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CENTRAL TO AMERICA'S ECONOMY®

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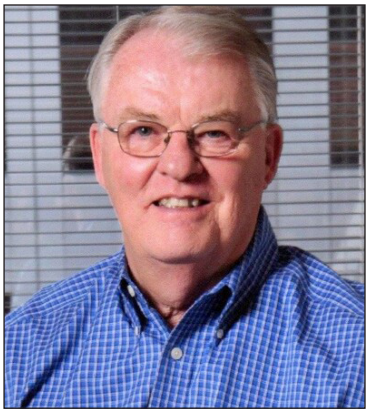
In Memoriam: Daniel L. Thornton



Daniel L. Thornton
1944-2024
Former Vice President and
Economic Advisor
Federal Reserve Bank of St. Louis

Daniel (Dan) L. Thornton passed away on May 6, 2024, at age 79 after a brief illness. Dan was an economist and a senior officer at the Federal Reserve Bank of St. Louis, where he was employed from 1981 until his retirement in 2014. During his Bank tenure, he advised five St. Louis Fed presidents, published numerous articles in professional journals and the Bank's *Review*, organized conferences, and recruited and mentored many economists. Dan had many colleagues and friends throughout the economics profession. He was very generous with his skills and time in all aspects of his life. This memoriam celebrates Dan's major contributions to the St. Louis Fed's Research Division and the economics profession.

Dan was a native of Clinton, Iowa. He received his MA in Economics from Arizona State University in 1969 and his PhD from the University of Missouri at Columbia in 1976. Before joining the St. Louis Fed, Dan taught economics at Gannon University, Quincy University, and Central Michigan University.

Dan joined the Research Division of the St. Louis Fed in August 1981 as a staff economist and rose through the ranks, ultimately being promoted to Vice President and Economic Advisor in 1998. He retired from the Bank on July 31, 2014. During his tenure at the Bank, Dan published 55 articles in the Bank's *Review* and more than 50 papers in academic journals, including *Review of Economics and Statistics*; *Oxford Economic Papers*; *Oxford Bulletin of Economics and Statistics*; *Review of Financial Studies*; *Journal of Financial Economics*; *Journal of Banking and Finance*; *Journal of Monetary Economics*; and *Journal of Money, Credit, and Banking*.

Dan's article, "A Primer on Cointegration with an Application to Money and Income," co-authored with David A. Dickey and Dennis W. Jansen, is among the most highly cited articles ever to appear in the Federal Reserve Bank of St. Louis *Review*. An academic version of the article was published in the book *Cointegration for the Applied Economist* (Rao, B.B., ed., Palgrave Macmillan, 1994), and it is Dan's most-cited academic publication. After it was published, Dan commented, "I figured [the article] would be one of those papers that everyone would read but never cite." Despite Dan's prediction, the article has been cited more than 800 times, according to Google Scholar. In total, Dan's body of work has nearly 6,650 citations (Google Scholar, accessed May 9, 2024). At the time of his passing, Dan was ranked among the top 5 percent of all authors in 29 categories in Research Papers in Economics (RePEc).

Dan's scholarly record indicates work on relevant and timely topics, dogged persistence, and intellectual growth. He was keenly interested in researching topics in financial and monetary economics, such as the term structure of interest rates, monetary aggregates, and monetary policy communications and transmission. In a competitive environment that requires lifelong learning and a superb work ethic, Dan was an exemplary performer.

Dan's research publications are just one aspect of his numerous contributions to the economics profession. He served willingly as a referee for and held associate editor positions with the *Journal of Banking and Finance*; *Journal of International Financial Markets, Institutions, and Money*; *Applied Economics Letters*; and *Applied Financial Economics*. Dan was also a research fellow at the Centre for Finance and Credit Markets, and he organized and/or co-organized several conferences for the St. Louis Fed and professional societies.

Dan remained professionally active after retiring from the St. Louis Fed. In addition to writing several op-ed pieces and a newsletter, *Common Sense Economics*, Dan continued to write for the *Review* and, at the time of his death, had recently completed a book-length manuscript on monetary economics and macroeconomics.

Dan also made major contributions to economic education throughout his career at the Bank. He frequently contributed to the Research Division's economic education programs, and he served both on the board of the St. Louis Council on Economic Education and as a trustee of the Missouri Council on Economic Education.

Dan played a key role in hiring and mentoring junior economists for the Bank's Research Division, including James Bullard, who eventually served as president of the Bank from 2008 to 2023. Upon learning of Dan's passing, Jim wrote that "[Dan] was a very important mentor to me and helped me enormously in my career. He was a great economist, an institution at the St. Louis Fed, and a personal friend. I will miss him."

As a policy advisor to President Bullard and other St. Louis Fed presidents, Dan took his responsibility to provide independent, thoughtful advice very seriously. He was always willing to speak his mind even if he knew the person receiving his advice would not agree. Dan was "comfortable in his own skin." In the header of each of his *Common Sense Economics* essays, Dan included a famous John Adams quote: "Facts are Stubborn Things." Dan sent his commentaries to former colleagues and friends, current and former Fed economists, and numerous academic economists. His last essay was titled "What is the Fed's Monetary Policy?" In true fashion, Dan concluded that "the Fed has no monetary policy." If that was not clear, he went on to say that "there is very little compelling evidence that the Fed's 'monetary policy actions' have ever been successful" (April 19, 2024).

No one would ever characterize Dan as a yes-man, regardless with whom he was speaking. In the tradition of Homer Jones, Dan demanded strong empirical evidence and was adept at knocking holes in shaky economic theories built on feeble evidence. The St. Louis Fed historically has been a place where independent thinking is encouraged. Dan fit that culture perfectly—and, in fact, contributed to its development. According to Cletus Coughlin, his former Research colleague and Chief of Staff to President Bullard, "the St. Louis Fed has been and continues to be a better place because of Dan's contributions."

Dan is survived by his loving wife, Carolyn, former wife, Jeanne, three children, and stepdaughter. He was a fabulous grandfather of seven grandchildren and a step-granddaughter. Dan was an avid golfer, loved the St. Louis Cardinals, the Missouri Tigers, and, above all, his family and friends. Dan, as the old saying goes, lit up every room he entered. He had a wonderful sense of humor, and we will always remember his smile.

FEDERAL RESERVE BANK of ST. LOUIS
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The Last Mile

Isabel Schnabel

Abstract

This article is based on the Homer Jones Memorial Lecture delivered at the Federal Reserve Bank of St. Louis, November 2, 2023.

Headline inflation in the euro area declined rapidly to 2.9% in October 2023 from its peak of 10.6% one year earlier. The bulk of this large drop reflected the substantial decline in the contributions from energy and food inflation. Once these base effects reverse, continued disinflation relies critically on monetary policy succeeding in reducing underlying inflation in a steady and timely manner. The last mile is about this change in the disinflation process. Large uncertainty around the appropriate calibration and effective transmission of monetary policy, together with the risk of new supply-side shocks pulling inflation away from our target once again, makes this part of the disinflation process the most difficult. In particular, monetary policy transmission may be weaker, or less direct, than in the past, given the share of less-interest-rate-sensitive services industries in total activity has increased steadily in the euro area and globally over the past few decades. In addition, persistent worker shortages have muted the transmission through the labor market, with unemployment at record low levels despite the sharp increase in interest rates. So, although progress on inflation so far is encouraging, the disinflation process during the last mile will be more uncertain, slower, and bumpier. Continued vigilance is therefore needed.

JEL codes: E24, E31, E43, E50, E61, E71

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https://doi.org/10.20955/r.106.72-86

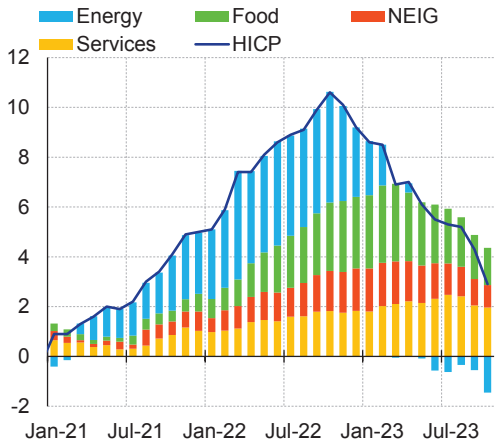
In long-distance running, the last mile is often said to be the hardest. With the finish line within reach, one must push even harder to achieve the long-held goal. The same could be said about tackling the last mile of disinflation.

Throughout 2023, we have seen the first phase of disinflation. Headline inflation fell rapidly and measurably, as previous supply-side shocks reversed. Dislocations in global supply chains were gradually resolved, and energy and food prices came off their peaks reached after Russia's invasion of Ukraine. These were the quick wins of the disinflation process.

Isabel Schnabel is a member of the Executive Board of the European Central Bank, a professor of financial economics at the University of Bonn, and a council member of the European Economic Association.

Figure 1

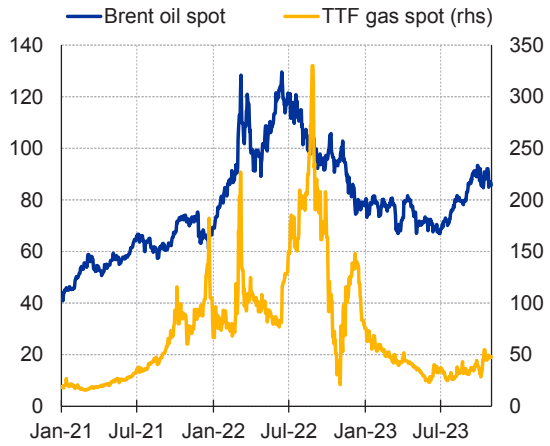
HICP Inflation and Contributions
(annual percentage change and percentage point contribution)



SOURCE: Eurostat and ECB calculations.
Latest observation: October 2023 (flash).

Figure 2

Crude Oil and Natural Gas Prices
(oil: EUR/barrel; gas: EUR/MWh)



SOURCE: Bloomberg and ECB calculations.
Latest observation: October 30, 2023.

Bringing inflation from here back to 2% in a timely manner may be more difficult: Unlike during the first phase, disinflation during the last mile hinges critically on the appropriate calibration and effective transmission of monetary policy. Large uncertainty around these two factors, together with the risk of new supply-side shocks pulling inflation away from our target once again, makes this part of the disinflation process the most difficult.

Monetary policy needs to respond to these challenges with perseverance and vigilance.

THE LAST MILE MARKS A CHANGE IN THE DISINFLATION PROCESS

Headline inflation in the euro area declined rapidly to 2.9% in October 2023 from its peak of 10.6% one year earlier. The bulk of this large drop reflects the substantial decline in the contributions from energy and food inflation (Figure 1).

To a large extent, these effects were to be expected, as was their magnitude. They arise from the statistical observation that, after a large price shock, inflation usually slows measurably once the unusually large monthly price increases of the previous year start to drop out of annual inflation rates.

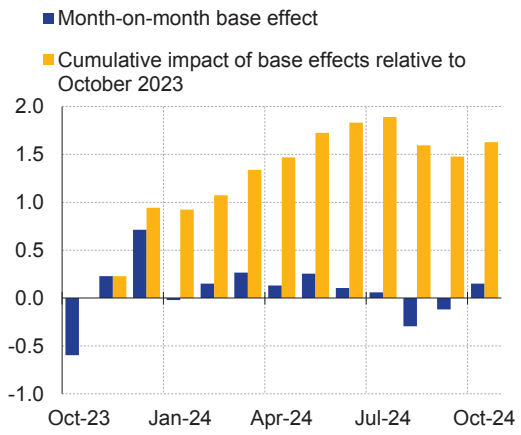
These mechanical dynamics are known as base effects. Oil and gas prices, in particular, have come down remarkably fast from the highs observed in the immediate aftermath of Russia's invasion of Ukraine (Figure 2). Today, oil and gas prices are trading close to, or below, pre-invasion levels.

Such outright price declines are rare. They are usually limited to highly volatile prices of commodities that are traded in international markets and for which the pass-through to final consumer prices is typically large and, in many cases, imminent, running directly through the energy component of the Harmonised Consumer Price Index (HICP).[1]

1. For an explanation of the various effects of oil prices on consumer prices, see ECB (2014), "Indirect effects of oil price developments on euro area inflation", *Monthly Bulletin*, December.

Figure 3

Impact of Base Effects from Energy Component on Headline HICP Inflation
(percentage points)



SOURCE: Eurostat and ECB calculations.

Latest observation: October 2023 (flash).
Latest data point: October 2024.

Figure 4

HICP Food Inflation
(annual percentage change)

SOURCE: Eurostat.

Latest observation: October 2023 (flash).

Following large commodity shocks, an initial rapid decline in headline inflation is therefore the norm rather than the exception. This was also the case after the global financial crisis in 2008 and the financial turmoil in 2012.[2]

A recent IMF study shows that such strong initial base effects have often given rise to "premature celebrations."[3] That is, when inflation starts falling, it is tempting to conclude that it has been fought off successfully and that it is a matter of when, and not if, inflation will fall back to target.

However, in about 90% of unresolved inflation episodes, inflation declined materially within the first three years after the initial shock, but then either plateaued at an elevated level or accelerated again.

Base effects themselves may be one reason why this can happen. By definition, they have a finite horizon. They often turn from being a source of disinflation to becoming a renewed headwind, as they operate in both directions. They swing like a pendulum, meaning that disinflation is not necessarily a smooth process but can be a rather bumpy road.

This also applies today. Our estimates suggest that, should energy prices over the coming months increase in line with their historical mean, energy is estimated to add nearly 1.9 percentage points to euro area headline inflation by July 2024 (Figure 3).

This primarily reflects the strong decline in oil and gas prices observed since November 2022. A rise in energy prices over and above the historical mean would further amplify such base effects.

The extraordinarily sharp rise in food prices in 2022 and early 2023 implies that similar dynamics for headline inflation may occur, at some point, for the food component of the HICP (Figure 4).

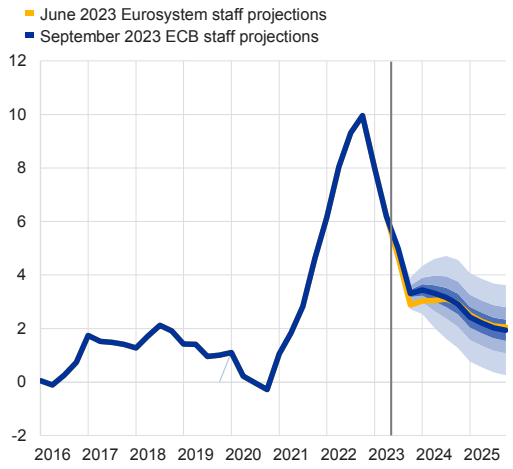
The other factor causing inflation persistence is that underlying price pressures can prove much stickier than volatile commodity prices.

2. Headline inflation also fell strongly in the wake of the "crude" shock in 2014. See also Grigoli, F. et al. (2017), "A Crude Shock: Explaining the Impact of the 2014-16 Oil Price Decline Across Exporters", *IMF Working Papers*, No 2017/160, IMF, 18 July.

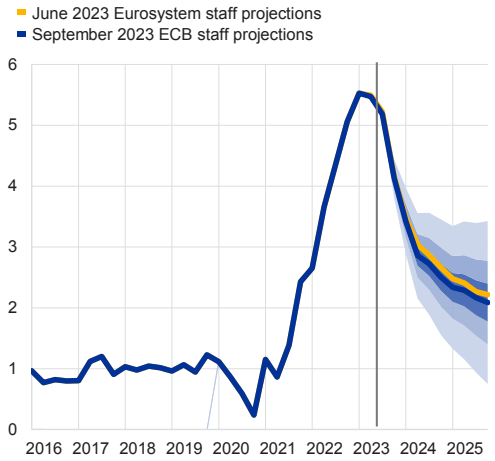
3. Ari, A. et al. (2023), "One Hundred Inflation Shocks: Seven Stylized Facts", *IMF Working Papers*, No 2023/190, IMF, 15 September.

Figure 5

HICP Inflation Projections
(annual percentage change)



HICP Excluding Energy and Food Inflation Projections
(annual percentage change)



NOTE: The ranges shown around the central projections are based on past projection errors, after adjustment for outliers. The bands, from darkest to lightest, depict the 30%, 60%, and 90% probabilities that the outcome will fall within the respective intervals. For more information, see Box 6 of the March 2023 ECB staff macroeconomic projections for the euro area.

SOURCE: September 2023 ECB staff projections.

Last year's energy price shock quickly turned into a broad-based price level shock, as firms passed most of their cost increases on to final consumer prices. As a result, core inflation, which excludes the direct effects of energy and food, increased strongly in the euro area, reaching its peak of 5.8% in March 2023, significantly later than headline inflation. In October, it was still running at 4.2%.

The reversal of base effects implies that continued disinflation will need to rely on a steady decline in underlying inflation. The last mile is about this change in the disinflation process. It is no longer about mechanical price reversals but about creating the conditions required for the indirect and second-round effects of supply-side shocks not to become entrenched in underlying inflation. This is the task of monetary policy.

PRICE AND WAGE RIGIDITIES MEAN UNDERLYING INFLATION IS STICKIER

Our most recent ECB staff projections see both headline and core inflation declining toward 2% by the end of 2025 (Figure 5).

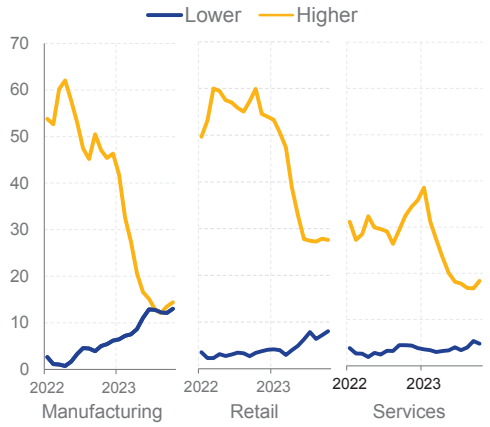
The projections highlight a key characteristic of the last mile: while it took a year to bring inflation from 10.6% to 2.9%, it is expected to take about twice as long to get from here back to 2%.

In other words, the disinflation process is projected to slow significantly. Essentially, this has to do with the way wages and prices are set.[4]

4. Wang and Werning (2022) show that inflation can be more persistent with gradual markup adjustment by oligopolistic firms with sticky prices. See Wang, O. and I. Werning (2022), "Dynamic Oligopoly and Price Stickiness", *American Economic Review*, Vol. 112, No. 8, pp. 2815-49.

Figure 6

Selling Price Expectations
(share of firms expecting lower/higher selling prices)



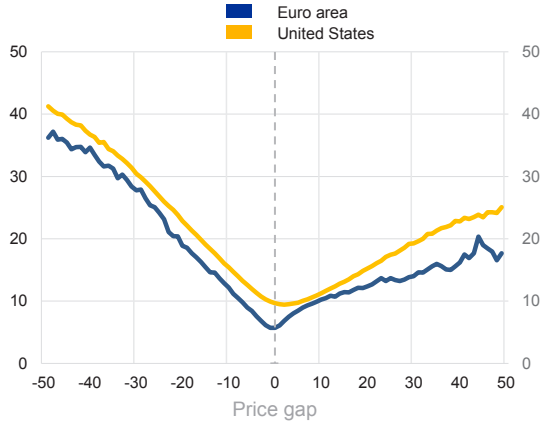
NOTE: Data are non-seasonally adjusted.

SOURCE: European Commission (including Eurostat) and ECB calculations.

Latest observation: October 2023.

Figure 7

Evidence of State Dependence: Repricing Probability as Function of Price Gap
(percent)



NOTE: The figure shows the probability of a price change as a function of mispricing in the euro area and the United States. The V-shape of the curve is consistent with state-dependent price setting: The probability of adjustment steadily increases with the extent of mispricing. The extent of mispricing is proxied as a distance from the average price of the same product among those competitors that reset their prices in the same month. The measure also controls for the persistent heterogeneity among products and stores by eliminating the impact of product-store fixed effects. Additional details on the methodology are available in the paper.

SOURCE: Karadi, P., J. Amann, J. S. Bachiller, P. Seiler and J. Wursten (forthcoming), "Price setting on the two sides of the Atlantic – Evidence from supermarket scanner data," *Journal of Monetary Economics*.

Last year, firms revised their selling prices much more frequently than they usually do (Figure 6).

They were doing this to protect their profit margins at a time of rapidly rising input costs. In the jargon of economists, this is referred to as state-dependent pricing: If prices are far away from their optimal level, firms are more likely to adjust them (Figure 7).[5] In many cases, firms even raised their selling prices beyond the increase in costs, bolstering unit profits (Figure 8).

This was possible because aggregate demand remained exceptionally resilient at a time of significant supply constraints, with fiscal transfers shielding firms and households from the adverse income effects of the pandemic and the war in Ukraine (Figure 9).[6]

But when input costs are falling, or when conditions are broadly stable, most firms behave differently. They then revise their prices more reluctantly, which makes underlying inflation stickier and disinflation slower.

In addition, wages are often set in a staggered way, affecting firms' cost base only with a lag.[7] In the euro area, wage growth has picked up sharply over the past year as employees are trying to make up for lost purchasing power.

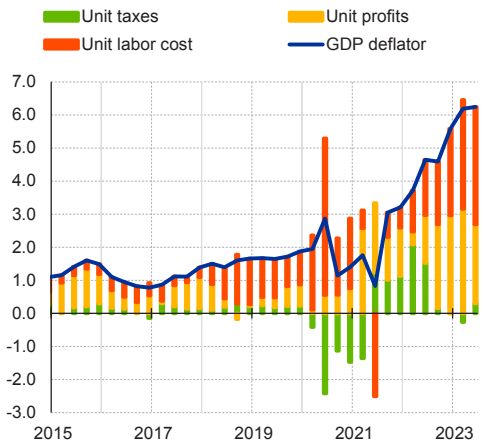
5. Schnabel, I. (2023), "Disinflation and the Phillips curve", speech at a conference organized by the European Central Bank and the Federal Reserve Bank of Cleveland's Center for Inflation Research, "Inflation: Drivers and Dynamics 2023", August 31, 2023.

6. Schnabel, I. (2023), "Money and inflation," Thünen Lecture at the annual conference of the Verein für Socialpolitik, Regensburg, September 25, 2023.

7. Blanchard, O. and Galí, J. (2007), "Real Wage Rigidities and the New Keynesian Model", *Journal of Money, Credit and Banking*, Vol. 39 (S1), pp. 35-65.

Figure 8

Contributions to GDP Deflator
(annual percentage change and percentage change contributions)

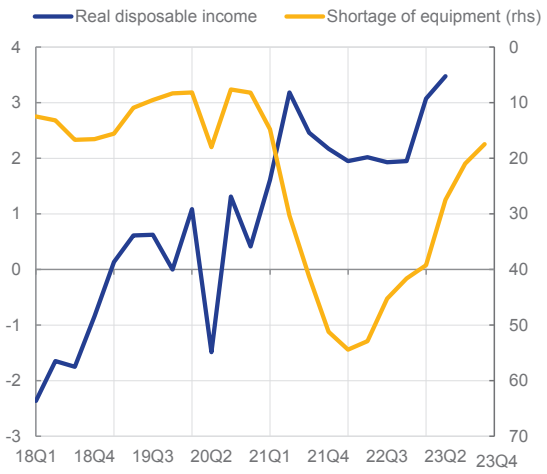


SOURCE: Eurostat and ECB calculations.

Latest observation: 2023:Q2.

Figure 9

Real Disposable Income and Shortage of Equipment as a Factor Limiting Production
(lhs: index: 2019:Q4 = 100; rhs: percentage balances, deviations from long-term mean)



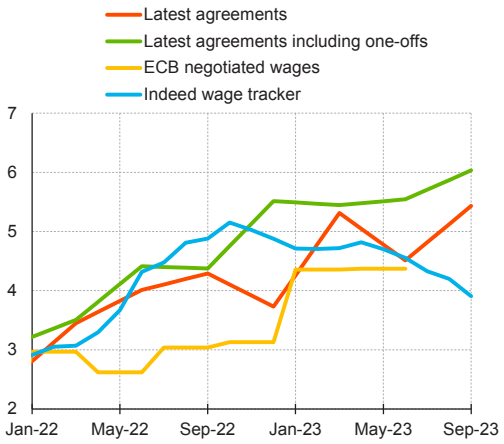
NOTE: The series for shortage of equipment is inverted, and refers to the manufacturing sector.

SOURCE: Eurostat, DG-ECFIN, and ECB calculations.

Latest observations: 2023:Q2 for real disposable income; 2023:Q4 for shortage of equipment.

Figure 10

Wage Trackers
(annual percentage change)



NOTE: Indicator of latest wage agreements shows the wage growth implied by agreements reached in a quarter for 12 months ahead. Indeed tracker measures wage growth in online job ads, computed by the Central Bank of Ireland.

SOURCE: Calculated based on micro data on wage agreements provided by Deutsche Bundesbank, Banco de España, the Dutch employer association (AWVN), Oesterreichische Nationalbank, Bank of Greece, Banca d'Italia, and Banque de France.

Latest observations: September 2023 for Indeed Wage Tracker; 2023:Q3 for indicators of latest agreements; 2023:Q2 for ECB negotiated wages.

Figure 11

Unit Labor Costs
(annual percentage change)

SOURCE: Eurostat and ECB calculations.

Latest observation: 2023:Q2.

