

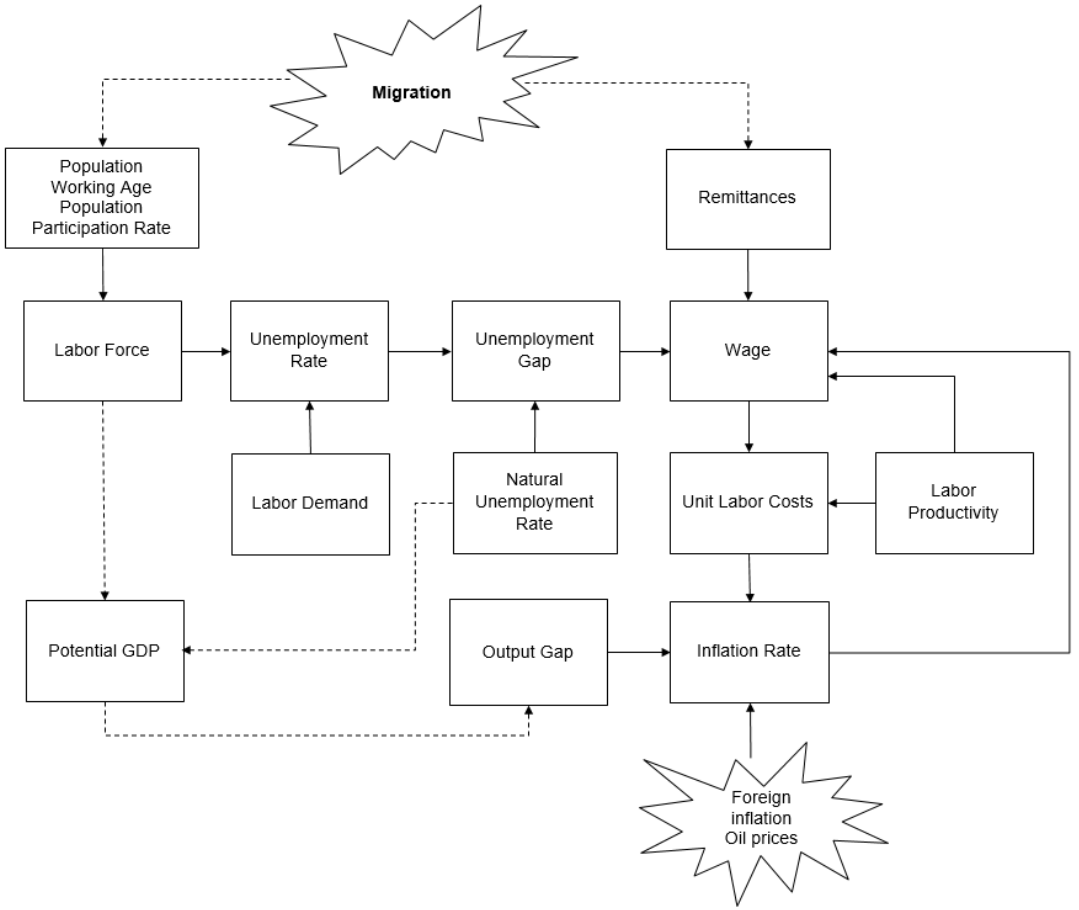

Figure 3.A1 Model transmission mechanism

Source: Authors' calculations.
Note: The diagram illustrates the full transmission channels of migration in wage and inflation. The dotted line indicates an indirect effect.

LAG:	AIC	SC	HQ
Equation 3.1			
0	-5.0	-4.9	-4.9
1	-16.7	-16.1 *	-16.4 *
2	-16.8	-15.8	-16.4
3	-16.7	-15.2	-16.1
4	-16.8 *	-14.8	-16.0
Equation 3.2			
0	-1.1	-0.9	-1.0
1	-12.6	-11.8 *	-12.3 *
2	-12.8	-11.2	-12.2
3	-13.0 *	-10.7	-12.0
4	-13.0	-9.9	-11.8
Equation 3.1			
0	-8.5	-8.2	-8.4
1	-16.8 *	-16.3 *	-16.6 *
2	-16.7	-15.9	-16.4
3	-16.7	-15.7	-16.3
4	-16.7	-15.4	-16.2
Observations	84		

Table 3.A1 Lag Order Selection Criteria

Source: Authors' calculations.
Note: * indicates the lag order selected by the criterion. AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

Indicator	Coefficient	Std. Error	t-Statistic	P-Value
Autoregressive term	0.91	0.05	19.25	0
Constant term	7.15	3.64	1.96	0.05
Remittances	-0.13	0.07	-1.67	0.09
R-squared	0.89			

Table 3.A2 The impact of remittances on labor market participation rate

Source: Authors' calculations.
Note: The impact of remittances on labor market participation rate is estimated through OLS technique over 2002-2022.

Chapter 4

Does FX hedge mitigate the impact of exchange rate changes on credit risk? Evidence from a small open economy

Abstract

This study investigates the impact of exchange rate fluctuations on non-performing loans (NPLs), using a unique bank-by-bank dataset on lending to FX hedged and FX unhedged borrowers. Employing fixed effects and panel quantile regression, we analyze how changes in exchange rate affect the NPL ratio of hedged versus unhedged borrowers, differentiating between non-financial corporations and households, and controlling for additional macroeconomic factors and bank-specific characteristics in Albania for the period from 2009 to 2023. Our empirical findings confirm that the sensitivity of unhedged non-financial corporations to exchange rate changes is higher than in the case of hedged borrowers. However, we find the opposite effect for households, where risk seems to be for some reason higher for hedged borrowers.

JEL Classification	C23, C31, E5, G3
Keywords	Nonperforming loans, hedging, exchange rate, panel quantile regression, households, and non-financial corporations

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This chapter was co-authored with Adam Geršl. The paper is published as IES WP. The work will be presented at the '*World Finance Conference, 2025*'.

4.1 Introduction

The international financial landscape has witnessed significant changes in the past few decades, with credit risk management playing a crucial role in financial stability. Understanding the determinants of non-performing loans (NPLs) among agents and currencies is crucial for policymakers, financial institutions, and borrowers alike. In this context, our study focuses on the Albanian market, where the dynamics of NPLs has evolved among economic fluctuations and structural reforms. The allocation of loans denominated in FC (foreign currency) constitutes a noteworthy segment within the banking sector. As mentioned by Kazinczy (2013) FC risk is particularly relevant in Albania given the floating exchange rate regime and the unhedged position of borrowers.

The fundamental question is whether the FC NPL ratio of unhedged borrowers is associated with a higher risk of exchange rate depreciation compared to hedged borrowers. We start with a simple fixed effect model to test the heterogeneity across banks, and then we expand to a panel quantile regression approach to estimate NPL ratio across various quantiles of the distribution. As stated by Kanas & Molyneux (2018), there are no solid theoretical and empirical reasons for assuming a linear relationship between risk and macroeconomic variables. Previously, Engle & Manganelli (2004) suggested that quantile regression methods are naturally applied to risk estimation. Several studies that relate to NPLs also have used quantile regression analysis (Aydemir, Atik & Guloglu 2023, Karadima & Louri 2020, Le & Le 2023). Our dataset spans the period from 2009 to 2023, and includes both non-financial corporations and households. Importantly, we distinguish between hedged and

unhedged foreign currency loans, categorizing them by both bank and borrower segments.[22]

Our empirical results reveal two key insights: heterogeneity across borrower types and NPLs sensitivity to exchange rate. Non-financial corporations (NFCs) and households display heterogenous behavior across the percentiles, with borrower heterogeneity being more pronounced in the right tail of the distribution. The NPL ratio is sensitive to exchange rate movements, regardless of whether borrowers have implemented hedging strategies or not. Unhedged NFCs face a higher risk to exchange rate depreciation compared to hedged ones. In contrast, for households, the opposite holds true, particularly in the right-hand end of the distribution. However, it is important to note that hedging is not a random decision. Our research reaffirms the determinants of NPLs identified from the existing literature.

A key contribution of our study to the existing literature is the unique and detailed dataset we employ, which allows us to differentiate between hedged and unhedged FC loans. To our knowledge, no prior study has utilized such a rich dataset, particularly one that distinguishes FC loans by both bank and borrower segment (households vs. NFCs). This distinction provides a valuable advantage in analyzing the dynamics of FC NPLs and their association with exchange rate depreciation. Therefore, our study is able to offer insights that are not only rare but also highly granular in nature, significantly advancing the understanding of FC loan exposure between different types of borrower and banking institutions. Furthermore, our study

[22] In this study, based on a Bank of Albania regulation, a borrower is classified as "hedged" if at least 80% of their income is denominated in the same currency as the loan. This classification is determined by the lending bank, based on income documentation at the time of loan approval.

contributes to the literature on credit risk by examining the conditional distribution of NPLs in the Albanian context. We differ from the literature in several fundamental respects. The previous literature appeals to the reference but does not empirically specify the precise difference between hedged and unhedged borrowers, while we exploit this distinguishing feature to better capture the effect of exchange rate credit risk. Second, we find that tail risk associated with exchange rate is concentrated in periods of high NPL ratio. It is also useful to contrast our analysis with reference, who find that credit risk increases the sensitivity to exchange rate for unhedged borrowers, suggesting that the unhedged borrower contributes to a higher default risk on loan repayment. However, while depreciation can negatively impact borrowers to repay the loan, it is not clear what being hedged/unhedged implies about a borrower's vulnerability to tail risk. Thus, we extend the literature by showing that the exchange rate increases the vulnerability of the hedged/unhedged borrower to depreciation in the right tail of the distribution.

The remainder of the study is organized as follows. Section 4.2 presents a literature review, Section 4.3 and 4.4 describes the data and methodology used, Section 4.5 discusses the results, and Section 4.6 concludes.

4.2 Literature review

The existing corpus of literature on the underlying factors of credit risk delves into the main macroeconomic variables, along with specific banking and loan characteristics (Manz 2019). Notable syntheses of these determinants are presented in the works of Salas et al. (2024); Ari et al. (2021); Boumparis et al. (2019); as well as Beck et al. (2015).

They suggest that bank-specific factors include factors like size and profitability. For example, Salas et al. (2024) and Ari et al. (2023) document that higher lending rates may boost margins but also raise default risk. Yet, empirical studies such as Abdymomunov et al. (2025) show that a large portion of variation in loan interest rates remains unexplained by observable risk factors, suggesting limits to how strongly rates map to bank outcomes. On capital adequacy, Boumparis et al. (2019) emphasize its buffering role, but Santioso et al. (2022) report that CAR has no statistically significant effect on ROA. On return on assets, while Beck et al. (2015) highlight its importance for long-term resilience, studies in emerging markets observe that CAR and RoA may not always resonate.

The macroeconomic factors cover GDP growth or output gap, unemployment rates, interest rates, exchange rates, and levels of public and private debt.

The impact and magnitude of each determinant differ among authors. This heterogeneity in the estimated results across studies is attributed to the specification forms, the data types, and the periods sampled (Magkonis et al. 2019 and Macháček et al. 2017). For example, despite the predominant empirical consensus indicating a negative correlation between macroeconomic conditions and credit quality, divergences in this relationship are evident, contingent upon specific variables such as credit type and sectors (Vazquez, Tabak & Souto 2012), economic agents (Louzis, Vouldis & Metaxas 2012), bank-specific factors (Aydemir, Atik & Guloglu 2023, and Gerlach, Peng & Shu 2005), and the existence of asymmetry (Quagliariello 2007 and Kanas & Molyneux 2018). Kanas & Molyneux (2018) suggest that there are no solid theoretical and empirical reasons for assuming a linear relationship between risk and macroeconomic variables.

The discussion is more intense on the implications of exchange rate fluctuations on credit risk. A depreciation in the FC (foreign currency) impacts credit risk through different channels, creating either advantageous or detrimental outcomes.

Through the trade channel, a depreciated exchange rate boosts competitive terms. Numerous enterprises with FC debt are positively selected and often naturally hedged to exchange rate oscillations (Bleakley & Cowan, 2008). For instance, Bodnár (2009) found that Hungary's enterprises could improve the profitability of the corporate sector and its debt servicing capacity during periods of currency depreciation. Bethlendi (2011) explains that the exposure of non-financial corporations to FC is considerably less pronounced due to the economic openness of CEE countries and the different hedge opportunities compared to households. Furthermore, Verner & Gyöngyösi (2020) demonstrated that household FC exposure has larger local aggregate effects relative to firms.

Within the context of the balance-sheet channel, a weak currency increases the financial burden of FCL of unhedged borrowers. The ECB (2011) found positive evidence that countries with significant levels of FCL to unhedged borrowers experience increased financial stress. Klein (2013) highlighted that the exchange rate depreciation has contributed to higher NPLs for CESEE countries. Similarly, Kuzucu & Kuzucu (2019) observed that exchange rate depreciation decreases income for households and companies, thus inflating the volume of bad debt in emerging economies. Festić & Bekő (2008) found a direct correlation between exchange rate fluctuations and NPL ratio in Hungary, Poland, and Slovakia, noting these countries' substantial exposure to FCL. Beck et al. (2013) reported a positive relationship between the exchange rate and NPLs in countries with low international claims,

whereas a converse relationship was noted in countries with high international claims. Fink et al. (2016) suggested that an economy's higher share of FCL in total loans is linked with an increased share of NPLs, supporting the hypothesis that the exchange rate affect NPLs through balance-sheet channel of unhedged FC borrowers rather than through the export channel of hedged ones.

Numerous studies have recognized the impact of the exchange rate on the risk of FCL credit, yet there is a lack of detailed analysis regarding the borrowers' hedging position. Explicit estimations on hedge and unhedged borrowers have received little attention. For example, the ECB (2011) suggested that the behavior of unhedged borrowers is reflected in the high ratio of international claims. Essentially, they utilize a dummy variable that interacts with the exchange rate, assigning a value of one to countries whose international claims to GDP exceed the median, and zero otherwise. Fink et al. (2016) also explored the share of FCL held by non-financial corporations and households, providing supportive evidence for the balance-sheet effect.

Although the prevailing literature often categorizes households with FCLs as unhedged, this may not uniformly hold true, as households might partially hedge their FCL exposure through remittances (Hudecz 2013), or any FC income (Brown et al. 2012). Particularly in the context of mortgage loans as indicated by Alvarez et al. (2015).

We contribute to fill the gap on FC credit risk by examining the hedging position of households and non-financial corporation across NPLs distribution. We offer insights that are highly granular in nature, significantly advancing the understanding of FC loan exposure across different types of borrower and banking institutions.

4.3 Data

The dataset used in this study is collected from three main sources: the Bank of Albania (BoA 2024), the Albanian Association of Banks (AAB 2024), and the Albanian National Institute of Statistics (INSTAT 2024). It includes data with a monthly frequency spanning from 2009 to 2023. For indicators initially reported quarterly, a linear interpolation method is applied to convert these figures to a monthly frequency. This research focuses on second level banks within the Albanian banking sector, which comprises a total of eleven banks.

With the private sector credit risk being unobservable (the non-repayment of loan probability), we approximate it with the NPL ratio as suggested by many (Magkonis, Chortareas & Zekented 2019). The NPL ratio is the ratio of non-performing loans over 90 days overdue to granted loans. Figure 4.1 illustrates the NPLs trajectories for the private sector between agents and currencies.[23] As indicated in the graphs, there is a nice co-movement of NPLs among agents and currencies. NFCs have higher NPLs compared to households. However, borrowing in FC induces

[23] Since 2009 NPLs ratio feature a positive trend in Albanian banking system. The ratio of NPLs began to rise with the Global Financial Crisis and followed Greece's financial markets collapse. In 2012, four Greek-owned banks were operating in Albania, out of a total of sixteen (BoA 2013). By the end of 2015 Bank of Albania prepared the "Action plan for reducing non-performing loans", which aimed at reducing non-performing loans in the banking system (BoA 2015). As a result, the non-performing loan ratio felt quickly by few percentage points (see Figure 4,1). Still, the credit risk remained high till 2016. In 2016, the Bank of Albania amended the law on the recovery and resolution of banks in the Republic of Albania for banks and branches of foreign banks licensed by the Bank of Albania (BoA 2016). At the end of 2016, foreign capital accounted for around 89 percent of the capital structure. The remaining of 11 percent of domestic capital was allocated in four banks out of a total of sixteen. After 2016, the NPLs ratio started to decline permanently.

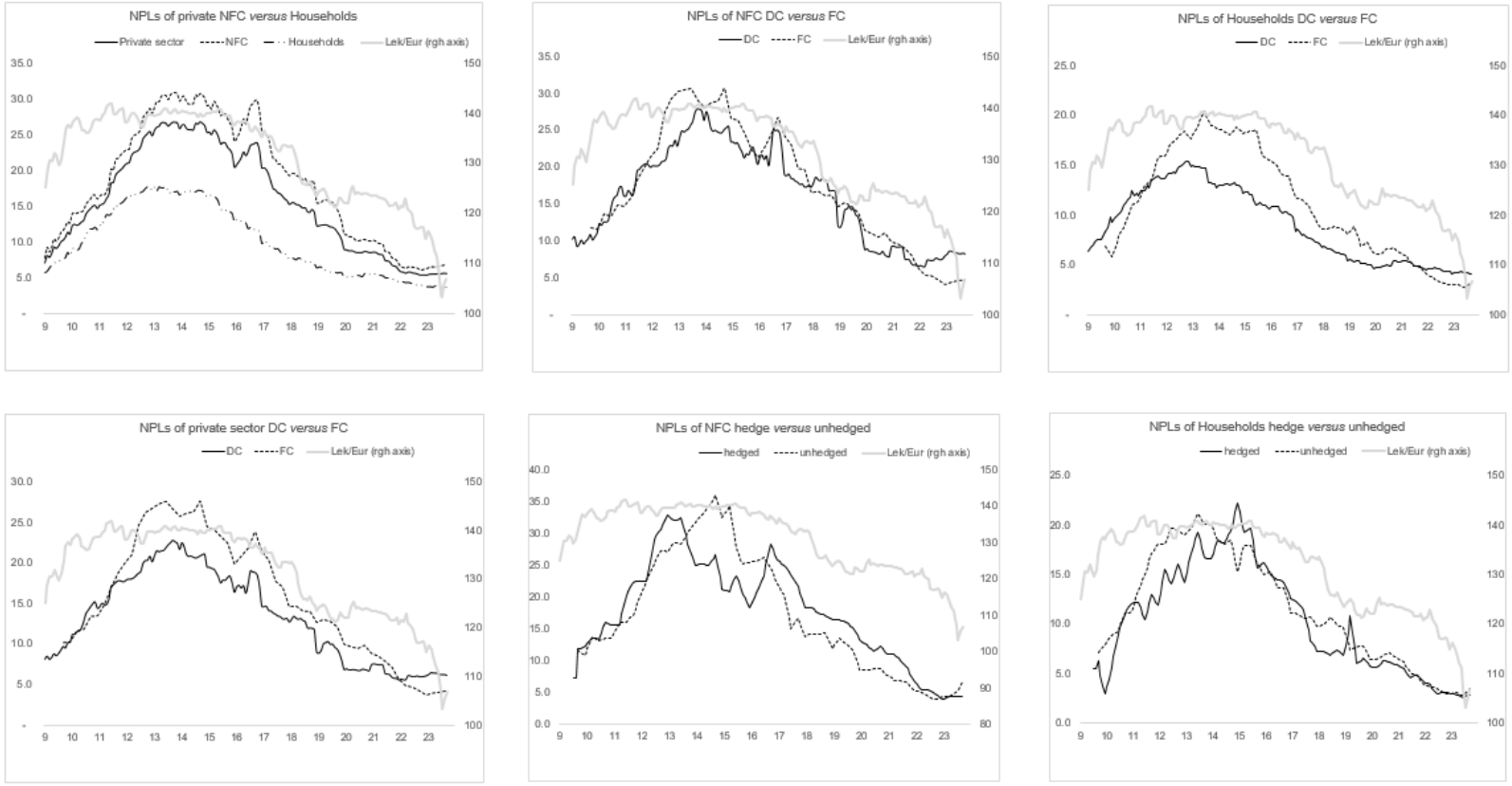

Figure 4.1 The NPLs developments and exchange rate

Source: AAB (2024), BoA (2024) and authors' calculations.
Note: The figure illustrates the evolution of NPLs among agents and currencies.

slightly higher credit risk overall. The distribution of NPLs is not uniform across banks. In Appendix 4.A, we examine the heterogeneity in NPLs across banks by constructing fan-charts (see Figure 4.A1 in Appendix 4.A for the distribution of NPLs among agents and currencies).

Macroeconomic indicators are selected from the existing literature Salas et al. (2024). Among many macroeconomic factors that impact the NPLs of the private sector, we employ economic activity, the exchange rate, and the remittances. Generally, it is recognized that credit risk increases in times of economic downturns and in whenever financial burden related to the loan increases versus borrower's income (Verner & Gyöngyösi 2020, Kuzucu & Kuzucu 2019, Marcucci & Quagliariello 2008). In our sample, the COVID-19 pandemic period makes an exception. The measurements taken to protect the financial sector during the lockdown and afterwards broke the link between the financial sector and the real economy (Skufi & Geršl, 2023). Following Demirguc-Kunt & Huizinga (2000) economic activity is approximated by the year-on-year growth in percentage of the GDP.

The exchange rate serves as a significant determinant in the temporal mitigation of credit risk. The sustained appreciation of the Albanian Lek post-2016 is considered to have contributed to the decrease in NPLs for NFCs and households. According to Fink et al. (2016) the correlation between exchange rate fluctuations and NPLs is suggested to be stronger in the case of FC borrowing. Thus, it exerts a greater influence on hedged borrowers compared to unhedged borrowers.

Remittances might reduce the credit risk of households as they provide a partial hedge for the beneficiaries as well as increase the revenues (Hudecz, 2013; Brown, Haas, Tille, & Halpern, 2012). In fact, most emigrants would bring money home not

only to help the consumption expenditures of their families, but also to buy properties (Alvarez, Briod & Ferrari 2015).

Bank and loan-specific factors include loan interest rate, capital adequacy ratio, and return on assets.

The interest rate is expected to have a negative relationship with NPLs. The lower the interest rate, the lower the financial burden and therefore a lower credit risk. Salas et al. (2024) and Ari et al. (2023) support that higher lending rates can improve margins but also raise credit risk by undermining borrowers' repayment capacity. However, other studies suggest that the effect of lending rates on risk is weaker or insignificant, as banks may offset pressures through portfolio rebalancing or improved screening.

Capital adequacy ratios are included among explanatory variables, motivated by the fact that safer banks (i.e. those with higher capital ratios) should display lower NPLs (Boumparis et al., 2019). However, the relationship between CAR and NPLs needs not be uniformly decreasing. Some studies, like Calem & Rob (1999) have mentioned the possibility of a U-shaped relationship, such that when CAR is high enough banks might have an incentive to take more risk. The capital adequacy ratio is calculated as the ratio of TIER 1 capital to risk-weighted assets in percentage. Motivated by the hypothesis that banks with greater capital adequacy are safer, we expect an inverse relation with the NPL ratio.

