

This issue of the Research Highlights reviews the following subjects that have been recently analyzed at the Central Bank of Chile (CBC):

- The first 1,000 working papers of the Central Bank of Chile and milestones behind.
- Using new sources of information to understand the evolution of inflation during the COVID-19 crisis.
- Income heterogeneity and its effect on macroeconomic dynamics.

The first 1,000 working papers of the Central Bank of Chile and milestones behind

The first Central Bank of Chile working paper (DTBC) saw the light in 1997 and, in November of 2023, that is, 26 years on, we have hit the mark of 1,000 publications. Below is a summary of some of the most salient milestones of these two and a half decades.

Figure 1 shows the evolution of the number of DTBCs published up to November 2023. We can see that, after a timid start, the number of documents published per year was consolidated in the 2000s, when the number of publications was consolidated at over 40 publications annually and reached its record high in 2002 with 62 DTBCs published that year. The following decade was a bit more austere in terms of releases and in 2018 it fell to an all-time low with 14 papers published. That year, the Bank's Economic Research Department decided to revitalize the DTBC series by reforming the publication process by simplifying it and encouraging a higher number of papers to be authored each year. Consequently, an average of 35 papers per year were published between 2020 and November 2023.

“DTBCs constitute the first stage of the dissemination of economic research papers produced at the Central Bank of Chile. Many of them are then submitted for publication to international and national academic journals.”

About author

In all these years of history many authors have contributed to the working paper series. In total, 763 professionals have had their research work published as a DTBC. They have been not only Bank staff; for example, in 2018, Nobel laureate in economics sciences Robert J. Shiller published his paper *“Indexed Units of Account: Theory and Assessment of Historical Experience”* as DTBC No. 28. Fernando Lefort, then Senior Economist of the Economic Research Division, opened the series with DTBC No.1. The author with the most DTBCs is Klaus Schmidt-Hebbel (Economic Research Manager, 2008), with a total of 45. The second place is shared by Roberto Álvarez (Senior Economist of the Financial Policy Division, 2013), César Calderón (Senior Economist of the Economic

Research Division, 2005) and Rodrigo Valdés (Research Division Director, 2008) with a total of 30. Since 2011, economists Rodrigo Alfaro, Carlos Madeira and Pablo Pincheira also appear in this ranking with a total of 28.

Other curiosities worth noting are the following:

- The DTBC with the most co-authors is DTBC No.937 with a total of 10.
- The most repeated first name is: Rodrigo with 113 times.
- The most repeated surname is García with 57 times.
- The longest surname has 14 characters and is Touloumtzoglou (DTBC N°782).

Figure 1: DTBCs published per year

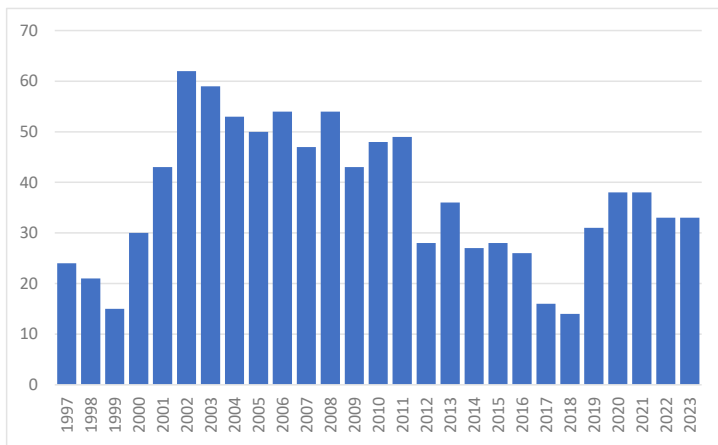


Figure 2: Cloud of words in the titles



The topics

Figure 2 shows, in a word cloud, the most repeated terms in the titles of the DTBCs. As can be seen, the most repeated words have a direct relationship with the objectives of the Central Bank of Chile, namely, to safeguard the stability of the currency and the normal functioning of internal and external payments. Among these words “Chile” is found as the most repeated one followed by: “monetary”, “policy”, “inflation”, “financial”.