Figure 12

Weighted Distribution of Price Changes for Services

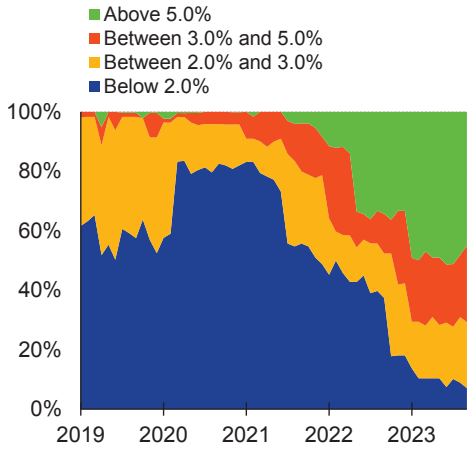
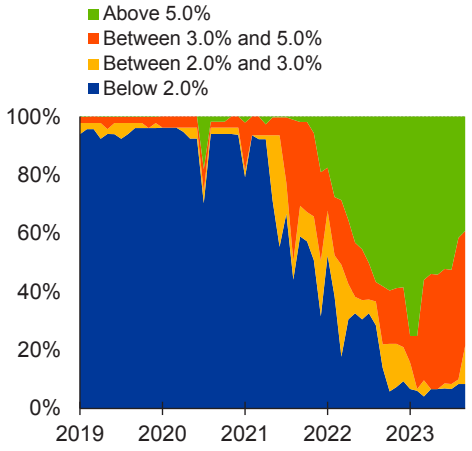


Figure 13

Weighted Distribution of Price Changes for Non-energy Industrial Goods



NOTE: The weight of items sums up the weight of items in the HICP basket in the different categories.

SOURCE: Eurostat and ECB calculations.

Latest observation: September 2023.

Our indicators, especially those tracking recently signed wage agreements, point to continued strong wage growth at a time when inflation is already falling (Figure 10).

These are the slow-moving second-round effects of the adverse supply-side shocks that hit the euro area economy in previous years.

Meager productivity growth is putting additional pressure on firms' unit labor costs, which have been rising sharply since the beginning of 2022 (Figure 11).

The distribution of price changes illustrates these rigidities. In September, around 45% of services prices, weighted according to their share in the HICP basket, were still increasing at a rate above 5%, with this share declining only very slowly (Figure 12). In the goods sector, the share of products seeing particularly strong price increases started to decline earlier (Figure 13).

But even in this sector, still nearly 40% of products are currently rising at a rate above 5%.

Given these rigidities, disinflation will slow down appreciably. For core inflation to evolve in line with ECB staff projections, two key conditions need to be met. One is that the growth in unit labor costs eventually falls back to levels that are broadly consistent with 2% medium-term inflation. The second is that firms will use their profit margins as a buffer to limit the pass-through of the current strong wage increases to consumer prices.

The last mile is about ensuring that these two conditions materialize in a timely manner. That process faces two key challenges. The first is the appropriate calibration and transmission of monetary policy. The second is the potential occurrence of new supply-side shocks.

CALIBRATION AND TRANSMISSION UNCERTAINTY MAKE THE LAST MILE THE HARDEST

Disinflation during the last mile relies critically on monetary policy succeeding in reducing underlying inflation in a steady and timely manner. During the first phase of disinflation, a determined policy response was mainly required to keep inflation expectations anchored, thereby reducing the macroeconomic costs associated with restoring price stability.[8] During the last mile, the demand channel of monetary policy—whereby tighter policy slows economic activity—becomes critical when the long and variable lags are gradually drawing to a close.

As such, monetary policy needs to steer wage- and price-setting in a way that ensures that the two conditions on unit labor costs and profit margins are met. This is particularly true in an environment in which the multi-year suspension of fiscal rules and the potential absence of a revised economic governance framework in the European Union risk leaving fiscal policy too expansionary for too long.

While economic growth in the euro area has been weak over the course of this year, considerable uncertainty about the lags and effects of monetary policy remains. A broad distinction can be drawn between the uncertainty around the appropriate calibration of monetary policy and the uncertainty regarding its transmission.

Calibration uncertainty relates to the choice of the appropriate level of the policy rates and the period over which they need to remain at this level. It is inherently difficult to estimate the degree of monetary tightening required to bring inflation back to 2% over a certain horizon.

This is especially relevant in the current context. There is considerable uncertainty about the impact of recent shocks on the supply capacity of the economy, and hence on the level of slack. For example, if recent shocks were to depress the level of potential output more persistently, the output gap could be smaller or even positive rather than negative, as in the conventional estimates.

At the same time, digitalization, rapid progress in artificial intelligence, and ongoing efforts to accelerate the green transition could boost potential output growth. This is what financial markets seem to expect increasingly. Since early 2022, market-based estimates of the natural rate have increased measurably in both the euro area and the United States (Figure 14).

Overall, therefore, there is large uncertainty about how structural changes will affect activity in the euro area and globally, making the calibration of monetary policy more difficult.

Transmission uncertainty can amplify calibration uncertainty—that is, even if policy is initially calibrated appropriately, it is unclear how fast and to what extent a given policy impulse is transmitted to activity, prices, and wages (Figure 15).[9]

The pace and strength of transmission affect the optimal level and duration of policy. The transmission of our past policy actions to bank lending conditions has been strong, with the cost of borrowing rising sharply (Figure 16). As a result, net credit flows have virtually come to a standstill, for both firms and households (Figure 17).

With interest rates on time deposits rising, saving has also become more attractive, contributing to a rise in households' savings ratio. The transmission through capital markets has been more mixed.

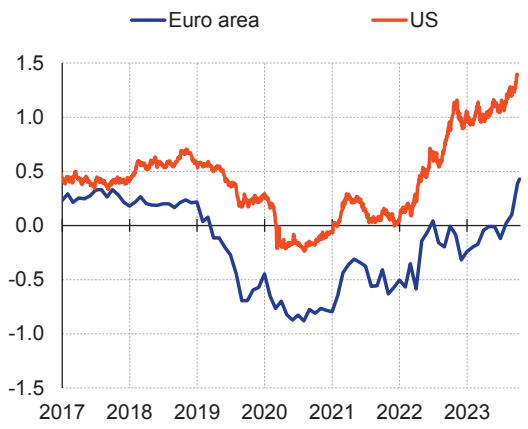
Until recently, risk premia in most segments remained exceptionally compressed. In the past, risk premia in both equity and corporate bond markets rose when the euro area composite Purchasing Managers' Index fell below the growth threshold of 50 (Figure 18).

8. Put differently, the expectations channel of monetary policy was a necessary condition for potentially achieving a soft landing of the economy, above all when considering the excessive inflation overshoots. See Beaudry, P., Carter, T.J. and Lahiri, A. (2022), "Looking Through Supply Shocks versus Controlling Inflation Expectations: Understanding the Central Bank Dilemma", Staff Working Papers, No 2022-41, Bank of Canada; and Sargent, T. (1983), "Stopping Moderate Inflations: The Methods of Poincare and Thatcher", in Dornbusch, R. and Simonsen, M.H. (eds.), *Inflation, Debt, and Indexation*, Cambridge, MA, MIT Press.

9. Schnabel, I. (2023), "The risks of stubborn inflation," speech at the Euro50 Group conference on "New challenges for the Economic and Monetary Union in the post-crisis environment", Luxembourg, June 19, 2023.

Figure 14

Market Estimates of Natural Rate r*
(percent p.a.)



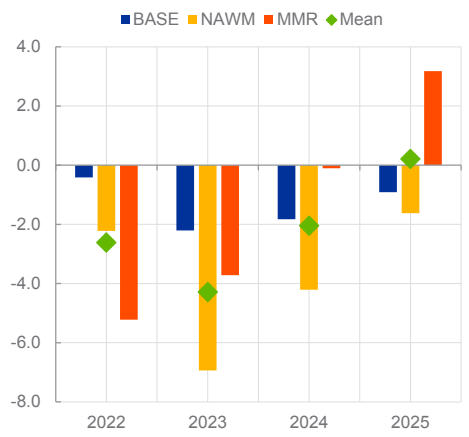
NOTE: "Euro area" refers to the 1y9y real rate adjusted by removing the term premium and "US" shows the DKW 5y5y real rate.

SOURCE: Bloomberg and ECB calculations.

Latest observation: October 16, 2023.

Figure 15

Impact of Monetary Policy Tightening on Real GDP Growth
(p.p., annual rates)

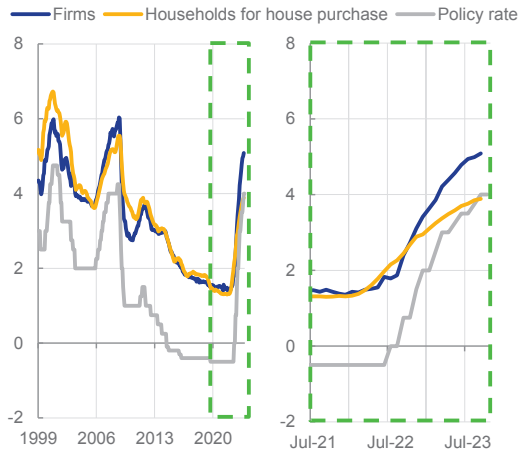


NOTE: This chart reports the results of a simulation involving changes to short-term rate expectations between December 2021 and October 2023, and changes to expectations regarding the ECB's balance sheet between October 2021 and September 2023.

SOURCE: ECB calculations based on NAWM II, the MMR model, and the ECB-BASE model.

Figure 16

Composite Cost of Borrowing
(percentage per annum)



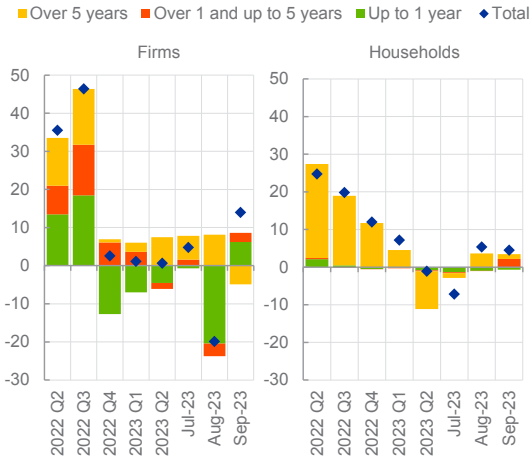
NOTE: The indicator for the total cost of bank borrowing for firms is calculated by aggregating short-term and long-term rates using a 24-month moving average of new business volumes. The ECB relevant policy rate is the MRO from January 1999 to May 2014 and DFR thereafter.

SOURCE: ECB (MIR) and ECB calculations.

Latest observations: September 2023 for composite cost of borrowing indicators and October 2023 for policy rate.

Figure 17

Bank Loans to Firms and Households by Maturity
(average monthly flows in EUR bn)



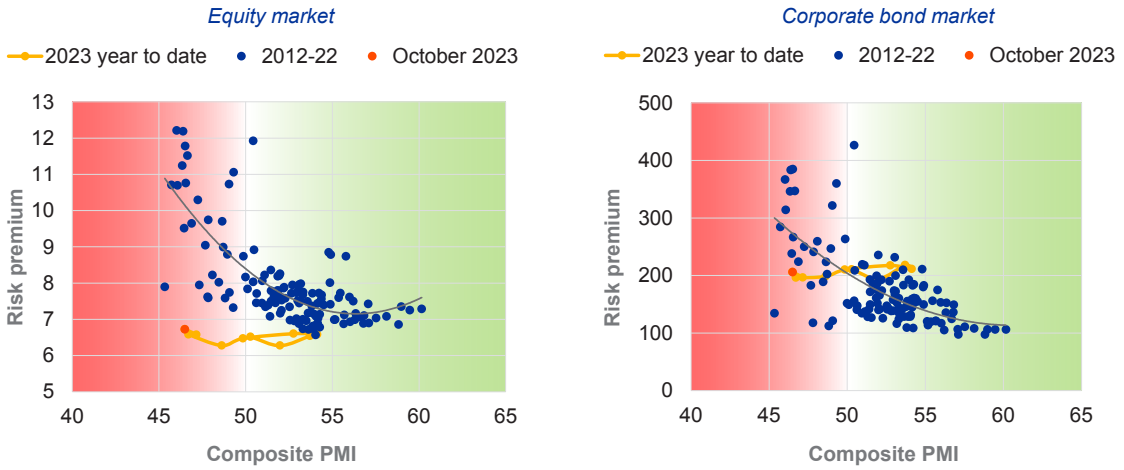
NOTE: All series are adjusted for write-offs/write-downs, reclassifications, exchange rate variations, and seasonality. Total loans for both firms and households are also adjusted for sales and securitization (total loans to firms are also adjusted for cash pooling). The maturity breakdowns are not adjusted for sales and securitization (the seasonal adjustment of the breakdowns for households is internal).

SOURCE: ECB (BSI) and ECB calculations.

Latest observation: September 2023.

Figure 18

Euro Area Risk Premium and Composite PMI
(January 2012 to October 2023; *x*-axis: balance statistics; *y*-axis: percent and basis points)

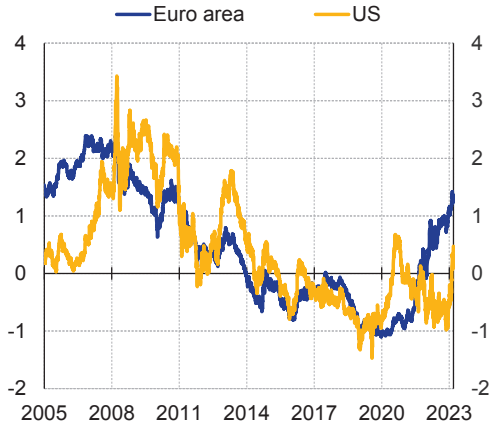


NOTE: The fitted lines are quadratic functions and exclude the first three months of coronavirus-related lockdown (March 2020–May 2020) as outliers. Equity risk premia (left panel) are calculated as the five-year CAPE yield for the EURO STOXX less 5Y real (inflation swap adjusted) German government bond yield. Credit risk premia (right panel) are calculated as the option-adjusted spread for BBB-rated corporate bonds with a residual maturity of five to seven years.

SOURCE: Bloomberg, S&P Global Market Intelligence, and ECB calculations.

Figure 19

10-Year Euro Area OIS and US Treasury Term Premium
(percentage per annum; basis points)



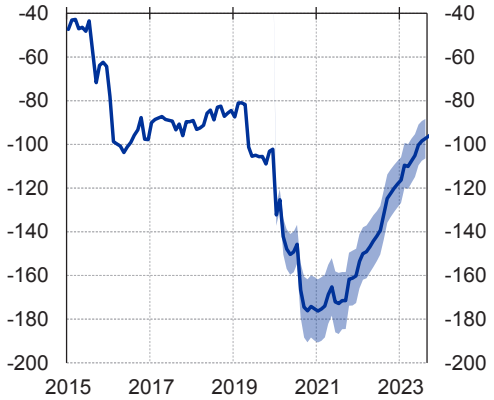
NOTE: The 10-year OIS term premium is based on an affine term structure model fitted to the euro area OIS curve. The estimation method follows Joslin, Singleton, and Zhu (2011). The 10-year UST term premium is based on a five-factor, no-arbitrage term structure model proposed by Adrian, Crump, and Moench (2013).

SOURCE: Thomson Reuters, ECB calculations, Haver Analytics, and the Federal Reserve Bank of New York.

Latest observations: October 23, 2023 for the euro area OIS and October 19, 2023 for the UST.

Figure 20

APP and PEPP Portfolios: Impact of Sovereign Bonds on Risk Premia
(basis points)



NOTE: The upper range of estimates of the impact of APP and PEPP on sovereign bond term premia and other risk premia are derived using an arbitrage-free affine model of the term structure with a quantity factor (see Eser et al., 2023). The lower range is derived using an alternative verson of the model recalibrated so that the model-implied yield reactions to the March PEPP announcement match the two-day yield changes observed after March 18. The model results are derived using GDP-weighted averages of the zero-coupon yields of the big-four sovereign issuers (DE, FR, IT, ES). The blue line is based on projections of the Eurosystem's holdings of big-four sovereign bonds as informed by the ECB's September 2023 survey of monetary analysts.

SOURCE: ECB calculations.

Latest observation: October 2023 (monthly data).

This has not been the case this year, however: Although economic sentiment deteriorated measurably, the risk premium has held firm, making financial conditions easier than usual.

In sovereign bond markets, term premia—that is, the risk premia investors demand for bearing duration risk—have increased continuously and persistently since we started removing policy accommodation in December 2021 (Figure 19). The current and expected future run-off of all our asset purchase programs has contributed to this development (Figure 20).

However, the unusually low level of the term premium in the United States is likely to have also held back a return to higher levels in the euro area through arbitrage conditions. The recent rise in global term premia has helped bring market-based financing conditions closer to those expected given the current level of the policy rates, although volatility remains large.

STRUCTURAL CHANGES MAY WEAKEN POLICY TRANSMISSION

Significant uncertainty also remains about how broader policy transmission will be affected by two structural factors. The first relates to the services sector.

Monetary policy works predominantly by affecting the cost of capital. It is therefore natural that it has a stronger impact on more capital-intensive activities, such as construction and manufacturing. However, over the past few decades the share of capital-intensive industries in total activity has declined steadily in the euro area and globally (Figure 21).

Today, market services account for more than half of gross value added. In our most recent corporate telephone survey, three out of four firms in the services sector reported that the substantial change in financing conditions over the past 12 months had no impact on their business activity (Figure 22). And an even larger share of services firms expect this to be the case over the coming 12 months. Monetary policy transmission may therefore be weaker, or less direct, than in the past, which may lengthen the disinflation process

The second source of uncertainty concerns the persistent shortages of workers. Surveys continue to point to labor as a critical factor limiting production. Shortages remain near historic highs across sectors, especially in the services sector (Figure 23).

As a result, companies have responded to weakening economic activity by hanging on to their employees out of concern that they might be unable to find workers once demand picks up again. So, despite the strongest tightening in the history of the euro area, by 450 basis points in little more than a year, the unemployment rate fell to a new historic low in August, while the labor force continued to increase throughout the first half of this year (Figure 24).

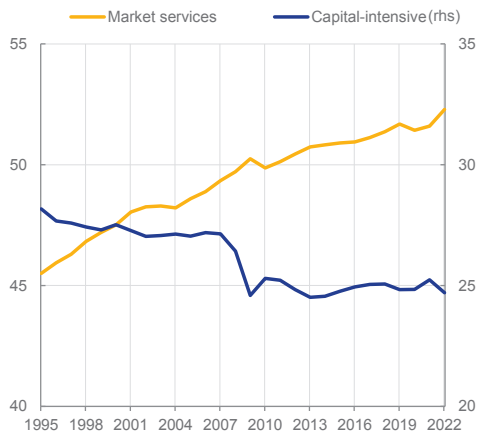
It is unclear how long the transmission through the labor market will remain muted. It is reasonable to assume that the longer economic activity stagnates, the harder it will be for firms, most notably small and medium-sized firms, to hoard labor. And indeed, we are seeing the first signs that the labor market is softening and demand for labor slowing.

But the more slowly this process unfolds and the weaker it is, the higher the risks that persistent labor market tightness will challenge the assumptions underlying the projected decline in core inflation. In particular, unit labor costs may grow more strongly than projected as labor hoarding continues to weigh on productivity growth and labor shortages support favorable wage bargaining conditions at a time when workers are still trying to make up for the substantial losses in their purchasing power.

Higher unit labor costs, in turn, raise the risk that firms will pass a larger part of their cost increases on to final consumer prices, which could lay the ground for a wage-price spiral.

Figure 21

Sectoral Shares in Euro Area Gross Value Added
(percentages)

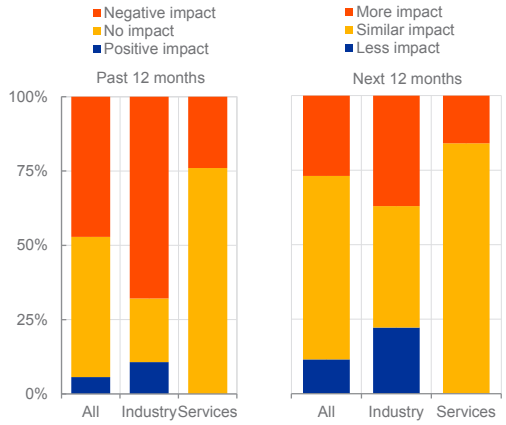


NOTE: The market services sector includes, among others, wholesale and retail trade, transportation, accommodation and food services, information and communication, and financial and real estate services. The capital-intensive sector includes, among others, mining, manufacturing, energy and water supply, and construction.

SOURCE: Eurostat and ECB calculations.

Figure 22

Survey: Impact of Changes in Financing Conditions on Firms' Activity
(percentage of firms)



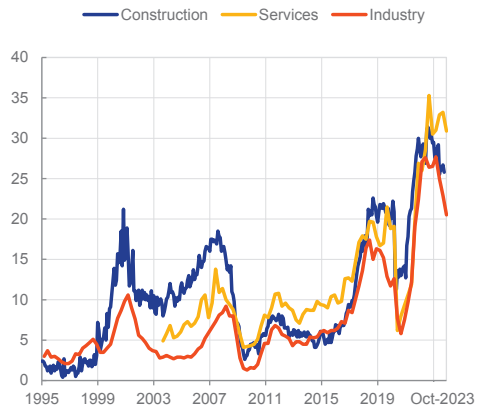
NOTE: How do financing conditions (cost and availability of funding) since mid-2022 affect business activity over the past 12 months and in the next 12 months?

SOURCE: Corporate Telephone Survey.

Latest observation: October 2023.

Figure 23

Labor as a Factor Limiting Production
(percentage of firms)

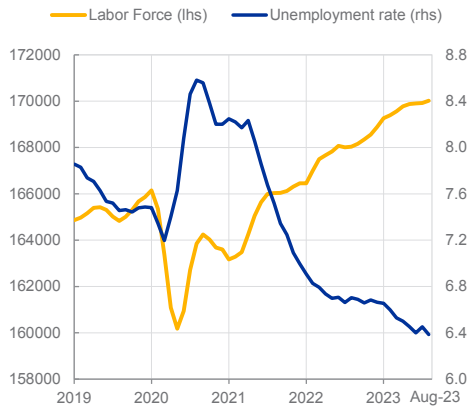


SOURCE: European Commission.

Latest observation: October 2023.

Figure 24

Unemployment Rate and Labor Force
(lhs: thousands of persons; rhs: percentage of the labor force)

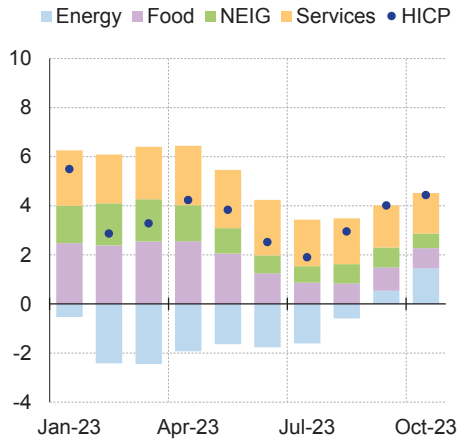


SOURCE: ECB calculations based on Eurostat data.

Latest observation: August 2023.

Figure 25

Momentum of HICP and Main Components
(annualized 3m-on-3m percentage changes, percentage points)

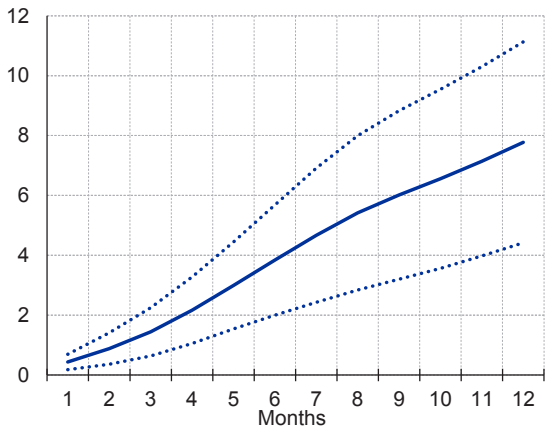


SOURCE: Eurostat and ECB calculations.

Latest observation: October 2023 (flash).

Figure 26

Global Food Price Effects of a One-Degree Temperature Rise During El Niño
(percent)



NOTE: Price reaction shows impact of a 1°C increase in temperature during El Niño controlling for fertilizer and oil prices and global industrial activity with 68% confidence intervals.

SOURCE: Haver, NOAA, Bloomberg, and ECB calculations.

Latest observation: May 2023 (monthly sample starting in January 1960).

NEW SHOCKS COULD DERAIL THE DISINFLATION PROCESS

This brings me to the second challenge facing monetary policymakers during the last mile: Because disinflation will slow down appreciably, there is a high risk of a new shock pulling inflation away from our target once again before it has been reached and of inflation expectations becoming unanchored. This is especially relevant in the current geopolitical environment.

The tragic events in the Middle East triggered by the terrorist attack on Israel are a case in point. Oil and gas price futures rose noticeably, adding to concerns over supply following the recent gas pipeline leak in the Baltic Sea. More generally, we have recently observed a rising sensitivity of energy prices to even remote risks, such as strikes at liquefied natural gas plants in Australia.

Such shocks can visibly disrupt the disinflation process. Compared with the end of June, oil prices are up by 25% in euro terms. Since then, the energy contribution to the inflation momentum, defined as the annualized three-month-on-three-month percentage change, has increased measurably (Figure 25).

As a result, while in July the inflation momentum was consistent with annual inflation of 2%, in October it was 4.4%.

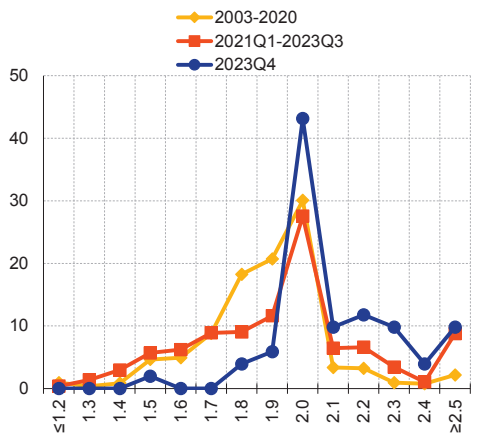
Other shocks are already on the horizon. This year's El Niño is expected to bring months of extreme heat and rainfall to parts of the world, reinforcing the risks stemming from global warming. This is threatening to disrupt crop cycles and put further pressure on global food markets (Figure 26).