The return on assets represents bank profitability, which measures the bank's ability to generate profits. The importance of return on assets for long-term resilience is stresses by Beck et al. (2015), yet other contributions note that ROA may be an incomplete measure of profitability under stress conditions, with its impact on stability

proving insignificant once macroeconomic or institutional factors are controlled for. We expect a negative relationship between NPLs and profitability. The greater the profits, the lower the losses of the bank analyzed.

Table 4.1 provides summary statistics for NPLs and its selected determinants.

Panel A: Dependent variables	N	Mean	Std.Dev.	1%	5%	10%	25%	50%	75%	90%	95%	99%
NPL ratios												
Private sector	1 815	16	11	2.8	4.2	4.8	7.5	12.4	20.8	31.9	43.8	51.8
Private sector DC	1 815	14	12	2.5	4.1	5.1	7.2	11.0	17.0	27.6	38.3	63.1
Private sector FC	1 815	17	13	1.6	3.5	4.4	7.4	13.3	23.8	35.0	38.8	61.7
Private sector FC hedged	1 815	16	12	1.1	2.6	3.6	6.3	12.7	21.3	33.7	41.2	54.2
Private sector FC unhedged	1 815	16	13	1.4	2.2	3.1	5.9	11.7	21.7	31.2	43.8	64.0
Non-financial corporation	1 815	18	13	2.8	4.0	5.0	8.3	14.6	24.5	39.5	49.6	57.8
Non-financial corporation DC	1 814	17	14	1.2	3.1	4.9	7.9	12.9	21.8	36.7	46.6	70.0
Non-financial corporation FC	1 815	19	14	1.2	3.3	4.3	8.0	14.5	25.8	39.6	46.0	66.0
Non-financial corporation FC hedged	1 716	17	14	1.0	2.3	3.5	6.2	13.7	23.4	38.0	45.1	62.0
Non-financial corporation FC unhedged	1 806	19	16	0.0	1.5	2.4	5.6	13.9	27.7	41.4	50.7	68.4
Households	1 815	11	8	2.0	3.0	3.8	5.2	8.3	14.0	21.8	28.4	37.5
Households DC	1 815	11	8	2.2	3.0	3.6	5.3	8.4	13.6	18.9	33.5	44.4
Households FC	1 815	11	8	0.3	1.9	2.9	4.6	7.6	14.1	23.1	27.4	33.4
Households FC hedged	1 716	12	14	0.4	1.3	1.9	4.4	7.8	14.5	26.6	32.6	56.8
Households FC unhedged	1 815	11	9	0.2	1.0	2.1	4.1	7.8	15.3	24.2	27.5	35.7

Panel B: Independed variables	N	Mean	Median	Std.Dev.	Min.	Max.
Bank indicators						
Capital adequacy ratios	1 492	16.7	15.5	6.8	8.1	50.0
Return on assets	1 492	0.4	0.6	1.5	-8.1	4.6
Loans interest rate private sector	1 584	7.2	6.9	2.4	2.6	16.4
Loans interest rate private sector DC	1 584	9.0	8.6	3.2	2.6	21.7
Loans interest rate private sector FC	1 584	6.2	6.1	1.9	1.2	12.6
Loans interest rate non-financial corporati	1 584	7.3	6.9	2.8	1.9	16.5
Loans interest rate non-financial corporati	1 584	8.4	8.1	3.3	1.6	21.5
Loans interest rate non-financial corporati	1 584	6.8	6.5	2.7	1.2	17.3
Loans interest rate households	1 584	7.7	7.1	3.0	2.4	19.9
Loans interest rate households DC	1 584	10.0	9.4	3.8	3.3	23.6
Loans interest rate households FC	1 584	5.7	5.3	2.4	0.8	13.0
Macroeconomic indicators						
GDP growth	130	2.0	2.3	2.4	-11.2	4.4
Exchange rate growth	132	-0.6	-0.4	2.8	-7.2	10.1
Remittances as share of GDP	142	12.5	12.1	1.7	9.2	17.7

Table 4.1 Summary statistics

Source: AAB (2024), BoA (2024), and authors' calculations.
Note: The table provides the main descriptive statistics of the variables used in the model, namely: mean, median, standard deviation, minimum, maximum, and selected percentiles for the NPLs.

4.4 Methodology

Determinants of non-performing loans can be synthesized to bank characteristics, loan-specific factors, and macroeconomic events (Manz 2019). Bank and loan-specific factors aim at analyzing the failure of loan repayment under a micro approach, whereas macroeconomic events seek to the credit risk of agents under a macro approach. Our research focuses on both perspectives. We examine the relation between NPLs of hedged/unhedged borrowers, macroeconomic variables, and bank characteristics that count for a distinguished and heterogenous relationship. The challenge is to design a research design powerful enough to explore the heterogeneity between agent types and the connection with hedging strategies.

4.4.1 The fixed effect model

To analyze the heterogeneity among banks we use a Fixed Effect (FE) model (Anderson & Hsiao 1981) and contrast it with the Random Effect (RE) model (Theil 1957). A FE model treats explanatory variables as non-random while the RE model assumes that these variables are derived from random processes. As each bank's unique characteristics may influence the set of explanatory variables, the FE model allows for the control of variables that cannot be observed or measured, for example, management factors between banks. Our models with individual fixed effects empirical analysis is based on the following specification:

$$Y_{j,t} = \alpha Y_{j,t-1} + \beta_1 X_{1j,t} + \beta_2 X_{2,t} + \phi_j + \varepsilon_{j,t} \quad (4.1)$$

where, Y_j is the dependent variable (the NPL ratio) of bank *'j'*; X_{1j} comprises bank -specific variables (the capital adequacy ratios, the return on assets and the loan interest rate); X_2 includes macroeconomic indicators (economic activity, exchange rate and remittances); ϕ_j represents the unobserved individual bank specific effects; ε_j is the

error term; and *'t'* stands for time (a month). The RE model follows the same specification, excluding the term 'ϕ_j'. All the explanatory variables are incorporated as six-term moving averages. This ensures that the regressors capture ex-ante information rather than contemporaneous or purely realized values. By averaging over six months, we mitigate the impact of transitory shocks and allow the model to capture the underlying trends in both bank-specific and macroeconomic indicators.

4.4.2 The quantile regression

To investigate the heterogenous relationship of NPLs, we follow the approach introduced by Roger & Bassett (1978) and updated by Koenker (2005). As illustrated by Engle & Manganelli (2004) regression quantile methods are naturally applied to risk estimation. We estimate the conditional distributions of NPLs and examine whether macroeconomic variables and bank characteristics affect the likelihood of outcomes. Using quantile regression (QR), we estimate the conditional distribution of NPLs overall, domestic loans, foreign loans, and hedged and unhedged borrowers. The downside credit risk represents the lower left hand side tail of the distribution (lower percentiles), indicating that the banking system will experience the lowest risk on loans given the macroeconomic situation and bank characteristics. Moving toward the right-hand side of the distribution (higher percentiles) implies a higher risk.

We estimate the NPLs at different level of percentiles for the non-financial corporations, the households, and the private sector as a whole. Especially, we examine how the exchange rate impacts the NPLs for hedged versus unhedged borrowers over a defined period. Thus, if the NPLs of a bank hedged/unhedged borrower is 0.5% at the first percentile, there is only 1% chance that the NPLs will drop below 0.5% over any other percentile.

Formally, *Y* represents the NPLs and *F(y)* its probability distribution function *(Eq. (4.2))*. For $\tau \epsilon\ ]\ 0;\ 1[$, the first quantile of NPLs (τ =1%) is defined as the inverse cumulative distribution function of NPLs satisfying *F(y) ≥ 1% (Eq. (4.3))*. Given *n* observations of *Y*, the sample quantile 'Q_τ' is obtained by sorting the NPLs series in ascending order or by optimizing for the smallest deviation *(Eq. (4.4))*, where $\rho_\tau(u)=u(\tau-1(u<0))$, is the so-called check function that asymmetrically weights positive and negative values and ξ is the value over which the minimization is performed.

$$F(y) = probability\ (Y \leq y) \tag{4.2}$$

$$Q(\tau) = inf\ \{y: F(y) \geq \tau\} \tag{4.3}$$

$$Q_n(\tau) = argmin_\xi \{\sum_i \rho_\tau(Y_i - \xi)\} \tag{4.4}$$

The QR allows for explanatory variables *X*, in our study, namely, economic activity, exchange rate, loan interest rate, capital adequacy ratios, and return on assets. Here, the conditional quantile of NPLs is linearly related to explanatory variables. Therefore, the quantile minimization is the conditional QR estimator *(Eq. (4.5)):*

$$\hat{\beta}_n(\tau) = argmin_{\beta(\tau)} \{\sum_i \rho_\tau(Y_i - X_i'\beta(\tau))\} \tag{4.5}$$

To address the main question whether the FC NPLs of unhedged borrowers are associated with a higher risk of exchange rate depreciation compared to hedged borrowers, we initially estimate the β_n parameters using the standard QR across various quantiles. Next, we estimate again the QR *(Eq. (5))* by incorporating the additional explanatory variable remittances. In this context, *X* comprises economic activity, the

exchange rate, the loan interest rate, the capital adequacy ratios, return on assets and remittances, solely for the households.

4.5 Results and discussion

The results of both the fixed effects and the random effects models are presented in Table 4.2. The estimated parameters are similar in both models. The Hausman test (Hausman 1978) does not reject the null hypothesis of no significant difference between the models, indicating that bank-specific effects are not correlated with the explanatory variables (see Table 4.A1 in the Appendix 4.A for the Hausman test results).

The variation in fixed effects, printed in Table 4.A2 in the Appendix 4.A, suggests that each bank has unique unobserved characteristics that affect its NPL ratio, such as management quality and risk management practices. However, given that the Hausman test fails to reject the null hypothesis, these unobserved effects do not significantly correlate with the regressors, ensuring that the estimated parameters remain representative across banks. However, panel quantile regression yields different parameter estimates across different quantiles, thereby reintroducing some degree of heterogeneity.

The results of the NPLs conditional on economic activity, exchange rate, loan interest rate, capital adequacy ratio, and the return on assets are presented in Table 4.A3 for the private sector, Table 4.A4 for NFCs, and Table 4.A5 for households in Appendix 4.A, with distinctions made based on currency types and hedging positions.

	Private sector						Non-financial corporations						Households					
	FE			RE			FE			RE			FE			RE		
NPLs																		
Gross domestic product growth	-0.4	(0.1)	[-4.7]	-0.4	(0.1)	[-4.7]	-0.5	(0.1)	[-5.3]	-0.5	(0.1)	[-5.3]	1.0	(0.1)	[8.9]	1.0	(0.1)	[8.9]
Exchange rate growth	0.4	(0.1)	[3.5]	0.4	(0.1)	[3.6]	0.3	(0.1)	[1.8]	0.3	(0.1)	[1.9]	1.5	(0.2)	[9.9]	1.5	(0.2)	[10.0]
Loans interest rate	1.4	(0.1)	[10.7]	1.3	(0.1)	[10.5]	1.4	(0.2)	[9.0]	1.3	(0.2)	[8.9]	0.6	(0.1)	[5.3]	0.5	(0.1)	[5.1]
Capital adequacy ratios	0.3	(0.0)	[5.5]	0.3	(0.0)	[5.7]	0.2	(0.1)	[4.1]	0.2	(0.1)	[4.2]	0.4	(0.0)	[9.6]	0.4	(0.0)	[9.8]
Return on assets	-1.0	(0.2)	[-4.4]	-1.0	(0.2)	[-4.5]	-1.3	(0.3)	[-5.0]	-1.3	(0.3)	[-5.1]	-0.6	(0.1)	[-4.3]	-0.6	(0.1)	[-4.5]
Remittances													-1.5	(0.2)	[-6.5]	-1.5	(0.2)	[-6.5]
NPLs DC																		
Gross domestic product growth	-0.3	(0.1)	[-4.1]	-0.3	(0.1)	[-4.1]	-0.5	(0.1)	[-5.2]	-0.5	(0.1)	[-5.2]	1.0	(0.1)	[7.8]	1.0	(0.1)	[7.8]
Exchange rate growth	0.4	(0.1)	[3.6]	0.4	(0.1)	[3.6]	0.1	(0.1)	[1.0]	0.1	(0.1)	[1.0]	1.7	(0.2)	[9.7]	1.7	(0.2)	[9.8]
Loans interest rate	0.8	(0.1)	[6.8]	0.8	(0.1)	[6.7]	0.9	(0.2)	[6.0]	0.9	(0.2)	[6.0]	0.3	(0.1)	[2.8]	0.3	(0.1)	[2.7]
Capital adequacy ratios	0.4	(0.0)	[7.6]	0.4	(0.0)	[7.6]	0.3	(0.1)	[5.7]	0.3	(0.1)	[5.8]	0.6	(0.0)	[13.3]	0.6	(0.0)	[13.4]
Return on assets	-1.2	(0.2)	[-5.9]	-1.3	(0.2)	[-6.0]	-0.6	(0.3)	[-2.5]	-0.7	(0.3)	[-2.5]	-1.4	(0.2)	[-8.3]	-1.4	(0.2)	[-8.5]
Remittances													-1.4	(0.3)	[-5.5]	-1.4	(0.3)	[-5.5]
NPLs FC																		
Gross domestic product growth	-0.4	(0.1)	[-5.1]	-0.4	(0.1)	[-5.0]	-0.6	(0.1)	[-5.0]	-0.5	(0.1)	[-5.0]	0.9	(0.1)	[8.3]	0.9	(0.1)	[8.4]
Exchange rate growth	0.3	(0.1)	[2.8]	0.4	(0.1)	[2.9]	0.2	(0.2)	[1.6]	0.3	(0.2)	[1.6]	1.0	(0.1)	[7.3]	1.0	(0.1)	[7.4]
Loans interest rate	1.4	(0.1)	[11.1]	1.4	(0.1)	[11.0]	1.6	(0.2)	[9.6]	1.6	(0.2)	[9.5]	0.5	(0.1)	[5.7]	0.5	(0.1)	[5.6]
Capital adequacy ratios	0.3	(0.1)	[6.0]	0.3	(0.1)	[6.2]	0.3	(0.1)	[5.1]	0.3	(0.1)	[5.3]	0	(0.0)	[1.0]	(0.0)	(0.0)	[1.1]
Return on assets	-0.8	(0.2)	[-3.6]	-0.8	(0.2)	[-3.7]	-1.3	(0.3)	[-4.6]	-1.3	(0.3)	[-4.7]	-0.3	(0.1)	[-2.2]	-0.3	(0.1)	[-2.2]
Remittances													-1.1	(0.2)	[-5.1]	-1.1	(0.2)	[-5.1]
NPLs FC hedged																		
Gross domestic product growth	-0.4	(0.1)	[-4.2]	-0.4	(0.1)	[-4.1]	-0.4	(0.1)	[-3.8]	-0.4	(0.1)	[-3.8]	0.6	(0.2)	[2.5]	0.6	(0.2)	[2.7]
Exchange rate growth	0.3	(0.1)	[2.0]	0.3	(0.1)	[2.1]	0.2	(0.2)	[1.5]	0.2	(0.2)	[1.6]	0.9	(0.3)	[2.7]	0.9	(0.3)	[2.9]
Loans interest rate	1.3	(0.1)	[9.6]	1.3	(0.1)	[9.5]	1.6	(0.2)	[10.2]	1.6	(0.2)	[10.1]	0.4	(0.2)	[1.8]	0.3	(0.2)	[1.5]
Capital adequacy ratios	0.3	(0.1)	[5.4]	0.3	(0.1)	[5.6]	0.2	(0.1)	[3.7]	0.2	(0.1)	[3.9]	-0.2	(0.1)	[-2.8]	-0.2	(0.1)	[-2.2]
Return on assets	-1.5	(0.2)	[-6.2]	-1.5	(0.2)	[-6.2]	-1.8	(0.3)	[-6.6]	-1.8	(0.3)	[-6.6]	-1	(0.3)	[-3.4]	-1.1	(0.3)	[-3.7]
Remittances													-0.1	(0.5)	[-0.3]	-0.1	(0.5)	[-0.3]
NPLs FC unhedged																		
Gross domestic product growth	-0.4	(0.1)	[-4.2]	-0.4	(0.1)	[-4.1]	-0.6	(0.1)	[-4.3]	-0.6	(0.1)	[-4.3]	0.7	(0.1)	[5.7]	0.7	(0.1)	[5.7]
Exchange rate growth	0.4	(0.1)	[2.7]	0.4	(0.1)	[2.8]	0.3	(0.2)	[1.5]	0.3	(0.2)	[1.6]	0.7	(0.2)	[4.3]	0.8	(0.2)	[4.4]
Loans interest rate	1.8	(0.2)	[11.5]	1.7	(0.2)	[11.4]	1.4	(0.2)	[7.2]	1.4	(0.2)	[7.0]	0.7	(0.1)	[6.0]	0.7	(0.1)	[5.9]
Capital adequacy ratios	0.4	(0.1)	[6.5]	0.4	(0.1)	[6.8]	0.4	(0.1)	[5.1]	0.4	(0.1)	[5.2]	0.1	(0.0)	[3.3]	0.1	(0.0)	[3.4]
Return on assets	0.3	(0.3)	[1.3]	0.3	(0.3)	[1.2]	0.5	(0.3)	[1.6]	0.5	(0.3)	[1.5]	-0.2	(0.2)	[-1.4]	-0.2	(0.2)	[-1.4]
Remittances	0.3	(0.3)	[1.3]	0.3	(0.3)	[1.2]	0.5	(0.3)	[1.6]	0.5	(0.3)	[1.5]	-1.2	(0.3)	[-4.4]	-1.2	(0.3)	[-4.4]

Table 4.2 Results of FE and RE models

Source: Authors' calculations.

Note: The table provides the sensitivity of NPLs on macroeconomics and bank variables for the FE and RE models, with standard errors in ( ) and t-statistics in [ ].

The influence of macroeconomic variables on NPLs is statistically significant in most quantiles, demonstrating a heterogenous relationship, particularly at the higher percentiles. This observation corroborates the findings of Kanas & Molyneux (2018), who contend that there is no strong theoretical or empirical foundation for assuming a linear relationship between risk and macroeconomic variables.

Economic activity exerts a marginal and nearly flat impact on the lower percentiles of the NPLs, up to the 25th percentile for NFCs and up to the 50th percentile for households. As we move towards higher percentiles, NPLs become increasingly sensitive to economic performance. At the 99th percentile, the relationship reverses, possibly due to the COVID-19 pandemic, which disrupted the connection between the financial and macroeconomic sectors (Skufi & Geršl 2023).

The depreciation of the exchange rate positively impacts private sector NPLs, consistent with Klein (2013), by Festić & Bekő (2008), and Kuzucu & Kuzucu (2019), who analyzed respectively CESEE countries, CE countries, and emerging economies. Exchange rate oscillations are statistically significant across most percentiles, exhibiting variability that confirms the presence of heterogeneity, as noted by Quagliariello (2007). As NPLs increase, credit risk becomes more sensitive to exchange rate volatility, corroborating the findings of Aydemir et al. (2023) for the Turkish banking system. Up to the 50th percentile, there is a homogeneous response to exchange rate among currencies and hedging position, while the heterogeneity becomes more pronounced at the 95th and 99th percentiles. Indicating that banks with already high NPLs react more strongly to FX depreciation than the median bank.

Focusing on the hedging position, our findings indicate that for NFCs, the hedging position of loans in foreign currency has a statistically significant negative

effect on NPLs. Also, currency depreciation increases the NPLs for the unhedged one compared to the hedged one. This outcome is more pronounced on the right-hand side of the distribution, as illustrated in Figure 4.2. On the left-hand side of the distribution, hedged borrowers are slightly more sensitive to exchange rate fluctuations compared to unhedged borrowers, particularly up to the 25th percentile. In addition, we find that the trade channel is not predominant, contrary to the findings of Bodnár (2009) and Bleakley & Cowan (2008).

In contrast to expectations, households exhibit the opposite trend, illustrated in Figure 4.3. From the 5th percentile onward, unhedged households demonstrate a lower sensitivity to exchange rate fluctuations compared to their hedged counterparts. This finding contradicts the balance sheet effect, which posits that exchange rate depreciation should theoretically exert a less impact on the incomes and solvency of hedged borrowers. While Brown et al. (2012), Hudecz (2013), and Alvarez et al. (2015) attribute this phenomenon to the presence of foreign income in foreign currencies, our analysis does not yield statistically significant evidence supporting this claim (see Table 4.A6 in Appendix 4.A). We propose that this behavior may instead be attributed to the increased prudence exercised by banks when granting FC loans to unhedged households.