Downloads

DTBCs constitute the first stage of the dissemination of economic research papers produced at the Central Bank of Chile. Many of them are then submitted for publication to international and national academic journals. As a scientific dissemination series, these papers serve as a reference for other scholars on similar topics and therefore, the DTBCs are regularly cited in the literature. The most cited DTBC is entitled *“Financial Intermediation and Growth: Causality and Causes”* (DTBC N°56, 1999), authored by Thorsten Beck, Ross Levine and Norman Loayza. The most

downloaded paper in the second half of 2023, which is when statistics became available on the Bank’s website, is DTBC No.617, titled *“Estimation of the Risk Premium in Chile”* from 2011, authored by Francisca Lira and Claudia Sotz, and has been downloaded 999 times.

Other interesting facts: The titles with the most and least characters are:

- With 136 characters, the longest title goes to DTBC No.348: *“The Effect of Adverse Oil Price Shocks on Monetary Policy and Output Using a Dynamic Small Open Economy General Equilibrium Model With Staggered Price for Brazil”* by Mirta Noemi Sataka Bugarin, Marcelo Kfoury Muinhos, Jose Ricardo da Costa e Silva and Maria da Glória Silva Araújo (2005).
- With four characters, the shortest title goes to DTBC No.878: *“Big G”* by authors Lydia Cox, Gernot Muller, Ernesto Pastén, Raphael Schoenle and Michael Weber.

For the next years, we aim to keep the working papers series of the Central Bank of Chile contributing to expand the frontier of economic knowledge both in Chile and the rest of the World.

Using new sources of information to understand the evolution of inflation during the COVID-19 crisis

Understanding in real time the supply and demand factors that affect inflation dynamics is a critical need for all central banks. While monetary policy affects demand, achieving price stability also depends on supply-side factors that escape the control of central banks. In this sense, early warning indicators are tremendously useful to quickly monitor and assess the evolution of inflation. This need became clear during the COVID-19 crisis, where the literature showed that the rise in inflation stemmed from both supply and demand shocks.

The paper *“Disentangling demand and supply inflation shocks from electronic payments data”*, by economists [Guillermo Carlomagno](#) and [Nicolás Eterovic](#) of the Central Bank of Chile and Luis Hernández Román of the University of Warwick, presents a methodology for decomposing inflation into demand and supply shocks at the product level using digital payments (DP) data. This paper focuses on the Chilean economy, for which DP information is available as from February 2018 and cover a significant portion of the items in the consumer price index (CPI) basket. Using monthly price and quantity indexes constructed from DP data, an autoregressive vector model is estimated using Bayesian techniques (BVAR) for each product. The identification scheme is based on sign restrictions (Arias et al., 2018) and on the assumption that a demand shock moves prices and quantities in one direction, and a supply

“By using data from digital payments in Chile, it is possible to decompose the evolution of inflation during the COVID-19 crisis into supply and demand factors. The results show that, although supply factors played an important role at the beginning and at the end of the crisis, the main drivers were demand factors.”

shock moves them in the opposite way. In turn, this decomposition at the product level allows extracting different sub-indexes using the official weights of the CPI components.

While the use of digital payment data has gained prominence in recent years in the literature on real-time forecasting of macroeconomic variables, its application to decompose shocks at the disaggregated level is new in the literature. The methodology employed in this paper also presents an alternative to the decomposition of inflation into demand and supply shocks at the category level proposed by Shapiro (2022), which has become popular after the pandemic. The merit of the approach described here lies in combining the gains of using DP data for forecasting purposes with an identification scheme that allows both shocks to coexist at any point in time. Thus, this methodology is a valuable tool for the conduct of monetary policy by allowing the monitoring of inflation at a high level of disaggregation that

distinguishes between supply- and demand-side factors. This distinction is important because of their different policy implications.

This paper documents two main results. First, using simple real-time forecasting models, it confirms the usefulness of DP data for the Chilean case by showing that indicators based on them provide an early and reliable source for inflation monitoring. Second, as shown in Figure 3, the estimates offer a reasonable description of the evolution of the dynamics of inflation since the pandemic in Chile. The decomposition suggests that inflation can be characterized by three periods. The first period saw the onset of the pandemic as a combination of supply and demand shocks cancelling each other out. In the second period (i.e., 2021), the end of confinements, along with liquidity injections to households, led to an increase in the demand for goods. This demand shock continued to escalate throughout the year, outpacing the recovery on the supply side and