By delaying the return of inflation to 2%, such adverse supply-side shocks pose larger than usual risks to medium-term price stability, as they are more likely to trigger shifts in inflation expectations.[10] It is well known that people tend to pay little attention to inflation when it is low and stable. But the theory of rational inattention suggests that firms and households start paying attention when inflation

10. On the role of inflation expectations after adverse supply-side shocks, see Tenreyro, S. (2023), "Monetary policy in the face of supply shocks: the role of inflation expectations", ECB Forum on Central Banking, June 2023.

Figure 27

SPF: Cross-Sectional Distribution of Longer-Term Inflation Point Forecasts
(percent)

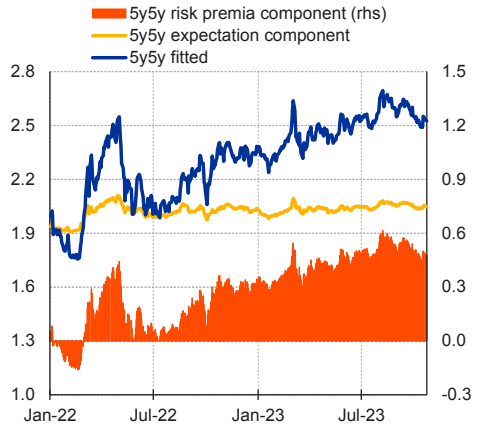


SOURCE: SPF.

Latest observation: 2023:Q4.

Figure 28

Model-Based Decomposition of Euro Area Inflation-Linked Swap Rates
(percentages)



NOTE: Premia-adjusted forward ILS rates are average estimates from two affine term structure models as in Joslin, Singleton, and Zhu (2011) applied to ILS rates non-adjusted for the indexation lag; see Burban et al. (2022), ECB Economic Bulletin issue 8, 2021.

SOURCE: Refinitiv and ECB calculations.

Latest observation: October 23, 2023.

is high, making price- and wage-setting more sensitive to new price shocks.[11] This is especially true if such shocks concern salient goods such as energy and food.

Private-sector participants are factoring in these risks. Although our determined monetary policy decisions have secured the broad anchoring of long-term inflation expectations, surveys and financial market prices continue to point to concerns that inflation may stay elevated.

For example, the distribution of longer-term inflation expectations in our survey of professional forecasters, while remaining broadly anchored around our target, has shifted visibly to the right compared with the periods before and during the pandemic (Figure 27), with risks to the inflation outlook being tilted to the upside. Similarly, risk premia in the swap market for inflation far into the future remain elevated (Figure 28).

IMPLICATIONS FOR MONETARY POLICY

In the light of all of this, and with this I would like to conclude, disinflation really does seem like a long-distance race. When the runner enters the last mile, the hardest work begins. While the first phase of the race may have appeared easy, the last mile requires perseverance and vigilance. The same is true for our fight against inflation.

Perseverance is needed to avoid declaring victory too early. With our current monetary policy stance, we expect inflation to return to our target by 2025. The progress on inflation that we have seen so far is encouraging and in line with our projections. We therefore decided to leave our key policy rates unchanged at the October 26, 2023, monetary policy meeting.

11. Maćkowiak, B. et al. (2021), "Rational inattention: a review", Working Paper Series, No 2570, ECB, June 2021.

However, the disinflation process during the last mile will be more uncertain, slower, and bumpier. Continued vigilance is therefore needed. After a long period of high inflation, inflation expectations are fragile and renewed supply-side shocks can destabilize them, threatening medium-term price stability. This also means that we cannot close the door to further rate hikes.

If we stay vigilant, we will be able to spot early on any risks to the inflation outlook that are materializing, just as the runner listens to the signals from her body. This means that we need to carefully monitor all incoming data and continuously verify whether they are consistent with the assumptions underlying our projections.

Data dependence ensures that our monetary policy is at all times calibrated in accordance with the circumstances we are facing. The inflation target is now within reach, but let's celebrate only once we have truly tackled the last mile.

Real Wage Growth at the Micro Level

Victoria Gregory and Elisabeth Harding

Abstract

This article investigates patterns in real wage growth in 2022 to determine whether wages have kept up with rising price levels and how this differs among labor market participants. Using the consumer price index for wages and imputing expenditure data from the Consumer Expenditure Survey, we separately measure nominal wage growth and inflation rates at the micro level. We find that there is more heterogeneity in the former, meaning that when we combine them, an individual's real wage growth is primarily driven by their nominal wage growth. In 2022, 57 percent of individuals experienced negative real wage growth, with older and less-educated workers, as well as job stayers, being hit the hardest. Conversely, younger and highly educated workers, as well as job switchers, had higher real wage growth.

JEL codes: E24, E31, J31

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https://doi.org/10.20955/r.106.87-105

1. INTRODUCTION

Until the beginning of 2021, the past decade saw consistent positive year-over-year real wage growth, showing that wage growth outpaced the rising cost of living. However, in the past two years, the U.S. has experienced high inflation combined with strong wage growth. With aggregate inflation reaching a high of 9 percent in June 2022 and average nominal wage growth soaring to 6.4 percent in 2022, most households experienced both rising wages and rising cost of living. The difference between these two values determines real wage growth. However, the contributions of these components may differ across individuals or households. The unequal impact of inflation across age, education, household size, and income is of great interest to policymakers.

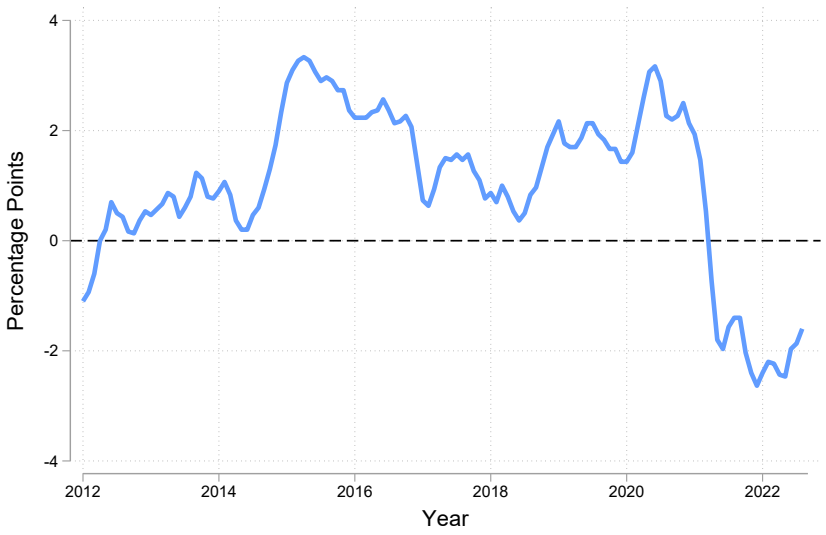
To illustrate these trends, Figure 1 depicts median real wage growth in the United States over the past decade. The figure shows that while workers saw increases in real wage growth in 2015 and 2020, it typically ranged from 1 percent to 3 percent until 2021. However, more recently, median real wage growth has hovered around –2 percent, indicating a notable shift in economic conditions.

In this article, we explore the heterogeneity behind the negative values shown in Figure 1 by analyzing the distribution of real wage growth in 2022 across households. Specifically, we examine nominal wage growth and inflation rates at the individual level to determine the real wage growth rates for each worker in our sample. However, measuring real wage growth at the individual level presents a challenge. To calculate individual real wages, we must observe both wage and consumption for each individual, but there are no current microdata that cover both consumption and nominal wage growth.

We overcome this challenge by combining consumption data from the Consumer Expenditure Survey (CEX) and wage growth data from the Current Population Survey (CPS). We begin by pinpointing individuals in the CPS for whom we can observe wages 12 months apart. The CPS records wage information for individuals as they rotate out of the survey. We then follow the methodology of the Federal Reserve Bank

Victoria Gregory is an economist and Elisabeth Harding is a research associate at the Federal Reserve Bank of St. Louis.

Figure 1
Aggregate Real Wage Growth



NOTE: The figure is constructed using the inflation estimates from the CPI as well as the Federal Reserve Bank of Atlanta's Wage Growth Tracker, which uses the CPS to calculate a three-month moving average of the median of overall unweighted year-over-year nominal wage growth.

of Atlanta's Wage Growth Tracker to measure median nominal wage growth, finding that the distribution of nominal wage growth has a wide range, with most values between –50 percent and 50 percent.

Rather than use the Bureau of Labor Statistics's (BLS) measure of average inflation, we calculate individual inflation rates that account for differences in consumption patterns of different demographic groups. We impute consumption information from the CEX to the CPS based on demographic characteristics: age, education, income, and household size. This imputation estimates consumption baskets for our sample of individuals in the CPS, thus providing us with a data set of observed wage and imputed consumption. To measure inflation, we match the consumer price index (CPI) inflation series to our 19 CEX expenditure categories to calculate individual inflation rates based on the estimated consumption baskets. Unlike that of nominal wage growth, the distribution of inflation rates has a narrow range, from 7 percent to 13 percent for most individuals.

Last, we calculate individual real wage growth as the difference between an individual's nominal wage growth and inflation rate and analyze real wage growth across demographic groups. Our results highlight three important features of real wage growth in 2022. First, 57 percent of individuals experienced negative real wage growth, 10 to 15 percentage points higher than in typical years. Second, real wage growth varies significantly across demographic groups. Younger workers as well as individuals who switched jobs experienced the highest real wage growth. The wage of workers older than 55 and individuals with children in the household were least likely to keep up with their rising cost of living. Third, the distributions of nominal wage growth and inflation suggest that variations in real wage growth are driven by variations in nominal wage growth. This observation stems from the fact that we find a lot more heterogeneity in nominal wage growth compared with inflation across households.

This article contributes to several aspects of existing literature. Similar to Argente and Lee (2021) and Kaplan and Schulhofer-Wohl (2017), we study differences in the cost of living across households. While these papers incorporate more sources of these differences that we cannot account for here (such as differences in shopping behavior and quality of items consumed), we explore the connection with wage growth. In addition, they also use the Nielsen Consumer Panel and Retail Scanner data sets, which focus primarily on grocery stores and drug stores. In contrast, we incorporate a much larger set of goods and services using the CEX.

Accordingly, we also borrow some techniques from other papers that use the CEX micro data to study household consumption baskets. For instance, Hobijn and Lagakos (2003) examine inflation inequality across the U.S. from 1987 to 2001 using consumption data from the CEX and aggregating expenditures into 19 categories to best match the CPI series, as we do here. Cravino, Lan, and Levchenko (2018) also use the CEX to document the relative prices of goods consumed across households, but they aggregate households

into income percentiles and examine the distributional effects of monetary policy shocks on those consumption baskets. Several other papers also perform related, but different, imputation techniques to link consumption data with other micro data sources, such as Blundell, Pistaferri, and Preston (2008) and Pretnar (2022).

Finally, our work relates to studies examining the characteristics of the income growth distribution, such as Guvenen et al. (2015). We find that the distributions we recover in this article exhibit similar properties.

The rest of the article proceeds as follows. Section 2 discusses the data, their structure, and how they are used in combination to estimate real wage growth. Section 3 presents estimates of individual nominal wage growth, inflation, and real wage growth and their distribution across households and demographic groups. Section 4 concludes.

2. DATA AND METHODOLOGY

We draw on two sources of microdata for our analysis. We use the CPS for nominal wage growth and the CEX for data on household expenditures of different item categories. We then impute the CEX data into the CPS to construct individual real wage growth rates. All of these steps are described below.

2.1 The CPS for Nominal Wage Growth

To measure year-over-year nominal wage growth for individuals from 2021 to 2022, we use the CPS conducted by the BLS. The CPS is a monthly survey that collects individual and household information, producing a broad body of data on demographic characteristics, employment, the labor force, and earnings. It covers a monthly sample of households across the 50 states and the District of Columbia. Individuals in the CPS are interviewed a total of eight times. They are first interviewed once per month for four consecutive months, and then eight months later, they are interviewed for another four consecutive months. The fourth and eighth interviews are considered the Outgoing Rotation Groups in which individuals are asked for additional information beyond what is asked in the other interviews. In particular, they are asked about their earnings, meaning that for each individual, we observe data on their earnings set 12 months apart. These data are pretax and focus on wage and salary earners, excluding those who are self-employed. For hourly and salaried workers, hourly and weekly earnings are collected, respectively.

Following the methodology of the Federal Reserve Bank of Atlanta's Wage Growth Tracker, we use the earnings data for wage and salary earnings to compute year-over-year nominal wage changes for each worker. We examine individuals who first are in the Outgoing Rotation Group in 2021 and appear in the Outgoing Rotation Group again in 2022, based on a match in their unique person ID number. We first confirm that these individuals match based on their age, gender, and race to avoid any coding errors in the ID number. We also restrict our sample to exclude agricultural workers. Weekly earnings for salaried workers are then converted to hourly by dividing weekly wage by usual hours worked per week (or actual hours worked if usual hours worked is not available). Finally, we calculate one-year log wage changes as follows:

$$\Delta y_i = \left[\log(y_{i,2022}) - \log(y_{i,2021})\right] \times 100,$$

where $y_{i,2021}$ and $y_{i,2022}$ are wages in 2021 and 2022, respectively, for individual i.

Our final sample includes about 1,400 observations per month.

2.2 The CEX for Individualized Consumption Baskets

The CEX is a nationwide household survey on expenditures and incomes collected by the BLS. Expenditures are split into about 600 categories, called Universal Classification Codes (UCCs), of goods and services. For our analysis, we use any data collected that pertain to spending during 2021. The CEX is composed of two different surveys, the Interview Survey and the Diary Survey. The Interview Survey asks consumers for expenditure information over a three-month period and typically covers large or recurring purchases, including vehicles, property, appliances, rent, and insurance. The consumer unit at the Interview Survey address is interviewed each quarter for up to four consecutive quarters and is asked about the previous three months of expenditures. For example, an address that enters the Interview Survey in March 2021 will be asked about purchases in December 2020, January 2021, and February 2021. They can then be interviewed again in June, September, and December 2021. The sample depends on address rather than on household, so if a consumer unit moves from the address, the new consumer unit at the address will be interviewed instead.

The Diary Survey collects weekly data on frequent expenditures, such as food, personal care, and medicine. Consumer units are interviewed for two consecutive weeks. While the Interview and Diary surveys both follow the same consumer units across multiple time periods, the CEX treats each interview as separate, independent observations in the data. To maintain a representative sample and account for the relocation of households, the

Table 1
Matching CEX Expenditure Categories to CPI Series

	CEX expenditure category	CPI series
1	**Food at Home**	Food at Home
2	**Food Away from Home**	Food Away from Home
3	**Alcoholic Beverages**	Alcoholic Beverages
4	**Owned Dwellings**	Owners' Equivalent Rent of Primary Residence
5	**Rented Dwellings**	Rent of Primary Residence
6	**Other Lodging**	Lodging Away from Home
7	**Utilities**	Fuels and Utilities
		Telephone Service
8	**Household Operations, Supplies, and Furnishing**	Household Equipment and Operations
		Information Processing Other Than Telephone
9	**Apparel**	Apparel
10	**Vehicles**	New and Used Motor Vehicles
11	**Gasoline**	Motor Fuel
12	**Other Vehicle Expenses**	Vehicle Parts and Equipment
		Vehicle Maintenance and Repair
		Motor Vehicle Insurance
		Motor Vehicle Fees
13	**Public Transportation**	Public Transportation
14	**Healthcare**	Medical Care
15	**Entertainment**	Recreation
16	**Personal Care**	Personal Care
17	**Reading**	Recreational Reading Materials
18	**Education**	Educational Books and Supplies
		Tuition, Fees, and Child Care
19	**Tobacco**	Tobacco

consumer unit is given a new ID number and weight each quarter or week in the Interview and Diary surveys, respectively. This yields about 35,000 households in the Interview Survey and 12,000 households in the Diary Survey in 2021.

Because the Diary and Interview surveys collect data on different households, we do not observe the complete consumption data of any household. For example, households in the Interview Survey are not asked about grocery purchases, and those in the Diary Survey are not asked about vehicle purchases. Further, households rarely report consumption in every UCC, and when these are aggregated to calculate population-wide expenditures by UCC, the BLS counts them as zeros.[1] We do the same before aggregating the UCCs into 19 more broad categories, as shown in the first column of Table 1.

After aggregating, we obtain for each household a value for its expenditures on 19 different categories (with many zeros). When averaged over the whole sample using the appropriate weights, our mean expenditures line up well with those of the published tables (see the first two columns of Table 2 for a comparison). We also have the following demographic categories for both the CPS and the CEX: household size; income; metropolitan status; geographic region; number of children under 18 years old in the household; and the reference person's age, race, ethnicity, marital status, and education. Table 3 compares our CEX and CPS samples along these

1. Based on our analysis, not doing so massively overstates the expenditure levels in their published tables.

Table 2
Average Consumer Expenditures

	CEX published tables	Author calculated	CPS imputation
Food at Home	5,259	4,901	6,961
Food Away from Home	3,030	2,948	3,785
Owned Dwellings	7,591	9,580	13,434
Rented Dwellings	4,684	4,259	5,959
Utilities	4,223	5,515	6,713
Household Equipment/Operations	5,142	4,999	5,397
Vehicle Purchases	4,828	4,868	5,951
Other Vehicle Expenses	3,534	3,364	4,348
Healthcare	5,452	6,250	5,311
Entertainment	3,568	3,598	3,847

dimensions. The two samples are very similar, with the most major difference being that the CEX has a much larger share of households over 65 years of age. We use these variables in our imputation method and in our analysis of the resulting real wage growth rates.

To create inflation rates for items in our estimated consumption baskets, we construct a concordance between CEX expenditures and CPI series by aggregating the UCCs into 19 expenditure categories and using nonseasonally adjusted indices for "All Urban Consumers" and "U.S. City Average," following the methodology of Hobijn and Lagakos (2003). For the CEX categories that do not match exactly to a CPI series, multiple CPI series are combined using the 2021 relative importance weights created by the BLS. For example, utilities in the CEX match to both fuels and utilities in the CPI series as well as telephone service in the CPI series. In this case,

$$W_u = \frac{w_f}{w_f + w_t} + \frac{w_t}{w_u + w_t},$$

where w_f is the CPI relative importance weight of fuels and utilities, w_t is the CPI relative importance weight of telephone service, and W_u is the constructed CPI series for utilities to match to the CEX.

Table 3
Shares of Demographic Categories in the CEX and CPS

Household size	CEX share	CPS share	Marital status	CEX share	CPS share
1 Person	32.06	19.70	Married	50.43	57.34
2 People	33.73	33.32	Widowed	9.33	2.68
3-4 People	25.59	35.23	Divorced	15.73	13.13
5-6 People	7.31	10.17	Separated	2.17	2.01
7+ People	1.32	1.58	Never married	22.35	24.84
Age	CEX share	CPS share	**Race**	CEX share	CPS share
Younger than 25	4.27	3.61	White	80.36	81.30
25-35	14.64	17.41	Black	10.80	9.76
35-45	16.56	23.76	Native American	0.58	0.93
45-55	16.16	23.61	Asian and Pacific Islander	6.20	6.37
55-65	18.84	22.65	Other	0.53	0.00
65 and Older	29.54	8.97	Two or more races	1.54	1.64
Education	CEX share	CPS share	**Region**	CEX share	CPS share
Less than HS	8.27	4.72	Northeast	17.27	16.15
HS degree	21.31	23.31	Midwest	20.69	21.07
Some college	28.69	26.79	South	33.91	36.35
At least bachelor's degree	41.72	45.18	West	28.13	26.43
Ethnicity	CEX share	CPS share	**Metro status**	CEX share	CPS share
Hispanic	13.88	12.77	Urban	94.14	82.52
Not Hispanic	86.12	87.23	Rural	5.86	17.48

2.3 Imputing CEX Expenditures into the CPS

2.3.1 Imputation Technique

A major challenge for researchers interested in individualized real wage growth is the absence of microdata containing both nominal wage growth and spending on a variety of items. We aim to overcome this by using the CEX data on expenditures to impute a consumption basket for each individual in the CPS. The idea is to estimate the relationship between spending and observable household characteristics in the CEX and apply these estimates to each individual in the CPS based on their own characteristics.

Because of the large number of zeros in our data, we model expenditures on UCC g with a hurdle model. This approach consists of two parts. The first models the probability of having a value of zero (the selection model). The second models the values of the nonzero observations (outcome model). Let c_{ig} be household i's expenditure on UCC g. In our model, for each g,

$$c_{ig} = s_{ig} h_{ig}.$$

s_{ig} is an indicator variable that determines selection:

$$s_{ig} = \begin{cases} 1 & \text{if } \boldsymbol{z}_i \boldsymbol{\beta}_g^s + \varepsilon_{ig}^s > 0 \\ 0 & \text{otherwise,} \end{cases}$$

where $\boldsymbol{z}_i$ is a set of explanatory variables that vary by household, $\boldsymbol{\beta}_g^s$ is a vector of coefficients, and ε_{ig}^s is a standard normal error term.

Table 4
Share of Expenditure by Income

	Less than $10,000	$10,000-25,000	$25,000-40,000	$40,000-60,000	$60,000-75,000	$75,000-100,000	$100,000-150,000	More than $150,000
Food	13.5	12.5	11.4	10.4	9.9	9.8	9.5	9.0
Food Away from Home	5.1	5.1	5.0	5.4	5.4	5.2	5.8	5.8
Owned Dwellings	8.0	6.7	8.6	11.7	13.5	15.3	18.5	20.7
Rented Dwellings	20.7	24.2	20.9	16.7	14.2	10.9	7.2	4.8
Utilities	11.7	11.5	11.3	11.4	11.0	10.8	10.1	8.4
Household Equipment/Operations	6.4	6.2	6.4	6.7	6.9	6.9	7.3	8.1
Vehicle Purchases	7.0	5.2	7.1	7.3	7.8	9.1	9.0	10.1
Other Vehicle Expenses	4.9	5.8	6.2	6.7	7.1	7.1	6.7	5.9
Healthcare	4.8	6.2	6.5	6.9	7.1	7.3	7.7	6.3
Entertainment	3.9	4.3	4.2	4.5	4.5	4.8	5.4	6.0

h_{ig} is continuous and only observed if $s_{ig} = 1$. The outcome model is the following:

$$\log h_{ig} = \boldsymbol{x}_i \boldsymbol{\beta}_g + \varepsilon_{ig},$$

where x_i is a set of explanatory variables, $\boldsymbol{\beta}_g$ is a vector of coefficients, and ε_{ig} is a standard normal error term.

We use the same set of explanatory variables in the selection and the outcome equations to remain agnostic as to what household features may be associated with expenditures (and the presence or lack of data in some cases). These variables include the following: family size (1 person, 2 people, 3–4 people, 5–6 people, 7+ people), education (less than high school, high school diploma, some college/associate's degree, and bachelor's degree and higher), and family income (< $10,000, $10,000–25,000, $25,000–40,000, $40,000–60,000, $60,000–75,000, $75,000–100,000, $100,000–150,000, $150,000+).[2]

We estimate 19 hurdle models, one for each UCC category g.[3] With the estimates $\boldsymbol{\beta}_g^s$ and $\boldsymbol{\beta}_g$ in hand, we use them to construct predicted values of expenditure on each UCC category for every CPS respondent in our sample. The explanatory variables we used in the CEX are also available in the CPS, and the binning of the categories is made consistent across the two data sets.[4]

2.3.2 Validation

In this section, we embark on a brief detour to show that our imputation approach yields sensible results for the CPS respondents' consumption. In the rightmost column of Table 2, we report the average consumption in each UCC category for our imputed CPS data. These line up very closely with both the CEX's published tables and our own calculations from the CEX microdata.

As another check, we look at the expenditure shares (an individual's share of imputed consumption spent on a given UCC category) of the most popular categories as a function of household income.[5] Table 4 displays these results. Our imputation results in expenditure shares that are qualitatively and quantitatively in line with those of the published tables of the CEX. For example, we reproduce the fact that poorer households use more of their budget on necessities such as food at home, rented dwellings, and utilities.

2.4 Individualized Inflation Rates and Real Wage Growth

Having established that we have credible estimates for expenditures for individuals in the CPS, we then use them as the basis for our individualized inflation rates. To do this, we apply the CPI series that correspond to

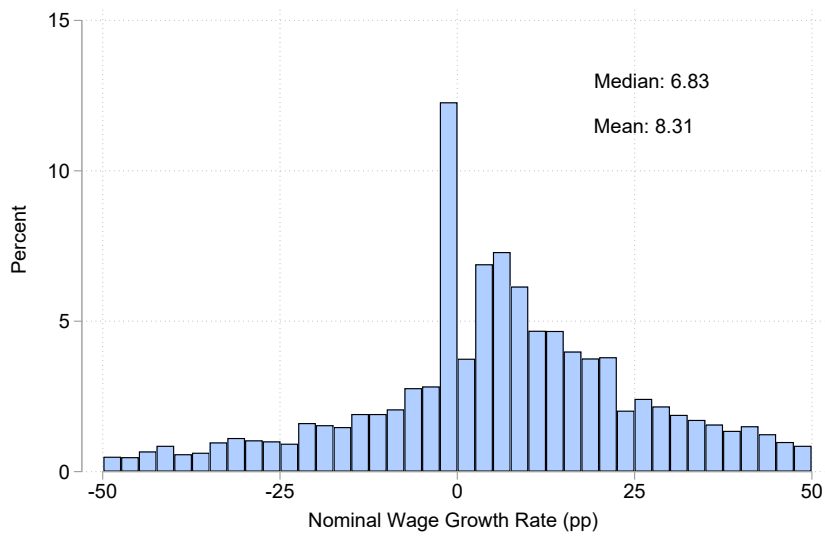
2. Household income and family size are only available in brackets from the CEX.

3. Although many categories are asked about both in the Diary and Interview surveys, some expenditures—including food at home, food away from home, and alcohol—are only collected in the Diary. In these cases, we only estimate the model on households in the Diary.

4. Note that although the CEX surveys households and the CPS surveys individuals, we have information on household characteristics in the CPS and thus use this information to generate the predicted expenditures.