When comparing non-financial corporations with households, it is observed that hedged households exhibit greater sensitivity to exchange rate depreciation, particularly above the median percentiles. This finding aligns with the arguments Bethlendi (2011) and Verner & Gyöngyösi (2020), who suggest that firms are less

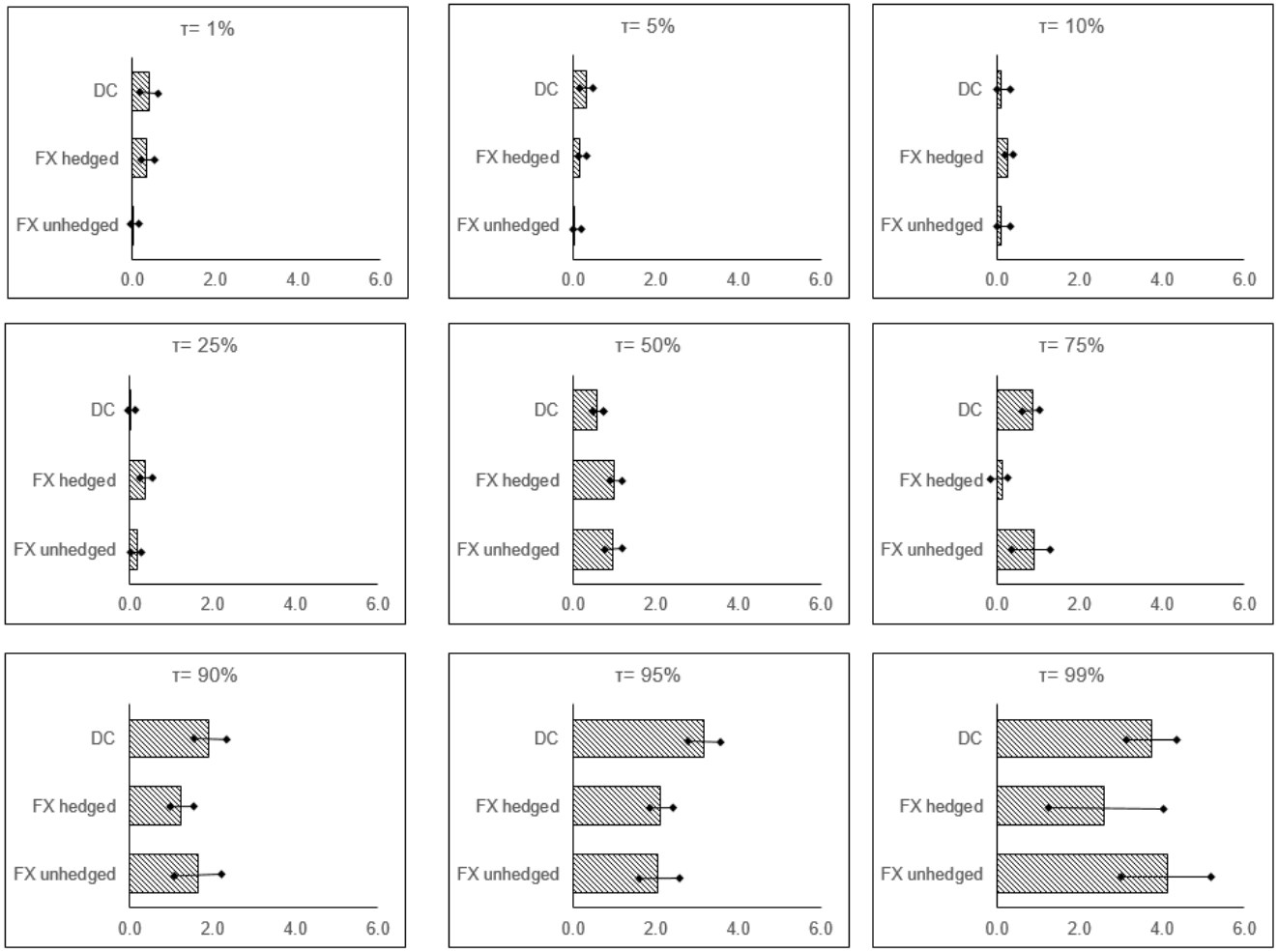

Figure 4.2 Results of exchange rate changes on different levels of NPLs distribution for non-financial corporation

Source: Authors' calculations

Note: The figure provides the sensitivity of NPLs on exchange rate for selected percentiles, with standard errors in arrows.

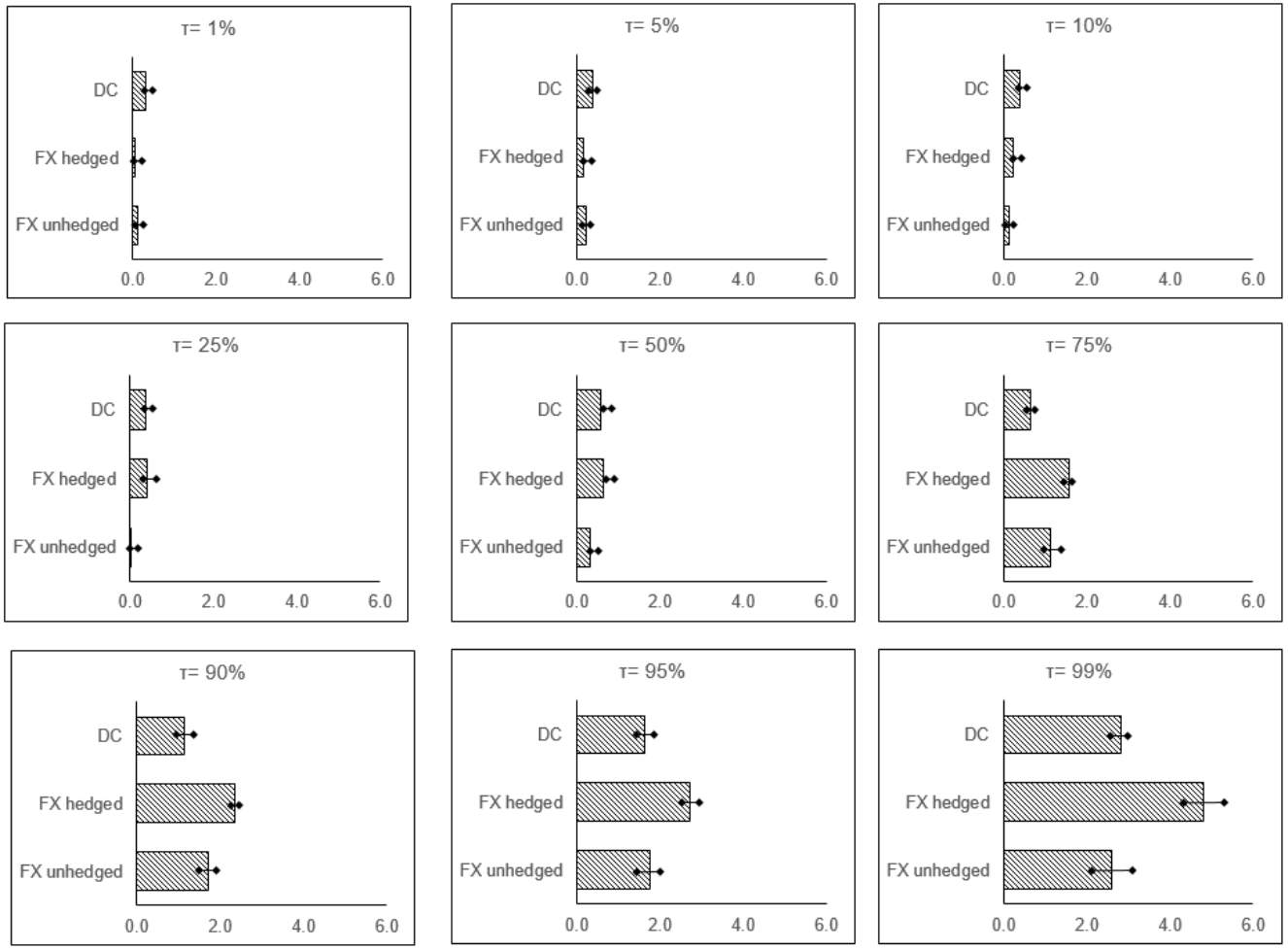

Figure 4.3 Results of exchange rate changes on different levels of NPLs distribution for households

Source: Authors' calculations.
Note: The figure provides the sensitivity of NPLs on exchange rate for selected percentiles, with standard errors in arrows.

affected by depreciation due to their distinct hedging strategies. On the contrary, the opposite trend is observed among unhedged borrowers. In our opinion, this result may be attributed to households representing a safer profile compared to non-financial corporations. Most household loans are mortgages, which are considered significant life decisions, typically involving less risky borrower profiles and often accompanied by collateral. Furthermore, our results indicate that the hedging strategies affects the NPLs differently at the tails of the distribution regarding exchange rate depreciation.

It is important to stress, however, that an apparently limited heterogeneity in sensitivity between hedged and unhedged borrowers may not be unexpected. Hedging is not a random decision: firms that choose to hedge may in fact be those that are more financially fragile, and therefore less willing, or allowed by their bank, to take on exchange rate risk. In contrast, stronger firms may be more willing to accept such exposure. This selection mechanism helps explain the observed patterns in our results.

The relationship between NPLs and various bank indicators exhibits significant variation across different quantiles. For the lower percentiles, both loan interest rates and the capital adequacy ratio show the expected signs. However, these parameters become statistically insignificant at higher percentiles.

Regarding interest rates, we hypothesize that the observed results may be influenced by the "Action Plan for Reducing Non-Performing Loans" implemented by the Bank of Albania in 2015 (BoA 2015). This initiative aimed to mitigate the prevalence of non-performing loans within the banking system, which could affect the sensitivity of interest rates to NPLs.

The relationship between the capital adequacy ratio (CAR) and NPLs requires careful interpretation. While higher CAR generally signals stronger capitalization and prudential behavior, the mechanism through which CAR improves can vary. In many

cases, banks may achieve higher CAR by rebalancing their loan portfolios which can lead to a decline in NPL ratios. However, an increase in CAR might also result from a contraction in the overall loan portfolio. If the stock of NPL remains unchanged, this mechanical effect could temporarily increase the NPLs. This dynamic may be particularly relevant in smaller or less diversified banking systems, such as Albania, where portfolio adjustments are more challenging and options for raising capital are limited. In this case, an increase in the capital adequacy ratio would lead to a reduction in the lending, thereby resulting in higher NPLs. This outcome aligns with the theoretical expectation that a more robust capital base would constrain lending activities, thus increasing the proportion of non-performing loans.

Furthermore, our analysis suggests that the impact of return on assets increases across higher conditional NPL quantiles, highlighting a more pronounced association in the upper tail. Specifically, increased credit risk appears to incentivize better bank performance in efforts to reduce NPLs. This finding indicates that profitability, as measured by the return on assets, becomes a significant factor in managing credit risk when the NPLs ratios are elevated. Conversely, at lower percentiles of NPLs, the return on assets does not exhibit the expected sign, suggesting a different dynamic at play in less risky environments.

To assess the robustness of the observed asymmetry in quantile regressions, we employ panel least squares (LS) estimation (see Table 4.A7 in the Appendix 4.A). Initially, we used the entire sample (Model 1) and subsequently divided the sample into pre and post-2016 periods (Models 2 and 3), considering the decline in NPLs and the sustained appreciation of the Albanian Lek after 2016. The results reveal considerable variability, suggesting a non-linear relationship between NPLs and their determinants. In particular, the LS estimations confirm a heterogenous relationship

with the exchange rate, as the pre- and post-2016 periods align with the depreciation and appreciation of the Lek, respectively.

4.6 Conclusions

The banking sector is essential for economic development, primarily through its role in financial intermediation between savers and borrowers. The discourse on the NPL ratio is critical, as defaults pose a threat to economic growth. The existing literature on this topic has limitations, particularly concerning the hedging positions of borrowers. Additionally, many previous works call to the reference but do not take into account the difference in distribution among the different percentiles of NPLs related to currency depreciation.

Our research reaffirms the key determinants of NPLs by employing fixed effect model and panel quantile regression, thereby contributing to a deeper understanding and extension of existing models through insights into borrowers' hedging profiles. By analyzing data from 11 banks in Albania, we differentiate between hedged and unhedged foreign currency loans and categorize them by borrower segment (households vs. NFCs). We construct a panel quantile regression model with the NPL ratio as the dependent variable, enabling us to investigate the determinants of credit risk across various quantiles. For this analysis, we select six macroeconomic and banking factors, drawn from the existing literature, to examine their influence on NPLs.

Among the percentiles analyzed, the majority of determinants yielded statistically significant results. The relationship between NPLs and their determinants is heterogenous across the percentiles, with borrower heterogeneity being more pronounced in the right tail of the distribution.

Regarding hedging strategies, which most probably is not a random decision nor by borrowers nor by banks, we find that FC credit risk of unhedged borrowers is associated with a higher risk of exchange rate depreciation compared to hedged borrowers in the case of non-financial corporations. On the contrary, for households, the opposite holds true. Furthermore, our results indicate that the hedging strategies affect the NPLs at the tails of the distribution concerning exchange rate depreciation.

Our findings indicate that macroeconomic developments and financial conditions have larger coefficients at higher conditional NPL quantiles, indicating stronger associations in the upper tail. Consequently, policymakers must promote market competition to improve efficiency. Policymakers and financial institutions can use these insights to refine risk assessment frameworks and devise targeted interventions. Regulatory frameworks should emphasize the importance of rigorous credit risk assessment and implement optimal capital adequacy requirements for banks to achieve a balance between growth and risk.

We identify the primary limitation of this study as the absence of a comparative analysis with other countries. How might hedging strategies have influenced the impact of exchange rate depreciation across varying levels of non-performing loan (NPL) ratios in other euroized economies? For future research, we recommend investigating time-varying distributions with additional determinants of NPLs and evaluating the effectiveness of risk mitigation strategies in a dynamic environment.

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Reference

AAB. 2024. "Albanian Association of Banks ." Statictics. https://aab.al/en/rreth-nesh/statistika/.

Alvarez, Sandra Paola, Pascal Briod, and Olivier Ferrari. 2015. “Remittances: How reliable are the data?” *Migration Policy Practice* 2: 42-46.

Anderson, Theodore W., and Cheng Hsiao. 1981. "Estimation of Dynamic Models with Error Components." *Journal of the American Statistical Association* 76 (375): 598-606. doi: https://doi.org/10.1080/01621459.1981.10477621.

Ari, Anil, Sophia Chen, and Lev Ratnovski. 2021. "The dynamics of non-performing loans during banking crises: A new database with post-COVID-19 implications." *Journal of Banking & Finance* 133. doi:https://doi.org/10.1016/j.jbankfin.2021.106140.

Aydemir, Resul, Zehra Atik, and Bulent Guloglu. 2023. "Macro Stress Testing the Credit Risk of Conventional and Participation Banks in Turkey: A Nonparametric Quantile Regression Approach." *Eastern European Economics* 1–35. doi:https://doi.org/10.1080/00128775.2023.2253226.

Beck, Roland, Petr Jakubik, and Anamaria Piloiu. 2015. "Key determinants of non-performing loans: New evidence from a global sample." *Open Economies Review* 26 (3): 525–550.

Beck, Roland, Petr Jakubik, and Anamaria Piloiu. 2013. "Non-performing loans: What matters in addition to the economic cycle?" *ECB Working Paper* 1515. http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1515.pdf.

Bethlendi, Andras. 2011. "Policy measures and failures on foreign currency household lending in central and eastern Europe." *Acta Oeconomica* (Akadémiai Kiadó) 61 (2): 193-223. https://www.jstor.org/stable/41318103.

Bleakley, Hoyt, and Kevin Cowan. 2008. "Corporate Dollar Debt and Depreciations: Much Ado about nothing?" *Review of Economics and Statistics* 90 (4): 612–26.

BoA. 2016. *Bank of Albania.* https://www.bankofalbania.org/rc/doc/Resolution_Law_Eng_Aggreg_11734.pdf.

—. 2013. *Bank of Albania.* https://www.bankofalbania.org/Publications/Periodic/Supervision_Annual_Report/2012_Supervision_Annual_Report.html.

—. 2015. *Bank of Albania.* https://www.bankofalbania.org/Supervision/Action_plan_for_non-performing_loans/.

—. 2024. *Bank of Albania.* https://www.bankofalbania.org/Statistikat/Seri_Kohore/.

Bodnár, Katalin. 2009. "Exchange rate exposure of Hungarian enterprises – results of a survey." *MNB Occasional Papers* (Central Bank of Hungary).

Boumparis, Periklis, Costas Milas, and Theodore Panagiotidis. 2019. "Non-performing loans and sovereign credit ratings." *International Review of Financial Analysis* 64: 301-314. doi:https://doi.org/10.1016/j.irfa.2019.06.002.

Brown, Martin, Ralph De Haas, Cédric Tille, and László Halpern. 2012. "Foreign banks and foreign currency lending in emerging Europe." *Economic Policy* 69 (57): 59-98. https://www.jstor.org/stable/41428846.

Demirguc-Kunt, Asli, and Harry Huizinga. 2000. "Financial structure and bank profitability." *Policy Research Working Paper Series* (World Bank) 2430.

ECB. 2011. "Empirical determinants of non-performing loans." *ECB Financial Stability* 132-139.

Festić, M., and J. Bekő. 2008. "The Banking Sector and Macroeconomic Performance in Central European Economies." *Czech Journal of Economics and Finance* 58 (3-4): 131–151.

Fink, Gerhard, Wolfgang Rainer, and Peter R. Haiss. 2016. "The euro as international currency: Euro-loans in central and south-east european countries." In *A Monetary hope for Europe: the Euro and the Struggle for the Creation of a New Global Currency*, edited by Max Guderzo and Andrea Bosco. Studi e Saggi.

Gerlach, Stefan, Wensheng Peng, and Chang Shu. 2005. "Macroeconomic conditions and banking performance in Hong Kong SAR: a panel data study." Working Paper, BIS.

Hausman, James A. 1978. "Specification tests in econometrics." *Econometrica* 46 (6): 1251-1271. doi:https://doi.org/10.2307/1913827.

Hudecz, András. 2013. "Parallel Stories: Fx Lending To Households In Poland, Romania And Hungary, 1997—2011." *Acta Oeconomica* 63 (3): 257-286. https://www.jstor.org/stable/23526175.

INSTAT. 2024. *Instituti i Statistikave.* https://www.instat.gov.al.

Kanas, Angelos, and Philip Molyneux. 2018. "Macro stress testing the U.S. banking system." *Journal of International Financial Markets, Institutions and Money* 204-227. doi:https://doi.org/10.1016/j.intfin.2017.12.006.

Karadima, Maria, and Helen Louri. 2020. "Non-performing loans in the euro area: Does bank market power matter?" *International Review of Financial Analysis* 72. doi:doi.org/10.1016/j.irfa.2020.101593.

Kazinczy, Eszter. 2013. "The catching-up of the banking sector in south-eastern Europe: a fragiledevelopment model dominated by credit growth." *Society and Economy* 35 (4): 493-511. https://www.jstor.org/stable/43774187.

Klein, Nir. 2013. "Non-Performing loans in CESEE: Determinants and impact on macroeconomic performance." *IMF Working Paper* WP/13/72. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Non-Performing-Loans-in-CESEE-Determinants-and-Impact-on-Macroeconomic-Performance-40413.

Koenker, Roger. 2005. "Quantile Regression." *Econometric Society Monographs* (Cambridge Univeristy Press).

Kuzucu, Narman, and Serpil Kuzucu. 2019. "What Drives Non-Performing Loans? Evidence from Emerging and Advanced Economies during Pre- and Post-Global Financial Crisis." *Emerging Markets Finance and Trade* 55 (8): 1694-1708. doi:10.1080/1540496X.2018.1547877.

Le, Chi Diem Ha, and Anh Hoang Le. 2023. "MACROECONOMIC DETERMINANTS OF NON-PERFORMING LOANS: A QUANTILE REGRESSION APPROACH EVIDENCE FROM VIETNAM'S BANKING SYSTEM." *JOURNAL OF EASTERN EUROPEAN AND CENTRAL ASIAN RESEARCH* 70 (5). doi: https://doi.org/10.15549/jeecar.v10i5.1255.

Louzis, Dimitrios P., Angelos T. Vouldis, and Vasilios L. Metaxas. 2012. "Macroeconomic and bank-specific determinants of non-performing loans in

Greece: A comparative study of mortgage, business and consumer loan portfolios." *Journal of Banking and Finance* 36.

Macháček, Martin, Aleš Melecký, and Monika Šulganová. 2017. "Macroeconomic Drivers of Non-Performing Loans: A Meta-Regression Analysis." *Prague Economic Papers* 27 (3): 1-24.

Magkonis, Georgios, Georgios Chortareas, and Kalliopi Zekented. 2019. "Credit risk and the business cycle: What do we know?" *International Review of Financial Analysis* 67 (4).

Mancini, Loriano, and Fabio Trojani. 2011. "Robust Value at Risk Prediction." *The Journal of Financial Econometrics, Society for Financial Econometrics* 9 (2): 281-313.

Manz, Florian. 2019. "Determinants of non-performing loans: What do we know? A systematic review and avenues for future research." *Management Review Quarterly* 69: 351–389.

Marcucci, Juri, and Mario Quagliariello. 2008. "Credit Risk and Business Cycle Over Different Regimes." *Temi di Discussione (Working Paper) 670* (Bank of Italy). https://ssrn.com/abstract=1160155 or http://dx.doi.org/10.2139/s.

Quagliariello, Mario. 2007. "Banks' riskiness over the business cycle: a panel analysis on Italian intermediaries." *Applied Financial Economics* 17 (2): 119–138.

Robert F. Engle, Simone Manganelli. 2004. "CAViaR: Conditional Autoregressive Value at Risk by Regression Quantiles." *Journal of Business & Economic Statistics* 22 (4): 367-381.

Roger, Koenker, and Gilbert J Bassett. 1978. "Regression Quantiles." *Econometrica* 46(1).

Salas, MBelen, Prosper Lamothe, and Enrique Delgado. 2024. "Determinants of nonperforming loans: A global data analysis." *Computational Economics* (Springer). doi:https://doi.org/10.1007/s10614-023-10543-8.

Skufi, Lorena, and Adam Geršl. 2023. "Using Macrofinancial Models to Simulate Macroeconomic Developments During the COVID-19 Pandemic: The Case of Albania." *Eastern European Economics* 61 (5): 517-553. doi:10.1080/00128775.2023.2215229.

Theil, Henri. 1957. "Specification Errors and the Estimation of Economic Relationships." *Review of the International Statistical Institute* 25: 41-51. doi:https://doi.org/10.2307/1401673.

Vazquez, Francisco, Benjamin M. Tabak, and Marcos Rietti Souto. 2012. "A Macro Stress Test Model of Credit Risk for the Brazilian Banking Sector." *Journal of Financial Stability* 8 (2).

Verner, Emil, and Győző Gyöngyösi. 2020. "Household Debt Revaluation and the Real Economy." *The American Economic Review* (American Economic Association) 110 (9): 2667-2702. https://www.jstor.org/stable/10.2307/26966313.

4.A Appendix

In Figure 4.A1 we illustrate the heterogeneity across banks by constructing fan-charts for the NPLs among agents and currencies. In each graph we show the median and three bands for the respective quantiles [0.05-0.95 quantiles; 0.10-0.90 quantiles; and 0.35-0.65 quantiles]. The bands for outer quantiles are much wider and asymmetric compared to the 0.35-0.65 quantile band. This outcome indicates that the distribution of NPLs across banks is not uniform. At the same time, the culminating points reflect the presence of outliers. Outliers seem to be more dominant in the case of households borrowing in FC.

The fan-charts are wider and more asymmetric during the high NPLs period 2012-2016, showing a high credit risk at the time and a lot of variability among banks. The variation across banks is more pronounced in the case of NFCs compared to households. This heterogeneity, in our opinion, may be related to the business sector that each bank targets. Bank heterogeneity appears with no distinguishing trait amongst currencies.