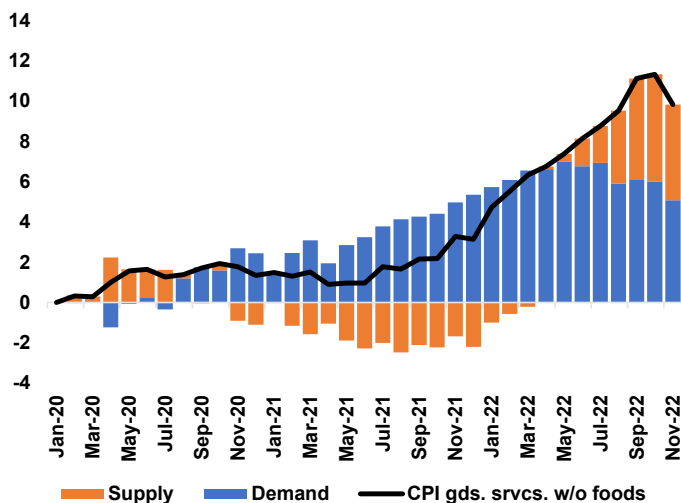
driving a major acceleration in goods inflation. In the third period, (i.e., during 2022), with demand already high, Russia's invasion of Ukraine plus China's zero COVID policy resulted in a significant increase in commodity prices and a disruption of global supply chains, triggering

supply shocks on top of the already high level of inflation.

Summing up, digital payments data provide early and reliable indicators to monitor demand- and supply-driven inflationary shocks in Chile.

While this paper focuses on the Chilean case, DP data are expected to be useful for monitoring inflation in other countries as well, especially those where these data cover a significant proportion of the products that make up the CPI basket.

Figure 3: Historical decomposition of the CPI w/o volatile items



Note: Historical decomposition (HD) for the sample from March 2020 to November 2022. HDs are expressed as deviations from zero. Indexed to March 2020 equal to zero and cumulative contributions thereafter.

Income heterogeneity and its effect on macroeconomic dynamics

The recent development of Heterogeneous-Agents New Keynesian models, better known as HANK models, has made it possible to study the impact of income and wealth distributions on macroeconomic aggregates. These models have shown that changes in income distribution can generate important effects on fluctuations in the business cycle. More importantly, these models have proven to be key for understanding the redistributive effects of public policy.

In their paper *“Time-Varying Expenditure Shares and Macroeconomic Dynamics”*, Central Bank of Chile researchers [Benjamín García](#), [Mario Giarda](#), [Carlos Lizama](#) and [Damián Romero](#), contribute to this debate by studying household consumption decisions and how these, coupled with income heterogeneity, affect the business cycle. The authors then propose a novel methodology. First, by using microdata from electronic payment transactions in Chile, they identify whether household consumption patterns vary by income level, and whether these patterns also change depending on the phase of the business cycle. Second, using a dynamic

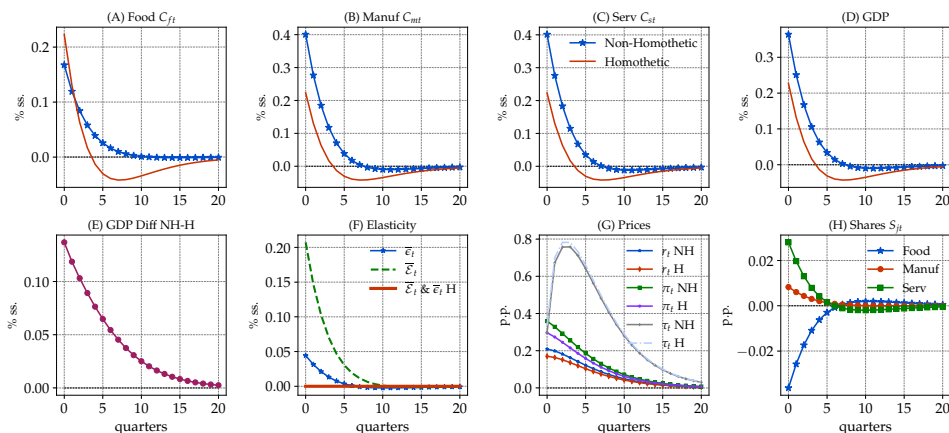
“Considering a mechanism that allows for a heterogeneous reallocation of consumption among various types of goods is crucial for understanding the response of aggregate variables to income shocks and for understanding the response of the economy to fiscal policy.”

stochastic general equilibrium model adapted to reflect the heterogeneity found in the data, the authors study whether such expenditure distributions have an aggregate effect on macroeconomic dynamics or not.