5. In principle, we can do the same for other household characteristics, but the expenditure shares exhibit the most variation along the income dimension. The shares along other dimensions also match up well with the published tables.

Figure 2
Nominal Wage Growth Distribution



NOTE: This figure displays a percent histogram of the year-over-year nominal wage growth calculated for individuals in the CPS. Source: Authors' calculations.

the 19 expenditure categories that we estimated for each individual in our CPS sample. This matching exercise can be found in Table 1. For each individual, we calculate the share of total expenditure for each expenditure category, multiply by the expenditure's inflation rate, and sum across all expenditure groups. More precisely,

$$\pi_i = \sum_{g=1}^{19} \frac{c_{ig}}{C_i} \pi_g,$$

where π_i is household i's inflation rate in 2022, c_{ig} is an individual's expenditure on group g, C_i is an individual's total expenditure, and π_g is the inflation rate of group g from the CPI series. An individual's real wage growth is then calculated as the difference between their nominal wage growth and the inflation rate.

3. RESULTS

This section first reports our findings separately about the two components of real wage growth: nominal wage growth and inflation rates. Then we put them together and analyze real wage growth.

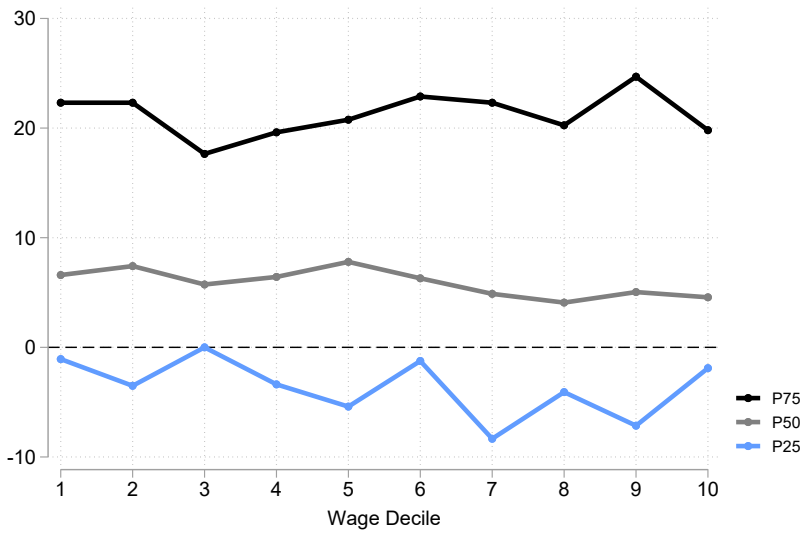
3.1 Nominal Wage Growth

Figure 2 depicts the distribution of nominal wage growth. The median nominal wage growth rate is 6.83 percent in 2022, and the mean is 8.31 percent. The distribution of nominal wage growth has two characteristics that stand out. First, the mass point around zero shows that many individuals, around 12 percent, experienced stable year-over-year wages: Their paychecks did not change at all in nominal terms. Second, the wide range in distribution shows that many workers experienced extreme wage changes. These features of the wage growth distribution—many small wage changes and very high kurtosis—are consistent with what has been documented by Guvenen et al. (2015) using U.S. administrative data.

Next, to see who is experiencing significant wage changes, we examine how nominal wage growth varies by wage decile, depicted in Figure 3. Overall, the median of the nominal wage growth distribution is still positive across all wage deciles, especially for lower-wage workers. In fact, among the lowest deciles, nearly 75 percent of them experienced positive wage growth. For the most part, the median and the 25th percentile of growth decline with movement up the wage distribution. Interestingly, the upper tail of the wage growth distribution is stable at all wage levels: The top quarter saw nominal wage growth of slightly more than 20 percent regardless of whether they were high- or low-wage workers.

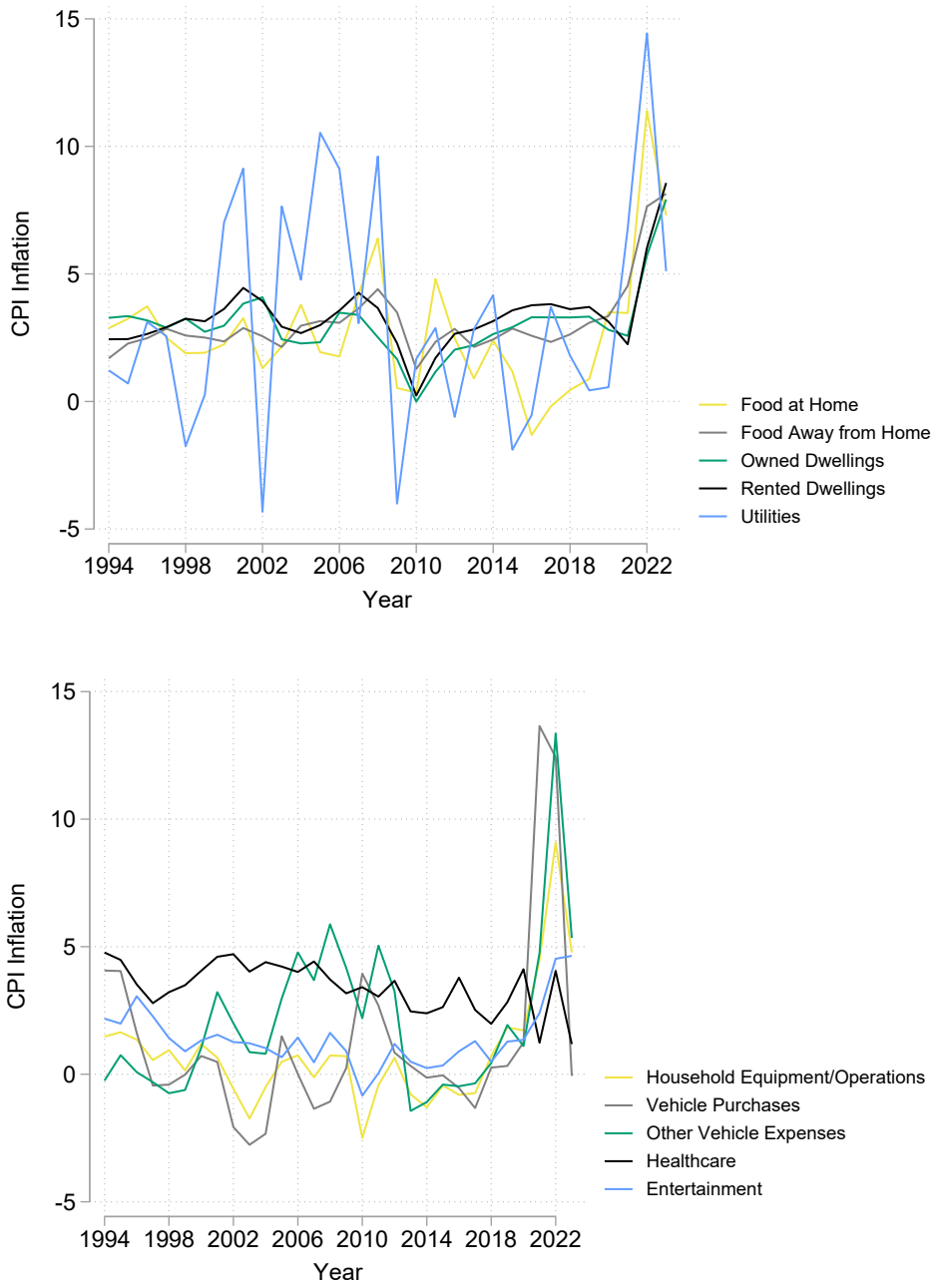
We have yet to consider how inflation cuts into these positive nominal wages. This will be addressed after we study the distribution of inflation rates for these workers.

Figure 3
Nominal Wage Growth by Wage Decile



NOTE: The figure plots nominal wage growth at the 25th percentile, median, and 75th percentile by wage decile. SOURCE: Authors' calculations.

Figure 4
Inflation over Time

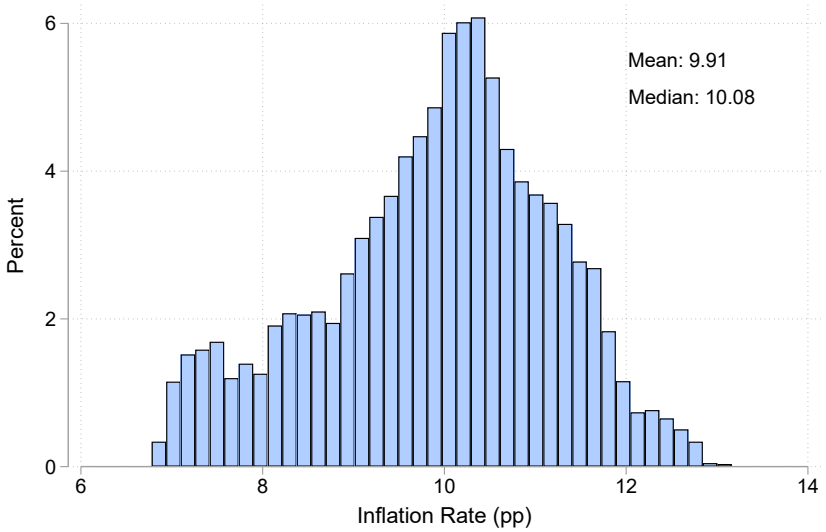


3.2 Inflation Rates

To get a sense of the raw inflation rates that went into our calculations (π_g) and the general context of inflation in 2022, we plot their time series in Figure 4. The spikes in 2022 are notable: Among the reasons are the fiscal policies enacted during the pandemic (such as the CARES Act and the American Rescue Plan Act) and the concurrent global supply chain crisis. The increase in the price level was particularly high among utilities (which includes fuel and gasoline), food at home, and vehicle purchases and expenses.

In Figure 5, we plot the distribution of inflation rates for the individuals in our CPS sample. The median household experienced a 10 percent increase in the price level of the goods basket it consumed from 2021 to 2022. Overall, individual inflation rates range from about 7 to 13 percent. By construction, the heterogeneity

Figure 5
Inflation Rate Distribution

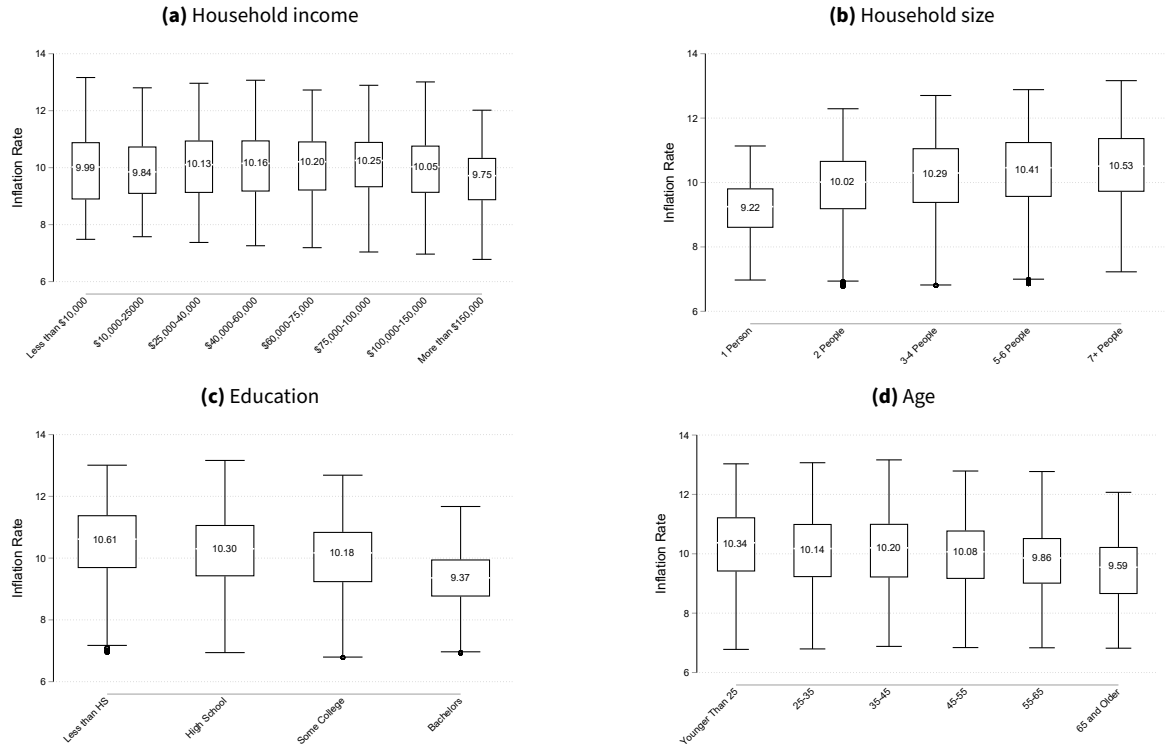


is due to individuals consuming different shares of each item category. Evidently, there is a lot less variation in terms of annual inflation rates compared with nominal income growth rates. This observation suggests that much of the variation in real growth rates will be driven by wages rather than by the prices of consumer goods.

Nevertheless, we can also use our imputation to examine which demographic groups experienced the highest inflation rates in 2021–22. Figure 6, panel (a) shows that we do not find a great deal of heterogeneity with respect to income: The highest income bracket has the lowest inflation rate, but below that there is no clear pattern.[6] We can discern the reasons for this by combining the inflation rates in Figure 4 with the expenditure shares in Table 4. Although low-income households spend more on high-inflation categories such as food at home and utilities, this is counteracted by high-income households' spending on different high-inflation categories such as vehicle purchases and expenses and household equipment/operations.

6. Other studies, such as Argente and Lee (2021), find that lower-income households experience much higher inflation rates, but that is due to differences in product quality and shopping behavior, which we cannot address here.

Figure 6
Distribution of Inflation by Demographic Group



NOTE: These box plots depict the distribution of inflation rates by demographic groups and report the median inflation rate in each category.

However, we do find more stark variations along the dimensions of household size, education, and age of the household head. Consumers who are in large households, have low education levels, or are young saw the highest inflation rates. At the same time, the household size, education, and age groups with the lowest inflation rates also had the least amount of heterogeneity within their groups. Appendix 1.2.1 reports the same statistics across other dimensions we can observe in the CPS, where we find little variation.

The key patterns in these findings can also be understood by combining the inflation rates with expenditure shares, reported in Appendix 1. For instance, older workers' lower inflation rates are primarily driven by more spending on healthcare, which had relatively low inflation. Less-educated workers' higher inflation rates are more attributable to their higher spending on food and utilities and lower spending on entertainment and healthcare.

3.3 Real Wage Growth

Finally, we subtract each individual's inflation rate off their nominal wage growth to arrive at their value for real wage growth. Figure 7 depicts this distribution. We find that the median worker experienced a 3.15 percent drop in their real wages between 2021 and 2022. In fact, for 57 percent of workers, their inflation rate was above their nominal wage growth rate, meaning their wages did not keep pace with inflation. This is unusual relative to previous decades: According to Rich, Tracy, and Krohn (2022), the share of workers whose wages fail to keep up with inflation has ranged from 42 to 48 percent over the past 25 years. The high proportion of negative real wage earners has only come close to that of 2022 twice in the past two decades: It was 54 percent in 2008 and 56 percent in 2011.

Turning to the heterogeneity, we find substantial variation in real wage growth rates. The majority range from –60 percent to 60 percent, with a large mass falling between 0 and –12.5 percent. This range encompasses many of the individuals who saw no change in nominal wages between 2021 and 2022. Because inflation rates have a much narrower spread than nominal wage growth rates, we can attribute much of these differences in real wage growth to variation in nominal growth rates rather than to inflation.

Figure 7
Real Wage Growth by Wage Decile

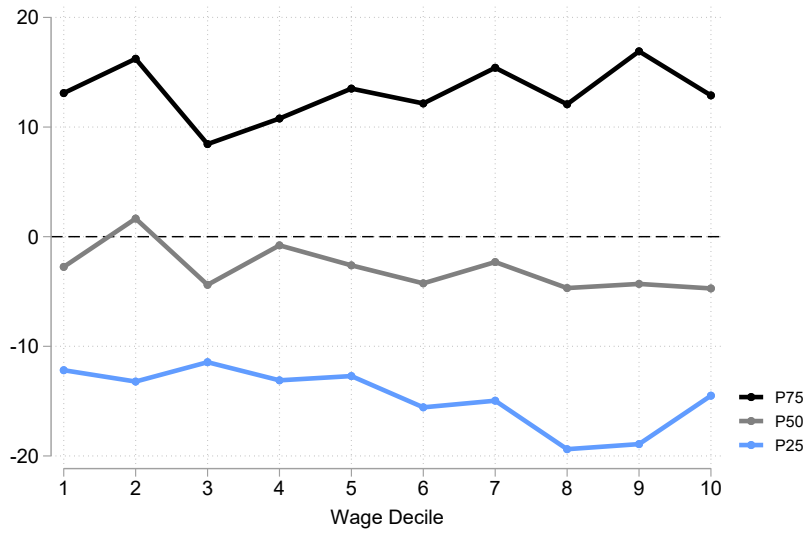


Figure 8
Real Wage Growth Distribution

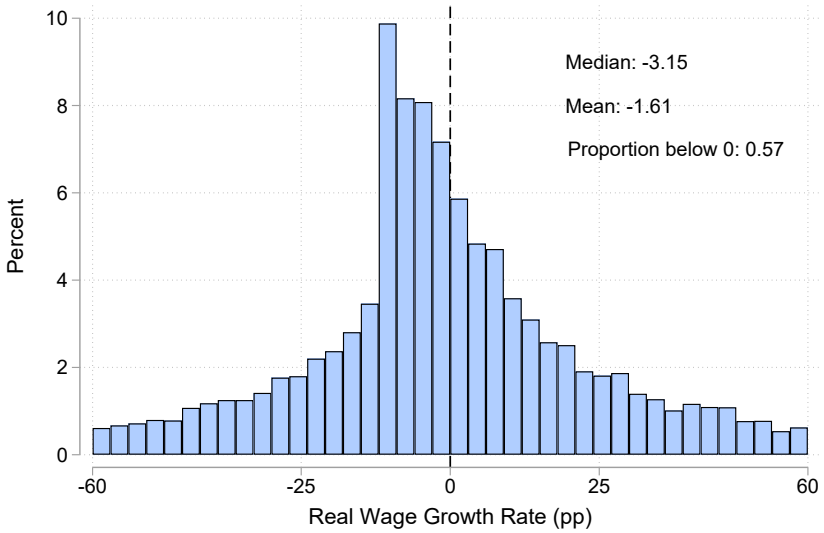
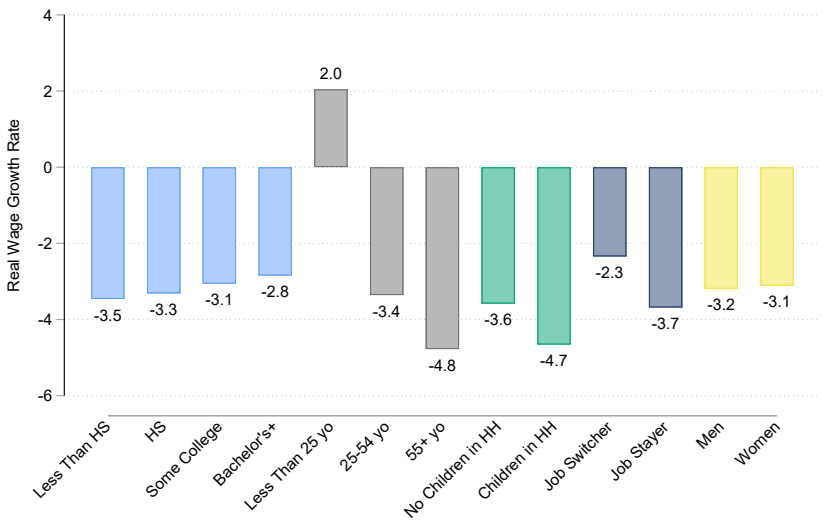


Figure 8 breaks this range down by decile of earnings, similar to how Figure 3 does for the nominal wage growth distribution. The general pattern remains the same: The values are just shifted downward after accounting for inflation. This finding indicates that the inflation rates within these deciles neither offset nor amplified the general patterns in wage growth.

A similar story emerges when analyzing the data by demographic group. Figure 9 highlights the median real wage growth for a few of the categories.[7] For example, real wage growth decreases as the worker's age increases. Despite the fact that workers younger than 25 years old saw the highest median inflation rate of any age group at 10.24 percent, they are the only demographic group that experienced a positive real wage growth

7. In Appendix 1.3.1, we present the same statistics for a broader set of characteristics.

Figure 9
Real Wage Growth by Demographic Group



rate, of 2 percent. This rate is 5.4 percentage points higher than workers between the ages of 25 and 54 and almost 7 percentage points higher than workers over the age of 54. Since young workers often experience the highest rates of wage growth across all stages of the business cycle, it is not surprising that we find that this held true in 2021–22. However, we do learn that even in this period of high inflation, the median worker under age 25 still came out ahead.

Figure 9 also shows that the real wage growth rates across the education distribution are more aligned than across age groups. Workers with less than a high school education experienced both the highest inflation rates and the lowest real wage growth rates, while workers with college degrees saw low inflation rates and high real wage growth rates. Households with children also saw a larger drop in real wages compared with households without children. We do not find any major difference in real wage growth between men and women, consistent with the observation that women had caught up to men at this point during the pandemic economic recovery.

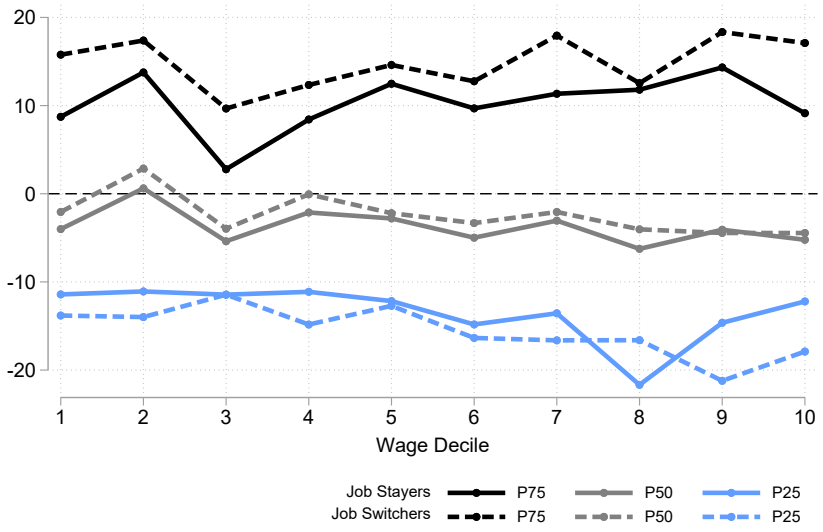
Finally, we note the important differences between job switchers and job stayers. Job switchers are those who are observed to have a change of employer between their 2021 and 2022 CPS interviews,[8] while job stayers encompass everyone else. Figure 9 shows that job switchers experienced higher real wage growth rates than job stayers, with a 1.4-percentage-point median real wage growth. This difference holds up even when controlling for the other demographic factors. This phenomenon is related to the historically tight labor market during this time frame. With soaring labor demand, the environment was favorable for job seekers. Workers took advantage of this, and those who switched jobs could secure higher wages compared with other periods.

Variations in real wage growth become more dramatic when zooming into smaller groups that combine these demographic characteristics. For example, workers who were younger than 25 years old, held a college degree, had no children in the household, and switched jobs in 2022 saw a positive real wage growth rate of 13.33 percent. On the other hand, workers who were at least 55 years old, did not hold a high school degree, had at least one child in the household, and stayed in their jobs in 2022 saw a negative real wage growth rate of –22.20 percent, 35.53 percentage points lower than someone with their "opposite" characteristics.

We view the job switcher versus job stayer distinction as important. Unlike the other dimensions that we study, this one is, to some extent, controllable by the worker: They have the option to search for new jobs in pursuit of wage increases. Therefore, we further explore the differences between job switchers and job stayers by breaking up the statistics in Figure 7. The results are shown in Figure 10, revealing that at all wage levels, the largest differences between switchers and stayers come mainly from the upper parts of the distribution. Although at all deciles, the median job switcher does better than the median job stayer, this is especially true

8. To identify individuals who switch jobs, we generate 12-month lags for industry, employer, and employment activity. We define job switchers as those whose industry, employer, or activity changes between their first and second reports of wages.

Figure 10
Real Wage Growth by Wage Decile for Job Stayers and Switchers



for at the 75th percentile of wage growth, where the gap between them is much greater. These large real wage changes also do not differ much across wage levels. Unlike the median among switchers, the highest percentage increases in real wages for the bottom earners are similar to those of the top earners.

4. CONCLUSION

In this article, we explore patterns in real wage growth in 2022 to pinpoint the individuals whose wages are the most and least likely to keep up with the rising cost of living. To overcome the lack of up-to-date data on wage and consumption, we use the CPS Outgoing Rotation Groups to track workers' wages 12 months apart and estimate their consumption by imputing expenditure information from the CEX. We find considerable variation in both nominal wage growth and inflation, with some coherent patterns across demographic groups. However, the distribution of nominal wages has a greater range than that of inflation, suggesting that a given individual's real wage growth is driven mainly by their nominal wage growth. We also find that 57 percent of individuals experienced negative real wage growth in 2022, which is 10 to 15 percentage points higher than the average year. The workers hit with the lowest real wage growth were generally older, were less educated, had children in the household, and did not switch jobs in 2022. On the other hand, the real wages of young, highly educated, job-switching workers and those without children fared relatively well in 2022.

More broadly, this analysis highlights the importance of considering how periods of high inflation affect different segments of the population. As monetary policy works to stabilize price levels going forward, it is clear that not all groups will have the same experiences throughout the recovery: How a given individual is impacted depends on the price levels of the goods they consume and how their job situation evolves. Moreover, this study has suggested how together, labor market conditions and expenditure patterns can impact real income inequality. It is clear that the evolution of inequality in the near future will depend on how this unique situation in 2022—a tight labor market combined with high inflation—plays out.