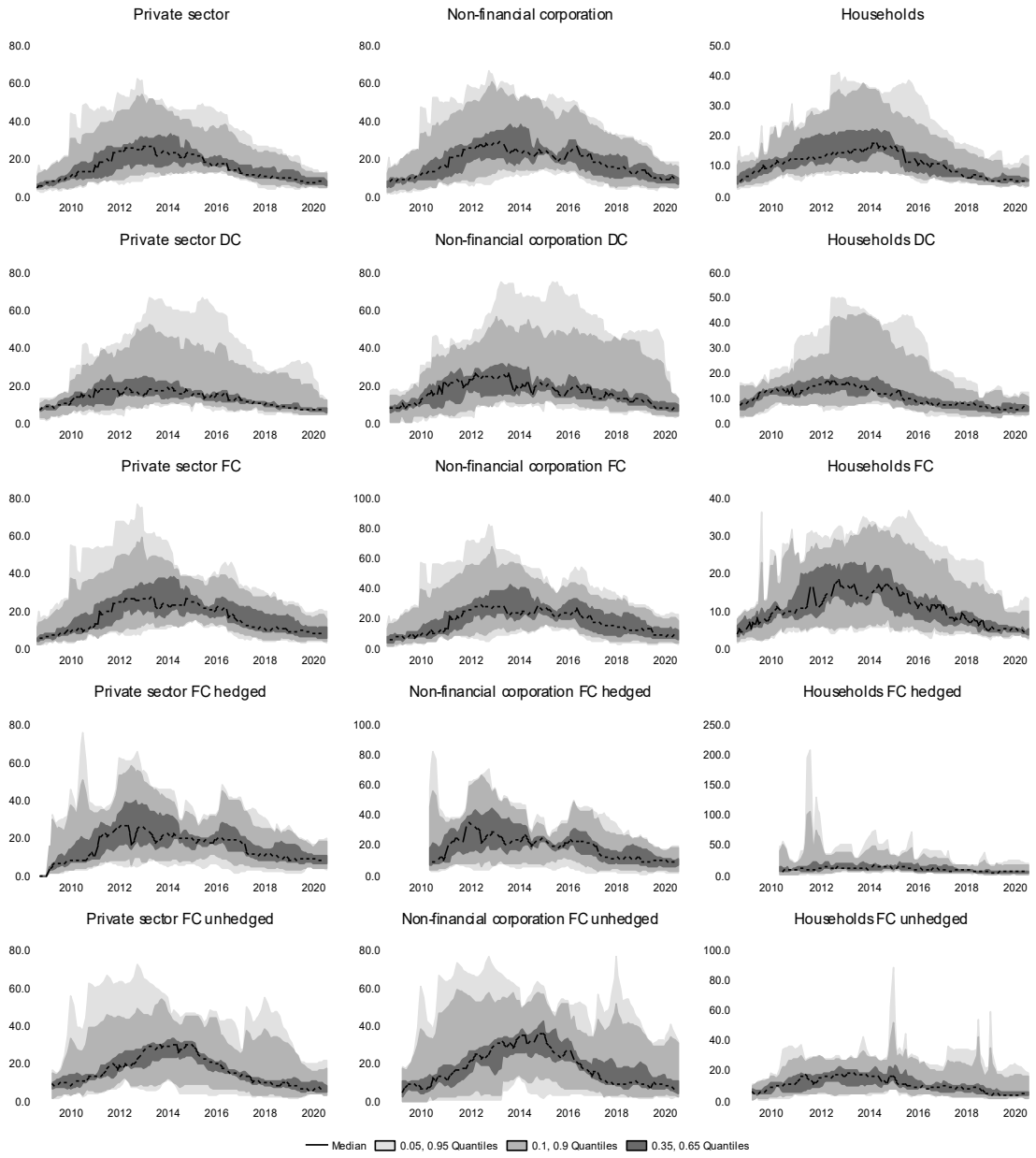

Figure 4.A1 The NPLs fan-charts

Source: Authors' calculations.
Note: The figure presents fan-charts for the NPLs among agents and currencies for the bands: [0.05-0.95], [0.10-0.90], [0.35-0.65] and the median.

	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Private sector			
NPLs	4.5	5.0	0.5
NPLs DC	2.1	5.0	0.8
NPLs FC	5.0	5.0	0.4
NPLs FC hedged	5.2	5.0	0.4
NPLs FC unhedged	4.9	5.0	0.4
Non-financial corporations			
NPLs	3.4	5.0	0.6
NPLs DC	2.3	5.0	0.8
NPLs FC	0.0	5.0	1.0
NPLs FC hedged	0.0	5.0	1.0
NPLs FC unhedged	0.0	5.0	1.0
Households			
NPLs	0.0	6.0	1.0
NPLs DC	0.0	6.0	1.0
NPLs FC	0.0	6.0	1.0
NPLs FC hedged	0.0	6.0	1.0
NPLs FC unhedged	0.0	6.0	1.0

Table 4.A1 Results of Hausman test

Source: Authors' calculations.
Note: The table provides the Hausman test statistic value along with the associated p-value.

	Private sector	Non-financial corporations	Households
NPLs			
Bank 1	4.9	9.1	-4.1
Bank 2	-2.0	-3.6	-2.7
Bank 3	-9.7	-11.7	-4.0
Bank 4	-3.5	-2.0	-4.2
Bank 5	11.7	12.8	10.2
Bank 6	-6.1	-9.6	-0.1
Bank 7	-4.4	-3.3	-5.4
Bank 8	2.6	1.3	-0.9
Bank 9	0.2	-1.8	4.6
Bank 10	6.4	10.8	3.5
Bank 11	-0.1	-1.9	3.0
NPLs DC			
Bank 1	-2.2	-1.0	-1.7
Bank 2	-0.4	-2.8	0.1
Bank 3	-7.5	-10.5	-4.5
Bank 4	-3.8	-3.4	-2.9
Bank 5	18.8	22.8	11.8
Bank 6	-4.6	-8.6	2.9
Bank 7	-3.4	-2.4	-3.4
Bank 8	-0.4	-2.0	-1.3
Bank 9	-4.3	-5.3	-3.6
Bank 10	6.5	13.0	0.3
Bank 11	1.1	0.3	2.3
NPLs FC			
Bank 1	8.6	11.5	-6.6
Bank 2	-2.6	-1.7	-5.2
Bank 3	-9.0	-12.8	-2.2
Bank 4	-4.8	-0.3	-1.8
Bank 5	7.8	6.3	11.5
Bank 6	-5.5	-8.6	-6.2
Bank 7	-4.4	-3.7	-6.0
Bank 8	4.2	3.1	-0.2
Bank 9	1.1	-1.1	9.4
Bank 10	5.3	10.0	3.8
Bank 11	-0.6	-2.7	3.3
NPLs FC hedged			
Bank 1	9.7	12.4	-3.8
Bank 2	-2.4	-3.5	-8.1
Bank 3	-10.0	-10.9	-5.4
Bank 4	1.4	1.5	-4.4
Bank 5	5.1	3.7	13.3
Bank 6	-9.7	-10.6	-10.2
Bank 7	-4.6	-3.9	-8.2
Bank 8	4.1	3.8	14.0
Bank 9	2.4	2.1	10.7
Bank 10	7.2	8.2	9.0
Bank 11	-3.2	-2.7	-6.9
NPLs FC unhedged			
Bank 1	9.4	11.6	-7.9
Bank 2	-5.2	-4.5	-3.3
Bank 3	-7.2	-8.5	0.6
Bank 4	-11.5	-14.6	-5.3
Bank 5	9.1	5.5	8.2
Bank 6	-2.3	-4.1	-6.6
Bank 7	-4.0	3.9	-6.1
Bank 8	4.1	2.5	-0.5
Bank 9	0.0	-3.7	11.7
Bank 10	5.1	11.3	2.0
Bank 11	2.5	0.8	7.2

Table 4.A2 Results of fixed effects

Source: Authors' calculations.
Note: The table A2 provides the estimated fixed effects across banks.

	τ = 1%	τ = 5%	τ = 10%	τ = 25%	τ = 50%	τ = 75%	τ = 90%	τ = 95%	τ = 99%
Gross domestic product growth									
Private sector	0.0 (0.0) [-0.7]	-0.1 (0.0) [-2.8]	-0.1 (0.0) [-3.2]	-0.2 (0.0) [-5.3]	-0.4 (0.1) [-4.0]	-1.4 (0.2) [-8.1]	-2.0 (0.2) [-9.5]	-2.5 (0.3) [-9.4]	-0.4 (2.3) [-0.2]
Private sector DC	0.0 (0.0) [-2.0]	-0.1 (0.0) [-3.3]	-0.1 (0.0) [-4.3]	-0.1 (0.0) [-3.7]	-0.4 (0.1) [-6.0]	-0.9 (0.1) [-6.8]	-1.7 (0.3) [-6.5]	-2.7 (0.7) [-4.0]	-4.7 (0.2) [-21.5]
Private sector FC	0.0 (0.0) [-1.1]	-0.1 (0.0) [-3.0]	-0.1 (0.0) [-4.1]	-0.2 (0.0) [-4.0]	-0.3 (0.1) [-3.7]	-1.4 (0.2) [-8.6]	-1.9 (0.2) [-11.5]	-0.2 (4.5) [0.0]	3.1 (0.1) [21.3]
Private sector FC hedged	-0.1 (0.0) [-5.0]	-0.1 (0.0) [-2.7]	-0.1 (0.0) [-3.4]	-0.1 (0.0) [-3.1]	-0.3 (0.1) [-2.7]	-1.0 (0.2) [-4.2]	-1.3 (0.7) [-2.0]	-0.9 (3.2) [-0.3]	1.2 (4.9) [0.2]
Private sector FC unhedged	-0.1 (0.0) [-3.9]	-0.1 (0.0) [-2.4]	-0.1 (0.0) [-2.2]	-0.1 (0.1) [-2.5]	-0.5 (0.1) [-4.5]	-1.4 (0.2) [-7.0]	-2.2 (0.2) [-12.0]	-2.8 (0.3) [-10.0]	4.5 (0.5) [9.4]
Exchange rate growth									
Private sector	0.5 (0.0) [14.4]	0.3 (0.0) [5.7]	0.3 (0.1) [4.7]	0.2 (0.1) [2.9]	0.6 (0.1) [4.4]	1.0 (0.2) [4.3]	1.9 (0.3) [6.4]	3.0 (0.2) [14.6]	4.0 (0.5) [8.6]
Private sector DC	0.4 (0.1) [5.9]	0.3 (0.1) [4.3]	0.2 (0.1) [3.4]	0.2 (0.1) [2.5]	0.5 (0.1) [5.6]	0.8 (0.2) [4.0]	0.9 (0.4) [2.2]	2.7 (0.6) [4.5]	4.3 (0.3) [14.0]
Private sector FC	0.3 (0.0) [11.4]	0.2 (0.0) [5.0]	0.2 (0.1) [4.3]	0.4 (0.1) [4.4]	0.7 (0.2) [4.2]	1.2 (0.3) [4.8]	1.4 (0.3) [4.1]	2.0 (1.7) [1.2]	3.3 (0.2) [18.1]
Private sector FC hedged	0.2 (0.0) [7.4]	0.2 (0.0) [5.5]	0.3 (0.1) [5.8]	0.4 (0.1) [4.6]	1.0 (0.1) [7.3]	0.4 (0.2) [1.8]	1.1 (0.3) [3.6]	1.8 (0.7) [2.6]	3.0 (1.1) [2.7]
Private sector FC unhedged	0.3 (0.0) [7.4]	0.2 (0.1) [3.8]	0.2 (0.1) [2.8]	0.1 (0.1) [0.7]	0.4 (0.1) [3.1]	1.9 (0.2) [10.5]	1.9 (0.5) [3.6]	2.9 (0.6) [5.1]	4.9 (0.5) [10.4]
Loans interest rate									
Private sector	0.1 (0.0) [4.8]	0.3 (0.0) [9.2]	0.4 (0.0) [10.3]	0.5 (0.1) [8.1]	0.6 (0.2) [3.2]	0.4 (0.6) [0.7]	-1.0 (0.6) [-1.7]	-1.5 (0.5) [-2.8]	-0.6 (0.3) [-2.0]
Private sector DC	0.0 (0.1) [0.3]	0.3 (0.0) [7.1]	0.3 (0.0) [8.0]	0.4 (0.1) [6.2]	0.6 (0.2) [3.1]	0.4 (0.4) [0.9]	-1.5 (0.4) [-3.3]	-3.6 (0.9) [-4.2]	-5.6 (0.3) [-18.8]
Private sector FC	0.0 (0.1) [0.5]	0.3 (0.1) [5.9]	0.4 (0.0) [9.8]	0.4 (0.1) [6.3]	0.7 (0.2) [2.9]	-0.4 (0.4) [-1.2]	0.4 (0.5) [0.8]	1.3 (1.1) [1.2]	2.1 (0.3) [7.7]
Private sector FC hedged	0.1 (0.0) [5.5]	0.2 (0.0) [3.6]	0.3 (0.0) [7.0]	0.3 (0.1) [4.0]	1.0 (0.3) [3.4]	1.7 (0.6) [3.0]	0.9 (0.8) [1.1]	0.7 (0.9) [0.7]	2.4 (1.4) [1.7]
Private sector FC unhedged	0.1 (0.1) [1.6]	0.2 (0.1) [1.7]	0.4 (0.1) [2.8]	0.7 (0.1) [7.2]	0.7 (0.1) [6.1]	0.4 (0.4) [1.1]	-1.5 (0.3) [-5.0]	-2.3 (0.5) [-4.6]	0.9 (1.2) [0.7]
Capital adequacy ratios									
Private sector	-0.1 (0.0) [-3.4]	-0.1 0.0 [-2.0]	-0.1 (0.0) [-1.8]	-0.2 (0.1) [-2.4]	0.1 (0.1) [1.6]	0.7 (0.1) [11.6]	0.8 (0.0) [18.7]	0.8 (0.1) [15.7]	0.6 (0.1) [7.5]
Private sector DC	-0.1 (0.1) [-1.0]	-0.2 (0.1) [-2.5]	-0.1 (0.1) [-2.1]	-0.1 (0.1) [-1.4]	0.0 0.0 [0.8]	0.5 (0.1) [13.4]	1.0 (0.3) [3.1]	1.3 (0.5) [2.5]	0.4 (0.4) [1.0]
Private sector FC	-0.2 (0.0) [-5.3]	-0.1 0.0 [-2.7]	-0.1 (0.1) [-2.3]	0.0 (0.1) [0.5]	0.4 (0.1) [4.4]	0.9 (0.1) [19.8]	1.1 (0.0) [24.8]	0.9 (0.1) [10.4]	0.8 (0.0) [31.3]
Private sector FC hedged	0.0 (0.0) [0.2]	-0.1 0.0 [-2.6]	-0.1 (0.1) [-1.2]	0.1 (0.1) [0.9]	0.5 (0.1) [6.2]	0.7 (0.1) [9.4]	0.9 (0.1) [13.2]	0.8 (0.1) [11.3]	0.9 (1.0) [0.9]
Private sector FC unhedged	0.0 (0.0) [-0.7]	0.0 (0.1) [-0.8]	0.0 (0.1) [-0.5]	0.2 (0.1) [2.5]	0.4 (0.1) [3.9]	1.0 (0.1) [13.2]	1.3 (0.0) [31.0]	1.2 (0.1) [23.3]	1.4 (0.4) [4.0]
Return on assets									
Private sector	0.6 (0.1) [4.5]	0.7 (0.2) [3.1]	0.7 (0.3) [2.7]	0.9 (0.3) [3.4]	0.0 (0.3) [0.1]	-2.1 (0.5) [-4.6]	-3.5 (0.4) [-9.3]	-2.7 (0.4) [-6.2]	-2.0 (0.7) [-2.8]
Private sector DC	-0.1 (0.2) [-0.3]	0.7 (0.2) [3.7]	0.7 (0.2) [3.4]	0.3 (0.2) [1.3]	-1.0 (0.3) [-3.6]	-2.8 (0.3) [-10.9]	-4.3 (0.9) [-4.8]	-5.3 (0.5) [-10.2]	-2.7 (0.6) [-4.4]
Private sector FC	0.4 (0.2) [2.3]	0.3 (0.3) [1.1]	0.7 (0.3) [2.2]	0.8 (0.3) [3.1]	-0.1 (0.3) [-0.4]	-2.6 (0.3) [-7.9]	-2.2 (0.3) [-7.0]	-1.3 (0.4) [-3.7]	-1.1 (0.1) [-7.6]
Private sector FC hedged	0.9 (0.1) [6.4]	1.1 (0.2) [4.9]	1.1 (0.2) [5.3]	1.3 (0.2) [6.1]	0.7 (0.4) [1.7]	-1.7 (0.4) [-4.7]	-2.3 (0.4) [-5.1]	-2.2 (0.6) [-3.8]	-1.3 (1.0) [-1.3]
Private sector FC unhedged	-0.1 (0.2) [-0.5]	-0.3 (0.3) [-1.0]	-0.3 (0.4) [-1.0]	-1.4 (0.3) [-5.4]	-0.7 (0.2) [-2.8]	-1.4 (0.3) [-4.3]	-1.6 (0.4) [-4.5]	-0.2 (0.5) [-0.5]	0.5 (0.5) [1.1]

Table 4.A3 Results of multivariate QR models for private sector

Source: Authors' calculations.
Note: The table provides the sensitivity of NPLs condition on macroeconomics and bank variables for selected percentiles, with standard errors in ( ) and t-statistics in [ ].

	τ = 1%	τ = 5%	τ = 10%	τ = 25%	τ = 50%	τ = 75%	τ = 90%	τ = 95%	τ = 99%
Gross domestic product growth									
Non-financial corporations	0.0 (0.0) [0.0]	-0.1 (0.0) [-3.6]	-0.1 0 [-3.9]	-0.2 0 [-5.2]	-0.5 (0.1) [-4.3]	-1.6 (0.2) [-6.8]	-2.9 (0.3) [-10.8]	-3.2 (0.2) [-13.1]	-0.9 (2.2) [-0.4]
Non-financial corporations DC	0.0 (0.0) [-2.2]	-0.1 (0.0) [-3.3]	-0.2 0 [-5.0]	-0.3 0 [-5.7]	-0.5 (0.1) [-4.5]	-1.4 (0.2) [-8.9]	-2.7 (0.5) [-5.0]	-3.4 (0.8) [-4.2]	-5.0 (0.5) [-9.8]
Non-financial corporations FC	0.0 (0.0) [-1.2]	-0.1 (0.0) [-3.5]	-0.2 0 [-4.1]	-0.3 (0.1) [-3.8]	-0.4 (0.1) [-3.7]	-1.4 (0.3) [-5.4]	-2.2 (0.2) [-9.7]	-1.8 (2.7) [-0.6]	3.0 (3.7) [0.8]
Non-financial corporations FC hedged	0.0 (0.0) [2.0]	-0.1 (0.0) [-3.0]	-0.1 0 [-2.8]	-0.2 (0.1) [-3.0]	-0.2 (0.1) [-2.1]	-0.9 (0.3) [-3.5]	-1.6 (0.6) [-2.6]	-1.7 (0.7) [-2.3]	2.3 (4.4) [0.5]
Non-financial corporations FC unhedged	-0.1 (0.0) [-2.1]	0 (0.0) [-0.8]	-0.1 0 [-1.5]	-0.2 (0.1) [-2.7]	-0.9 (0.2) [-5.0]	-1.7 (0.4) [-4.2]	-1.8 (-1.0) [-1.9]	-1.4 (0.7) [-2.1]	2.5 (1.7) [1.5]
Exchange rate growth									
Non-financial corporations	0.4 (0.1) [8.7]	0.2 (0.1) [3.3]	0.2 (0.1) [2.3]	0.2 (0.1) [2.4]	0.9 (0.2) [5.4]	0.7 (0.3) [2.0]	2.3 (0.3) [7.7]	2.9 (0.3) [10.6]	3.9 (0.5) [7.4]
Non-financial corporations DC	0.4 (0.1) [6.1]	0.3 (0.1) [3.3]	0.1 (0.1) [1.0]	0.0 (0.1) [0.2]	0.6 (0.1) [4.2]	0.9 (0.2) [3.8]	1.9 (0.4) [4.8]	3.2 (0.4) [8.4]	3.7 (0.6) [6.2]
Non-financial corporations FC	0.5 (0.0) [11]	0.2 (0.1) [3.8]	0.2 (0.1) [2.5]	0.5 (0.1) [4.3]	0.8 (0.2) [4.3]	0.7 (0.5) [1.6]	1.4 (0.4) [3.3]	1.2 (1.0) [1.2]	4.1 (1.2) [3.4]
Non-financial corporations FC hedged	0.3 (0.0) [8.6]	0.2 (0.1) [3.1]	0.3 (0.1) [4.1]	0.4 (0.1) [4.1]	1.0 (0.2) [5.6]	0.1 (0.2) [0.6]	1.2 (0.3) [4.2]	2.1 (0.3) [6.7]	2.6 (1.4) [1.9]
Non-financial corporations FC unhedged	0.0 (0.0) [0.6]	0.0 (0.1) [0.5]	0.1 (0.1) [1.1]	0.2 (0.1) [1.7]	1.0 (0.2) [4.1]	0.9 (0.5) [2.0]	1.6 (0.6) [2.8]	2.1 (0.5) [4.1]	4.1 (1.1) [3.7]
Loans interest rate									
Non-financial corporations	0.0 (0.0) [0.1]	0.2 0 [4.9]	0.3 0 [6.5]	0.4 (0.1) [5.9]	0.7 (0.3) [2.8]	-0.4 (0.7) [-0.6]	-3.1 (0.4) [-6.9]	-2.4 (0.6) [-3.9]	-1.0 (0.4) [-2.7]
Non-financial corporations DC	0.0 (0.1) [0.6]	0.1 (0.1) [1.0]	0.2 (0.1) [3.7]	0.3 (0.1) [4.3]	0.6 (0.2) [2.5]	-0.2 (0.4) [-0.4]	-3.7 (0.4) [-9.3]	-5.2 (0.6) [-9.3]	-6.1 (1.2) [-5.1]
Non-financial corporations FC	-0.1 (0.0) [-1.5]	0.2 (0.1) [3.9]	0.4 (0.1) [6.7]	0.3 (0.1) [4.0]	1.2 (0.3) [3.6]	1.2 (0.9) [1.3]	1.3 (0.8) [1.5]	2.9 (0.9) [3.2]	0.7 (1.2) [0.6]
Non-financial corporations FC hedged	0.1 (0.0) [4.0]	0.1 (0.1) [1.9]	0.3 0 [6.1]	0.4 (0.1) [6.1]	1.5 (0.5) [3.0]	2.3 (0.6) [3.6]	1.0 (0.6) [1.6]	1.1 (0.8) [1.4]	4.9 (1.6) [3.2]
Non-financial corporations FC unhedged	-0.2 (0.1) [-2.1]	0.0 (0.2) [0.2]	0.1 (0.2) [0.6]	0.4 (0.1) [3.8]	0.2 (0.2) [1.1]	-0.5 (0.5) [-1.0]	-2.0 (0.5) [-3.6]	-2.4 (0.6) [-4.1]	-1.1 (1.5) [-0.7]
Capital adequacy ratios									
Non-financial corporations	0.0 (0.0) [0.7]	-0.1 (0.1) [-1.1]	-0.1 (0.1) [-1.3]	-0.2 (0.1) [-2.0]	0.2 (0.1) [1.7]	0.7 (0.1) [10.5]	0.9 (0.1) [16.9]	0.7 (0.1) [11.4]	0.5 (0.1) [8.4]
Non-financial corporations DC	-0.2 (0.1) [-2.3]	-0.1 (0.1) [-1.0]	-0.1 (0.1) [-0.7]	0.1 (0.1) [1.5]	0.1 (0.1) [2.1]	0.4 (0.1) [7.6]	1.4 (0.4) [3.8]	1.9 (0.6) [3.3]	0.8 (1) [0.7]
Non-financial corporations FC	-0.2 (0.0) [-5.1]	-0.2 (0.1) [-3.8]	-0.2 (0.1) [-3.3]	-0.1 (0.1) [-0.5]	0.2 (0.1) [2.1]	1.0 (0.1) [12.8]	0.7 (0.1) [8.0]	0.7 (0.1) [10.5]	0.8 (0.1) [7.2]
Non-financial corporations FC hedged	-0.1 (0.0) [-2.0]	-0.2 (0.1) [-2.7]	-0.1 (0.1) [-1.5]	-0.1 (0.1) [-0.8]	0.5 (0.1) [5.4]	0.6 (0.1) [9.1]	0.8 (0.1) [10.0]	0.7 (0.1) [10.6]	0.2 (0.1) [1.8]
Non-financial corporations FC unhedged	0.0 (0.0) [1.0]	0.0 (0.1) [-0.4]	0.0 (0.1) [-0.3]	0.2 (0.1) [2.3]	0.2 (0.1) [1.6]	1.0 (0.2) [4.5]	1.1 (0.1) [19.0]	1.0 (0.1) [19.7]	0.7 (0.1) [5.4]
Return on assets									
Non-financial corporations	0.0 (0.2) [-0.2]	1.3 (0.3) [4.2]	1.3 (0.3) [4.2]	1.4 (0.3) [5.0]	0.3 (0.3) [0.8]	-2.9 (0.5) [-5.9]	-4.0 (0.3) [-13.2]	-2.5 (0.5) [-5.6]	-2.1 (0.7) [-3.1]
Non-financial corporations DC	0.3 (0.2) [1.5]	0.8 (0.3) [2.5]	1.2 (0.3) [4.0]	0.8 (0.3) [2.6]	0.0 (0.3) [0.0]	-2.7 (0.3) [-10.4]	-3.6 (0.8) [-4.8]	-4.3 (0.4) [-11.6]	-2.2 (0.6) [-3.7]
Non-financial corporations FC	0.7 (0.2) [3.3]	0.8 (0.3) [2.6]	1.2 (0.3) [3.5]	1.5 (0.3) [5.1]	-0.4 (0.5) [-0.8]	-2.1 (0.6) [-3.6]	-2.0 (0.5) [-3.8]	-1.6 (0.5) [-3.1]	-3.2 (1.1) [-3]
Non-financial corporations FC hedged	0.9 (0.2) [5.5]	1.2 (0.2) [4.7]	1.0 (0.2) [4.3]	1.4 (0.2) [5.8]	1.0 (0.5) [2.1]	-2.1 (0.4) [-4.8]	-2.2 (0.4) [-5.7]	-2.1 (0.5) [-4.1]	-0.9 (0.6) [-1.4]
Non-financial corporations FC unhedged	0.0 (0.1) [0.4]	0.6 (0.2) [3.4]	0.6 (0.2) [2.6]	-0.2 (0.4) [-0.6]	0.4 (0.5) [0.8]	-2.8 (0.7) [-4.0]	-3.0 (0.4) [-7.1]	-2.5 (0.4) [-6.4]	-1.1 (1.0) [-1.1]