For the empirical part, the authors construct a database that combines household-level consumption information with aggregate data. Among the data used, the use of debit and credit card transactions stands out. With this information, they can reconstruct consumption at the municipality level and track it over time. The results allow them to identify three stylized facts in the data, as shown below:

- **Stylized fact 1: Expenditure shares vary across the income distribution.** The results point to an ordering in which spending on food presents the lowest income elasticity, followed by spending on manufactured products, while services present the highest elasticity. Consequently, as income increases, the percentage of spending on food falls and that on services rises. Spending on manufactures, on the other hand, remains relatively stable as income increases.
- **Stylized fact 2: Expenditure shares correlate with income elasticity over the business cycle.** During distinct phases of the cycle,

Figure 4: Impulse Response Functions (IRFs)



there is a significant reallocation of spending among diverse types of goods. Expenditure shares change over time and with economic growth. During boom periods in the Chilean economy, consumers replace foods with manufactures and, more strongly, with services. This finding generalizes stylized fact number 1 in a dynamic context. Over the business cycle, when aggregate income increases, households replace low income-elasticity goods with others that have high income elasticity.

- Stylized fact 3: Expenditure shares respond to income shocks according to their income elasticities.** To study the sensitivity of household expenditure shares to income shocks, the authors analyze how fiscal transfers affect consumption. The results show that an increase in transfers at the municipality level disproportionately increases expenditures on services compared to manufactures and foods in the first six months after the shock. Then, the effect remains positive but like that of manufacturing, becoming positive and statistically significant four months after the shock. This effect is persistent and lasts at least twelve months. Consistent with stylized facts 1 and 2, the increase in the shares of manufacturing and services is accompanied by a decrease in the share of food expenditures, reaching its lowest point four months after the shock. Thus, in response to a positive income shock, the shares of services and manufacturing increase, while the share of foods decreases.

To examine the aggregate implications of these three stylized facts, the study proposes a standard HANK-type general equilibrium model but modified to include *non-homothetic* (NH) preferences). The inclusion of NH preferences is key to model the various patterns of expenditure composition observed in the data. The model has

households at different income levels having different expenditure shares, different price indices and different average income elasticities. In this context, the average household income elasticity is a crucial object, as it determines the sensitivity of the household consumption composition to income shocks and, hence, the sensitivity of the overall economy.

The heterogeneity of expenditure shares interacts with the source of heterogeneity traditionally included in standard HANK models. In the model proposed by this paper, poorer households have lower average income elasticities and higher marginal propensities to consume (MPC) than richer households. At the individual level, non-homothetic (NH) preferences operate as an insurance as they allow for optimal readjustment of the consumer basket after an income shock, resulting in lower consumption volatility. The authors call this effect the insurance channel. On aggregate, if the economy-wide average income elasticity increases sufficiently in response to an income shock, households become, on average, more sensitive to income changes, amplifying the aggregate response of consumption. The authors refer to this channel as the *average elasticities* effect.

After breaking down the changes in consumption between the two channels mentioned above, the results show that the average aggregate elasticity, if procyclical, amplifies the effects of income shocks (such as fiscal transfers) given an average MPC, and that the covariance between the elasticities of households and their MPCs causes an additional amplification or attenuation of the shocks, depending on the sign of this covariance. The main result shows that the response to income shocks depends on the relative weight assigned to both the *insurance* channel and the *average elasticities* channel.

Having a general equilibrium model also allows the authors to evaluate the aggregate response

of the economy to a shock in fiscal transfers. In this experiment, the government makes an unexpected transfer of income that is the same for all households. Figure 4 shows the impulse-response functions (IRF) of the economy after the transfer shock. Panels (A)-(C) show the aggregate response of consumption in each sector, while panel (D) shows the response of GDP. The blue lines with stars represent the responses in the non-homothetic (NH) preference model, while the solid red lines are the responses in the standard model (H).