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APPENDIX 1.

Appendix 1.1 Expenditure Shares by Observables

Table Appendix 1.1
Share of Expenditure By Age Group

	Less than 25	25-54	55+
Food	9.3	10.3	10.6
Food Away from Home	6.6	5.5	4.4
Owned Dwellings	9.8	13.8	17.1
Rented Dwellings	19.9	14.2	7.7
Utilities	9.2	10.5	11.8
Household Equipment/Operations	6.6	7.0	7.1
Vehicle Purchases	9.4	8.3	7.2
Other Vehicle Expenses	6.5	6.6	6.6
Healthcare	3.1	6.0	11.5
Entertainment	4.4	4.7	5.3

Table Appendix 1.2
Share of Expenditure By Education Group

	Less than HS	HS	Some college	Bachelors+
Food	12.5	10.5	9.5	10.1
Food Away from Home	5.0	5.4	5.5	5.3
Owned Dwellings	9.0	12.0	14.3	19.5
Rented Dwellings	18.9	15.0	12.3	10.1
Utilities	11.8	11.6	10.5	8.7
Household Equipment/Operations	5.9	6.7	7.1	7.8
Vehicle Purchases	8.8	7.5	9.2	7.2
Other Vehicle Expenses	6.3	6.8	6.9	5.7
Healthcare	4.9	6.9	7.0	7.7
Entertainment	3.6	4.8	4.9	5.3

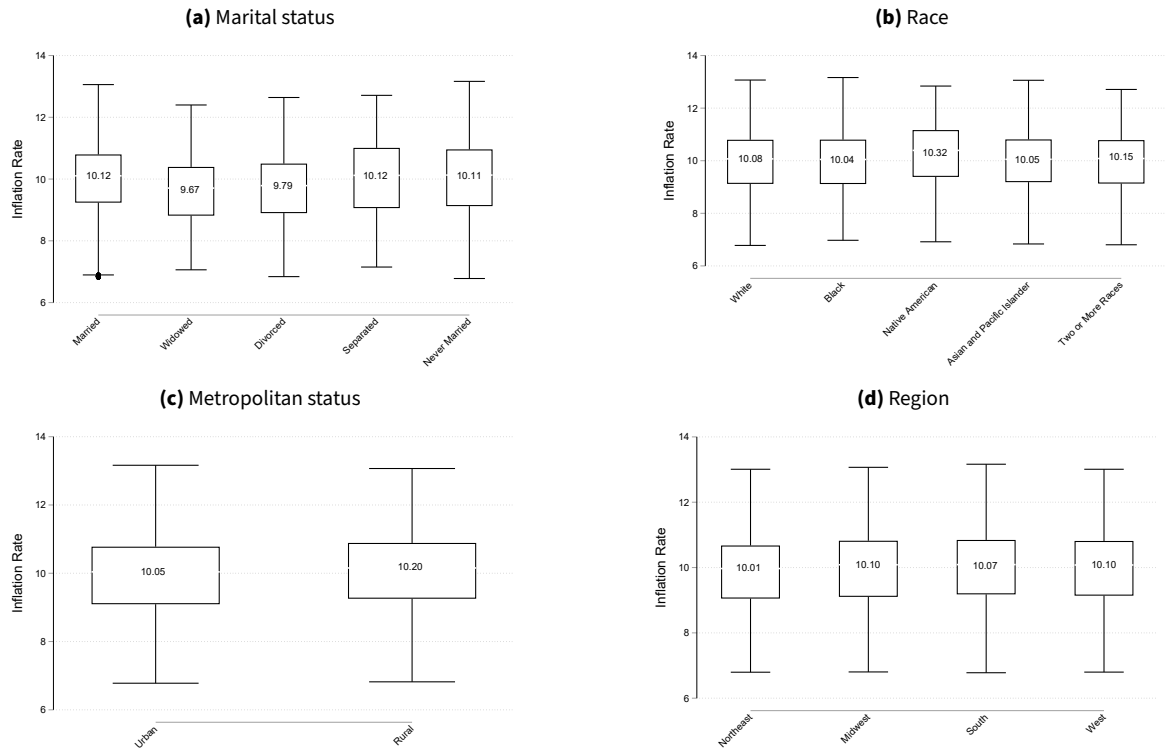
Table Appendix 1.3
Share of Expenditure For Job Switchers and Stayers

	Job stayer	Job switcher
Food	10.3	10.3
Food Away from Home	5.3	5.5
Owned Dwellings	14.6	13.7
Rented Dwellings	12.8	13.8
Utilities	10.7	10.6
Household Equipment/Operations	7.0	6.9
Vehicle Purchases	8.1	8.2
Other Vehicle Expenses	6.5	6.6
Healthcare	7.3	6.7
Entertainment	4.9	4.8

Appendix 1.2 Inflation Rate Distribution

While the following demographic groups were not used to impute consumption information from individuals in the CEX to individuals in the CPS, Figure Appendix 1.2.1 depicts their inflation rates for reference.

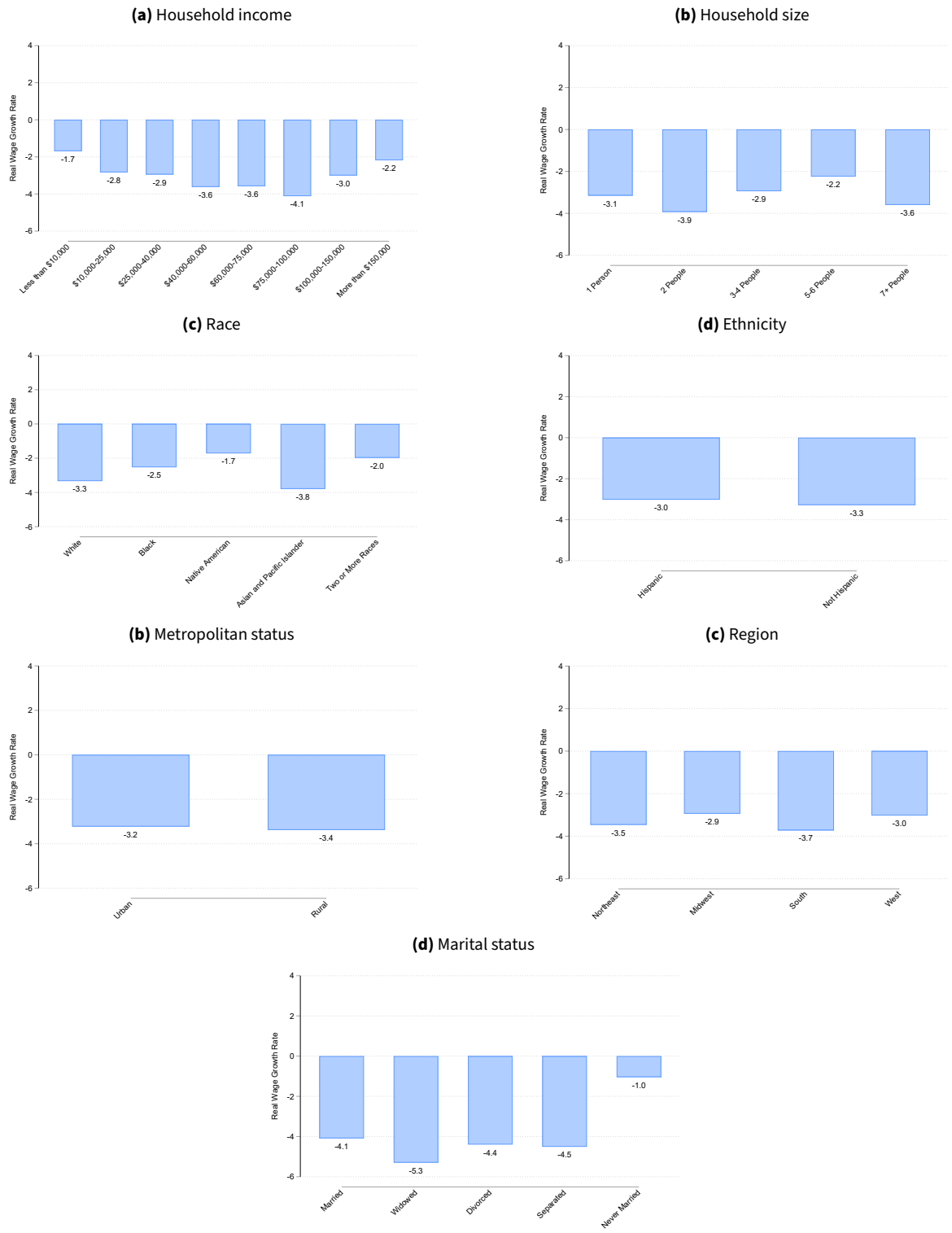
Figure Appendix 1.2.1
Distribution of Inflation by Demographic Group



Appendix 1.3 Real Wage Growth Distribution

While inflation typically varies only within 1 percentage point across demographic groups, real wage growth often varies to a greater degree across different characteristics. Figure Appendix 1.3.1 extends Figure 10.

Figure Appendix 1.3.1
Distribution of Inflation by Demographic Group



Policy Instability and the Risk-Return Trade-Off

Rody Manuelli and Jose Martinez-Gutierrez

Abstract

What is the impact of large swings in economic policy on the risk-return trade-off faced by investors? What is the impact of changes in policy regimes on investment strategies? In this paper we study the impact on returns of switches between periods of market-friendly economic policies and periods of populist policies. To quantify the impact of policy instability, we use data from Argentina—a country that has experienced frequent and very large regime changes—and find that the risk-return for individual assets and minimum variance portfolios are quite different across regimes. We then develop a dynamic model to understand optimal portfolios when investors are cognizant that regimes can change. We find that when portfolios are unrestricted, it is optimal for investors to take a large amount of risk. On the other hand, when portfolios are restricted to include only long positions, a real asset (real estate) dominates financial assets.

JEL codes: E44, G11, G12

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1. INTRODUCTION

Over the last few years, many countries have adopted economic policies that can be broadly defined as populist. Typically, these policies include different forms of interventions that disrupt market mechanisms.[1] The impact of a given policy is determined by, not only its features, but also its stability. Policy regimes that change very frequently create uncertainty and negatively affect investment decisions.[2] The historical records of many Latin American economies show that many have experienced frequent switches between (relatively) market-friendly and populist regimes, and some view these changes as imposing significant costs.[3]

A country's economic performance depends crucially on its ability to direct savings to the most productive uses. Economic policies have a large impact on how investors choose to allocate their savings. In this paper we document how the risk-return trade-off faced by an investor changes with the policy regime and we

1. For a discussion, see Edwards (2019).

2. The negative effects of high uncertainty on economic performance have been studied by Bloom (2009, 2014) and Bloom et al. (2018), among others. In particular, the effects of policy uncertainty have been documented by Boutchkova et al. (2012), Fernandez-Villaverde et al. (2015), and Baker, Bloom, and Davis (2016). While these studies focus mainly on the U.S. economy, others focus on small open economies. For example, Fernandez-Villaverde et al. (2011) document that interest rate volatility at which small open economies borrow can trigger a contraction in output, consumption, and investment.

3. In the Latin American context, see Dornbusch and Edwards (1991). Edwards (2019) draws lessons from Latin America for the rest of the world. Hopkin and Blyth (2019) discuss the impact of populism in Eastern Europe. Rodrik (2018) discusses the interplay between globalization and populism. In a series of papers edited by Kehoe and Nicolini (2022), several authors study the structural changes and economic performances of many Latin American countries in the last six decades.

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illustrate how portfolios that perform well in one regime can generate large losses when the regime changes. We then develop a model of dynamic portfolio selection to study how a rational investor should choose his portfolio, accounting for the possibility of regime changes and the costs—both in terms of time and resources—of adjusting the portfolio.

To illustrate the forces at work, we study the impact of policy instability in Argentina, a country characterized by frequent and dramatic swings in economic policies. We use monthly data on the *real* returns on a collection of assets that include time deposits (both fixed and adjustable rate), real estate, and foreign exchange (U.S. dollar) at both the official exchange rate—which is typically controlled by the government during populist periods—and the black market rate that is easily accessible to individual investors. The sample period is from 1981 to 2019 and includes four populist periods and three market periods.

We find that the risk-return trade-off using the full sample—which corresponds to the appropriate approach if one ignores regime changes—is very misleading of the actual options available to investors. If we allow for unrestricted portfolios—that is, portfolios in which some assets can be shorted—the minimum variance frontier during market periods uniformly dominates that of populist periods. This means that for a given riskiness of the portfolio, expected returns are higher during the market regime.

This finding, somewhat surprisingly, depends crucially on the assumption that the investor can go short in some assets. In the case of Argentina, the returns on investing in foreign exchange are negative during market periods and positive during populist periods. Thus, a policy of contracting debts in U.S. dollars during market periods is behind the large returns of the optimal portfolio. This result is roughly consistent with the observation that Argentina has, in the past, significantly increased borrowing in foreign currency during market periods. It also shows that high returns are associated with leverage and the regime-dependent returns encourage even risk-averse investors to take significant risk by highly leveraging their portfolios.

To capture the trade-offs faced by investors that cannot short any asset, we compute the minimum variance frontier, imposing the restriction that no asset can be used to borrow to finance long positions. The results are radically different. Two extreme observations give a good sense of the differences. First, the safest (lowest variance) portfolio that can be constructed using returns during the populist period has a level of risk—as measured by the standard deviation of the returns—that is about 50 percent higher than the riskiest portfolio during the market period. Second, the highest expected return that is possible to attain in the market regime falls short of 9 percent, while the portfolio with the highest expected return in the populist period earns over 60 percent per year.

To better understand optimal investment decisions, we develop a dynamic portfolio choice model. We consider a long-lived investor who understands that regime changes are stochastic and that it is costly—both in terms of time and resources—to adjust a portfolio. We consider several scenarios and find that the composition of the optimal portfolio depends, crucially, on whether assets can be shorted or not. In the case that the investor can borrow, they take advantage of this possibility by creating high return-high risk portfolios during market regimes by borrowing in foreign exchange and investing in domestic real estate. The negative positions are undone during populist regimes to reduce the riskiness of the portfolio, but investments in real estate are still a major component.

These large differences in the composition of the optimal portfolios are a reflection of the large differences in returns across policy regimes. These differences imply that a fixed portfolio, apart from one invested in real estate, that performs well in one regime can earn poor returns upon a regime change.

A more general, although somewhat speculative, message from our exercise is that policy instability that is associated with increased uncertainty will generally induce large changes in positions and hence in the price of different assets. Even though Argentina is an extreme example of poor and unstable policy, it is a perfect laboratory to study the potential costs of instability as they appear to be large.

The rest of the article is as follows. Section 2 briefly describes the major features associated with populist and market-friendly policies. Section 3 describes the risk-return trade-offs across policy regimes. Section 4 develops a dynamic model of optimal portfolio choice and illustrates—using data from Argentina—the impact of regime changes on the allocation of wealth across assets. Section 5 concludes.

2. ARGENTINA: POPULIST AND MARKET-FRIENDLY REGIMES

Simon Kuznets is said to have remarked that there were four types of countries: developed, developing, Japan, and Argentina. If Kuznets were writing today, he would probably subtract Japan from that list as its economic performance can be readily understood using standard models. However, Argentina, a country characterized by an above-average endowment of natural resources and a relatively high endowment of human capital, remains a puzzle (and interesting case study) due to its frequent and large policy changes and poor performance.

It is impossible to summarize the economic history of Argentina since 1980 in a few paragraphs.[4] At a general level, the economic policies implemented in the last 100 years alternate between a version of *populism*[5] and more market-friendly policies. It is misleading to believe that, within a regime, policies are stable. Typically, the first few months of the pro-market regime are devoted to undoing the regulations and fixing the distortions inherited from the populist regime. Similarly, a populist regime spends the first few months creating the institutional framework to implement its preferred policies.

There is no agreement on what constitutes a populist economic policy. Edwards (2019) distinguishes between *classical* and *new* populism. He views most populist experiments in Latin America before 1990 as being of the classical variety that relies on heterodox macroeconomic policies. New populism emphasizes "blanket regulations, deep protectionist policies, large expansions of the public sector, and mandated minimum wage increases"(Edwards 2019). However, given that our interest is in the relationship between policies and portfolio choices, it is useful to describe some features of both policy regimes that directly influence asset returns and, consequently, optimal portfolios.

Populist economic policies typically include (especially in the latter stages) the following:

- Exchange rate and capital mobility controls
- Significant regulation of financial intermediaries, including caps on yields and quantitative restrictions
- Use of extreme adjustment (or unorthodox taxation) mechanisms (confiscation of assets either through mispriced mandatory exchanges or inflation)
- High taxes on the formal sector (which promote informality)
- Price controls, including rents

From the perspective of an investor choosing his portfolio, there are two important features. First, price (or rate of return) controls and regulations that require some economic agents to invest in those assets as part of their economic activity distorts portfolio choices and rates of return. Some assets might display a "convenience yield" if they provide a way of bypassing costly regulations. The returns of other assets might reflect the existence of, for want of a better word, a "convenience tax," which is the case when holding these assets exposes the investor to some form of penalty. This includes assets that have low liquidity (e.g., real estate) as well as assets that expose investors to risk (black market operations in foreign exchange).

Second, during periods of populist policies, governments have resorted to a variety of actions that are tantamount to expropriation. Examples of this type of policy include exchanging at par bank deposits for government bonds whose market price was about 30 percent of their par value, episodes of hyperinflation that amount to a tax on nominal assets, and "unilaterally rewriting contracts in U.S. dollars in depreciated pesos, imposing huge losses to investors and international firms"(Edwards 2019, 95).

Some of the main features of market-friendly policies are the following:

- Elimination of many regulations and controls
- Minimal restrictions on capital mobility and restrictions on portfolios (e.g., allowing portfolios to include assets denominated in foreign currency)
- Low probability of expropriation

In a market-friendly regime, the standard approach to asset pricing should yield a better fit conditional on the regime. However, since regime changes are rightfully viewed as random events, the pricing equation has to take that into account.

To make progress on understanding asset valuation, we use the sample in Mosquera and Sturzenegger (2020), which contains data on returns on a variety of assets for the period 1981-2019, and split it into two subsamples according to the policy regime. As mentioned above, there is no uncontroversial procedure for determining whether a particular policy is populist or market friendly. We use the following criteria:

- Market regime: This includes the period during which Argentina followed a traditional monetary policy with a constant exchange rate from April 1991 to November 2001; December 2002 to March 2011, during which there were few restrictions on asset transactions; and January 2016 to August 2019, when the Macri government liberalized the economy and did not impose exchange controls.
- Populist regime: This consists of the rest of the sample.

4. Recent short summaries of the economic history of Argentina include Buera and Nicolini (2019) and the various papers that appeared in the December 2018 issue of the *Latin American Review*. A good summary of the economic outcomes can be found in the introduction of Glaeser et al. (2018). See also Cavallo and Cavallo Runde (2018) and Della Paolera and Taylor (2003). De Pablo (2019) (in Spanish) discusses the difficulties of designing economic policy in Argentina.

5. See Dornbush and Edwards (1991) for traditional populism and Edwards (2019) for the new populism as applied to Latin America.

Table 1
Monthly Growth Rates (%)

	Real wage		Prices	
Regime	Mean	St. dev.	Mean	St. dev.
Full sample	0.121	3.55	5.37	13.92
Populist	0.010	5.30	13.63	20.12
Market	0.200	1.40	1.03	1.34

It is clear that there is a fair amount of policy heterogeneity within each of these phases. However, to preserve degrees of freedom, we ignore the within-regime differences.[6]

In this article we present results on the real returns of a collection of assets, and we discuss the evidence from the perspective of a standard asset pricing model. The set of assets that we consider include the following:

- Time deposits (CD): These are regular time deposits (the minimum term varies greatly over time, but they could be as short as 7 days and as long as a year). We use the 30-day CD rate. The interest is set in nominal terms, but the returns are deflated by a measure of inflation using the consumer price index (CPI).
- Adjustable bank deposits (UVA): Interest paid is adjusted using a formula that, effectively, is a distributed lag of the inflation rate during the previous two months. The resulting nominal rate is deflated using the CPI.
- Real estate (RE): The return is an index of the change in house prices and an allocation for the monthly value of a lease.
- U$S dollar (U$S): This is the real return in pesos of holding non-interest earning dollars valued at the "official" (legal) exchange rate. Thus if the peso-dollar exchange rate is denoted as S_t (pesos per dollar), then the return is computed as
$$e^{r_{Dt}} = \frac{S_t/S_{t-1}}{P_t/P_{t-1}},$$
where P_t is a measure of the aggregate price index.
- U$S dollar "blue" (B): It is also the return from holding U$S dollars except we use the black market exchange rate instead of the official exchange rate. Even though there are some costs associated with exchanging dollars at this rate, it is relatively easy for middle-class Argentinians (but not necessarily for low-income households) to access this informal market.
- The data are monthly and have not been seasonally adjusted.

From the perspective of the U.S., it might be surprising that we exclude investments in some form of security that tracks the overall value of the stock market. However, the reason for this exclusion is the lack of a consistent index that covers the period under study.[7]

How different are these two regimes? Table 1 presents data for the whole sample and each subsample separately for the growth rate of the real wage and inflation. The differences across regimes are stark. Real wages (a proxy for consumption) grow faster and are more stable during market-friendly periods. At an annual level, they exhibit zero growth during populist periods and about 0.2 percent (per month) during periods in which the prevailing macro policy is market friendly. Relative to more developed economies, Argentina shows a very large variability of the growth rate of our proxy for consumption. The ratio of the mean growth rate to its standard deviation for the whole period is about 29, while in the U.S. the ratio is about 1.88, measured by the Real Personal Consumption Expenditure, from 1981 to 2019.

The differences in inflation across regimes are even larger. The monthly inflation rate is about 11 times higher, on average, in populist periods. The standard deviation is also higher. At these levels of inflation, it

6. This classification is arbitrary. We have experimented including the 2002-2011 period as part of the populist regime, and the results are virtually identical. Ocampos (2018) developed an index that includes the gap between official and black market exchange rates, fiscal deficit, and differences between import and export exchange rates, among other variables. His sample includes the years 1982–2013. According to his Index 1, the relevant value for the years that we consider market friendly is 3.90, while the corresponding value for the populist years is 6.42. In the appendix (Section 6.9) we report the results of the exercise where portfolios are chosen optimally for alternative definitions of the two regimes. The results are similar.

7. It is possible to use official statistics corresponding to the MERVAL index for the period 2004–20, but we could not find data covering the whole period. The stock market capitalization relative to GDP in Argentina is very small. According to the World Bank, it was less than 9 percent in 2019, while the average for Latin American countries exceeds 50 percent, and it reaches 190 percent in the U.S.: https://databank.worldbank.org/reports.aspx?source=2series=CM.MKT.LCAP.GD.ZScountry=

Table 2
Monthly Asset Returns (%)

Asset	Mean ($\bar{r}_i^S$)	St. deviation (σ_i^S)
CD	-0.77	4.65
UVA	0.42	8.27
RE	0.79	7.92
U$S	0.61	12.17
B	2.02	29.14

is reasonable to assume that minimally informed investors can distinguish between nominal and real returns. Thus, our choice of only focusing on real returns appears to be justified.

Overall, we find that these two indicators convey the basic message: economic outcomes under the two policy regimes are starkly different. Ignoring the possibility of regime switching is likely to result in mistakes in understanding the performance of individual portfolios.

3. RISK AND RETURN

In this section we present the basic features of the risk-return trade-off for a variety of assets.

3.1 Individual Assets

What is the return-risk trade-off for individual assets? Table 2 shows average monthly (real) returns, $\bar{r}_i^S$, (in percentage terms) as well as their standard deviations, σ_i^S, (also in percentages) corresponding to the full sample.[8] The differences are large. Investing in blue (B) dollars earns the highest return but also has the highest standard deviation. Investing in real estate (RE) earns the second-highest return. From the perspective of a mean-variance investor, these two assets dominate the returns of investing in UVAs and U$S dollars.

Even though we have ignored the possibility of default (at least conditional on the regime), it is important to emphasize that some "safe" investments from the perspective of an American investor (e.g., bank CDs) are risky in Argentina due to the large (and many times hard to predict) swings in the inflation rate. Thus, the riskiness of some assets is associated to the large change in their value in terms of goods associated with unanticipated changes in inflation.

These results hide large differences in the first and second moments of asset returns depending on the policy regimes. Table 3 presents the same statistics but distinguishes the policy regime.

The differences are shocking: First, investments in dollars (both official (U$S) and blue (B)) earn high returns during populist periods and negative returns during periods in which financial markets operate more freely. Second, the standard deviations of the returns are also much smaller during periods in which the policy is more market friendly, which reflects the overall stability of the economy during those periods. The third interesting feature is that the asset that displays the smallest difference between regimes is real estate: the expected returns are similar across periods, and the standard deviation during market periods is about one-third of the value in the populist periods. This is a much smaller relative decrease than the corresponding changes for other asset classes, and in part it reflects the preference of Argentinean middle-class investors for saving in the form of "bricks," as investments in real estate are popularly known. Tables 4 and 5 display the correlation matrices for the two regimes. In general, except for real estate and the two measures of the returns to foreign exchange, the correlations are rather small. A low return asset (UVA) is the only one that displays a negative correlation with real estate, official dollar, and dollar blue.

Another tool to describe the risk-return trade-off is the minimum variance frontier.[9] This frontier displays the highest possible return from combining all assets for a given measure of the portfolio's risk (its variance). To highlight how different regimes result in different risk-returns trade-offs, we compute the minimum variance frontier for the whole sample and for each subsample. When we allow investors to form unrestricted portfolios (which allow shorting), we find that for any given level of risk—as measured by the standard deviation—the expected return in a market regime is uniformly higher.

8. All the data were kindly provided by Federico Sturzenegger and Santiago Mosquera and were used in Mosquera and Sturzenegger (2020). The appendix contains a brief description of the data.