Table 4.A4 Results of multivariate QR models for NFCs

Source: Authors' calculations.

Note: The table provides the sensitivity of NPLs condition on macroeconomics and bank variables for selected percentiles, with standard errors in ( ) and t-statistics in [ ].

	τ = 1%	τ = 5%	τ = 10%	τ = 25%	τ = 50%	τ = 75%	τ = 90%	τ = 95%	τ = 99%
Gross domestic product growth									
Households	0.0 (0.0) [-0.3]	0.0 (0.0) [-1.6]	0.0 (0.0) [-0.4]	-0.1 (0.0) [-4.0]	-0.3 (0.1) [-4.7]	-1.1 (0.1) [-11.1]	-1.2 (0.2) [-5.6]	-1.4 (0.3) [-5.4]	-1.8 (0.7) [-2.8]
Households DC	0.0 (0.0) [0.8]	0.0 (0.0) [1.0]	0.0 (0.0) [0.5]	-0.1 (0.0) [-2.3]	-0.2 (0.1) [-2.6]	-0.4 (0.2) [-2.6]	-0.7 (0.2) [-3.4]	-1.2 (0.2) [-5.3]	-2.5 (0.1) [-16.7]
Households FC	-0.1 (0.0) [-7.1]	-0.1 (0.0) [-5.0]	-0.1 (0.0) [-3.4]	-0.1 (0.0) [-3.8]	-0.2 (0.1) [-3.0]	-1.1 (0.1) [-8.3]	-1.5 (0.2) [-9.8]	-1.6 (0.2) [-6.5]	-1.3 (0.5) [-2.9]
Households FC hedged	-0.1 (0.0) [-3.9]	-0.1 (0.0) [-3.0]	-0.1 (0.0) [-4.2]	-0.1 (0.0) [-3.1]	-0.3 (0.1) [-5.0]	-1.0 (0.2) [-5.0]	-1.6 (0.2) [-7.3]	-2.2 (0.2) [-8.9]	-3.5 (0.3) [-12.8]
Households FC unhedged	-0.1 (0.0) [-8.3]	-0.1 (0.0) [-3.4]	-0.1 (0.0) [-4.3]	-0.2 (0.0) [-5.0]	-0.3 (0.1) [-2.3]	-0.8 (0.2) [-3.6]	-1.2 (0.2) [-5.3]	-1.3 (0.2) [-5.3]	0.4 (2.5) [0.2]
Exchange rate growth									
Households	0.4 (0.0) [12.4]	0.2 (0.0) [7.3]	0.3 (0.0) [8.2]	0.2 (0.0) [6.2]	0.5 (0.1) [6.0]	1.4 (0.1) [12.3]	1.8 (0.1) [22.3]	2.2 (0.2) [13.8]	2.5 (0.3) [7.6]
Households DC	0.3 (0.0) [8.3]	0.4 (0.1) [5.9]	0.4 (0.0) [8.4]	0.4 (0.0) [7.4]	0.6 (0.1) [8.1]	0.7 (0.1) [4.9]	1.2 (0.2) [7.1]	1.6 (0.2) [8.6]	2.8 (0.2) [11.6]
Households FC	0.3 (0.0) [13.1]	0.3 (0.0) [8.6]	0.3 (0.0) [7.5]	0.2 (0.1) [3.0]	0.3 (0.1) [3.8]	1.4 (0.1) [10.4]	2.0 (0.1) [16.0]	2.3 (0.1) [16.6]	2.2 (0.2) [9.7]
Households FC hedged	0.1 (0.0) [2.4]	0.2 (0.0) [3.3]	0.2 (0.1) [4.2]	0.4 (0.1) [6.3]	0.7 (0.1) [8.0]	1.6 (0.1) [10.7]	2.4 (0.1) [18.0]	2.7 (0.2) [15.2]	4.8 (0.5) [9.9]
Households FC unhedged	0.1 (0.0) [4.8]	0.2 (0.0) [5.2]	0.1 (0.0) [2.7]	0.0 (0.1) [0.5]	0.3 (0.1) [2.9]	1.1 (0.2) [6.0]	1.7 (0.2) [10.1]	1.7 (0.3) [6.5]	2.6 (0.5) [5.0]
Loans interest rate									
Households	0.3 (0.1) [5.3]	0.6 (0.1) [11.2]	0.6 (0.1) [13.9]	0.6 (0.1) [14.3]	0.4 (0.1) [4.4]	-0.6 (0.1) [-4.0]	-0.8 (0.2) [-4.6]	-0.9 (0.5) [-1.9]	-1.1 (2.1) [-0.5]
Households DC	0.2 (0.0) [8.1]	0.2 (0.0) [4.2]	0.3 (0.1) [5.5]	0.4 (0.1) [6.7]	0.5 (0.1) [5.3]	0.7 (0.2) [3.0]	0.1 (0.3) [0.5]	-0.6 (0.3) [-2.0]	-2.0 (0.6) [-3.6]
Households FC	0.3 (0.0) [11.9]	0.4 (0.0) [9.9]	0.5 (0.1) [9.9]	0.5 (0.1) [9.1]	0.7 (0.1) [6.4]	-0.4 (0.1) [-3.3]	-1.3 (0.1) [-11.5]	-1.5 (0.2) [-9.2]	-0.4 (0.9) [-0.4]
Households FC hedged	0.0 (0.0) [0.9]	0.1 (0.1) [1.0]	0.3 (0.1) [4.7]	0.4 (0.1) [5.6]	0.1 (0.1) [1.5]	-1.0 (0.2) [-4.5]	-1.6 (0.3) [-5.5]	-2.1 (0.4) [-5.7]	0.5 (1.9) [0.3]
Households FC unhedged	0.3 (0.0) [6.0]	0.5 (0.1) [8.6]	0.5 (0.1) [8.8]	0.6 (0.1) [6.9]	0.9 (0.1) [6.2]	0.1 (0.2) [0.6]	-0.7 (0.2) [-4.8]	-1.2 (0.2) [-7.6]	1.3 (1.1) [1.2]
Capital adequacy ratios									
Households	0.0 (0.0) [1.5]	0.0 (0.0) [1.6]	0.0 0 [-0.3]	-0.1 (0.1) [-2.0]	0.2 (0.1) [2.6]	0.6 (0.1) [21.7]	0.7 (0.0) [15.9]	1.2 (0.3) [4.1]	1.1 (1.2) [0.9]
Households DC	0.0 (0.0) [2.2]	0.0 (0.0) [-0.1]	-0.1 0.0 [-3.2]	-0.1 (0.1) [-4.0]	0.0 (0.1) [-0.2]	0.7 (0.1) [10.2]	0.9 (0.0) [32.7]	0.9 (0.1) [10.3]	0.7 (0.1) [5.8]
Households FC	0.1 (0.0) [5.6]	0.1 (0.0) [2.8]	0.0 0.0 [1.6]	0.0 (0.1) [0.9]	0.2 (0.0) [4.8]	0.3 (0.1) [7.5]	0.9 (0.1) [7.0]	1.0 (0.2) [5.8]	1.1 (0.5) [2.5]
Households FC hedged	0.0 (0.0) [-0.7]	0.0 (0.0) [-0.2]	0.0 0.0 [0.6]	0.2 (0.1) [2.8]	0.4 (0.0) [9.0]	0.6 (0.1) [6.5]	1.2 (0.2) [5.6]	1.4 (0.2) [5.8]	2.2 (0.4) [6.0]
Households FC unhedged	0.1 (0.0) [5.1]	0.1 (0.0) [2.7]	0.1 0.0 [2.2]	0.1 (0.1) [1.5]	0.2 (0.0) [4.9]	0.3 (0.2) [1.9]	0.9 (0.2) [4.4]	1.1 (0.2) [6.0]	1.8 (0.6) [3.3]
Return on assets									
Households	0.7 (0.2) [4.5]	0.6 (0.2) [2.9]	0.5 (0.2) [2.5]	0.1 (0.1) [1.0]	-0.8 (0.2) [-3.4]	-2.0 (0.2) [-12.3]	-2.0 (0.2) [-12.3]	-2.0 (0.4) [-4.7]	-2.5 (1.1) [-2.3]
Households DC	0.4 (0.2) [2.2]	0.2 (0.3) [0.6]	0.0 (0.2) [0.1]	-0.3 (0.2) [-2.2]	-1.0 (0.2) [-5.9]	-2.6 (0.2) [-12.5]	-3.8 (0.2) [-18.0]	-4.2 (0.3) [-15.3]	-3.7 (0.5) [-7.6]
Households FC	0.1 (0.1) [0.7]	0.3 (0.2) [2.0]	0.4 (0.2) [2.3]	-0.1 (0.2) [-0.8]	-0.7 (0.2) [-3.8]	-0.8 (0.2) [-4.2]	-1.2 (0.3) [-4.9]	-1.1 (0.3) [-3.2]	-1.2 (0.5) [-2.2]
Households FC hedged	0.5 (0.1) [3.5]	0.5 (0.2) [2.2]	0.5 (0.3) [1.6]	0.0 (0.2) [-0.1]	-0.2 (0.2) [-0.8]	-1.5 (0.3) [-4.4]	-3.8 (0.3) [-12.9]	-4.2 (0.3) [-13.9]	-7.8 (0.8) [-9.6]
Households FC unhedged	-0.4 (0.1) [-3.2]	-0.3 (0.2) [-1.9]	-0.2 (0.2) [-1.0]	-0.3 (0.2) [-1.5]	-0.6 (0.2) [-2.6]	-0.1 (0.3) [-0.5]	-0.9 (0.5) [-1.7]	-0.7 (0.6) [-1.2]	-0.4 (0.8) [-0.5]

Table 4.A5 Results of multivariate QR models for households

Source: Authors' calculations.
Note: The table provides the sensitivity of NPLs condition on macroeconomics and bank variables for selected percentiles, with standard errors in ( ) and t-statistics in [ ].

	τ = 1%	τ = 5%	τ = 10%	τ = 25%	τ = 50%	τ = 75%	τ = 90%	τ = 95%	τ = 99%
Gross domestic product growth									
Households	0.1 (0.0) [3.2]	0.3 (0.1) [5.0]	0.4 (0.1) [4.9]	0.4 (0.1) [5.9]	1.1 (0.1) [9.3]	1.8 (0.3) [7.3]	1.9 (0.4) [4.3]	-0.1 (2.5) [0.0]	-0.9 (2.0) [-0.5]
Households DC	0.3 (0.1) [5.4]	0.3 (0.1) [4.3]	0.4 (0.1) [4.5]	0.6 (0.1) [7.4]	0.8 (0.1) [7.9]	1.1 (0.2) [5.5]	1.2 (0.2) [7.1]	1.8 (0.4) [4.7]	-0.9 (5.1) [-0.2]
Households FC	0.1 (0.0) [3.4]	0.2 (0.1) [3.2]	0.3 (0.1) [3.6]	0.4 (0.1) [5.2]	1.2 (0.1) [8.7]	2.1 (0.2) [10.8]	2.6 (0.2) [12.2]	0.2 (2.1) [0.1]	-0.8 (1.5) [-0.5]
Households FC hedged	0.3 (0.1) [3.7]	0.4 (0.1) [3.3]	0.5 (0.1) [4.3]	0.7 (0.1) [7.7]	1 (0.1) [6.7]	1.7 (0.2) [8.5]	2.5 (0.3) [7.5]	3.3 (0.3) [12.2]	5.9 (0.8) [7.1]
Households FC unhedged	0.3 (0.1) [3.7]	0.4 (0.1) [3.3]	0.5 (0.1) [4.3]	0.7 (0.1) [7.7]	1.0 (0.1) [6.7]	1.7 (0.2) [8.5]	2.5 (0.3) [7.5]	3.3 (0.3) [12.2]	5.9 (0.8) [7.1]
Exchange rate growth									
Households	0.1 (0.1) [2.1]	0.4 (0.1) [4.4]	0.5 (0.1) [4.3]	0.6 (0.1) [5.4]	1.4 (0.2) [7.6]	3.0 (0.2) [15.1]	3.1 (0.2) [12.3]	2.2 (1.0) [2.2]	3.6 (0.6) [5.8]
Households DC	0.7 (0.1) [7.4]	0.6 (0.1) [5.1]	0.6 (0.1) [4.7]	1.0 (0.1) [8.2]	1.2 (0.2) [6.8]	1.8 (0.2) [7.6]	1.6 (0.3) [5.9]	2.1 (0.5) [4.1]	4.1 (1.8) [2.2]
Households FC	0.3 (0.1) [4.6]	0.2 (0.1) [2.2]	0.3 (0.1) [2.4]	0.5 (0.1) [3.9]	1.6 (0.2) [6.9]	3.0 (0.3) [10.9]	3.5 (0.2) [19.7]	2.5 (0.9) [2.6]	3.1 (0.6) [5.0]
Households FC hedged	0.3 (0.1) [1.9]	0.5 (0.2) [2.2]	0.7 (0.2) [3.7]	1.0 (0.1) [7.7]	1.5 (0.2) [7.2]	2.3 (0.3) [8.0]	3.4 (0.3) [10.0]	4.2 (0.4) [10.0]	8.5 (1.7) [5.0]
Households FC unhedged	0.3 (0.1) [1.9]	0.5 (0.2) [2.2]	0.7 (0.2) [3.7]	1.0 (0.1) [7.7]	1.5 (0.2) [7.2]	2.3 (0.3) [8.0]	3.4 (0.3) [10.0]	4.2 (0.4) [10.0]	8.5 (1.7) [5.0]
Loans interest rate									
Households	0.6 (0.1) [10.3]	0.2 (0.1) [2.1]	0.2 (0.1) [1.9]	0.1 (0.1) [1.7]	-0.1 (0.1) [-1.4]	-0.7 (0.1) [-7.4]	-1.3 (0.1) [-10.3]	-1.4 (0.5) [-2.6]	-1.4 (0.9) [-1.6]
Households DC	0.2 (0.0) [4.7]	0.1 (0.1) [1.6]	0.0 (0.1) [0.0]	-0.2 (0.1) [-3.4]	0.0 (0.1) [-0.2]	0.2 (0.2) [0.7]	0.0 (0.2) [0.1]	-1.0 (0.5) [-2.0]	-1.2 (1.5) [-0.8]
Households FC	0.1 (0.1) [2.0]	0.0 (0.1) [0.2]	0.0 (0.1) [0.2]	0.0 (0.1) [0.0]	0.0 (0.1) [-0.1]	-0.8 (0.1) [-6.3]	-1.4 (0.1) [-18.9]	-1.5 (0.2) [-7.8]	-0.7 (0.7) [-1.0]
Households FC hedged	-0.3 (0.1) [-5.0]	-0.5 (0.1) [-3.9]	-0.1 (0.1) [-1.4]	-0.1 (0.1) [-0.7]	-0.3 (0.1) [-3.0]	-1.3 (0.1) [-8.8]	-2.1 (0.2) [-11.3]	-2.6 (0.2) [-10.4]	0.1 (3.2) [0.0]
Households FC unhedged	-0.3 (0.1) [-5.0]	-0.5 (0.1) [-3.9]	-0.1 (0.1) [-1.4]	-0.1 (0.1) [-0.7]	-0.3 (0.1) [-3.0]	-1.3 (0.1) [-8.8]	-2.1 (0.2) [-11.3]	-2.6 (0.2) [-10.4]	0.1 (3.2) [0.0]
Capital adequacy ratios									
Households	0.1 (0.0) [3.6]	0.0 (0.0) [-1.1]	0.0 (0.0) [-1.7]	-0.1 (0.0) [-1.8]	0.4 (0.1) [5.8]	0.7 (0.0) [19.7]	0.8 (0.1) [8.2]	1.2 (0.3) [4.6]	1.5 (0.5) [3.0]
Households DC	0.0 (0.0) [-0.5]	-0.1 (0.0) [-3.0]	-0.1 (0.0) [-3.1]	-0.1 (0.0) [-4.3]	0.2 (0.1) [4.4]	0.9 (0.0) [17.4]	0.9 (0.0) [29.9]	0.9 (0.0) [21.8]	1.8 (0.8) [2.2]
Households FC	0.0 (0.0) [-0.1]	0.0 (0.0) [-0.5]	0.0 (0.0) [-0.4]	0.1 (0.0) [2.7]	0.3 (0.0) [8.5]	0.3 (0.0) [6.7]	1.0 (0.1) [8.8]	1.0 (0.2) [6.5]	1.2 (0.3) [4.6]
Households FC hedged	-0.1 (0.1) [-1.4]	-0.1 (0.1) [-0.7]	0.1 (0.1) [0.7]	0.3 (0.0) [8.7]	0.5 (0.0) [12.9]	1.0 (0.1) [8.2]	1.2 (0.2) [7.0]	1.5 (0.4) [4.1]	2.2 (0.4) [5.4]
Households FC unhedged	-0.1 (0.1) [-1.4]	-0.1 (0.1) [-0.7]	0.1 (0.1) [0.7]	0.3 (0.0) [8.7]	0.5 (0.0) [12.9]	1 (0.0) [8.2]	1.2 (0.2) [7.0]	1.5 (0.4) [4.1]	2.2 (0.4) [5.4]
Return on assets									
Households	0.5 (0.1) [4.3]	0.2 (0.2) [0.8]	-0.2 (0.2) [-0.9]	-0.5 (0.1) [-3.3]	-1.4 (0.2) [-8.3]	-2.3 (0.2) [-10.4]	-2.3 (0.3) [-8.4]	-2.1 (0.6) [-3.5]	-1.9 (0.7) [-2.6]
Households DC	0.0 (0.2) [0.2]	0.0 (0.2) [0.0]	0.0 (0.2) [-0.1]	-0.8 (0.1) [-5.5]	-1.6 (0.1) [-14.1]	-3.3 (0.2) [-16.2]	-4.1 (0.3) [-14.1]	-5.4 (0.6) [-8.8]	-3.5 (0.9) [-4.0]
Households FC	0.1 (0.1) [2.0]	-0.3 (0.1) [-3.0]	-0.2 (0.1) [-1.9]	-0.4 (0.1) [-2.8]	-0.6 (0.2) [-2.7]	-1.2 (0.2) [-5.2]	-1.9 (0.2) [-7.7]	-1.1 (0.6) [-1.9]	-1.1 (0.6) [-1.7]
Households FC hedged	-0.1 (0.1) [-0.8]	0.2 (0.2) [1.0]	0.0 (0.2) [-0.2]	-0.2 (0.2) [-1.5]	-0.4 (0.3) [-1.4]	-2.8 (0.3) [-8.1]	-4.8 (0.3) [-14.2]	-6.9 (0.6) [-11.5]	-11.1 (1.5) [-7.4]
Households FC unhedged	-0.1 (0.1) [-0.8]	0.2 (0.2) [1.0]	0.0 (0.2) [-0.2]	-0.2 (0.2) [-1.5]	-0.4 (0.3) [-1.4]	-2.8 (0.3) [-8.1]	-4.8 (0.3) [-14.2]	-6.9 (0.6) [-11.5]	-11.1 (1.5) [-7.4]
Remittances									
Households	-0.2 (0.1) [-1.3]	-0.1 (0.2) [-0.8]	-0.2 (0.2) [-1.2]	-0.2 (0.2) [-1.1]	-0.6 (0.3) [-1.8]	-1.6 (0.4) [-3.8]	0.3 (0.7) [0.4]	2.3 (1.3) [1.8]	-0.9 (1.3) [-0.7]
Households DC	-0.1 (0.2) [-0.8]	0.2 (0.2) [1.2]	0.3 (0.2) [1.3]	0.0 (0.2) [0.2]	-0.6 (0.3) [-2.3]	-1.4 (0.3) [-4.3]	0.5 (0.7) [0.7]	1.2 (0.7) [1.6]	-1.5 (2.6) [-0.6]
Households FC	-0.3 (0.1) [-3.2]	-0.1 (0.2) [-0.6]	-0.1 (0.2) [-0.4]	0.0 (0.2) [0.0]	-1.2 (0.4) [-3.2]	-1.0 (0.5) [-1.9]	0.0 (0.4) [0.1]	1.9 (1.2) [1.5]	0.2 (0.9) [0.2]
Households FC hedged	-0.1 (0.3) [-0.4]	0.0 (0.5) [0.1]	-0.4 (0.3) [-1.3]	-1.0 (0.2) [-4.4]	-0.4 (0.4) [-0.9]	1.0 (0.5) [2.1]	1.8 (0.7) [2.5]	2.1 (0.9) [2.4]	-3.1 (3.1) [-1.0]
Households FC unhedged	-0.1 (0.3) [-0.4]	0.0 (0.5) [0.1]	-0.4 (0.3) [-1.3]	-1.0 (0.2) [-4.4]	-0.4 (0.4) [-0.9]	1.0 (0.5) [2.1]	1.8 (0.7) [2.5]	2.1 (0.9) [2.4]	-3.1 (3.1) [-1.0]

Table 4.A6 Results of multivariate QR models for remittance-exposed households

Source: Authors' calculations.