Since the fiscal shock boosts the level of income in the economy, all sectoral and aggregate responses increase the level of consumption and activity, irrespective of the type of preferences used. However, there are important quantitative differences between the two economies. Regarding sectoral consumption (panels A-C), we observe a less pronounced response of food expenditures in the NH model, but a stronger response of spending in manufactures and services compared to H. This is consistent with reduced spending on less income-elastic goods and increased consumption of more income-elastic goods. Panel (D) of the figure shows that the response of GDP is about 60 percent stronger and more persistent in the NH economy than in its counterparty H. This difference is also visible in panel (E), which shows the differences between the response of GDP in the NH case and the response observed in the H model.

These results highlight the importance of analyzing the role of diverse types of income heterogeneity in explaining changes in the composition of demand over the business cycle and how such changes influence the response and persistence of aggregate variables. Considering a mechanism that allows for a heterogeneous reallocation of consumption among various types of goods is crucial for understanding the response of aggregate variables to income shocks and for understanding the response of the economy to fiscal policy.

Publications in academic journals by researchers of the Central Bank of Chile

- Acosta-Henao, M., Pratap, S., & Taboada, M. (2023). "Four facts about relationship lending: The case of Chile 2012-2019". *Journal of Corporate Finance*, 80:102415.
- Acosta-Henao, M. (2023). "Law enforcement and the size of the informal sector". *Economic Modelling*, 1006400.
- Albagli, E., Ceballos, L., Claro, S. y Romero, D. (Forthcoming), "UIP deviations: Insights from event studies". *Journal of International Economics*.
- Alfaro, R. & Drehmann, M. (2023). "The Holt-Winters filter and the one-sided HP filter: A close correspondence". *Economics Letters* 222 (January): 110925.
- Alfaro, R. & Inzunza, A. (2023). "Modeling S&P 500 returns with GARCH models" *Latin America Journal of Central Banking* 4(3): 100096.
- Alfaro, R. & Piña, M. "Estimates of the US Shadow-Rate" (2023) *Latin America Journal of Central Banking* 4(1): 100080.
- Andreasen, E., Bauducco, S., & Dardati, E. (Forthcoming). "Capital controls and firm performance". *Journal of International Economics*.
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- Cortina, M., & Madeira, C. (2023). "Exposures to climate change's physical risks in Chile". *Latin American Journal of Central Banking*, 4(2), 100090.
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- Huneus, F., Larrain, B., Larrain, M., & Prem, M. (2023). "Ownership networks and labor income". *The Journal of Law, Economics, and Organization*.
- Huneus, F., & Rogerson, R. (Forthcoming). "Heterogeneous Paths of Industrialization". *The Review of Economic Studies*.
- Inzunza, A., & Ruiz, J. (2023). "Pension knowledge in Chile and regional development characteristics". *Journal of Pension Economics & Finance*, 1-29.
- Madeira, C., Madeira, J., & Monteiro, P. S. (2023). "The origins of monetary policy disagreement: the role of supply and demand shocks". *Review of economics and statistics*, 1-45.
- Moreno, J., Medina, J.P., & Palma-Behnke, R. (Forthcoming). "Latin America's Renewable Energy Impact: Climate Change and Global Economic Consequences". *Energies*.
- Pasten, E., Schoenle, R., & Weber, M. (Forthcoming). "Sectoral Heterogeneity in Nominal Price Rigidity and the Origin of Aggregate Fluctuations". *American Economic Journal: Macroeconomics*.
- Peña, J., & Prades, E. (Forthcoming). "International Sourcing during COVID-19: How did Chilean Firms Fare?" *Latin American Journal of Central Banking*.