9. The original pioneering works are Markowitz (1952), Sharpe (1964), and Lintner (1965). For a good summary of the Capital Asset Pricing Model, see Perold (2004).

Table 3
Monthly Asset Returns (%)

	Populist sample		Market sample	
Asset	Mean	St. Dev.	Mean	St. Dev.
CD	-1.92	7.03	0.03	0.92
UVA	0.78	12.86	0.17	1.18
RE	0.86	11.78	0.74	3.21
U$S	2.08	18.65	-0.41	2.80
B	5.68	45.17	-0.52	3.46

Table 4
Correlation Coefficient (Market)

	CD	Dollar	Real estate	UVA	Blue
CD	1.000	0.237	0.296	0.259	0.070
Dollar	0.237	1.000	0.708	-0.102	0.781
Real estate	0.296	0.708	1.000	-0.087	0.507
UVA	0.259	-0.102	-0.087	1.000	-0.090
Blue	0.070	0.781	0.507	-0.090	1.000

Figure 1 shows the minimum variance frontier for the whole sample and for each of the two subsamples. It shows that not only are expected returns higher (for a given standard deviation) during market periods, but the lowest risk portfolio in a market regime is also several times safer than the minimum variance portfolio in the populist regime, consistent with the differences in the covariances between assets in the two regimes.

Figure 1
Minimum Variance Frontier (Unconstrained)

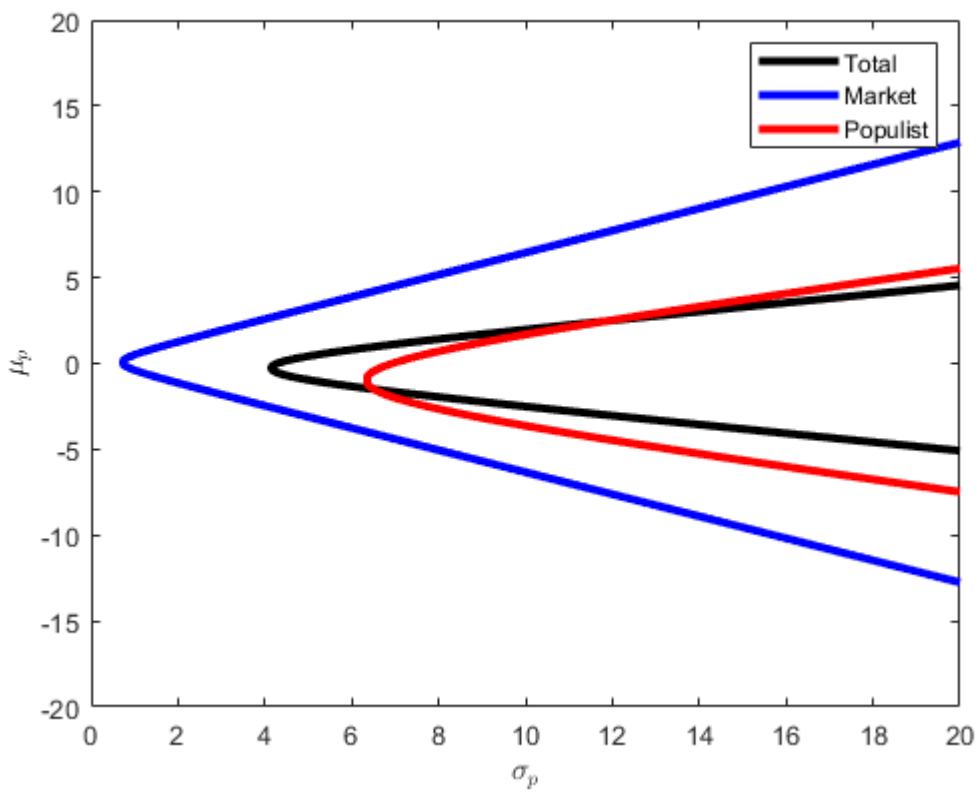
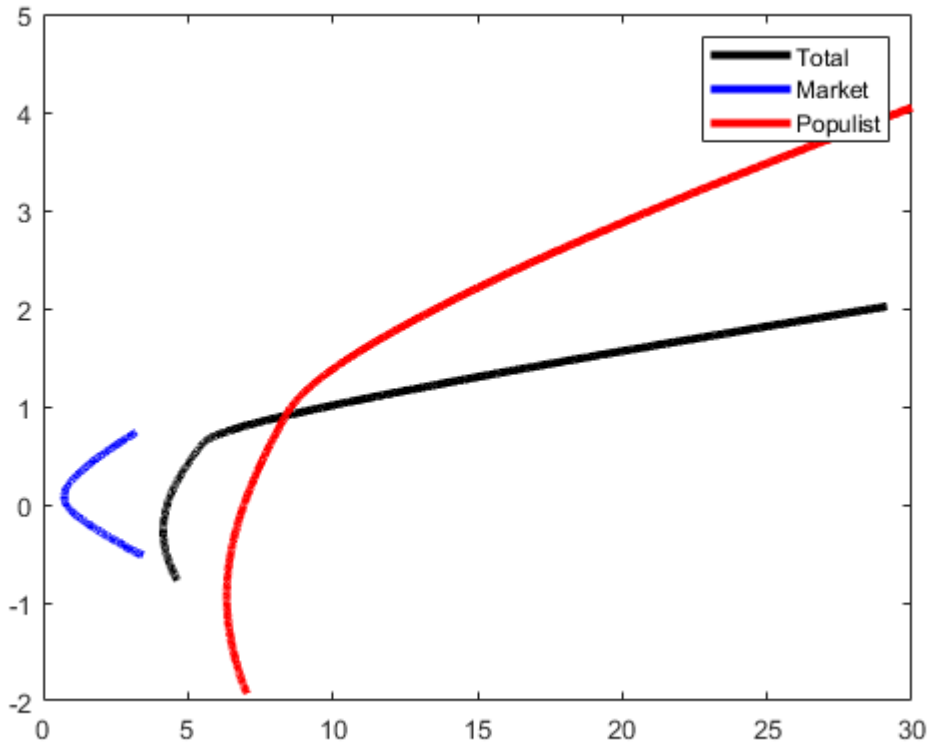


Table 5
Correlation Coefficient (Populist)

	CD	Dollar	Real estate	UVA	Blue
CD	1.000	0.111	-0.017	0.087	0.164
Dollar	0.111	1.000	0.813	-0.083	0.890
Real estate	-0.017	0.813	1.000	0.107	0.740
UVA	0.087	-0.083	0.107	1.000	-0.011
Blue	0.164	0.890	0.740	-0.011	1.000

The previous result allows investors to short every asset. If we restrict portfolios to contain only long positions, the differences across regimes are starker. Figure 2 displays the risk-return trade-offs in the no-shorting case. The differences across regimes are very large: the safest portfolio in the populist regime has a risk that is almost twice the standard deviation of the riskiest portfolio in the market regime. On the other hand, the highest expected returns during populist periods greatly exceed those of the market periods.

Figure 2
Minimum Variance Frontier (Constrained)



Overall, this first look at the risk-return trade-offs across regimes shows there are large differences in returns (and in the standard deviation) and that even the minimum variance portfolios vary across regimes. In Appendix Section 6.9 we report changes in the sample to allow financial crisis in the market periods, and we find no significant differences with the benchmark case.

4. PORTFOLIO RETURNS AND REGIME CHANGE

A natural next step is to go beyond the simple measures of risk and return and to determine what is the *optimal* portfolio for an investor who understands that returns vary across regimes and regimes are not permanent; that is, there is a nonzero probability of a regime change at any given time.[10]

The previous exercise shows that, depending on the desired rate of return, a portfolio's composition changes dramatically across policy regimes. In this section we make progress on understanding the optimal portfolio for risk-averse investors who account for regime changes and know it is not costless to change their portfolio's composition.[11]

In our setting a portfolio is a set of weights, $\alpha = (\alpha_{CD}, \alpha_{U\$S}, \alpha_{RE}, \alpha_{UVA}, \alpha_B)$, that add up to one. A restricted portfolio requires that, in addition, the α_k cannot be negative. We assume that the expected return of a portfolio in state $j \in \{M, P\}$ is given by

$$\mu_j(\alpha) = \sum_{k \in Y} \alpha_k r_{k,j}$$

and the variance of the portfolio is

$$\sigma_j^2(\alpha) = \sum_{k \in Y} \left(\alpha_k r_{k,j} - \mu_j(\alpha)\right)^2,$$

where the set Y is $\{CD, U\$S, RE, UVA, B\}$.

Preferences are then given by

$$U_j(\alpha) = \mu_j(\alpha) - \frac{\theta}{2}\sigma_j^2(\alpha).$$

We assume that the investors care about expected returns and dislike uncertainty.

We consider the problem of an investor over a long horizon who understands there will be regime changes and that it is (potentially costly) to change a portfolio. Formally, the investor solves

$$\max_{\alpha \in Y} E \int_0^\infty e^{-\rho t} U_{j(t)}(\alpha_t) dt - \sum_{n=0}^{\infty} e^{-\rho n} c_{j(n)},$$

where the expectation is taken over the stochastic process of regime change and individual states that capture frictions in adjusting the optimal portfolios. Here $j(s)$ indicates the state (either M or P) at time s, while $c_{j(n)}$ is the fixed cost of changing a portfolio when the state is $j(n)$ time n. We use n to denote the jump times when the economy switches from one regime to the other.

Since regime changes are often periods in which many activities are disrupted, it is not obvious that investors can adjust their portfolio instantaneously. We capture this delay by creating a state after a regime switch in which portfolios are unchanged. We view the switch from state M to P as driven by a Poisson process with parameter π_M, implying that the expected duration of a market period is $1/\pi_M$. The switch from P to M is captured by a Poisson process with parameter π_P.

Suppose the economy is in state M and it switches to P. An individual i cannot immediately change his portfolio (at any cost) for a random period of time with expected duration $1/\eta_M^i$. There is a similar waiting period when the switch is from P to M. In this case the relevant expected time is $1/\eta_P^i$.

It is convenient to describe the value of a portfolio using a recursive formulation. Let $V_j(\alpha)$ be the value of holding portfolio α in state $j \in \{M, P\}$. Then, the appropriate valuation formula is

$$\rho V_M^i(\alpha) = U_M^i(\alpha) + \pi_M \left[V_{MP}^i(\alpha) - V_M^i(\alpha)\right],$$

10. Note that our specification of regimes does not coincide with political mandates. In other words, the same administration can choose populist and market-friendly policies.

11. There is extensive literature on portfolio adjustment costs. There are two types of costs, transaction costs and observation costs. The former generate state-dependent portfolio rebalancing, while the latter generate time-dependent portfolio rebalancing. Our model falls into the first category; some examples of these can be found in Bonaparte and Cooper (2010); Bonaparte, Cooper, and Zhu (2012); and Muhle-Karbe, Reppen, and Soner (2017). For our case, fixed adjustment costs generate an inaction region, so investors tend to make infrequent adjustments of their portfolios. In particular, Rieger (2015) documents that these costs tend to lower the volume of trading but increase the volatility of asset prices. On the other hand, for models with observational costs, the adjustment is time dependent. Examples of these can be found in Abel, Eberly, and Pangeas (2007); Alvarez, Guiso, and Lippi (2012); and Huang and Liu (2007).

where $V^i_{MP}(\alpha)$ is the value of the (fixed) portfolio α in state P *before* the investor has had a chance to make any adjustments. It follows that $V^i_{MP}(\alpha)$ is the solution to

$$\rho V^i_{MP}(\alpha) = U_P(\alpha) + \eta^i_P \left[\max\left(\max_{\alpha'} V^i_P(\alpha') - c^i_P, V^i_P(\alpha)\right) - V^i_{MP}(\alpha)\right].$$

Note that when the individual can change the portfolio, the optimal decision depends on both the cost of switching and the value of the "old" portfolio in the new regime.

The value of switching (net of costs) is simply $\max_{\alpha'} V^i_P(\alpha') - c^i_P$. If this exceeds the value of the old portfolio in state P, $V^i_P(\alpha)$, then it is optimal to pay the cost and switch. In this case the new payoff is $\max_{\alpha'} V^i_P(\alpha') - c^i_P$. If the cost of switching is high, then the investor does not adjust the portfolio and the value is $V^i_P(\alpha)$.

The Hamilton-Jacobi-Bellman equations that describe the value in state P are similar.

4.1 Small Switching Costs

If monetary switching costs are small, that is, if the c^i_j are small, then the investor will choose the best portfolio after a regime switch as soon as this is possible. In this section we let the monetary switching costs be small but keep the time switching costs unchanged. Formally, we assume that $\max_{\alpha'} V^i_P(\alpha') - c^i_P > V_P(\alpha)$. In this case, the optimal portfolio in state M is given by

$$\alpha^*_M = \text{argmax}_\alpha \, H_M(\alpha) \equiv U_M(\alpha) + \frac{\pi_M}{\rho + \eta_P} U_P(\alpha).$$

The optimal portfolio maximizes a weighted average of the payoffs in each of the two states. The magnitude of the factor $\pi_M/(\rho + \eta_P)$ determines how much weight an investor who is choosing his portfolio during a market period will assign to the performance of the portfolio in the populist regime. This factor increases as the likelihood of a switch to the populist regime becomes higher (the higher is π_M) and as the waiting period until the portfolio can be adjusted grows longer (the lower is η_P).

The optimal portfolio in the populist regime solves an analogous equation, and it is given by

$$\alpha^*_P = \text{argmax}_\alpha \, H_P(\alpha) \equiv U_P(\alpha) + \frac{\pi_P}{\rho + \eta_M} U_M(\alpha).$$

Let

$$V^+_j \equiv \max_{\alpha'} V_j(\alpha'), \text{ for } j \in \{M, P\}.$$

The appendix describes the expressions for V^+_j, which gives the value of an investor in state j of following the optimal strategy, taking into account switching regimes and costs.

Let $\hat{\alpha}_M$ be the optimal portfolio for an investor in state M if the economy were to stay in that state forever. Thus, the value that this investor would obtain is

$$\hat{V}_M = \frac{U_M(\hat{\alpha}_M)}{\rho} = \frac{\mu_M(\hat{\alpha}_M) - \frac{\theta}{2}\sigma^2_M(\hat{\alpha}_M)}{\rho}.$$

Then we can define an "equivalent expected return,"$\tilde{\mu}_M$, as the expected return that an investor who faces risk $\sigma^2_M(\hat{\alpha}_M)$ would demand to be indifferent between this portfolio and the value $\bar{V}_M$. Thus,

$$\frac{\tilde{\mu}_M - \frac{\theta}{2}\sigma^2_M(\hat{\alpha}_M)}{\rho} = V^+_M.$$

It follows that

$$\tilde{\mu}_M = \mu_M(\hat{\alpha}_M) - \rho\left(\hat{V}_M - V^+_M\right).$$

The term $\rho\left(\hat{V}_M - V^+_M\right)$ measures the loss of utility—in expected returns—associated with the instability of the Argentine economy relative to the ideal alternative in which the economy is always in the M regime.

4.2 Large Switching Costs

In this section we examine the optimal decision of individuals that face large switching costs. Effectively, this assumption implies that $\max_{\alpha'} V_j^i(\alpha') - c_j^i < V_j(\alpha)$ for $j \in \{M, P\}$. This, in turn, implies that in the market regime, the value of a portfolio α is given by

$$\rho V_M^i(\alpha) = U_M^i(\alpha) + \pi_M \left[V_{MP}^i(\alpha) - V_M^i(\alpha) \right],$$

and $V_{MP}^i(\alpha)$ is

$$\rho V_{MP}^i(\alpha) = U_P(\alpha) + \eta_P^i \left[V_P^i(\alpha) - V_{MP}^i(\alpha) \right].$$

Solving for $V_M^i(\alpha)$ (see the appendix), it follows that its value is proportional to

$$G_M(\alpha) = H_M(\alpha) + \frac{\pi_M}{\rho + \eta_P} (Z_M - 1) U_P(\alpha)$$

and $Z_M > 1$ if and only if

$$(\rho + \eta_P)(\rho + \eta_M) > \pi_P \pi_M,$$

which is satisfied when the expected time required to adjust the portfolio is relatively short (this corresponds to a high η_j) relative to the duration of a regime. These restrictions are clearly satisfied in the data. Consequently, the implications are as follows. Since the optimal portfolio with small costs maximizes $H_M(\alpha)$, the optimal portfolio for agents with large switching costs puts more weight on the return of the portfolio after a switch: during the market period, these investors choose a portfolio (relative to the small-cost investors) that puts more weight on the payoff in the populist period. A similar expression holds for the investor who enters the market in the populist regime.[12]

4.3 Taking Stock

For an investor who can be characterized as a "small switching cost" investor based on the amount of time he has to wait until he can adjust his portfolio (as captured by η_M and η_P) and the actual costs he faces when changing the composition of his portfolio (as captured by (c_P, c_M)), the model implies that he continuously readjusts his portfolio every time a regime changes. At the other end, a "large switching cost" investor chooses his optimal portfolio—which depends on the regime when he first entered the market—and never changes.

The truth for a given investor is probably a mixture of the two extremes: an individual sometimes faces small costs and sometimes large costs. In what follows we will explore—under a variety of possible parameterizations—the differences in the portfolios across types of investors (high and low switching costs) and regimes (market and populist).

4.4 Calibration

To quantify the impact of regime changes, we must estimate the parameters of the model. In this section we describe the strategy that we use to select reasonable parameter values. One key parameter is the degree of risk aversion θ. To estimate risk aversion, we consider the expected value of an investor in the U.S. who chooses between a risky portfolio and safe portfolio using the same risk-variance preferences. Standard calculations show that the share of the risky portfolio is given by

$$\alpha = \frac{E(r^s) - r^f}{\theta \sigma_s^2},$$

where $E(r^s)$ is the expected return to the risky asset and σ_s^2 its variance, and r^f is the risk-free rate. In the U.S. the equity premium is somewhere between 4 and 8 percent, and the standard deviation of a broad index of the stock market is about 16 percent. There is some controversy regarding the share of the U.S. portfolio that is composed of safe assets (which correspond to $1 - \alpha$ in this calculation). Gorton, Lewellen, and Metrick (2012) estimate the safe share to be somewhere between 31 and 33 percent. Martin (2018), using a more conservative definition, estimates it at 25 percent. We take 30 percent as a compromise, and hence the risky asset share is 70 percent. This implies that, depending on the assumption about the equity premium, $\theta \in \{2, 4\}$.

The value of $1/\pi_j$ measures the expected duration of regime j in months. In our sample we find that, on average, market regimes last 91 months and populist regimes last 62. Thus, we estimate π_M=0.011 and π_P=0.016.

12. The appendix contains the expressions for the value of the dynamic problem in all cases.

Table 6
Calibration

Parameter	Notation	Value
Discount rate	ρ	0.0025
Market regime intensity	π_M	0.011
Populist regime intensity	π_P	0.016
Market delay	η_M	1
Populist delay	η_P	1
Market adjustment cost	c_M	0.0001
Populist adjustment cost	c_P	0.0001

Table 7
Optimal Portfolios

	Low costs				High costs			
Asset	$\alpha^U_{M,L}$	$\alpha^C_{M,L}$	$\alpha^U_{P,L}$	$\alpha^C_{P,L}$	$\alpha^U_{M,H}$	$\alpha^C_{M,H}$	$\alpha^U_{P,H}$	$\alpha^C_{P,H}$
CD	1.2774	0.0001	-0.3551	0.0000	1.2770	0.0000	-0.4198	0.0000
Dollar	-6.1307	0.0000	0.1786	0.1184	-6.1303	0.0000	-0.0484	0.0000
Real estate	5.5760	0.9994	0.5623	0.3945	5.5760	1.0000	0.8291	0.5531
UVA	-0.3486	0.0004	0.6252	0.4714	-0.3484	0.0000	0.6246	0.4302
Blue	0.6259	0.0000	-0.0109	0.0156	0.6257	0.0000	0.0145	0.0167
Mean	6.26%	0.74%	1.97%	1.04%	6.26%	0.74%	1.99%	0.91%
Variance	10.30%	3.21%	10.66%	8.70%	10.30%	3.21%	11.03%	8.46%

There are no estimates that we are aware of for time (delay) costs and rate of return costs. If there is no change of regime, the value of a portfolio is

$$V = \frac{\mu - \frac{\theta}{2}\sigma^2}{\rho}.$$

If we measure cost in terms of expected return, we have that

$$V - c = \frac{\mu - \frac{\theta}{2}\sigma^2}{\rho} - \frac{\bar{c}}{\rho}.$$

Then if $\bar{c} = x$, then $c = x/\rho$. A small switching cost is 0.01 percent on a monthly basis (which is about 12 basis points on an annual level).

If the time delay is about one month, then $\eta = 1$; if it is two weeks, then $\eta = 2$; and if it is two months, then $\eta = 1/2$. We experiment with those values. Our benchmark scenario assumes the delay is one month for both regimes, but we do a sensitivity analysis for different values of θ and η. The full calibration of our benchmark scenario is described in Table 6.

4.5 Findings

In this section we describe the results of our benchmark scenario. Table 7 shows the optimal portfolios for the low- and high-cost case.[13]

Our previous analysis showed that the minimum variance frontiers vary significantly depending on whether we assume (as in standard portfolio composition analysis) that the investor can hold negative positions in some asset (borrow) or not. To highlight how this distinction is critical, we separately analyze the two cases.

Unrestricted Portfolios The optimal portfolios for this case (when switching costs are relatively low) are in the columns labeled $\alpha^U_{M,L}$ for the market regime and $\alpha^U_{P,L}$ for the populist regime (Table 7). The corresponding portfolios for the high-switching cost case are $\alpha^U_{M,H}$ and $\alpha^U_{P,H}$.

13. In Appendix Section 6.9, we report the results using an alternative definition of regimes that includes, in the market regime, some crises. We do not find significant differences in the results.

There are several remarkable results. First, the existence of the two regimes encourage investors to take a large amount of risk. For example, in the market regime, $\alpha^U_{M,L}$, it is optimal to borrow a large amount (six times the value of the capital) in foreign currency to finance investments in real estate and time deposits. When the regime changes (the optimal portfolio is in the column labeled $\alpha^U_{P,L}$), the positions are undone: the only significant short positions is in domestic currencies at a fixed rate, while the most significant long positions are in real estate and adjustable deposits.

To illustrate how it is optimal to leverage a position, consider the return of the portfolio in the market regime. The expected return is a staggering 6.26 percent per month, compared with Table 3, where the highest return in the market regime is 0.74 percent. The standard deviation of the portfolio is over 10 percent. Interestingly, the riskiness of the portfolio is similar in both regimes, although the expected return is much lower (1.97 percent) in the populist regime.

We next estimate the costs of switching. Using a conservative estimate, the cost of a regime change from market to populism (relative to the alternative of a permanent market regime) is equivalent to a decrease in expected returns (controlling for the variability) of about 3 percent. This is a significant difference.

One way to summarize these results is that the market encourages investors to take risky positions with high leverage borrowing in foreign currency during market periods and a more conservative stance in populist periods. Note that the riskiness of the portfolio is about the same in both regimes but (see Table 3) the volatility of returns of individual assets is much higher in the populist regime.

The results for the large cost of switching (which is close to myopic investors) are very similar. The reason is simple: Given the (relatively small) instantaneous probability of change, it is optimal to invest for the present, paying little attention to the costs of switching.

Restricted Portfolios The results when investors cannot borrow are also surprising: In the market regime, basically 100 percent of the investment is allocated to real estate. During the populist regime, a little over 50 percent is invested in real estate and the rest in adjustable rate deposits. The returns are much lower than in the unrestricted case and so is the riskiness of the portfolio.

Sensitivity Analysis Since there is some uncertainty about some of the parameters section, Appendix Section 6.8 shows the results of changing some of the parameters. We find that decreases in risk aversion increase, as expected, the riskiness of the portfolio. Changes in the expected time of adjusting the portfolio have a small impact on the results. We also experiment with changes in the expected duration of a policy regime. When we make—contrary to the evidence—the market regime more transitory, the difference in the portfolios across regimes is very small, and the expected returns and the riskiness of the portfolio are much lower. When the market regime is transient, the optimal portfolio is close to the optimal portfolio in the base case in the populist regime. When only the populist period is transient, we get the opposite result. In addition, when the expected duration of the regimes changes, the differences between high- and low-cost switching become larger.

5. CONCLUSION

It is not surprising that in a country like Argentina—characterized by large and dramatic changes in economic policy, including changes that at times have amounted to confiscation of assets—the risk-return menus available to investors change with the policy regime. Using data from Argentina to better understand the consequences of populist economic policies relative to market policies, we find that relatively safe portfolios that perform well during market periods display a large negative return and very high risk during populist periods. In general, a robust finding is that if investors are constrained in terms of leverage (no shorting), then it is inevitable that a switch to a populist regime results in higher risk.

We also find that an investor who understands that regimes change randomly and that it is costly to adjust his portfolio will pick a portfolio that both reflects the current regime and accounts for the returns of that portfolio when the regime changes. In addition, we find that when investors (individuals as well as firms) are free to have short positions, a clear pattern emerges: It is optimal during market periods to borrow heavily in foreign exchange to invest (mostly) in domestic real estate. When the policy regime changes (to populism), the short position in U$S dollar is turned into a long position, and investments in real estate and adjustable deposits in domestic currency make up most of the portfolio. Investors are thus willing to take on a significant amount of risk.

This instability is a reflection of the costs of regime switches (and the poor economic performance of populism), but it is totally justified from the perspective of an individual: A fixed portfolio that performs relatively

well in one regime can perform poorly when it changes. Portfolio adjustment —with the consequent disruption and changes in relative prices—is a necessity in turbulent economies.

We also find that when investors are not allowed to borrow to finance their portfolios—a friction that captures rigidities in the financial sector—the optimal portfolios include almost exclusively real estate in the market regime and a mix of real estate and time deposits in the populist regime. Overall, our results show that regime switches between populist and market regimes result in portfolio compositions that are quite different from what is observed in a more stable environment such as the U.S.