Note: The table provides the sensitivity of NPLs condition on macroeconomics and bank variables for selected percentiles, with standard errors in ( ) and t-statistics in [ ].

	Private sector			Non-financial corporations			Households		
	Model I	Model II	Model III	Model I	Model II	Model III	Model I	Model II	Model III
NPLs									
Gross domestic product growth	-0.4 (0.1) [-3.6]	-2.1 (0.5) [-4.5]	-0.1 (0.1) [-2.0]	-0.5 (0.1) [-3.9]	-2.8 (0.5) [-5.2]	-0.2 (0.1) [-2.2]	-0.2 (0.1) [-2.7]	-1.2 (0.4) [-3.5]	0.0 (0.0) [0.1]
Exchange rate growth	0.8 (0.1) [6.2]	-0.7 (0.3) [-2.2]	0.1 (0.1) [0.7]	0.8 (0.2) [4.9]	-0.9 (0.4) [-2.6]	0.0 (0.2) [0.1]	0.6 (0.1) [5.6]	-0.3 (0.2) [-1.4]	0.0 (0.1) [-0.3]
Loans interest rate	0.5 (0.1) [3.7]	-2.5 (0.2) [-14.9]	1.0 (0.2) [4.5]	0.3 (0.2) [1.9]	-3.2 (0.2) [-16.3]	1.2 (0.3) [4.3]	0.2 (0.1) [2.1]	-1.5 (0.1) [-12.5]	-0.8 (0.2) [-5.1]
Capital adequacy ratios	0.5 (0.0) [10.8]	0.7 (0.0) [14.3]	0.0 (0.1) [0.7]	0.4 (0.1) [8.1]	0.6 (0.1) [10.8]	0.1 (0.1) [0.9]	0.4 (0.0) [13.3]	0.5 (0.0) [16.5]	0.0 (0.0) [0.8]
Return on assets	-1.6 (0.2) [-7.3]	-2.8 (0.3) [-11]	1.2 (0.3) [4.7]	-1.6 (0.3) [-6.1]	-3.7 (0.3) [-12.5]	2.5 (0.3) [7.5]	-1.3 (0.2) [-8.7]	-1.5 (0.2) [-8.7]	-0.2 (0.2) [-1.3]
Remittances							0.1 (0.0) [3.9]	0.0 (0.0) [0.5]	0.3 (0.0) [10.7]
NPLs DC									
Gross domestic product growth	-0.3 (0.1) [-3.1]	-1.5 (0.5) [-2.9]	-0.2 (0.1) [-2.2]	-0.5 (0.1) [-3.8]	-2.2 (0.6) [-3.7]	-0.3 (0.1) [-2.9]	-0.2 (0.1) [-2.3]	-1.0 (0.4) [-2.4]	0.0 (0.0) [-0.3]
Exchange rate growth	0.7 (0.1) [4.9]	-0.3 (0.3) [-0.8]	-0.1 (0.1) [-0.6]	0.6 (0.2) [3.4]	-0.5 (0.4) [-1.2]	-0.4 (0.2) [-1.9]	0.6 (0.1) [4.9]	-0.1 (0.2) [-0.4]	0.0 (0.1) [0.0]
Loans interest rate	0.0 (0.1) [0.2]	-2.4 (0.2) [-12.5]	0.1 (0.3) [0.3]	-0.3 (0.2) [-1.8]	-3.1 (0.2) [-14.3]	-0.4 (0.4) [-1.0]	0.3 (0.1) [3.0]	-1.3 (0.1) [-8.7]	-0.6 (0.2) [-3.7]
Capital adequacy ratios	0.4 (0.0) [9.2]	0.5 (0.1) [9.7]	0.2 (0.1) [2.7]	0.4 (0.1) [7.0]	0.4 (0.1) [6.1]	0.4 (0.1) [4.2]	0.5 (0.0) [15.0]	0.7 (0.0) [17.8]	-0.1 (0.0) [-1.9]
Return on assets	-2.3 (0.2) [-10.3]	-3.6 (0.3) [-12.9]	0.5 (0.3) [1.7]	-1.8 (0.3) [-6.2]	-3.9 (0.3) [-12]	2.3 (0.4) [5.5]	-2.2 (0.2) [-13.6]	-2.3 (0.2) [-10.9]	-1.1 (0.2) [-6.6]
Remittances							0.1 (0.0) [2.9]	0.0 (0.0) [0.3]	0.2 (0.0) [9.2]
NPLs FC									
Gross domestic product growth	-0.4 (0.1) [-3.9]	-2.2 (0.5) [-4.6]	-0.2 (0.1) [-2.0]	-0.5 (0.1) [-4.0]	-3.0 (0.6) [-5.0]	-0.2 (0.1) [-2.0]	-0.2 (0.1) [-2.6]	-1.1 (0.4) [-2.7]	0.0 (0.1) [-0.3]
Exchange rate growth	0.8 (0.1) [5.5]	-1.0 (0.3) [-3.2]	0.2 (0.1) [1.6]	0.8 (0.2) [4.3]	-1.2 (0.4) [-3.1]	0.2 (0.2) [1.1]	0.5 (0.1) [4.3]	-0.4 (0.2) [-1.8]	-0.1 (0.1) [-1.0]
Loans interest rate	0.6 (0.1) [5.2]	-2.0 (0.2) [-11.6]	1.0 (0.2) [4.5]	0.7 (0.2) [4.2]	-2.9 (0.2) [-13.4]	2.2 (0.3) [7.5]	0.0 (0.1) [0.4]	-1.6 (0.1) [-11.7]	-0.7 (0.2) [-3.7]
Capital adequacy ratios	0.6 (0.0) [12.8]	0.8 (0.0) [15.8]	0.1 (0.1) [1.1]	0.5 (0.1) [9.1]	0.8 (0.1) [13.4]	-0.1 (0.1) [-1.8]	0.2 (0.0) [7.2]	0.3 (0.0) [6.8]	0.2 (0.0) [3.5]
Return on assets	-1.3 (0.2) [-5.8]	-2.5 (0.3) [-9.7]	1.6 (0.3) [6.1]	-1.4 (0.3) [-5.0]	-3.4 (0.3) [-10.5]	2.7 (0.3) [8.3]	-0.5 (0.2) [-3.1]	-1.1 (0.2) [-5.3]	0.8 (0.2) [4.3]
Remittances							0.1 (0) [5.4]	0.0 (0.0) [1.2]	0.3 (0.0) [10.0]
NPLs FC hedged									
Gross domestic product growth	-0.3 (0.1) [-3.0]	-1.5 (0.5) [-2.8]	-0.1 (0.1) [-1.5]	-0.3 (0.1) [-2.8]	-1.7 (0.6) [-2.6]	-0.1 (0.1) [-1.3]	-0.2 (0.1) [-2.0]	-1.9 (0.9) [-2.0]	-0.1 (0.1) [-1.7]
Exchange rate growth	0.7 (0.1) [5.0]	-0.9 (0.4) [-2.6]	0.3 (0.1) [2.3]	0.8 (0.2) [4.6]	-1.1 (0.4) [-2.4]	0.3 (0.2) [1.7]	0.8 (0.2) [3.9]	-0.1 (0.6) [-0.2]	0.0 (0.1) [0.0]
Loans interest rate	0.6 (0.1) [4.4]	-2.1 (0.2) [-10.5]	1.6 (0.2) [6.3]	0.8 (0.2) [5.1]	-2.4 (0.2) [-10.1]	1.9 (0.3) [6.8]	-0.3 (0.2) [-1.8]	-2.5 (0.3) [-7.7]	-0.1 (0.2) [-0.5]
Capital adequacy ratios	0.6 (0.0) [11.9]	0.8 (0.1) [13.7]	0.1 (0.1) [1.9]	0.5 (0.1) [9.4]	0.8 (0.1) [11.4]	0.0 (0.1) [0.1]	0.5 (0.1) [9.6]	0.4 (0.1) [5.2]	0.8 (0.1) [13.3]
Return on assets	-1.2 (0.2) [-5.2]	-3.2 (0.3) [-10.7]	2.5 (0.3) [8.7]	-1.4 (0.3) [-5.3]	-3.5 (0.4) [-10.0]	2.7 (0.3) [8.6]	-1.8 (0.3) [-6.3]	-2.8 (0.5) [-5.9]	0.3 (0.2) [1.1]
Remittances							0.3 (0.0) [5.4]	0.3 (0.1) [2.6]	0.3 (0.0) [7.9]
NPLs FC unhedged									
Gross domestic product growth	-0.4 (0.1) [-3.2]	-2.5 (0.6) [-4.2]	-0.1 (0.1) [-1.3]	-0.5 (0.1) [-3.6]	-3.1 (0.8) [-4.0]	-0.2 (0.1) [-1.7]	-0.3 (0.1) [-3.3]	-0.3 (0.5) [-0.7]	-0.1 (0.1) [-1.8]
Exchange rate growth	0.8 (0.2) [4.9]	-1.2 (0.4) [-3.0]	0.1 (0.2) [0.6]	0.7 (0.2) [3.2]	-1.6 (0.5) [-3.2]	0.1 (0.2) [0.3]	0.2 (0.1) [1.3]	-0.5 (0.3) [-1.7]	-0.4 (0.1) [-2.7]
Loans interest rate	0.8 (0.1) [5.7]	-1.5 (0.2) [-6.8]	0.0 (0.3) [-0.1]	0.4 (0.2) [2.2]	-2.3 (0.3) [-8.1]	0.1 (0.4) [0.3]	0.4 (0.1) [3.4]	-0.8 (0.2) [-4.7]	-0.7 (0.2) [-3.1]
Capital adequacy ratios	0.7 (0.1) [12.9]	0.8 (0.1) [13.1]	0.2 (0.1) [3.1]	0.5 (0.1) [8.4]	0.7 (0.1) [9.1]	0.1 (0.1) [0.9]	0.3 (0.0) [8.2]	0.3 (0.0) [6.9]	0.2 (0.1) [3.8]
Return on assets	-0.7 (0.3) [-2.8]	-1.3 (0.3) [-3.9]	1.2 (0.3) [3.7]	-0.7 (0.3) [-2.2]	-1.8 (0.4) [-4.3]	2.0 (0.4) [4.6]	-0.4 (0.2) [-2.4]	-1.2 (0.2) [-5.1]	1.1 (0.2) [4.3]
Remittances							0.1 (0.0) [3.0]	-0.1 (0.1) [-2.0]	0.2 (0.0) [7.0]

Table 4.A7 Results of panel least square models for different samples

Source: Authors' calculations.
Note: The table provides the estimated parameters using the least square technique for different samples (Model I: 2009-2023; Model II: 2009-2015; Model III: 2016-2023), with standard errors in ( ) and t-statistics in [ ].

Chapter 5

Conclusion

This dissertation examines key macroeconomic challenges that affect Albania, focusing on three interconnected themes: the impact of the COVID-19 pandemic on macrofinancial stability, the inflationary effects of migration and remittances, and the role of FX hedging in mitigating credit risk in a highly euroized financial system. The overarching motivation behind this research was to explore how external shocks - such as pandemic, demographic changes, and exchange rate fluctuations - interact with Albania's macrofinancial system, labor market, and financial sector.

The first study developed a macrofinancial forecasting model to assess Albania's economic trajectory during the COVID-19 pandemic. The findings reinforced the limitations of traditional macroeconomic models in capturing large exogenous shocks, particularly in times of uncertainty when government interventions heavily influence economic outcomes. By incorporating quantile regressions to generate uncertainty bands, the study provided a more flexible approach to forecasting during crises.

The second study investigated the relationship between migration, remittances, and inflation. It established a direct feedback loop where persistent population decline exacerbates labor market constraints, leading to inflationary pressures. The role of remittances in further fueling inflation was also highlighted, emphasizing the need for structural policy responses, such as increasing labor force participation and adjusting the retirement age.

The third study examined the impact of exchange rate fluctuations on credit risk, differentiating between hedged and unhedged borrowers. The analysis showed that unhedged NFCs were particularly vulnerable to currency depreciation, whereas household borrowers exhibited unexpected differences in credit risk depending on their hedging strategies. These findings underscore the importance of developing more effective risk management tools in highly euroized banking environments.

This research makes several important contributions to the literature on macroeconomic resilience in small open economies. First, it demonstrates the need for flexible macrofinancial models for crisis forecasting, particularly in emerging markets. Second, it provides empirical evidence on how demographic trends and remittance inflows contribute to inflationary pressures, offering a unique perspective on the structural constraints shaping Albania's economic future. Third, it advances understanding of financial stability risks linked to FX exposure, emphasizing the heterogenous effects of hedging mechanisms among different economic agents using a unique granular dataset.

Future research could further refine macrofinancial modeling frameworks by incorporating behavioral responses to crises and policy changes into forecasting models. The study on migration and remittances suggests the need for deeper analysis of labor market dynamics, including more detailed transmission channels, gender-specific workforce participation trends, and policy interventions that could mitigate inflationary pressures. Finally, the findings on FX hedging strategies highlight the need for further investigation of financial literacy and risk management practices among borrowers, particularly within emerging markets facing structural euroization.

Together, these studies provide valuable information on Albania's macroeconomic resilience and contribute to broader discussions on economic stability in emerging economies facing systemic shocks.

Chapter 6

Responses to opponents' reports

I would like to express my sincere gratitude to all three opponents for the time and effort they devoted to reviewing my thesis. Their constructive feedback has been essential in enhancing the quality and clarity of this work. In what follows, I provide my detailed responses to their comments and suggestions. The opponents' remarks are presented in italics.

6.1 Prof. Cedric Tille Ph.D. (Graduate Institute of International and Development Studies)

The thesis consists of three chapters of empirical macroeconomic analyses applied to Albania. The various questions are relevant, show a solid knowledge of the literature, and the analysis follows rigorous steps. In my comments below, I provide feedback for each chapter. Before doing so, I start by answering the questions that listed above.

a) *Can you recognize an original contribution of the author?*

   Yes. The papers all offer substantial analyzes and contribution to economic knowledge. The make material contributions to the literature.

b) *Is the thesis based on relevant references?*

   Yes. All chapters include a detailed review of the literature that shows a solid grasp of what has been done, and a clear sense of what the new analysis brings.

c) *Is the thesis defendable at your home institution or another respected institution where you gave lectures?*

Yes. I have several comments for improvements, as detailed below for each chapter, but these denote improvements to strengthen the analysis and do not imply that the analysis would be at a level that would not warrant defense.

d) *Do the results of the thesis allow their publication in a respected economic journal?*

Yes. My understanding is that two chapters are published. If I was a referee for the chapters, my recommendation would be for favorable revisions, meaning that the chapters make relevant contributions, but could be strengthened.

e) *Are there any additional major comments on what should be improved?*

I list for each chapters several comments. These pertain primarily for clarification, and strengthening of the presentation. I find the last two chapters clearest, and the first one is the part of the thesis that can be improved most.

f) *What is your overall assessment of the thesis? (a) I recommend the thesis for defense without substantial changes, (b) the thesis can be defended after revision indicated in my comments, (c) not-defendable in this form.*

My understanding is that this question relates to the pre-defense of September 23. With this in mind, my recommendation is that I recommend the thesis for defense without substantial changes. My understanding is that on September 23 we will discuss the comments, and identify what could be strengthened in time for the final defense to take place later on. My approach being to provide a broad range of comments, I am fine with them not being all addressed by the final defense, and instead left for later improvements.

6.1.1 Chapter 2: Using Macrofinancial Models to Simulate Macroeconomic Developments During the COVID-19 Pandemic: The Case of Albania

The paper develops a macrofinancial model for Albania, based on quarterly data from 2010 to 2021. Based on this model, two sets of forecasts are built from 2020 onward.

The first is based on forecasted value for exogenous factors as of 2020, and the second based on the actual path of these factors. The paper argues that the realized values fall in the forecast confidence bands, which are built based on quantile regression.

The exercise is relevant and interesting, but I find that the paper can be challenging to follow. First, several elements that are in the appendix should be brought in the main text. This includes the equations of the model, as the description on pages 18-21 would be more transparent if the equation were presented then, instead of in the appendix. Second, I find the discussion of the estimation results on pages 21-22 short. The paper should provide more discussion of the estimated coefficients for the main equations.

To improve the readability and clarity of the paper, Section 2.3 *"Data used and the main features of the macrofinancial model"* has been reorganized into the Subsection 2.3.1 *"Data"* and the Subsection 2.3.2 *"The macrofinancial model"*. The main equations have been moved from the appendix and are now presented within Subsection 2.3.2. Furthermore, the subsection has been thoroughly restructured, with the equations of the model organized into coherent blocks to enhance transparency and ease of understanding.

I find that the discussion of "add factors" limits the clarity of the discussion. My understanding is that these are the residuals from the estimation procedure. If so, they should be referred as such. Unsurprisingly, Figure 2.3 shows that these residuals were much larger in the Covid period than before.

We acknowledge that the terminology can indeed be confusing, given that in our case the add-factors are built upon residuals. However, we prefer to maintain the distinction in naming, as using the term add-factors better captures their forward-looking nature. While, residuals represent what the model has failed to capture in the

historical sample, add-factors reflect adjustments that we intentionally introduce so that important dynamics are not missed by the model. Essentially, for many indicators over the forecast horizon, the values assigned to add-factors differ from the historical residuals. In addition, it should be noted that the model parameters are estimated only up to 2019, whereas add-factors are applied through 2020, which further differentiates them from pure residuals.

My understanding is that the "pre covid" and "covid forecasts" both start from early 2020 and differ through the assumptions of the various exogenous variables. The first forecast relies on forecasted values from various sources and assumptions, and can thus be understood as an out-of-sample forecast. The second relies on the actual paths of the exogenous variables, which I understand as essentially an in-sample fit (and not a forecast strictly speaking). If my understanding is not accurate, then the paper should better explain how the exercises differ.

We appreciate this observation and agree that clarification is needed. In the pandemic forecast, our aim was to test the flexibility of the macrofinancial model under highly abnormal circumstances, as the COVID-19 pandemic. By providing the observed path of exogenous variables, we wanted to free the model from errors stemming from incorrect assumptions and to examine how the model would perform if the underlying information were indeed accurate. The exercise thus evaluates whether the estimated parameters and the transmission channels are sufficiently robust for the model to remain informative during periods of high uncertainty. For the same reason, we assign add-factors to selected indicators to capture both the increased uncertainty and the lack of information in the data included in the model. We concur that the pandemic forecast should not be regarded as a real forecast in the strict sense,

but rather as a quasi-forecast, reflecting the specific purpose of its construction. To improve the clarity, we added the Footnote 6.

I am also unclear about the role of add factors in these forecasts. For the exercise that the paper undertakes, I would take the actual variables until 2020 and then use the model estimates and assumptions of the paths of exogenous variables (that differ between the two forecasts) to compute forecasted paths of the endogenous variables from then on.

We recognize that the role of add-factors may not have been sufficiently clear in the initial version of the paper. Add-factors are forward-looking adjustments designed to account for elements that the model structure or the data may fail to capture, particularly during periods of high uncertainty. In the pandemic forecast, add-factors are assigned to selected indicators precisely to reflect this uncertainty and to prevent the model from overlooking dynamics that are critical in abnormal times. In the prepandemic forecast, the add-factors are assigned to provide the missing information is the set of exogenous variables i.e. the nature of the reconstruction plan for the earthquake of November 2019. We added the Footnotes 3-5 for the prepandemic add-factors. While for the pandemic forecast the explanation is in the Footnote 8.

Given my understanding of the two forecasts, I recommend putting a table with rows corresponding to the various exogenous variables, and one column describing the approach in the first forecast, with another column describing the approach in the second. This would allow the reader to more clearly contrast the various steps. In addition, figures 2.4 and 2.5 should be combined, showing the actual path of variables, and the two forecasts starting in 2020. By contrasting the two forecasts we would see the impact of the shocks to exogenous variables on the estimates, while the gap

between the in-sample fit and the actual variables would illustrate the ability of the model to generate accurate predictions on endogenous variables.

We thank the opponent for this constructive suggestion. To improve clarity, we have added the Table 2.A3 in Appendix 2.A that summarizes the assumption of exogenous variables in both forecasts, accompanied with the Footnote 7 that follows to the two approaches. Regarding the figures, we note that a combined version of Figure 2.4 and Figure 2.5 is already available in the Appendix 2.A (Figure 2.A3). To make this more transparent, we have added explicit references in the main text so that interested readers can consult the appendix for the combined presentation.

The paper argues that the model is a good fit. This is not so clear, as figure 2.5 shows sizable gaps from the actual paths. In addition, as the bands of confidence in figure 2.8 are quite broad, stating that the path is within the band is of limit comfort. Instead, it seems that the model finds it challenging to generate precise forecasts.

We would like to clarify that the paper does not claim that the model is a "good fit" Rather, as stated in the conclusion:

> "In particular, our exercise implies that a linear model may act as a quantifier for approximating the crisis evolution of economic and financial variables. However, its flexibility should not be taken for granted, as it is heavily affected by regulations. Indeed, running an adequate simulation requires proper expert judgment."