Latest working papers of the Central Bank of Chile

Number	Title	Authors	Date
1001	The Effect of Cognitive Skills on Fertility Timing	Agustín Díaz	November 2023
1000	Time-Varying Expenditure Shares and Macroeconomic Dynamics	Benjamín García, Mario Giarda, Carlos Lizama, Damian Romero	November 2023
999	Relationship Lending: Characteristics and Real Effects	Miguel Acosta-Henao, Sangeeta Pratap, Manuel Taboada	November 2023
998	International Sourcing during COVID-19: How did Chilean firms fare?	Jennifer Peña, Elvira Prades	October 2023
997	A Preliminary Assessment of the Economic Effects of Climate Change in Chile	Felipe Beltrán, Luigi Durand, Mario González-Frugone, Javier Moreno	October 2023
996	Monetary Policy Tightening and Bank Lending Standards: Evidence from the Chilean Bank Loan Survey	Helmut Franken, Alejandro Jara	October 2023
995	Financial Constraints and Firm Adjustments During a Sales Disruption	Juan-Andrés Castro, Enzo A. Cerletti	October 2023
994	Forward Guidance: Estimating a Behavioral DSGE Model with System Priors	Agustín Arias, Benjamín García, Ignacio Rojas	October 2023
993	The origins of monetary policy disagreement: the role of supply and demand shocks	Carlos Madeira, João Madeira, Paulo Santos Monteiro	October 2023
992	The Heterogeneous Effect of Monetary Policy Shocks: Evidence for US Households	Tomás Opazo	September 2023
991	The impact of the Covid Pension Fund Withdrawals in Chile on the future retirement income of the Social Security affiliates and their households	Alejandra Inzunza, Carlos Madeira	August 2023
990	Financial and real effects of pandemic credit policies: an application to Chile	Felipe Garcés, Juan Francisco Martínez, M. Udara Peiris, Dimitrios P. Tsomocos	August 2023
989	Hard Commodities Hit Harder: Global Financial Risk and Commodity Exporters	Gabriela Contreras	August 2023
988	Precios y Holgura en el Mercado de Arriendo: Análisis de Avisos Listados	Felipe Córdova, Alejandra Cruces, Sergio Díaz	August 2023
987	Measurement of Efficiency and its Drivers in the Chilean Banking Industry	Adriana Cobas, Alexandros Maziotis, Andrés Villegas	July 2023
986	Disentangling Demand and Supply Inflation Shocks from Chilean Electronic Payment Data	Guillermo Carlomagno, Nicolas Eterovic, L. G. Hernández-Román	July 2023
985	Entrepreneurship and the Efficiency Effects of Migration	Gustavo González	July 2023

984	Heterogeneous Impacts of Commodity Price Shocks on Labour Market Outcomes: Evidence and Theory for the Chilean Mining Sector	José Valenzuela, David Coble	June 2023
983	Effectiveness of Foreign Exchange Interventions: Evidence and Lessons from Chile	Jorge Arenas, Stephany Griffith-Jones	June 2023
982	Freight costs and domestic prices during the COVID-19 pandemic	Gustavo González, Emiliano Luttini, Marco Rojas	June 2023
981	Anatomy of Firms' Margins of Adjustment: Evidence from the COVID Pandemic	Elías Albagli, Andrés Fernández, Juan Guerra-Salas, Federico Huneeus, Pablo Muñoz	June 2023
980	The Impact of Monetary Policy on a Labor Market with Heterogeneous Workers: The Case of Chile	Carlos Madeira, Leonardo Salazar	June 2023
979	Monetary Policy Surprises on the Banking Sector: the Role of the Information and Pure Monetary Shocks	Felipe Beltrán, David Coble	April 2023
978	Startup Employment and Career Trajectories	Gonzalo García-Trujillo, Nathalie González-Prieto, Alvaro Silva	April 2023
977	Commodity Price Shocks and Production Networks in Small Open Economies	Alvaro Silva, Petre Caraiani, Jorge Miranda-Pinto, Juan Olaya-Agudelo	April 2023
976	Exposures to climate change's physical risks in Chile	Magdalena Cortina, Carlos Madeira	April 2023
975	Global monetary policy surprises and their transmission to emerging market economies: an external VAR analysis	Felipe Beltrán	April 2023
974	Use of Financial Instruments among the Chilean households	Carlos Madeira	April 2023
973	The evolution of consumption inequality and riskinsurance in Chile	Carlos Madeira	April 2023
972	Government Purchases, the Labor Earnings Gap, and Consumption DynamicsFrom Patriarchy to Partnership: Gender Equality and Household Finance	Mario Giarda	April 2023
971	Spatial Production Networks	Costas Arkolakis, Federico Huneeus, Yuhei Miyauchi	February 2023
970	From Dominant to Producer Currency Pricing: Dynamics of Chilean Exports	José De Gregorio, Pablo García, Emiliano Luttini, Marco Rojas	January 2023
969	Where is the Inflation? The Diverging Patterns of Prices of Goods and Services	Gent Bajraj, Guillermo Carlomagno, Juan M. Wlasiuk	January 2023
968	From Patriarchy to Partnership: Gender Equality and Household Finance	Luigi Guiso, Luana Zaccaria	January 2023