6. APPENDIX

6.1 Data

The data were shared by Santiago Mosquera and Federico Sturzenegger from the University de San Andres in Argentina and were used in Mosquera and Sturzenegger (2020).

Time deposits (CD): These correspond to 30 certificates of deposits in the formal banking system in nominal terms. The real returns were deflated using a version of the CPI modified for the periods in which the economic authorities reported incorrect values.

Adjustable bank deposits (UVA): These are deposits in the formal banking system, and the nominal return is adjusted depending on a weighted average of the inflation over the previous two months.

Real estate: This is an index in real terms with an imputation for the market value of leases.

U$S dollar and U$S dollar blue: See the text for a description.

6.2 Chronology of Economic Policies

1975–1991

- Real per capita income decreases by 20 percent
- Annual inflation exceeds 300 percent
- External debt increases
- The real exchange rate is overvalued
- Capital flight occurs

1991–2001

- Free market reforms and increases in foreign investment
- Privatization of state-owned enterprises
- External shocks (Long-Term Capital Management collapse and Russian debt crises)

2001–2002

- Large restrictions on withdrawals of bank deposits

2002–2011

- Increases in regulation
- Renationalization of some formerly state-owned enterprises
- Little interference with asset markets

2011–2015

- Large sovereign debt crises
- Major devaluation
- Increases in regulation
- Exchange controls and, in the latter part of the period, capital controls
- Renationalization of many firms

2016–2019

- Pro-market reforms
- Large deficits that were lowered gradually
- Flexible exchange rates
- No capital controls

6.3 Minimum Variance Frontier

The first step is to build the Minimum Variance Frontier, or the efficient frontier, by choosing optimal asset allocations to minimize the variance of the portfolio given a specific return. Mathematically, this problem can be expressed for our case as

$$\begin{aligned} \min_{\{\omega_i\}_{i\in\Theta}} \quad & \sigma_p^2 = \sum_{i\in\Theta} \omega_i^2 \sigma_i^2 + \sum_{\{(i,j)\in\Theta\,:\,i\neq j\}} 2\omega_i\omega_j Cov(i,j) \\ s.t. \quad & \mu_p = \sum_{i\in\Theta} \omega_i \mu_i \\ & 1 = \sum_{i\in\Theta} \omega_i \\ & \underline{\omega} \leq \omega_i \leq \bar{\omega}, \end{aligned}$$

where $\Theta = \{CD, UVA, RE, U\$S, B\}$ and CD denote CDs described above, UVA denotes UVA, RE denotes real estate, $U\$S$ denotes dollars, and B denotes blue dollars. Finally, μ_i and σ_i^2 denote the mean and the variance of each asset, respectively; μ_p is the mean of the whole portfolio; and σ_p^2 denotes its variance. To find the Minimum Variance Frontier, we solve the portfolio problem for different values of μ_p, which we describe below.

6.4 Portfolios

6.4.1 Unrestricted

Unconstrained portfolios: total sample						
μ_p	σ_p	ω_{CD}	$\omega_{U\$S}$	ω_{RE}	ω_{UVA}	ω_B
0.1%	4.4014%	0.3747	-0.0271	0.3693	0.2838	-0.0007
0.3%	4.739%	0.2374	-0.0412	0.4594	0.3414	0.003
0.5%	5.1831%	0.1001	-0.0553	0.5495	0.399	0.0067
0.7%	5.7089%	-0.0372	-0.0695	0.6396	0.4565	0.0105

Unconstrained portfolios: market sample						
μ_p	σ_p	ω_{CD}	$\omega_{U\$S}$	ω_{RE}	ω_{UVA}	ω_B
0.1%	0.7175%	0.5798	0.1461	0.0325	0.3558	-0.1142
0.3%	0.8072%	0.6538	-0.0234	0.2043	0.3017	-0.1364
0.5%	0.9915%	0.7231	-0.188	0.3756	0.2516	-0.1622
0.7%	1.2286%	0.793	-0.35	0.5469	0.2004	-0.1903

Unconstrained portfolios: populist sample						
μ_p	σ_p	ω_{CD}	$\omega_{U\$S}$	ω_{RE}	ω_{UVA}	ω_B
0.1%	7.0662%	0.2706	0.0566	0.3473	0.3344	-0.0089
0.3%	7.3371%	0.2052	0.0697	0.3694	0.3648	-0.0092
0.5%	7.6575%	0.1363	0.0835	0.3927	0.3969	-0.0094
0.7%	7.9915%	0.0708	0.0966	0.4148	0.4274	-0.0097

6.4.2 Constrained

Constrained portfolios: total sample						
μ_p	σ_p	ω_{CD}	$\omega_{U\$S}$	ω_{RE}	ω_{UVA}	ω_B
0.1%	4.4081%	0.372	0.0007	0.3395	0.2874	0.0003
0.3%	4.7473%	0.2299	0.0002	0.4236	0.3462	0.0001
0.5%	5.1948%	0.0881	0.0006	0.5056	0.4052	0.0005
0.7%	5.9384%	0	0.0001	0.5734	0.3818	0.0446

Constrained portfolios: market sample						
μ_p	σ_p	ω_{CD}	$\omega_{U\$S}$	ω_{RE}	ω_{UVA}	ω_B
0.1%	0.7415%	0.5783	0.0167	0.0431	0.3569	0.005
0.3%	1.1603%	0.2328	0.0001	0.2879	0.4791	0.0001
0.5%	1.9889%	0.0038	0.0002	0.584	0.4117	0.0002
0.7%	3.0138%	0.0011	0.0001	0.9349	0.0637	0.0001

Constrained portfolios: populist sample						
μ_p	σ_p	ω_{CD}	$\omega_{U\$S}$	ω_{RE}	ω_{UVA}	ω_B
0.1%	7.0628%	0.28	0.0377	0.3491	0.3331	0.0001
0.3%	7.3402%	0.213	0.0507	0.3719	0.3644	0
0.5%	7.6522%	0.1464	0.0633	0.3945	0.3956	0.0003
0.7%	7.9943%	0.0795	0.0762	0.4172	0.4268	0.0003

6.4.3 Returns of Fixed Portfolio across Regimes

Returns of a fixed portfolio across regimes				
	Unrestricted		Constrained	
	Market	Populist	Market	Populist
Mean	0.1	-1.155	0.1	-0.7342
SD	0.7175	7.9707	0.7415	7.0104
Mean	0.5	-2.1846	0.5	0.8203
SD	0.9915	10.925	1.9889	8.3279
Mean	0.7	-2.7079	0.7	0.856
SD	1.2286	13.2963	3.0138	10.9845

Returns of a fixed portfolio across regimes				
	Unrestricted		Constrained	
	Populist	Market	Populist	Market
Mean	0.1	0.3025	0.1	0.3069
SD	7.0662	1.347	7.0628	1.3355
Mean	0.5	0.3318	0.5	0.3364
SD	7.6575	1.5511	7.6522	1.5374
Mean	0.7	0.346	0.7	0.3511
SD	7.9915	1.6553	7.9943	1.6435

6.5 Small Switching Costs

The relevant value functions are

$$V_M^+ = \frac{(\rho+\pi_P)\,H_M(\alpha_M^*) + \frac{\pi_M\eta_P}{\rho+\eta_P}H_P(\alpha_P^*)}{\Delta} - \left(\frac{\pi_M\eta_P}{\rho+\eta_P}\right)\left(\frac{(\rho+\pi_P)\,c_P + \frac{\pi_P\eta_M}{\rho+\eta_M}c_M}{\Delta}\right)$$

and

$$V_P^+ = \frac{(\rho+\pi_M)\,H_P(\alpha_P^*) + \frac{\pi_P\eta_M}{\rho+\eta_M}H_M(\alpha_M^*)}{\Delta} - \left(\frac{\pi_P\eta_M}{\rho+\eta_M}\right)\left(\frac{(\rho+\pi_M)\,c_M + \frac{\pi_M\eta_P}{\rho+\eta_P}c_P}{\Delta}\right),$$

where

$$\Delta = (\rho+\pi_M)\,(\rho+\pi_P)\,(1-\varkappa(\pi_M)\varkappa(\pi_P)\varkappa(\eta_M)\varkappa(\eta_P)) > 0,$$

and for any $x \geq 0$,

$$\varkappa(x) \equiv \frac{x}{\rho+x} \in [0,1).$$

In these formulations, α_j^* is the maximizer of $H_J(\alpha)$.

6.6 Large Switching Costs

In this case the value functions are

$$\tilde{V}_M(\alpha) = \frac{(\rho+\pi_P)\,H_M(\alpha) + \frac{\pi_M\eta_P}{\rho+\eta_P}H_P(\alpha)}{\Delta}$$

and

$$\tilde{V}_P(\alpha) = \frac{(\rho+\pi_M)\,H_P(\alpha) + \frac{\pi_P\eta_M}{\rho+\eta_M}H_M(\alpha)}{\Delta}.$$

The highest possible value for an investor who enters the market in regime M is

$$\tilde{V}_M^+ = \max_\alpha \frac{(\rho+\pi_P)\,H_M(\alpha) + \frac{\pi_M\eta_P}{\rho+\eta_P}H_P(\alpha)}{\Delta}.$$

Let the maximizer be denoted as $\tilde{\alpha}_M$. The corresponding value for an investor who joins the market in the P regime is

$$\tilde{V}_P^+(\alpha) = \max_\alpha \frac{(\rho+\pi_M)\,H_P(\alpha) + \frac{\pi_P\eta_M}{\rho+\eta_M}H_M(\alpha)}{\Delta}.$$

As above, the maximizer is denoted as $\tilde{\alpha}_P$.

6.7 Large and Small Switching Costs: A Comparison

When will an investor choose to pay the switching costs? In the M regime, an investor will choose to pay the switching costs if $V_M^+ > \tilde{V}_M^+$. It follows that

$$V_M^+ - \tilde{V}_M^+ = \frac{(\rho+\pi_P)\left(H_M(\alpha_M^*) - H_M(\tilde{\alpha}_M)\right) + \frac{\pi_M\eta_P}{\rho+\eta_P}\left(H_P(\alpha_P^*) - H_P(\tilde{\alpha}_P)\right)}{\Delta} - \left(\frac{\pi_M\eta_P}{\rho+\eta_P}\right)\left(\frac{(\rho+\pi_P)\,c_P + \frac{\pi_P\eta_M}{\rho+\eta_M}c_M}{\Delta}\right).$$

It is clear that the first term is positive since the investor who pays the cost can tailor his portfolio to the regime, while an investor who does not pay the cost has to suffer a potentially lower value of his (fixed) portfolio when the regime switches. The second term is negative and converges to zero as the vector (c_P, c_M) becomes arbitrarily small.

To the extent that waiting times to change the portfolio (as captured by η_M and η_P) and actual return costs (as captured by (c_P, c_M)) vary across investors, the model is consistent with a fair amount of heterogeneity in optimal portfolios even though all investors share the same preferences for risk and return.

6.8 Sensitivity Analysis

Case $\theta = 2$

Optimal portfolios (%)

Asset	Low costs				High costs			
	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	189.22	0.01	-134.42	0	189.23	0.00	-148.58	0.00
Dollar	-1232.38	0	37.33	14.59	-1232.41	0.00	-8.41	0.00
Real estate	1110.82	99.97	90.01	26.53	1110.86	100.00	145.06	53.74
UVA	-95.14	0.01	108.5	50.3	-95.15	0.00	108.31	39.84
Blue	127.48	0	-1.42	8.58	127.48	0.00	3.62	6.42

Case $\alpha_{U\$S} = 0$

Optimal portfolios (%)

Asset	Low costs				High costs			
	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	-91.13	0	-31.49	0	-91.12	0.00	-43.12	0.00
Dollar	0	0	0	0	0.00	0.00	0.00	0.00
Real estate	255.56	99.99	66.98	48.18	255.57	100.00	80.04	55.31
UVA	53.59	0.01	61.35	47.54	53.59	0.00	62.79	43.02
Blue	-118.02	0	3.16	4.28	-118.03	0.00	0.29	1.67

Case $\eta_M = \eta_P = 1/2$

Optimal portfolios (%)

Asset	Low costs				High costs			
	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	45.74	0	-35.62	0	45.76	0	-41.97	0
Dollar	-447.97	0	17.54	11.5	-448.04	0	-4.8	0
Real Estate	438.91	99.96	56.62	39.81	438.95	100	82.86	55.3
UVA	9.36	0.04	62.52	47.09	9.35	0	62.46	43.02
Blue	53.97	0	-1.05	1.6	53.98	0	1.45	1.68

Case $\eta_M = \eta_P = 2$

Optimal portfolios (%)

Asset	Low costs				High costs			
	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	214.62	0.01	-35.46	0	214.62	0.00	-41.98	0.00
Dollar	-742.6	0	18.02	12.01	-742.60	0.00	-4.86	0.00
Real Estate	663.23	99.95	56.03	39.28	663.23	100.00	82.93	55.32
UVA	-86.76	0.03	62.52	47.17	-86.76	0.00	62.46	43.01
Blue	51.51	0	-1.11	1.54	51.51	0.00	1.45	1.67

Case $\eta_M = 2$ ***and*** $\eta_P = 1$

Optimal portfolios (%)

Asset	Low costs				High costs			
	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	127.74	0.01	-35.46	0	127.70	0.00	-41.95	0.00
Dollar	-613.07	0	18.02	12.01	-613.03	0.00	-4.72	0.00
Real Estate	557.6	99.94	56.03	39.28	557.59	100.00	82.77	55.28
UVA	-34.86	0.04	62.52	47.17	-34.83	0.00	62.46	43.04
Blue	62.59	0	-1.11	1.54	62.57	0.00	1.44	1.68

Case $\eta_M = 1$ ***and*** $\eta_P = 2$

Optimal portfolios (%)

Asset	Low costs				High costs			
	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	214.62	0.01	-35.51	0	214.62	0.00	-42.01	0.00
Dollar	-742.6	0	17.86	11.84	-742.60	0.00	-4.98	0.00
Real Estate	663.23	99.95	56.23	39.45	663.23	100.00	83.07	55.36
UVA	-86.76	0.03	62.52	47.14	-86.76	0.00	62.46	42.99
Blue	51.51	0	-1.09	1.56	51.50	0.00	1.47	1.65

Case $\pi_M = 100$

Optimal portfolios

Asset	Low costs				High costs			
	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	-0.3547	0	-0.3551	0	-0.3558	0	-0.3551	0
Dollar	0.1798	0.1198	0.1786	0.1184	0.1766	0.1163	0.1786	0.1185
Real Estate	0.5608	0.3932	0.5623	0.3945	0.5647	0.3968	0.5622	0.3945
UVA	0.6252	0.4716	0.6252	0.4714	0.6252	0.4711	0.6252	0.4714
Blue	-0.011	0.0154	-0.0109	0.0156	-0.0107	0.0158	-0.0109	0.0155
Mean	0.44%	0.31%	1.97%	1.04%	0.45%	0.32%	1.97%	1.04%
S.D.	2.38%	1.72%	10.66%	8.7%	2.38%	1.72%	10.66%	8.7%

Case $\pi_P = 100$

Optimal portfolios

Asset	Low costs				High costs			
	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	1.2774	0.0001	1.3923	0	1.2771	0	1.2784	0
Dollar	-6.1307	0	-6.3271	0	-6.1305	0	-6.1327	0
Real Estate	5.576	0.9994	5.7248	1	5.5761	1	5.5778	1
UVA	-0.3486	0.0004	-0.4143	0	-0.3484	0	-0.3492	0
Blue	0.6259	0	0.6243	0	0.6257	0	0.6257	0
Mean	6.26%	0.74%	-7.68%	0.86%	6.26%	0.74%	-7.13%	0.86%
S.D.	10.30%	3.21%	68.34%	11.79%	10.30%	3.21%	65.86%	11.79%

Case $\pi_M = \pi_P = 100$

Optimal portfolios

Asset	Low costs				High costs			
	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	-0.3547	0	1.3923	0	0.5504	0	-0.4115	0
Dollar	0.1798	0.1198	-6.3271	0	-4.6931	0	-0.0141	0
Real Estate	0.5608	0.3932	5.7248	1	4.5392	1	0.7902	0.5424
UVA	0.6252	0.4716	-0.4143	0	0.0458	0	0.6249	0.4369
Blue	-0.011	0.0154	0.6243	0	0.5577	0	0.0106	0.0207
Mean	0.44%	0.31%	-7.68%	0.86%	4.99%	0.74%	1.99%	0.93%
S.D.	2.38%	1.72%	68.34%	11.79%	8.56%	3.21%	10.94%	8.5%

6.9 Different Sample

This section reports the results after changing the samples to avoid including/excluding key episodes in each sample, such as the 2001 crisis and the 2019 crisis. The new sample is constructed as follows:

- Populist periods
  - May 1981 to March 1991
  - January 2002 to November 2002
  - April 2011 to November 2015
- Market periods
  - April 1991 to December 2001
  - December 2002 to March 2011
  - December 2015 to December 2019

Table A reports the mean and standard deviation of each asset for both samples. After including the two crisis periods in the market sample, the results are not significantly different from the benchmark sample.

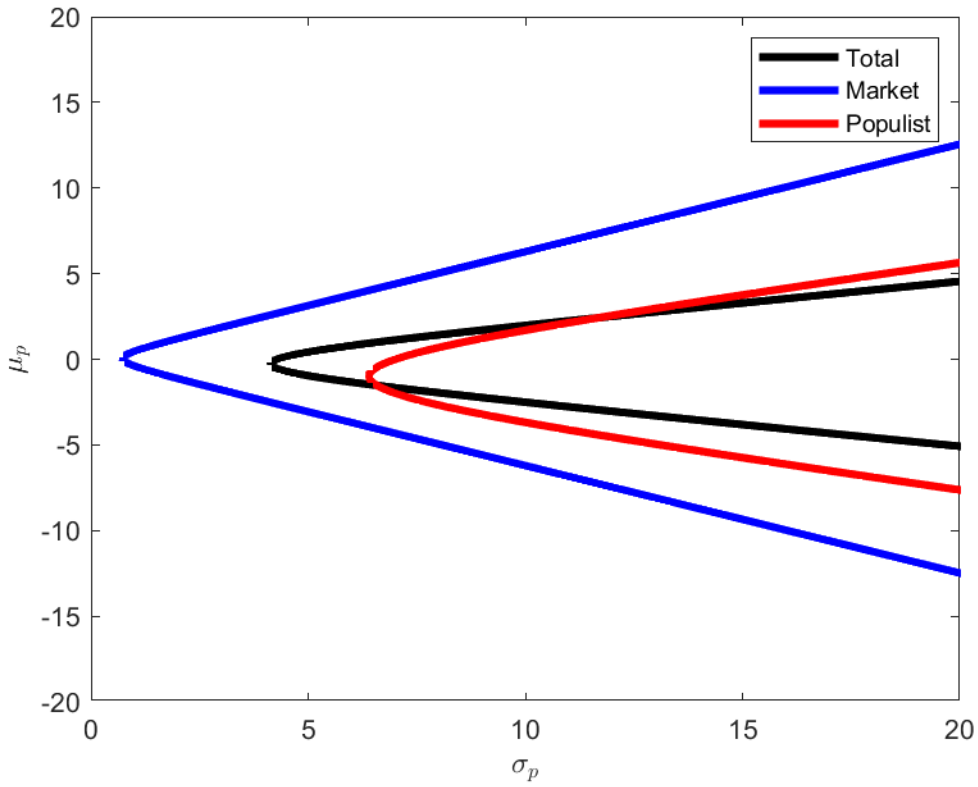
Table A: Monthly Asset Return (%)

Asset	Populist sample		Market sample	
	Mean	St. dev.	Mean	St. dev.
CD	-1.98	7.09	0.02	0.92
Dollar	2.16	18.84	-0.42	2.78
Real estate	0.91	11.90	0.70	3.19
UVA	0.81	12.99	0.16	1.18
Blue	5.74	45.63	-0.45	3.61

6.9.1 Unconstrained Case

As shown in the graph below, the results of changing the sample to include crisis episodes in a different regime are almost identical to the benchmark case shown in Section 3. During market periods, given a specific level of risk, the return in the market regime is always higher than in the populist regime. Moreover, as shown in Section 3, the minimum possible risk that can be achieved during the populist period is many times higher than the minimum possible risk in the market period.

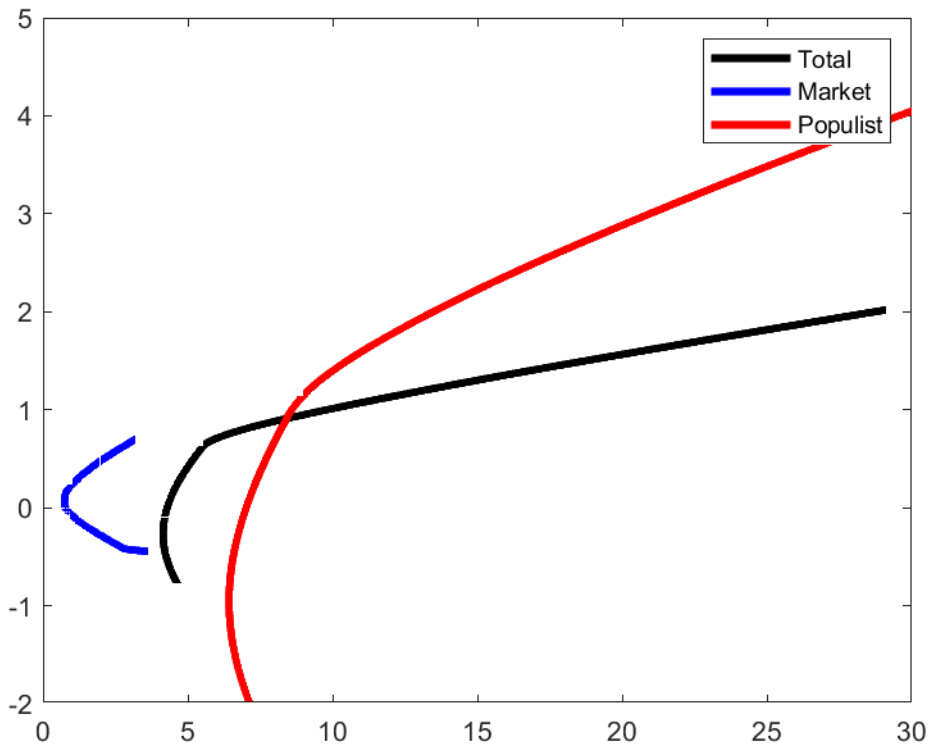
Figure 3
Minimum Variance Frontier (Unconstrained)



6.9.2 Constrained Case

The graph below shows the Minimum Variance Frontier for the case where agents cannot short any asset. In line with the previous results, the findings do not change significantly.

Figure 4
Minimum Variance Frontier (Constrained)



6.9.3 Optimal Portfolios

Here we present optimal portfolio allocations for the new sample. Compared with our benchmark case, the differences are small enough to confirm that our results are robust for the sample selection.

Table B: Optimal Portfolios (%)

	Low costs				High costs			
Asset	α_M^U	α_M^C	α_P^U	α_P^C	α_M^U	α_M^C	α_P^U	α_P^C
CD	130.71	0.00	-36.86	0.00	130.72	0.00	-42.31	0.00
Dollar	-627.09	0.00	18.80	12.51	-627.10	0.00	-3.53	0.00
Real estate	548.94	99.98	56.86	39.47	548.95	100.00	81.97	55.09
UVA	-30.46	0.01	62.77	46.83	-30.46	0.00	62.66	43.16
Blue	77.89	0.00	-1.57	1.19	77.89	0.00	1.21	1.75
Mean	6.10	0.70	2.07	1.08	6.10	0.70	2.08	0.95
Variance	10.13	3.20	10.85	8.78	10.13	3.20	11.17	8.58

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Accounting for the Effects of Fiscal Policy Shocks on Exchange Rates through Markup Dynamics

Hyungsuk Lee and Junsang Lee

Abstract

This study investigates how fiscal policy shocks affect the external sector through markup dynamics in advanced and developing economies. We focus on the role of markup dynamics as a channel through which fiscal policy has a distinct effect on real exchange rates. Using panel data from 32 countries, we employ a local projection to evaluate the impact of expansionary fiscal policy shocks on real exchange rates, markups, and current accounts. Our empirical findings show distinct responses to the shocks among advanced and developing countries regarding the real exchange rate, due to different markup dynamics. Expansionary fiscal measures result in an appreciation of the real exchange rate and an increase in markup for developing countries, whereas advanced economies experience a decrease in markup and a depreciation of the real exchange rate. Markup dynamics vary between advanced and developing economies due to differences in firms' entry and exit conditions in their institutions. In advanced economies, expansionary fiscal policy shocks promote competition and new firm entry, resulting in a reduced markup. On the other hand, unfavorable conditions in developing countries maintain or increase existing firms' market power. Our research highlights the heterogeneous effects of fiscal policy shocks on the external sector, emphasizing the need for policymakers to consider institutional and entry conditions while designing and implementing fiscal policies.

JEL codes: F41, H32, L11

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1. INTRODUCTION

In recent decades, fiscal policy has emerged as a pivotal instrument for governments worldwide to stimulate economic growth and maintain stability. Fiscal policy entails the strategic deployment of government expenditure and taxation to steer the economy toward desired objectives, such as achieving full employment, controlling inflation, and promoting equitable income distribution. However, the effectiveness of fiscal policy is not uniform among all countries and is influenced by factors such as institutional architecture, market entry conditions, and the level of competition among firms. For example, the institutional environment may shape the responsiveness of fiscal policy through factors such as governance quality, legal and regulatory frameworks, and fiscal decentralization (Acemoglu, Johnson, and Robinson, 2001; Rodrik, 2008; Avellán, Galindo, and Leon-Diaz, 2020). Market entry conditions and level of competition among firms can also influence how fiscal policy permeates through the economy (Djankov et al., 2002; Blanchard and Giavazzi, 2003; Aghion et al., 2005; Klapper, Laeven, and Rajan, 2006).