Our intention is to highlight the model's usefulness as a tool for approximation, not as a precise predictor. We fully admit the gaps observed in Figure 2.5 and the wide confidence bands in Figure 2.8 and Figure 2.9, which reflect both the inherent uncertainty of the environment and the limitations of the linear framework. What can be regarded as "good enough" performance in this context is inevitably blurred and subject to the degree of error one is willing to tolerate. Our exercise therefore

emphasizes the role of the model as a supportive instrument for analysis, rather than as a source of exact forecasts.

I have several secondary comments. The title as a typo, with Macrofinacial instead of Macrofinancial. There is a blank in the bullet points list of page 25. On page 8, the text refers to a "constrained" model. What is meant by that? Finally, the text should be clear at what is meant by a macro-financial model, as opposed to a macroeconomic model. Does it reflect the presence of some financial accelerator?

All typographical errors have been corrected, including the title and the formatting of the bullet points in Section 2.4. The word "constrained" is substituted with "preconstrained", that refers to a model specified and calibrated for normal times, i.e., before the COVID-19 pandemic hit the economy. Regarding the "macro-financial model", we have highlighted the paragraph *"The feedback loop between financial system and real sector"* in Subsection 2.3.2 to draw attention of what we mean by a macrofinancial model as the presence of the financial accelerator through the default probability channel amplifies the shocks.

6.1.2 Chapter 3: Migration, remittances, and wage-inflation spillovers: The case of Albania

The chapter estimates how changes in population (labor force participation) and remittances from abroad affect wage and price inflation. Using Phillips curve estimated by an ECM approach, the analysis shows that a lower participation raises inflation, as do remittances with a much larger effect of the later. This chapter provides a clear empirical analysis, and a novel contribution of the drivers of inflation in countries with large expatriate populations. I think that the presentation could be strengthened among many lines.

First, the paper should show figures with the paths of migration, remittances /% of GDP), and labor force participation. This would give a useful visual on the stylized facts, especially regarding whether these variables are pro- or counter-cyclical to Albanian GDP.

We added Figure 3.4 with the dynamics of migration, remittances and labor force participation and referred it in the text.

The text refers to the analysis as a "structural model" (page 80). I view it as a reduced form instead, focusing on the Phillips curves and not developing an overall general equilibrium. The wording should be adjusted.

"Structural model" is substituted with "reduced form model".

It should also be noticed that the effects could be a bit different in a general equilibrium, even though developing such a model would be for another paper. First, emigration also lowers demand, which limits the inflation effect (but only partially, as the remaining population consumes, but is less involved in the labor force). Second, it would show how the trade balance adjust, as remittances could be used to pay for imports, limiting the demand-supply imbalance in the economy. Also, a change in population spread over several years would change the potential output, and if the central bank recognizes this it could recalibrate its policy rule and prevent the inflation effect. The paper as it stands says nothing about monetary policy.

We agree that a proper general equilibrium framework would provide deeper insights into the demand-side effects of emigration, the role of remittances in the trade balance, the adjustment of potential output over time, and the implications for monetary policy. As you rightly point out, our current reduced form approach abstracts from these important interactions. To acknowledge this limitation more explicitly, we have expanded the Section 3.5.2 *"Limitations"* adding the following text:

> "Ideally, a general equilibrium model or a semi-structural model can provide thorough analysis of migration phenomena, taking into account several transmission channels and interactions with the economic sectors. However, given the linear nature of the model, partial analysis can be derived on the basis of assumptions in the set of exogenous variables in the model."

This addition complements the existing discussion, where we emphasize that our model framework keeps demand, monetary policy, and external conditions unchanged to highlight the potential upper-bound inflationary pressures. While this simplification makes the analysis tractable, it does come at the cost of omitting the mechanisms you highlight. We also point out that future research could endogenize demand, remittances, and policy reactions to capture more realistic dynamics.

Figure 3.6 clearly shows that remittances have a clearer impact than population. The text should emphasize this more (it is done several pages later, but could be done when discussing the figure).

We have revised the discussion of Figure 3.6 to emphasize more clearly that remittances exert a stronger impact than population changes. This adjustment was implemented directly in the text.

The middle column of table 3.4 shows a negative effect of remittances on wage inflation, it I read it correctly (coefficient -0.694). This it odd, as theoretically the positive wealth effect should reduce the labor supply, requiring higher wages. Also, figure 3.6 shows a positive effect of remittances on inflation, as expected. This should be clarified.

Following the ECM representation in *Eq. (3.2)*, the long-run parameters are multiplied by the error correction parameter, which is negative. As a result, the reported coefficients in Table 3.4 should be interpreted with this adjustment in mind. When multiplied by the negative error correction term, the effect of remittances is the

opposite of what is directly printed in the table, and therefore consistent with the simulation paths shown in Figure 3.6.

The long run analysis on page 101 shows that a 1% increase in the consumer price index leads to a 1.9% increase in the wage, so a sizable increase in the real wage. This strikes me as odd, as I would expect an inflation shock to ultimately have no effect on the real wage. What could explain this large effect?

We fully recognize that this outcome does not align with standard economic theory and may appear puzzling, but it reflects a structural feature of the Albanian economy rather than a theoretical expectation. The result indeed reflects some particularities of the estimation sample. Over this period, the observed inflation rate has been about 1 percentage point below the central bank's target of 3%. At the same time, wage statistics show that almost half of employees are paid at or very close to the minimum wage, which has been increased almost every year by more than the observed inflation rate. Given the relatively low starting level of the minimum wage (rising from about €200 to €400), these policy-driven adjustments have had a sizable impact on overall wage dynamics. Because the minimum wage carries such a large share in the average wage, we believe this mechanism explains why real wages have increased by roughly 0.9 percentage points in our estimation. Text was added in Section 3.4 *"Results"*.

I also have some small comment. There is a line break at the top of page 104 (3rd line). A similar break is seen at the bottom of page 108.

The line breaks have been removed.

6.1.3 Chapter 4: Does FX hedge mitigate the impact of exchange rate changes on credit risk? Evidence from a small open economy

The final chapter uses data from individual banks in Albania to assess how an exchange rate depreciation impacts the share of non-performing loans, using monthly data from 2009 to 2023. It distinguishes between households and firms, and for each between borrowers that have an exchange rate hedge and borrowers that don't. It finds that a hedge reduces the impact of an exchange rate movement on hedged borrowers, but only for firms. This is a relevant and novel contribution, and offers a good micro-based analysis that complements the first two chapters that consider macro analyses.

The results of the paper are very rich, but that makes them harder to absorb.

I recommend that the presentation be focuses on the effect of the "exchange rate growth", as it is the heart of the analysis. In particular, tables 4.3 to 4.5 being very dense, I would leave them in the appendix and add charts showing the coefficients for the exchange rate growth (1 chart for the firms and one for the households). Specifically, each chart would have several panels, each panel corresponding to a percentile. Within each panel, I would put horizontal bars showing the coefficients (for DC, FC hedged, FC non-hedged), with a horizontal line through the end of each bar showing the band of confidence. Each panel would look like the following:

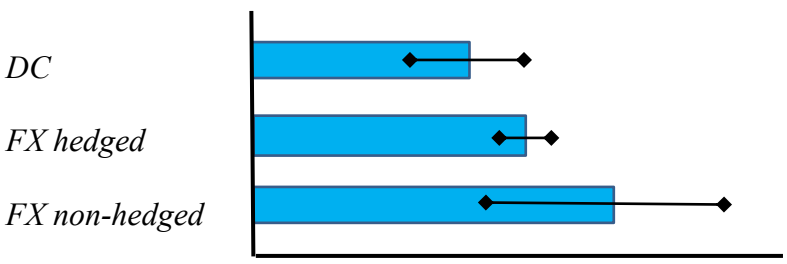

Figure 6.1 Chart example for illustrating the coefficients of exchange rate on NPLs

Source: Tille, 2025.

Note: The figure suggest how to present the sensitivity of NPLs to exchange rate among borrowers and loan type.

This would provide the reader with a clearer sense of the results, and the extent to which they are statistically different from each other. This is especially important as in the discussion of tables 4.3 to 4.5 the text points that the coefficients are different depending on hedging, something that is hard to see from the tables.

Table 4.3, Table 4.4, and Table 4.5 have been moved to the Appendix 4.A as Table 4.A3, Table 4.A4, and Table 4.A5. In the main text, we now display the proposed diagrams, which illustrate the coefficients for exchange rate growth by percentile with confidence bands in Figure 4.2 and Figure 4.3.

Convincing the reader of the heterogeneity of coefficients is particularly needed, as from table 4.2 it seems that among firms the coefficients on the exchange rate growth are not statistically different from each other across loans in domestic currency, foreign hedged, and foreign unhedged. Similarly, the coefficients for households look relatively similar to each other.

We ran both fixed effects and random effects models to test for heterogeneity among banks, and the results indicate that the coefficients are not heterogeneous. This ensures that we can run the quantile regressions with confidence that the estimated parameters are not biased by bank-specific characteristics correlated with the error term. The results presented in Table 4.2 serve primarily to check for heterogeneity across banks. We then analyze heterogeneity across the distribution of NPLs in the subsequent results.

Figure 4 also gives an impression of limited heterogeneity. Among firms, the lines for DC and FC look broadly similar, as do the lines for hedged and unhedged. While the lines for DC and FC differ for households, the lines for hedged and unhedged look close. This raises the question of the magnitude of heterogeneity.

While Figure 4.1 may give the impression of limited heterogeneity, the main turning points primarily reflect major shocks and measurements undertaken by regulatory institutions. The scale of the vertical axis, which extends to NPL ratios above 30%, actually indicates substantial heterogeneity across agents and currencies. We further analyze this heterogeneity through the conditional distribution of NPLs with respect to macroeconomic and bank-level indicators, which allows us to capture differences that are not immediately visible in the aggregate paths.

While at first a limited heterogeneity of the sensitivity to exchange rate across hedged or unhedged may seem surprising, it is important to recall that hedging is not a random decision. It could be that firms which hedge are the ones that are otherwise more fragile, so they (or their bank) do not want an exposure to exchange rate. By contrast, a more solid firm could be more willing to take a change on the exchange rate.

We have incorporated this point into the paper by adding text on the non-random nature of hedging decisions and the possible selection of more fragile firms into hedging. Specifically, this addition has been made in Section 4.5 *"Results"*, as well as highlighted in Section 4.1 *"Introduction"* and Section 4.6 *"Conclusions"*.

What form does the hedging take? It is presumable through derivative markets, or through the bank. It would be useful however to explain how hedging is actually done. My understanding is that it entails a fixed cost, and I would expect it to not to be too common among households.

In our analysis, a borrower is considered hedged if at least 80% of their income is in the same currency as the loan. The classification of whether a borrower is hedged or not is determined by the bank. To clarify this in the paper, we have added the Footnote 22 explaining precisely what is meant by hedged.

When presenting the data, the paper should have a chart of the exchange rate.

The path of the exchange rate has been added in Figure 4.1.

The chapter indicates that the results are "asymmetric across the percentiles". I would refer to this as heterogeneous, not asymmetric. I would however expect an asymmetry depending on the direction of movement of the exchange rate. When the lek appreciates, firms all firms face a better (or unchanged) situation, and thus the impact on NPL could be minimal. When the lek depreciates however, firms having borrowed in foreign currencies face a more direct situation and may become nonperforming. I would therefore expect an asymmetry with the sign of the exchange rate movement.

We have replaced the term "asymmetry" with "heterogeneity" throughout the chapter to better reflect the nature of our results. The question of asymmetry with respect to the direction of exchange rate movements is indeed important, and we acknowledge it as a promising avenue for future research.

As a minor comment: there is a line break towards the top of page 132.

The line breaks have been removed.

6.2 Ing. Jan Brůha, Ph.D. (Czech National Bank)

Overall, the dissertation makes highly relevant and original contributions to issues relevant to small open economies. I am very glad that I had the opportunity to write this report. Two of the papers have been already published in academic journals. Nevertheless, for each chapter, I have a set of comments, questions and/or suggestions that could be used to further improve the paper before the defense. I am looking forward the discussion during the pre-defense meeting.

6.2.1 Chapter 2: Using Macrofinancial Models to Simulate Macroeconomic Developments During the COVID-19 Pandemic: The Case of Albania

The first paper (Chapter 2) addresses the important issue of how a semi-structural macro model calibrated on pre-COVID data performs during the pandemic. This topic is relevant for at least two reasons: first, it allows us to assess the stability of economic relationships during periods of extreme shocks, and second, it informs policymakers about the reliability of macro models in such circumstances. The chapter makes a valuable contribution in this area, and I particularly appreciate the use of quantile regression to capture uncertainty. That being said, I have a set of comments and questions that could help to further strengthen the chapter.

The model used in this chapter is broadly consistent with other semi-structural models, including the well-known ECB model AWM. It features long-run relationships among variables derived from basic neoclassical assumptions, combined with short- and medium-term empirical dynamics around these trends. The external assumptions underlying the exercise are reported on page 27. My clarification questions are as follows:

- *Remittances: How are remittances treated in the model? Are they consistent with the outlook for foreign variables? Are they linked to the model presented in the next chapter?*

Remittances are treated as an exogenous variable in the semistructural model. The historical values are taken directly from Albania's balance of payments, while the forecasted values are derived from a satellite model, which uses foreign GDP projections based on Consensus Forecasts. To improve clarity, we have added Table 2.A3 in Appendix 2.A that summarizes the assumption of the set of exogenous

variables (including remittances) in the prepandemic and the pandemic forecasts, accompanied with the Footnote 7.

Yes, they are linked to the model presented in the following chapter. Specifically, in Chapter 2 remittances are introduced in levels, whereas in Chapter 3 they are expressed as a ratio to GDP.

• *Decrease in labor supply: Is the reduction due to health impacts of the pandemic? How does this assumption relate to the fall in remittances? My conjecture is that many Albanian workers abroad were forced to return home due to pandemic restrictions, which explains the fall in remittances. At the same time, however, their return should have increased the domestic labor force.*

The decline in labor supply is indeed related to the health impacts of the COVID-19 pandemic, but also to the acceleration of migration once lockdown restrictions were lifted. The fall in remittances, on the other hand, is mainly linked to the worsening foreign economic outlook during that period.

While, a limited number of migrants did return temporarily to Albania due to the restrictions, this effect was short-lived. Many quickly re-migrated, often to more developed countries compared to where they had previously resided. As a result, the short return was offset by renewed migration flows of both returning migrants and new residents, limiting any significant or lasting increase in the domestic labor force.

To clarify the assumptions made, explanatory text has been added.

• *Negative fiscal impulse: Please elaborate. Is it really the case that the disruption of the earthquake-related reconstruction plan outweighed the COVID-related expansion of fiscal transfers?*

The fiscal impulse was negative, mainly due to the interruption of the post-earthquake reconstruction plan and lower fiscal consumption resulting from reduced

government revenues. Although the government increased transfers to households and introduced guarantee schemes for businesses, these measures were provided through an application process. Consequently, not all the planned budget was absorbed by the economy, and the observed values indeed showed a restriction compared to the pre-pandemic assumptions.

Beyond assumptions about exogenous variables, model-based forecasts and scenarios are never purely 'push-the-button' exercises. They inevitably require additional assumptions and expert judgements—referred to in the thesis as add-on factors. In the context of the COVID-19 shock, one important question is whether the output decline should be attributed mainly to the trend component or to cyclical dynamics around the trend. This choice has important implications for inflation[25]*: If the decline is interpreted as cyclical, the Phillips-curve mechanism implies counter-inflationary effects. On the other hand, if the decline is interpreted as trend-related, the implications for inflation are much smaller. It is therefore essential to describe explicitly how this issue was addressed. Were only the short run dynamics affected, or were long-run values also adjusted? Was the decision based on data or on expert judgement? More generally, please clarify whether add-ons were applied to the trend or to the cyclical part of the model, and explain the rationale behind this choice.*

The COVID-19 shock was treated as cyclical, based on a combination of empirical data and expert judgment. Observed values were used for the set of exogenous variables, while the magnitude of the shocks was calibrated according to the standard deviations of model errors. By design, the model integrates a neoclassical

[25] *For more details on this point, see e.g.Oxana Babecka Kucharcukova & Jan Bruha & Petr Kral & Martin Motl & Jaromir Tonner, 2022. "Assessment of the Nature of the Pandemic Shock: Implications for Monetary Policy," Research and Policy Notes 2022/01CNB.*

supply side (with potential GDP is estimated via a Cobb-Douglas production function) and a New Keynesian demand side (estimated with the error correction model). Consequently, the short-run dynamics were primarily affected, whereas the long-run trend values remained less affected. This specification confirms that the output decline is captured through the cyclical channel, generating negative inflation pressures *via* the Phillips curve.

We have added the suggested paper in Section 2.2 *"Literature Review"*. Also, we added text in Section 2.5 *"Results"* to explicitly highlight the negative impact of output gap on inflation and referred Kucharcukova, Bruha, Kral, & Motl (2022) for a detailed discussion on the importance of implications for inflation of output decline (trend or cycle) during COVID-19 pandemic the Footnote 9.

I would also welcome a more detailed discussion of the results (Figure 2.5), in particular:

- *Inflation: The simulation shows a dramatic fall in inflation. I suspect this reflects an interpretation of the output decline as entirely cyclical.*
- *Exchange rate appreciation: What drives this result? Is it consistent with the cut in domestic interest rates? Did foreign rates fall even further?*
- *Wages: Average wage growth declines by about 6 p.p. I assume this refers to nominal wages. What was the effect on real wages? Given that inflation fell by about 4 p.p., it seems that real wages also declined. How is this consistent with both the fall in unemployment and the assumed reduction in labor supply?*

Yes, as explained above, the decline in inflation is attributed to the negative cyclical conditions during the COVID-19 pandemic. Which, coupled with the positive interest rate differential drives the appreciation of the exchange rate.

The reported decline of approximately 6 p.p. refers to nominal wage growth. Given that inflation fell by around 4 p.p., real wages indeed experienced a modest reduction. This outcome is consistent with the labor market conditions observed during the COVID-19 pandemic, where the reduction in labor supply and improvement in unemployment (driven mainly by officially unchanged labor demand given the supportive government measurements) did not fully translate into higher wages. One contributing factor is that, administratively, labor demand, particularly in certain sectors, did not immediately adjust to changes in economic activity, limiting upward pressure on wages despite tighter labor market conditions.

Additional text is added in Section 2.5 *"Results"* to elaborate about the dynamics in inflation, wages and exchange rate.

Regarding Table 2.1 (p. 44): How exactly were the RMSEs computed? Were they calculated under the given assumptions for exogenous variables? If so, it would be informative to consider a counterfactual where the true dynamics of exogenous variables were known (the 'oracle' case). This would allow one to disentangle forecast errors due to incorrect exogenous assumptions from those due to model dynamics or add-ons.

In the pandemic forecast, the RMSEs were computed using the observed paths of the exogenous variables. This approach was chosen to eliminate forecast errors arising from incorrect assumptions and to assess how the model would perform under the condition that the underlying information was accurate. Given that the aim of the study was to evaluate the flexibility of the macro-financial model in highly abnormal circumstances, the reported RMSEs therefore correspond to the "oracle" case.

Other comments on this chapter:

• *I do not understand what 'square meters growth' (p. 25, among the assumptions of the pre pandemic forecast) means. Is this related to post-2019 earthquake reconstruction?*

The term "square meters growth" refers to inhabited square meters per capita, which is included as an explanatory variable in the private investment equation (*Eq. (2.3)*). It is not directly associated with the post-2019 earthquake reconstruction but is used as a structural determinant of private investment. For greater clarity, this indicator is now further elaborated in Section 2.3 *"Data used and the main features of the macrofinancial model"*, within the newly added paragraph on *"The real economy"*.

• *Footnote 2 (p. 25) is oddly formatted, as is footnote 1 (p. 22), and there are similar issues elsewhere in the thesis.*

Thank you for pointing this out. The formatting of footnotes has been revised to ensure consistency and a uniform style throughout the thesis.

6.2.2 Chapter 3: Migration, Remittances, and Wage-Inflation Spillovers: The Case of Albania

The second essay (Chapter 3) is very interesting. It develops a small model that links remittances to inflation, with parameters partly estimated and partly calibrated using Albanian data. My comments are as follows:

• *Transmission channel: The model focuses on the cost channel operating through wages. Labor migration reduces domestic labor supply, raising wages and inflation. However, remittances also create a demand-side channel*[26]*. Do the authors think that this demand channel is quantitatively less important?*

[26] *Workers working abroad send money back home, this rises domestic demand that is not balanced by an increase in the domestic supply and inflation results.*

You are correct that, alongside the cost channel operating through wages, remittances also generate a demand-side channel. In the current specification, this demand-side effect is not explicitly captured, which we acknowledge as a limitation of the model. We agree that a richer model in transmission channels like semistructural model or proper general equilibrium framework would provide deeper insights into the demand-side effects of emigration, the role of remittances, *et cetera*. To acknowledge this limitation more explicitly, we have expanded the Section 3.5.2 *"Limitations"*.

• *Participation rate: If I understand correctly, participation is treated as exogenous. This assumption is partly reasonable, since participation is influenced by long-term structural factors and/or social norms that are indeed exogenous to the short-run model. At the same time, however, participation may respond endogenously to wages -- higher wages may encourage more people to enter the labor force. I am curious about the Albanian case: does the participation rate empirically respond to cyclical movements in wages to a significant extent?*

We agree with your observation regarding the potential endogeneity of the participation rate. However, based on a simple OLS regression, we find only a weak relationship between participation and wages in the Albanian context. In our opinion, this limited responsiveness may be attributable to the relatively low level of average wages and the significant wage gap compared to other European countries, which dampens the influence of cyclical wage fluctuations on labor force participation.

Figure 6.2 Minimum wages in European countries

Source: Eurostat, INSTAT, authors' calculations.

Note: The figure illustrates the minimum wage in several European countries in 2022 and 2025.

• *Remittances and labor migration: Migration decisions likely depend on the relative wage gap between foreign and domestic labor markets. Rising domestic wages may gradually reduce the incentive to work abroad. Is there evidence in Albanian data that this process is already visible? As a suggestion for future research, the model could be enriched by including foreign labor market variables to capture this effect more systematically.*

As illustrated in Figure 6.1, there remains a substantial wage gap between Albania and other developed countries. Based solely on this dimension, the incentive for migration would continue to be strong. Nevertheless, the decision to migrate is related also to other dimensions such as education and healthcare.

Finally, the paragraph beginning 'Policymakers should prioritize ...' on p. 113 reads somewhat as a truism. Could the analysis support more specific policy conclusions regarding stabilization strategies?

In response to your suggestion, we have added a new paragraph that provides more specific policy conclusions regarding stabilization strategies. This addition tailors the discussion to the Albanian context, highlighting fiscal and monetary

measures, structural reforms, and strategies to enhance resilience to external shocks such as the pandemic and fluctuations in migration and remittance inflows.

6.2.3 Chapter 4: Does FX Hedge Mitigate the Impact of Exchange Rate Changes on Credit Risk? Evidence from a Small Open Economy

The third essay (Chapter 4) tackles an important question: do hedged and unhedged Albanian bank loans respond differently to exchange-rate movements? As expected, the answer is yes. The main value-added lies in quantifying how much. The chapter employs linear panel regressions alongside quantile regressions. Readers would benefit from a more careful exposition of the data and a tighter discussion of results. My main comments are as follows:

- *Definition of hedging: Please clarify what exactly counts as 'hedged.' Is it the share of loans covered by financial instruments? Do households hedged via remittances count as hedged? Do firms with natural hedges (FC revenues or contracts) count as hedged?*

In our analysis, a borrower is considered hedged only if at least 80% of their income is denominated in the same currency as the loan. The classification of whether a borrower is hedged or not is determined by the bank. Borrowers receiving remittances are not automatically considered hedged, unless the remittance flows match the loan currency to the required threshold. Similarly, firms with natural hedges, such as foreign currency revenues or contracts, are classified as hedged only if these exposures cover at least 80% of the loan's currency risk. To clarify this, we have added the Footnote 22 explaining precisely what is meant by hedged.

- *FX movements vs. FX risk: The chapter appears to conflate realized FX changes with ex ante FX risk. These are distinct: risk can be high even if no depreciation materializes ex post. As I read it, your estimates identify how actual*

exchange-rate changes shift NPLs, not how ex-ante risk affects them. Therefore statements like "FC credit risk of unhedged borrowers is associated with a higher risk of exchange rate depreciation compared to hedged borrowers ..." (p. 149) are, strictly speaking, imprecise. A more accurate phrasing would be: "When the exchange rate depreciates, NPLs rise more for unhedged than for hedged borrowers." If you wish to study FX risk, the regressions should include a measure of ex-ante risk (e.g. realized or implied volatility, GARCH volatility, risk-reversal, or term structure-based measures) rather than realized FX changes.

Thank you for your observation, and we fully agree with your comment. In our model, the set of explanatory variables enters as six-term moving averages, which ensures that all variables are treated as ex-ante rather than reflecting purely realized outcomes. We recognize that this information was previously missing from the text, and its absence may have caused some confusion regarding the distinction between realized exchange rate movements and ex-ante FX risk.

To address this, we have added a detailed discussion in Section 4.4 *"Methodology"* clarifying the inclusion of lags in the explanatory variables and how this setup captures the ex-ante perspective of FX risk. We also appreciate your suggestions regarding the use of alternative measures, such as realized or implied volatility, GARCH-based volatility estimates, risk reversals, or term-structure-based indicators. While, our current analysis relies on moving averages, these techniques provide avenues for future research.

- *Interpretation of quantile regressions: Some conclusions ("During periods of elevated NPLs, credit risk exhibits a higher sensitivity to macroeconomic developments and financial conditions." p. 150, or "Return on assets plays a crucial role during periods characterized by high NPLs.", p. 148) seem stronger than what*

the specification supports. It would be more accurate to state that variables have larger coefficients at higher conditional NPL quantiles, indicating stronger associations in the upper tail. As written, these statements imply state-contingent sensitivities (i.e. that the marginal effect of macro variables/ROA changes with the NPL level). To claim that, the model would typically include interaction terms (e.g. High-NPL × Macro) or a formal quantile process interpretation showing parameter heterogeneity across the conditional distribution. Without such structure, a safer wording is something like: "The covariates have larger coefficients at higher conditional NPL quantiles, indicating stronger associations in the upper tail of the NPL distribution. For example banks with already high NPLs react more strongly to FX depreciation than the median bank." If I have misunderstood and your specification does capture state dependence, please make that explicit.

We fully agree with your observation. In response, we have reviewed the relevant text in both the Section 4.5 *"Results"* and Section 4.6 *"Conclusions"* to ensure that our interpretation aligns with what the specification supports. The language has been adjusted to indicate that the covariates have larger coefficients at higher conditional NPL quantiles, reflecting stronger associations in the upper tail of the distribution, rather than implying explicit state-contingent sensitivities. The text is revised.

Minor comments:

- *Equation (4.1): likely a typo — ϕjt should be ϕj.*
- *Equation (4.4): a variable ξ is undefined.*

Thank you for your feedback. The typo in *Eq. (4.1)* has been corrected ($\phi_{j,t}$ is now ϕ_j). We have also added text to Section 4.4.2 *"The quantile regression"* to clarify

that the variable '*xi'* in *Eq. (4.4)* represents the value over which the minimization is performed in the quantile regression.

6.3 Dr. Michele Caivano, Ph.D. (Banca d'Italia)

Short summary

The thesis investigates Albania's economy through three interconnected studies focused on challenges for macroeconometric models during deep economic crisis, the consequences of demographic shifts for inflation, and the impact of the exchange rate fluctuations for the quality of bank loans. The research addresses how exogenous shocks—namely the COVID-19 pandemic, migration and remittances, and exchange rate volatility—affect Albania's macrofinancial system, labor market, and banking sector.

The first study develops a macrofinancial model for the Albanian economy to simulate Albania's economic performance during the pandemic. By comparing pre-pandemic and pandemic forecasts, the study reveals that traditional linear models can capture broad trends but struggle to accommodate the some of the adjustment following non-economic shocks, in particular as regards nominal and financial variables. Through quantile regressions, the model is provided with uncertainty bands, which account for the possibility of changing economic relationship in presence of extreme shocks.

The second study explores the inflationary effects of Albania's demographic decline and remittance inflows. A dynamic wage-price model shows that population loss tightens labor markets, raising wages and inflation. Remittances further amplify this effect. Simulations suggest that a 1% population decline can increase inflation by up to 0.8 percentage points.

The third study analyzes the impact of exchange rate fluctuations on credit risk using bank level data. It finds that unhedged non-financial corporations are more vulnerable to depreciation, while households with FX hedging unexpectedly show higher credit risk. This asymmetry suggests that hedging strategies are not uniformly effective.

General assessment

The dissertation addresses three highly relevant topics: forecasting under crisis conditions (COVID-19), structural inflationary pressures from migration and remittances, and credit risk dynamics in euroized economies. These themes are relatively underexplored in the context of Albania and similar emerging markets.

In the first essay, the estimation of a large-scale semi-structural model using quantile regressions represents a challenging task. To my knowledge, there are only a few instances in the literature where relatively large macroeconometric models have been estimated across different quantiles of the distribution. This approach significantly enriches the model, allowing for a broad spectrum of insightful exercises and analyses. Even considering this methodological advancement alone, the work exhibits a high level of originality.

In the second essay, the estimation of a dynamic price-wage model offers an insightful application of the methodology introduced by Bernanke and Blanchard (2023) to assess the drivers of inflation using a minimal set of restrictions. The study contributes to the literature by incorporating remittances from emigrants as a factor exerting upward pressure on prices and by modeling the feedback loop explicitly.

The third essay's main innovation lies in the use of granular data at the bank level. The findings also stand out, revealing notable heterogeneity in the role of FX hedging across different sectors.

Each chapter employs appropriate and sophisticated econometric techniques. The first study uses a semi-structural macrofinancial model with quantile regression to simulate uncertainty bands. The second study applies error correction models and dynamic simulations to capture long-run wage-price dynamics, integrating remittances as a structural variable. The third study uses fixed effects and panel quantile regression to assess credit risk across the distribution of NPLs.

The thesis is a valuable contribution to applied macroeconomics and financial stability research, particularly in the context of emerging markets. The author acknowledges limitations such as simplified treatment of demand-side dynamics, static nature of some simulations, and lack of cross-country comparison.

Overall, I recommend the thesis for defense without substantial changes. I have not found specific weaknesses in the analysis, although some improvements could make the essays more suitable for publication in economic journals. I would recommend to undertake a thorough revision of the English language throughout the manuscript, as well as to ensure consistency in the use of notations and bibliographic citation conventions.

I list below my specific comments to each of the three essays.

6.3.1 Chapter 2: Using Macrofinancial Models to Simulate Macroeconomic Developments During the COVID-19 Pandemic: The Case of Albania

The exercise performed in the first chapter is as follows: first, a semi-structural model for the Albanian economy is simulated to produce a dynamic forecast for the biennium 2020-2021 with the information available at 2019Q4. Second, the model is simulated with appropriate add factors for 2020, aimed at capturing the impact of a fundamentally non-economic shock such as Covid-19. The ability of the model to correctly track the evolution of the Albanian economy is then assessed by comparing

the forecast error of the simulation performed with information at 2019Q4 with the simulation performed using pandemic shocks. I have the following comments.

1a) In the pre-pandemic simulation it is not clear why add-factors for the main aggregate demand components are calibrated to one-standard deviation for all variables. While it is not essential for the main exercise of the essay, maybe this add-factors should be better motivated from a quantitative point of view. It is not clear why a government measure (the reconstructing plan after the earthquake) cannot just be included by means of fiscal variables. Additionally, it is not clear why this plan should affect exports.

We would like to clarify the rationale behind our choices in the prepandemic simulation. Add-factors were applied in the prepandemic forecast because, in practice, a sound forecast often performs better when complemented with expert judgment. The calibration to one or half standard deviation was not intended to introduce strong subjectivity but rather to limit it, while signaling that a positive or negative shock was expected on top of the model's baseline assumptions.

The reconstruction plan following the earthquake was identified as a unique item in the fiscal balance sheets, with a different nature from the fiscal variables captured by our macromodel. For this reason, we treated the reconstruction plan as a separate shock. Since detailed information on the distribution and timing of this plan was not available, we considered it more appropriate to model it as an exogenous shock. Thus, by applying +/-1 standard deviation to the variables of interest allowed us to capture the expected impact and provide additional information not reflected in the variables of the model.

The plan was not limited to rebuilding houses; it also included financial aid to households and businesses, effectively increasing disposable income and liquidity.

Moreover, since the earthquake caused significant damage in the Durres area, home to the largest port in the Balkans, many exporting firms were affected and subsequently received aid. This explains why the reconstruction plan could influence exports indirectly through restored production capacity and trade flows.

To improve clarity, we added footnotes 3-5.

1b) In pandemic simulation the assumptions on the exogenous variables are illustrated only from a qualitative point of view ("worsening of…/lower…"). It would be of help to quantify the assumptions employed, either in a table (e.g. in the Appendix) or in a footnote. For exogenous variables it should be clarified which values have been used.

Thank you for this insightful comment. We fully agree that providing clarity on the assumptions for exogenous variables is important for transparency and reproducibility. However, the numerical values employed in the simulations are expressed in Lek and are specific to the Albanian economy. In our view, including these raw figures would not boost the reader's understanding, as their interpretation would require additional contextualization of Albania's macroeconomic structure and scale. To address your point, we have introduced Table 2.A3 in Appendix 2.A accompanied with the Footnote 7, which summarizes the values used for the assumptions for the exogenous variables in the pre-pandemic and pandemic forecasts.

1c) In the pandemic simulation the Covid-19 shock is identified essentially in a judgmental fashion, through specific add-factors on the main aggregate demand components. It should be clarified how these add-factors have been chosen from a quantitative point of view and how sensitive are the results to different calibration of the add-factor.

From a quantitative perspective, the add-factors applied in the COVID-19 pandemic simulation were derived from the in-sample forecast errors of the selected variables over the first four quarters. This approach allowed us to anchor the judgmental adjustments to historically observed deviations rather than arbitrary assumptions. The trajectory of these add-factors is reported in Figure 2.A2 in Appendix 2.A, and we added the Footnote 8 to clarify this procedure explicitly and elaborate further on Figure 2.A2 note.

Regarding the sensitivity of the results to alternative calibrations, it is important to note that the underlying model is linear in structure. Consequently, the impact of different magnitudes of add-factors would scale proportionally with the size of the assumed shocks. This property ensures that the qualitative interpretation of the results remains robust, even under alternative calibrations.

1d) Given that semi-structural models such as that employed in the essay are generally characterized by slow adjustment and strong persistence, it is key to clarify what kind of assumptions have been made about the shape of the pandemic shock. For instance, a V-shaped shock in 2020, characterized by a sudden drop followed by a quick recovery, would most likely generate a strong expansion of the economy in 2021. Conversely, an L-shaped shock, would involve persistent weakness of the economy in 2021.

The shape of the pandemic shock was not imposed *ex-ante* but rather derived from the data through the calibration of add-factors based on observed dynamics. As a result, the shock exhibits a V-shaped profile, reflecting a sharp contraction followed by a relatively quick recovery. This pattern is illustrated in Figure 2.A2 in Appendix 2.A, which reports the trajectory of the applied shocks in the prepandemic and pandemic forecasts.

1e) In the pandemic simulation the model tracks fairly well the pattern of real variables (except investment) but struggles to keep track of the pattern of prices. A comment on the likely driver of this inability of the model to track prices would be needed. One possibility could be to perform additional simulations in which the pattern of each price variable is set, one at a time, equal to that actually observed in 2020, in order to understand in which equation the model seems to fail to capture pandemic developments.

Thank you for this useful comment. The sharp decrease in output during the pandemic led to significant negative cyclical conditions, which in turn created downward inflationary pressures through the short-run dynamics of domestic supply prices equation. This effect, combined with foreign dynamics and the appreciation of the exchange rate, contributed to the deflation observed in the pandemic simulation and was next transmitted to nominal wages.

The model does not capture the observed nominal side of the economy, as no judgment was imposed to counterbalance the strong negative cyclical conditions affecting domestic supply prices. We have added text to the paper to reflect this limitation of the model in Sections 2.5 *"The pandemic simulations"* and 2.6 *"Conclusions"*.

1f) An additional table with RMSE computed separately for 2020 and 2021 could help clarifying what is the contribution of the assumptions employed for 2020 to the improvement in forecasting performance. This would inform on the ability of the model to track the adjustment of the economy after the shock.

We have computed the RMSE separately for 2020 and 2021 to assess the contribution of the assumptions employed for 2020 to the improvement in forecasting performance and to evaluate the model's ability to track the adjustment of the economy

after the shock. The results are reported in Table 2.A6 in Appendix 2.A, and the main text has been updated to reference this table.

1g) At page 32 it is stated that "the competitiveness term ... also support exports". However, a few lines below it is stated that consumer prices only increase due to the domestic component while "the foreign price component is attenuated by foreign price developments and the stable exchange rate". The latter sentence suggests that domestic prices grow faster than foreign prices. But this should translate in a loss of price competitiveness compared with foreign competitors, which seems at odds with the statement at the beginning of the paragraph.

Thank you for pointing out this apparent inconsistency. We recognize the potential confusion. While it is true that domestic prices increased faster than foreign prices, and the exchange rate appreciated slightly, the overall price level in Albania remained significantly lower compared to foreign price levels during the forecast horizon. As a result, the relative price competitiveness of Albanian goods and services was still favorable, which continued to support exports. This clarification has been incorporated into the revised text to avoid ambiguity, and the statement on competitiveness should now be interpreted in this context in Section 2.5.1.

6.3.2 Chapter 3: Migration, Remittances, and Wage-Inflation Spillovers: The Case of Albania

The paper studies the impact of demographic developments and remittances on inflation in Albania, using a simple partial-equilibrium model in the spirit of Bernanke and Blanchard (2023) and find a significant negative correlation of population growth with inflation and positive impact of remittances. The analysis is clear and well documented and motivated and brings relevant evidence for the case of Albania.

Furthermore, its result could be a useful benchmark for other middle-income economies. My comments are as follows.

2a) The results commented at page 101, highlight that a 1% permanent increase in prices leads to a 1.9% increase in wages in the long run. I find this result somewhat puzzling: in a general equilibrium setting, real wages should grow in line with labor productivity and nominal wage growth should be equal to the sum of productivity growth and inflation expectations. However, with a 1.9% response of wages to a 1% permanent increase in prices implies that real wages in the long run increase by 0.9% solely as a result of higher inflation, even if labor productivity remains constant. Maybe some more comment should be provided to explain this result.

We fully recognize that this outcome does not align with standard economic theory and may appear puzzling, but it reflects a structural feature of the Albanian economy rather than a theoretical expectation. The result indeed reflects some particularities of the estimation sample. Over this period, the observed inflation rate has been about 1 percentage point below the central bank's target of 3%. At the same time, wage statistics show that almost half of employees are paid at or very close to the minimum wage, which has been increased almost every year by more than the observed inflation rate. Given the relatively low starting level of the minimum wage (rising from about €200 to €400), these policy-driven adjustments have had a sizable impact on overall wage dynamics. Because the minimum wage carries such a large weight in the average wage, we believe this mechanism explains why real wages have increased by roughly 0.9 percentage points in our estimation. Text was added in Section 3.4 *"Results"*.

2b) The discussion on the limitations of the model in Section 3.5 motivates the assumption of a constant labor demand in the face of shocks to labor supply. However, the results of the various scenarios hold as long as the shock only affect the short run supply dynamics. For instance, a labor market reform aimed at increasing the labor force participation should, as long as it is permanent, affect both the actual participation rate and the long run participation rate and, if labor demand remains constant, it should ultimately result in an equal increase of both the actual and the natural unemployment rate, with no impact on the unemployment gap and on inflation. This caveat could be addressed by reframing the shock in terms of transitory (though possibly long-lasting) rather than permanent increase in participation.

We agree that the assumption of a constant labor demand is a key limitation of the model. You are correct that a permanent increase in labor force participation would affect both the actual and the natural unemployment rate, leaving the unemployment gap unchanged under the constant labor demand assumption. To address this, we have revised the text to clarify that the shocks analyzed in the paper should be interpreted as transitory, even though potentially long-lasting, changes in participation, rather than permanent shifts. This framing is consistent with the objective of assessing short- to medium-term dynamics rather than long-run equilibrium effects. We have added text in Section 3.1 *"Introduction"* and in Section 3.4 *"Results"*.

2c) Similarly, permanent declines in population can also be associated with a permanent shift of the demographic structure towards older age cohorts, which are generally characterized by higher participation and lower unemployment rates. This could translate in a lower NAIRU and reduce the tightness of the labor market. Section 3.5 could mention this caveat.

Thank you for this valuable suggestion. We have incorporated your comment in Section 3.5.1 *"Discussion"*.

2d) The impact of higher remittances on inflation is interpreted in terms of higher reservation wage. However, in a general equilibrium setting, higher remittances could be capturing the effects of (or at the least co-moving with) wage and price increases in foreign economies, which could transmit to inflation along completely different channels. One alternative possibility to model the effects of remittances on reservation wages is to specify a stochastic equation for the participation rate and include wages and remittances among explanatory variables: if remittances indeed increase the reservation wage, then a negative relationship between the participation rate and remittances should arise. This is not needed for the dissertation and could be included in refinements of the model, but it would be useful to mention the possibility that the estimated impact of remittances could capture other drivers, together with higher reservation wages.

We agree that the estimated impact of remittances on inflation could capture other drivers. A richer model like a proper general equilibrium framework would provide deeper insights into the demand-side effects of emigration, the role of remittances, the adjustment of potential output over time, *et cetera*. To acknowledge this limitation more explicitly, we have expanded the Section 3.5.2 *"Limitations"*.

To explore further this point, as suggested, we conducted a simple empirical check by estimating a simple OLS participation rate equation, including remittances as an explanatory variable. The results suggest a negative relationship between remittances and labor force participation, consistent with the hypothesis that higher remittances increase the reservation wage, providing empirical support for the

interpretation that remittances can influence participation through reservation wages (see Table 3.A2 in Appendix 3.A).

6.3.3 Chapter 4: Does FX Hedge Mitigate the Impact of Exchange Rate Changes on Credit Risk? Evidence from a Small Open Economy

The paper uses bank-level data to assess the impact of exchange rate fluctuations on non-performing loans in a panel quantile regression framework. The main finding is that exchange rate fluctuations have generally a negative impact on NPLs (with depreciations associated to increases in NPLs), which is stronger in the right-hand tail of the NPLs distribution and for unhedged loans in foreign currency to non-financial corporations (NFCs). Instead, the effect of the hedging position on loans in foreign currency to households has the opposite sign.

3a) The inclusion of specific variables (especially bank-specific variables) is motivated at page 135 by pre-facing the expected sign of the relationship with NPLs. I would suggest to elaborate on this relationship, also mentioning alternative interpretations and possible counterexamples. For instance, capital adequacy ratios (CAR) are included among explanatory variables, motivated by the fact that safer banks (i.e. those with higher capital ratios) should display lower NPLs. However, the relationship between CAR and NPLs needs not be uniformly decreasing. Some studies have mentioned the possibility of a U-shaped relationship, such that when CAR is high enough banks might have an incentive to take more risk (see, e.g. Calem and Robb, 1999 and the literature cited in the paper).

We have incorporated the recommended discussion by adding text in Section 4.3 *"Data"*. The revised section now elaborates on the expected relationships between bank-specific variables and NPLs providing acknowledging from the literature.

3b) Indeed, in Section 4.2 on the literature review, the relationship between macroeconomic variables, exchange rates and NPLs is thoroughly discussed, but a discussion on the relationship between bank-specific variables and NPLs is lacking. I would suggest to add a few words to Section 4.2 on the latter relationship.

We have added a discussion on the relationship between bank-specific variables and NPLs in Section 4.2 *"Literature Review"* to complement the existing analysis of macroeconomic and exchange rate factors.

3c) In the Results section, I would be sharper in presenting the effects of the hedging position. For instance, at page 146 it is stated that "the balance sheet channel surpasses the trade channel". However, there is no direct counterpart of the two channels in the estimated equation, and the expression is rather an alternative way to say the hedging has a negative impact on NPLs. I would state this clearly and directly, without invoking the trade and balance sheet channel, which may serve, at best, as an ex post interpretation of the result and should not be presented as the result itself.

We appreciate this comment and agree that the interpretation should be stated more clearly. In the revised version, we have removed references to the "balance sheet channel" and "trade channel" as direct results, and instead present the finding explicitly:

> "The hedging position of loans in foreign currency has a statistically significant negative effect on NPLs for NFCs."

3d) The interpretation of the findings on the relationship between bank-specific variables and NPLs is not clear. At page 147 it is stated that an increase in CAR leads to a reduction in the number of loans issued, i.e. in the denominator of the NPL ratio. However, it is not clear why higher CAR should be achieved through a decline in all type of loans. In order to improve their CAR, banks could manage the risk profile of

their loans (reducing the riskier loans and increasing the safer ones). This could result in lower NPL ratios.

We have clarified the interpretation in the Section 4.5 *"Results"*. The original statement may have been misleading. Higher CAR could be achieved through adjustments in the loan portfolio that can lead to a lower NPL ratio. However, in smaller or less diversified banking systems, such as Albania, portfolio adjustments can be more challenging. Thus, an increase in CAR might also be associated with a contraction in the overall loan portfolio, which could increase the NPL ratio if the stock of non-performing loans remains unchanged. We have revised the text.