We concentrate on examining the role of markup dynamics in assessing the impact of fiscal policy shocks on the external sector, such as the real exchange rate and current accounts, among countries based on their

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level of development. Previous studies have suggested that markup variability can explain real exchange rate dynamics. Specifically, a rise in markup results in an appreciation of the real exchange rate, whereas a decrease in markup leads to a depreciation of the real exchange rate (Bouakez, 2005; Gust, Leduc, and Vigfusson, 2010; Ravn, Schmitt-Grohe, and Uribe, 2012). Our study explores whether markup dynamics can be a key determinant in how expansionary fiscal policy shocks affect real exchange rate dynamics. Our study suggests that if aggregate markups increase (decrease) in response to a government expenditure shock, the real exchange rate will appreciate (depreciate).

The response of markup dynamics to expansionary fiscal policy shocks differs among advanced economies and developing countries, primarily due to differences in institutional and firm entry conditions. Advanced economies typically provide a more favorable and conducive business environment with lower regulatory burdens and greater competition, leading to firm growth and market entry. Expansionary fiscal policy shocks in these economies tend to intensify competition and lead to a decline in markup. On the other hand, in developing countries, firms with market power may exploit increased demand during economic booms, resulting in an increase in markup due to a lack of competition. The relationship between fiscal policy shocks and markup dynamics depends on the underlying institutional and entry conditions in both economies. To substantiate the claim that favorable institutional and entry conditions foster a competitive business environment, we use data from the World Bank's Global Entrepreneurship and Development Index (GEDI). This index reflects how such favorable conditions enable new firms to enter the market and compete with existing firms, which tends to result in a decline in overall markup. In contrast, elevated entry barriers and unfavorable institutional conditions hinder new firms from entering the market, thereby allowing established firms to preserve or even augment their market power.

Our study provides a comprehensive understanding of the intricate and diverse effects of fiscal policy shocks on the external aspects of both advanced countries and developing economies. Our empirical results highlight the fundamental importance attributed to institutional and entry conditions in shaping real exchange rate dynamics, emphasizing the importance of considering these factors in policy design and implementation. Our research contributes significantly to the previous literature on fiscal policy implications for the external sector, examining the varied changes in the real exchange rate and markup and identifying potential mechanisms driving these responses.

We propose a novel explanation for the distinct real exchange rate dynamics observed between advanced and developing nations by investigating the effect of markup dynamics on fiscal policy shocks. Miyamoto, Nguyen, and Sheremirov (2019) highlight the discrepancy between the theoretical results of canonical international business cycle models and the empirical evidence regarding real exchange rate dynamics. While these models can account for the appreciation of the real exchange rate in less developed nations, they inaccurately predict real exchange rate appreciation for advanced countries when empirical data indicate depreciation. Our empirical analysis suggests that the divergent markup dynamics in advanced and developing economies contribute significantly to the differing real exchange rate dynamics between these groups. In particular, we emphasize the pivotal role of institutional and entry conditions in shaping the behavior of real exchange rates to expansionary fiscal policy shocks, underscoring the need to consider these elements during the formulation and execution of policy initiatives.

In addition, we use variations in military or defense spending as instrumental variables (IVs) to identify government expenditure shocks, following Hall (2009), Barro and Redlick (2011), Ramey (2011), and Miyamoto, Nguyen, and Sheremirov (2019). The underlying assumption is that military spending is not correlated with the overall economic state, such as the business cycle, monetary policy, or private sector financial conditions. By instrumenting fiscal policy shocks with defense expenditure, we attribute government spending shocks to unanticipated variations in military spending, which neither output, fiscal policy, nor other control variables can predict.

The rest of the article is organized as follows. Section 2 discusses the previous literature. Section 3 provides details on the dataset used in our analysis, and Section 4 explains the empirical methodology. Section 5 presents the main empirical findings, and Section 6 concludes.

2. RELATED LITERATURE

In this section, we examine several studies relevant to our research. These include investigations into the effect of fiscal policy shocks on markup dynamics, the connection between markup and real exchange rates, and the responses of real exchange rates to fiscal policy.

2.1 Markup Dynamics

While some empirical studies such as Morrison (1994), Hall (2009), Anderson, Rebelo, and Wong (2018), and Nekarda and Ramey (2021) suggest that markups increase in response to expansionary fiscal policy shocks, other studies such as Marchetti (2002) report no discernible patterns or even suggest that markups decrease following positive demand shocks. For advanced economies, Bils, Klenow, and Malin (2018) observe that price markups in the U.S. are countercyclical. Similarly, Juessen and Linnemann (2012) show that a positive government spending shock yields a decline in price markups. Our study aligns with these findings; however, methodologically, we employ a local projection method and use military spending as an IV to investigate the influence of fiscal expenditure shocks on markups in advanced economies.

From a theoretical perspective, nominal rigidities and deep habit formation mechanisms offer plausible explanations for the observed decline in markups following expansionary fiscal policy measures. In the context of many New Keynesian models, an uptick in government expenditure shock enhances both output and marginal cost. Due to short-term price rigidities preventing firms from immediately adjusting prices, this scenario leads to a reduction in markup. Ravn, Schmitt-Grohe, and Uribe (2006) introduce an alternative explanation through their deep habit model, which suggests that government expenditure shocks contribute to a reduction in price markup due to an escalation in the price elasticity of demand. This phenomenon can be attributed to the persistent consumption patterns of households concerning particular goods and services, which shape their demand preferences.

Others explain a plausible mechanism for the procyclical markup. Stroebel and Vavra (2019) argue that wealth effects result in buyers exhibiting reduced price sensitivity, inducing firms to increase their markup. As buyers' elasticity decreases in response to expansionary fiscal policy shocks, aggregate markup increases. Additionally, within a framework based on search theory, Alessandria (2009) illustrates that markups increase after positive demand shocks. This increase occurs as workers dedicate less time to price-searching activities due to the rising opportunity cost of search (wage rate), leading households to exhibit diminished price sensitivity.

We find that markups show divergent responses to fiscal shocks, decreasing in advanced economies, while increasing in developing countries. Our analysis indicates that these contrasting reactions arise from disparities in the institutional conditions pertaining to firm entry between these two classifications of countries. Our empirical findings suggest the need to develop supplementary theoretical models that can more effectively elucidate the heterogeneous dynamics of markups to the fiscal shocks.

To the best of our knowledge, we believe our research is among the first to explore the cyclicality of markups in developing countries. The majority of comprehensive analyses have primarily focused on advanced countries, such as the U.S. and those within the OECD. A significant contribution of our article is presenting an understanding of markup dynamics in both advanced and developing economies.

2.2 Markup and Real Exchange Rate

Previous studies have highlighted the association between markup and real exchange rates, suggesting that when markup increases (decreases), the real exchange rate appreciates (depreciates). This supports our argument that it is crucial to consider markup behavior when analyzing the effect of fiscal stimulus on real exchange rates. Several studies have already explored the role of markup variability in explaining real exchange rate dynamics. For instance, Bouakez (2005) develops a model that considers variations in markup to explain the persistence of the real exchange rate. Similarly, Gust, Leduc, and Vigfusson (2010) construct a structural model that attributes fluctuations in markup to incomplete pass-through of exchange rate fluctuations into import prices. According to Ravn, Schmitt-Grohe, and Uribe (2012), the presence of deep habits implies that an increase in domestic government spending causes domestic markups to decrease relative to foreign markups, leading to a depreciation of the real exchange rate.

2.3 Real Exchange Rate Dynamics of Fiscal Policy

While the previous literature on the effect of government spending on real exchange rates has been vast, a unified consensus remains elusive. Auerbach and Gorodnichenko (2016) and Ferrara et al. (2021) suggest that government spending leads to real exchange rate appreciation. On the other hand, empirical research from Kim and Roubini (2008), Ravn, Schmitt-Grohe, and Uribe (2012), and Corsetti et al. (2012) indicates that expansionary fiscal policy leads to the depreciation of real exchange rate.

We offer a novel contribution to the ongoing debate by proposing a new explanation for the disparate real exchange rate dynamics between advanced and developing economies, with a focus on the effect of markup dynamics in response to fiscal policy shocks. Miyamoto, Nguyen, and Sheremirov (2019) demonstrate that canonical international business cycle frameworks can explain the appreciation of the real exchange rate in developing countries. However, these models fail to accurately predict the depreciation of the real exchange rate observed in advanced economies. Our analysis suggests that the contrasting markup dynamics in advanced

Table 1
Data Sources and Range of Coverage

Variable	N	Sample period	Source
Markups	32	1980:2016	De Loecker and Eeckhout (2021)
Government spending	32	1980:2016	NAMAD
Real exchange rate	32	1980:2016	Bruegel
Current accounts/GDP	32	1980:2016	NAMAD
Real GDP	32	1980:2016	NAMAD
Military spending	32	1980:2016	Military expenditure database (SIPRI)
Financial crises	32	1980:2016	Reinhart and Rogoff (2011)
War	32	1980:2016	UCDP/PRIO (2021)
Unemployment rate	32	1980:2016	World development indicators
Inflation rate	32	1980:2016	World Economic Outlook

NOTE: N refers to the number of countries, and NAMAD refers to the National Accounts Main Aggregates Database.

and developing economies play an important role in addressing this discrepancy. Specifically, we emphasize the significant influence of institutional factors and entry conditions in shaping the reaction of the real exchange rate to policies of fiscal expansion. This insight underscores the importance of considering these elements when analyzing real exchange rate dynamics and formulating policy strategies.

3. DATA

We collect data on aggregate markup, military spending, current accounts, real exchange rates, and other variables for 32 countries from 1980 to 2016. The data sources and coverage are presented in Table 1.

We obtain data on markups at the country panel level from De Loecker and Eeckhout (2021), who calculate markups specific to each country, drawing from the financial records distributed across 134 countries covering the years 1980–2016. We obtain real effective exchange rate (REER) data from Bruegel, with an increase signifying appreciation. Data on military spending come from the Stockholm International Peace Research Institute (SIPRI), encompassing expenditures related to ongoing military activities and forces, including salaries for personnel, acquisitions, operational costs, funds allocated for research and development in the military sector, and infrastructure development. We present all data points on a per capita basis and adjust them to the constant 2015 national currency units.

To consider other relevant factors, we include unemployment and inflation rates as control variables in our analysis. Unemployment rate data come from the World Bank's World Development Indicators dataset. Inflation rate data come from the International Monetary Fund's World Economic Outlook dataset, which provides annual consumer price index data. For the 32 countries, we use the average index over the period 1980–2016.

Our analysis also includes two dummy variables: financial crisis and a war index. Financial crises can impact the exogeneity of military spending, and our dataset covers various financial crises. We use crisis dates identified by Reinhart and Rogoff (2011), omitting all observations pertaining to banking crises, sovereign defaults, and stock market crashes, following the approach of Miyamoto, Nguyen, and Sheremirov (2019). We extract the war index from the UCDP/PRIO Armed Conflict Dataset, which contains details on the nations involved, the start and end dates of conflicts, and each conflict's fatality count.

Table 2
Country Characteristics

Country	Development	Sample period	Country	Development	Sample period
Australia	Advanced	1980:2016	Korea, Rep.	Advanced	1980:2016
Austria	Advanced	1980:2016	Mexico	Developing	1980:2016
Belgium	Advanced	1980:2016	Netherlands	Advanced	1980:2016
Brazil	Developing	1980:2009	Norway	Advanced	1980:2016
Canada	Advanced	1980:2016	Peru	Developing	1987:2016
Chile	Developing	1985:2016	Philippines	Developing	1988:2016
China	Developing	1989:2016	Portugal	Advanced	1985:2016
Colombia	Developing	1987:2016	South Africa	Developing	1982:2016
Denmark	Advanced	1980:2016	Spain	Advanced	1980:2016
Finland	Advanced	1980:2016	Sweden	Advanced	1980:2016
France	Advanced	1980:2016	Switzerland	Advanced	1980:2016
Germany	Advanced	1980:2016	Thailand	Developing	1987:2016
India	Developing	1989:2016	Turkey	Developing	1987:2016
Indonesia	Developing	1989:2016	United Kingdom	Advanced	1980:2016
Ireland	Advanced	1980:2016	United States	Advanced	1980:2016
Italy	Advanced	1980:2016	Japan	Advanced	1980:2016

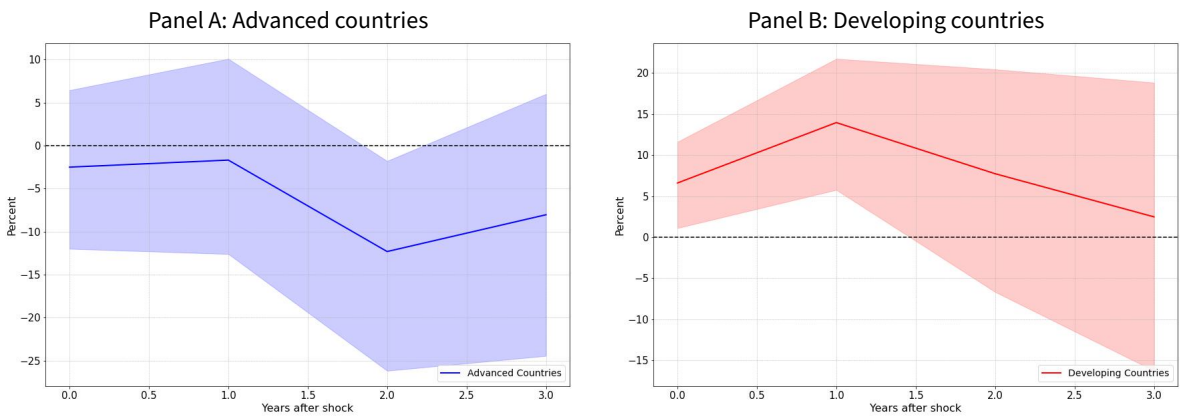
NOTE: Using the World Bank's 2000 gross national income as a reference, we categorize the sample into advanced and developing economies.

Table 2 presents the country characteristics of our complete sample, which is divided into two categories: advanced and developing countries, aligning with our study's focus on the effect of fiscal policy shocks on external sectors across different economic classifications. Building upon the work of Ilzetzki, Mendoza, and Végh, 2013, Miyamoto, Nguyen, and Sheremirov, 2019, and Sheremirov and Spirovska (2019), we use gross national income as of the year 2000 to split countries. We recognize that countries such as Mexico and China have robust trade relations with advanced economies during our sample period. However, we classify them as developing countries for two reasons. First, the year 2000 serves as a midpoint reference for our sample. Second, our classification aligns with that of Ilzetzki, Mendoza, and Végh (2013), Miyamoto, Nguyen, and Sheremirov (2019), and Sheremirov and Spirovska (2019), ensuring our findings remain consistent and comparable with existing literature.

There are two main reasons for differentiating the effects of a fiscal expenditure shock on real exchange rates between developing and advanced countries. First, existing studies have also segregated their analysis between advanced and developing economies based on their level of economic development when examining the effects of fiscal policy shocks on the external sector. For example, Miyamoto, Nguyen, and Sheremirov (2019) segregate a sample of 125 countries into advanced and developing economies based on their level of developmental status. Miyamoto, Nguyen, and Sheremirov (2019) indicate that expansionary fiscal policy shocks generate a depreciation of the real exchange rate in advanced countries, whereas they cause an appreciation in developing countries. Similarly, in developing economies, Ilzetzki, Mendoza, and Végh (2013) find that the real exchange rate appreciates immediately in response to a fiscal expenditure shock, but this effect diminishes within a year.

Furthermore, from a country-specific local projection method in our constructed dataset, the impacts of expansionary fiscal policy shocks on the real exchange rate exhibit variation between developing and advanced countries. Specifically, we assess the country-specific impact of a fiscal expenditure shock on the real exchange rate by using equation (6) in Appendix Appendix 1.1. The results of our analysis are depicted in Figure 1, which presents the estimated result, denoted as β_h in equation (6), of the real exchange rate followed by a fiscal expenditure shock for each country. Note that confidence intervals have not been included. The blue shading represents responses of the real exchange rate resulting from the shock in advanced countries, while the red shading shows the response for developing countries. The solid lines, respectively, represent the average estimates for advanced (blue) and developing (red) countries.

Figure 1
Country-Specific Impulse Response: Real Exchange Rate



NOTE: The red shaded area represents the country-specific beta coefficient result from equation (3) for developing countries, while the blue shaded area shows the results for advanced countries. The solid lines, respectively, represent the average estimates for advanced (blue) and developing (red) countries.

As can be discerned from the analysis, the reactions of the real exchange rate to the fiscal expenditure shock differ between advanced and developing countries. In general, advanced countries show a depreciation in the real exchange rate, whereas developing countries show an appreciation. Considering these observations, it is evident that, within our sample set, the response of the real exchange rate to fiscal expenditure shocks varies between advanced and developing countries.

4. ECONOMETRIC SPECIFICATION

In this section, we explain the methodology used in our empirical analysis. We first discuss the local projection approach introduced by Jordá (2005) and then describe the identification strategy based on Miyamoto, Nguyen, and Sheremirov (2019).

4.1 Local Projection

To estimate the effects of fiscal policy shocks, our study uses a combination of Jordá (2005)'s local projection framework and an IV approach. This approach has been used in previous studies, including Ramey and Zubairy (2018), Miyamoto, Nguyen, and Sheremirov (2019), and Sheremirov and Spirovska (2019). We estimate impulse responses to government spending, instrumented by military spending shocks. The local projection method offers several advantages compared to the vector autoregression approach. For instance, it does not require linear restrictions on the impulse response function (IRF) dynamics, making it more flexible and accommodating variations among nations regarding stages of development and institutional structures. The method also allows for using different variables in each equation, accommodating cross-country residual correlations and facilitating the direct application of the IV approach.

We estimate an augmented beta term that is an interaction between the shock and the level of development dummy. All the countries are in the sample, but the beta varies across developing and advanced countries but not the coefficient on the controls. We estimate the following equations:

$$(1) \qquad \frac{x_{i,t+h} - x_{i,t-1}}{x_{i,t-1}} = \beta_h \frac{\triangle g_{i,t}}{y_{i,t-1}} + \beta_{h,dev} \frac{\triangle g_{i,t}}{y_{i,t-1}} dev_i + \phi_h(L) w_{i,t-1} + \alpha_{i,h} + \gamma_h z_{i,t} + \delta_{t,h} + \varepsilon_{i,t+h}$$
$$\text{for } h = 0, 1, 2, \ldots$$

For country i and year t, x_{it} is the variable of our interest, while g_{it} and $g^m_{i,t}$ denote government spending and military expenditure, respectively. dev_i is a dummy variable capturing the level of development, equaling 1 for advanced countries and 0 for developing countries. y_{it} denotes real GDP. The lagged controls based on information criteria are included in the vector $w_{i,t-1}$, and contemporaneous controls are included in z_{it}. $\varepsilon_{i,t}$ represents the error term. The specification's left-hand side shows the change in the real exchange rate. $\alpha_{i,h}$

Table 3
Descriptive Statistics

	Obs.	$\sigma\left(\frac{\triangle g}{g}\right)$	$\sigma\left(\frac{\triangle g^m}{g^m}\right)$	$\sigma\left(\frac{\triangle g}{g}, \frac{\triangle g^m}{g^m}\right)$	$\frac{g^m}{g}$
	(1)	(2)	(3)	(4)	(5)
Full	1,102	2.66	7.08	0.30	11.7%
		(1.53)	(4.14)	(0.18)	(6.32)
Advanced	735	1.79	4.68	0.28	9.86%
		(0.71)	(1.59)	(0.16)	(5.32)
Developing	367	4.10	11.08	0.35	14.86%
		(1.45)	(4.01)	(0.21)	(6.81)

NOTE: Column (1) displays the number of observations. Columns (2) and (3), respectively, display the mean standard deviations for the rate of change in government and military spending. The correlation between the change rates of government consumption and military spending is outlined in column (4). Column (5) illustrates the average ratio of military spending to total government expenditure. Numbers in parentheses represent the standard deviation observed among various countries.

and $\delta_{t,h}$ capture country and year fixed effects, respectively. $\phi_h(L)$ and γ_h represent vectors of coefficients on contemporaneous and lagged controls, respectively.

We estimate the equation using two-stage least squares (2SLS), where we instrument $\frac{\triangle g_{i,t}}{y_{i,t-1}}$ with $\frac{\triangle g^m_{i,t}}{y_{i,t-1}}$. We estimate equation (6) separately for each horizon h. β_h denotes the response of the variable x in h years after the government spending shock. The shock to government spending is defined as a 1-percentage-point increase in the ratio of government spending to GDP. Based on the Akaike and Schwarz information criterion, we establish the number of lags to be 1. To handle serial correlations, we cluster standard errors by country. The vector z_{it} includes a war index and a financial crisis dummy to control for the effect of wars and financial crises on military spending and government budgets, respectively. The vector $w_{i,t-1}$ encompasses lags of the dependent variable, adjusted changes in government spending, and real GDP.

Note that β_h signifies the estimated impulse response for the full sample, while $\beta_{h,dev}$ indicates the differential impulse response for advanced economies. The coefficient $\beta_{h,dev}$ captures the interaction between the shock and the development dummy variable. Specifically, it isolates and represents the impulse response of advanced economies. Given the construction of the dev_i dummy variable, equal to 1 for advanced countries and 0 for developing countries, by using the classification in Table 2, the term $\beta_{h,dev}\frac{\triangle g_{i,t}}{y_{i,t-1}}dev_i$ becomes non-zero solely for advanced economies. Hence, the component reflects the differential effect or response of a shock in these advanced countries relative to the base effect captured by β_h. On the other hand, β_h depicts the general estimated impulse response derived from the entire sample, incorporating both advanced and developing economies. It also illustrates the response to the shock across all countries in the sample, without distinguishing between their developmental status.

For a more rigorous analysis, we split our samples into developing and advanced countries. We conduct separate analyses for each group to ensure robustness of the empirical results. Appendix Appendix 1.2 provides a detailed empirical specification and the results.

4.2 Identification Strategy for Government Spending

To identify the effects of fiscal policy shocks in an international context, we use military expenditure data as an IV for government consumption. This identification strategy satisfies the exogeneity and relevance conditions of the IV, which is necessary for obtaining unbiased estimates of the causal effects of a government expenditure shock. Using the exogeneity of defense expenditure as an instrument for fiscal policy is supported by studies such as Collier (2006) and Klein and Linnemann (2019), which demonstrate that military expenditure is primarily driven by foreign policy developments rather than by domestic economic factors and is often considered wasteful spending.

Table 3 illustrates that military expenditure serves as an IV capable of identifying fiscal expenditure shocks. Military expenditure constitutes roughly 11.7 percent of overall government expenditure in the sample, with a direct relationship observed between the expansion rate of government expenditure and that of military expenditure. The changes in military expenditure are also nearly twice as unstable as that of government expenditure, enhancing the precision in estimating the impacts of a positive shock in government expenditure on the dependent variable.

5. EMPIRICAL RESULTS

In this section, we present the empirical results of our study. We first provide an overview of the IRF results using the local projection method. We then investigate the possible mechanisms contributing to the different responses to fiscal policy shocks between advanced and developing countries.

5.1 Main Empirical Results

In Figure 2, we delineate the impulse responses resulting from equation (1) to a positive government expenditure shock. Panel A depicts the impulse response for the entire sample (β_h), encapsulating responses for the real exchange rate, markups, and current accounts. Panel B is specifically designed to focus solely on the responses seen within advanced economies ($\beta_{h,dev}$).

The responses to a positive government shock vary between the full sample and advanced economies, especially in terms of the real exchange rate and markups. In the full sample, the real exchange rate appreciates with statistically significant results. However, in advanced economies, the real exchange rate depreciates, again with statistically significant results.

Another notable difference lies in the markups. While the full sample's response shows an increase in markups, most of which are statistically significant, advanced economies present a contrast. In the advanced economies, markups tend to decrease, with 68 percent confidence within the level of significance. As for the current account, there is a discernible trend of decline in the full sample. This pattern is distinctly different when the lens is focused on advanced economies.

To test for robustness, we partition our sample into developing and advanced categories, analyzing each separately. The detailed empirical results of this division are presented in Appendix Appendix 1.2. The robustness analysis reveals distinct reactions of markup and real exchange rates between developing and advanced economies. In the developing countries, markups exhibit an increase and an appreciation of the real exchange rate. On the other hand, advanced economies show a decline in markups and a depreciation of the real exchange rate. These results reinforce the robustness of our main empirical results.

Our research indicates that the dynamics of markup are crucial for understanding how real exchange rates react to expansionary fiscal policy shocks. In developing countries, markups notably increase following a rise in government spending, whereas they decrease in advanced countries. This indicates that domestic economies in developing countries become relatively more expensive compared with foreign countries, leading to an appreciation of the real exchange rate. Conversely, the opposite effect emerges in advanced economies.

Previous studies have underscored the interplay between markups and real exchange rates. This focus was motivated by prior studies that consistently emphasized the link between markup and the real exchange rate. Specifically, when markup surges (or declines), the real exchange rate appreciates (or depreciates).

To validate our proposed mechanism, we use the local projection method to explore how the real exchange rate reacts to shocks in markup. The equation used to estimate the impulse responses for the real exchange rate to markup shocks at each horizon h is given by

$$REER_{i,t+h} = \alpha_h + \theta_h shock_{i,t} + \theta_{h,dev} shock_{i,t} \cdot dev_i + \varphi_{i,h}(L)\gamma_{i,t-1} + \epsilon_{i,t+h}, \tag{2}$$

where $REER$ is the real exchange rate and $shock_{i,t}$ is the identified shock. θ_h is the estimate of the impulse response of $REER$ at horizon h to a $shock_t$. γ_t is a vector of control variables, $\varphi_h(L)$ is a polynomial in the lag operator, and α_h is the constant. The variable dev_i serves as a dummy based on level of economic development by using the classification in Table 2. Figure 3 illustrates the IRF of the real exchange rate to markup shocks.

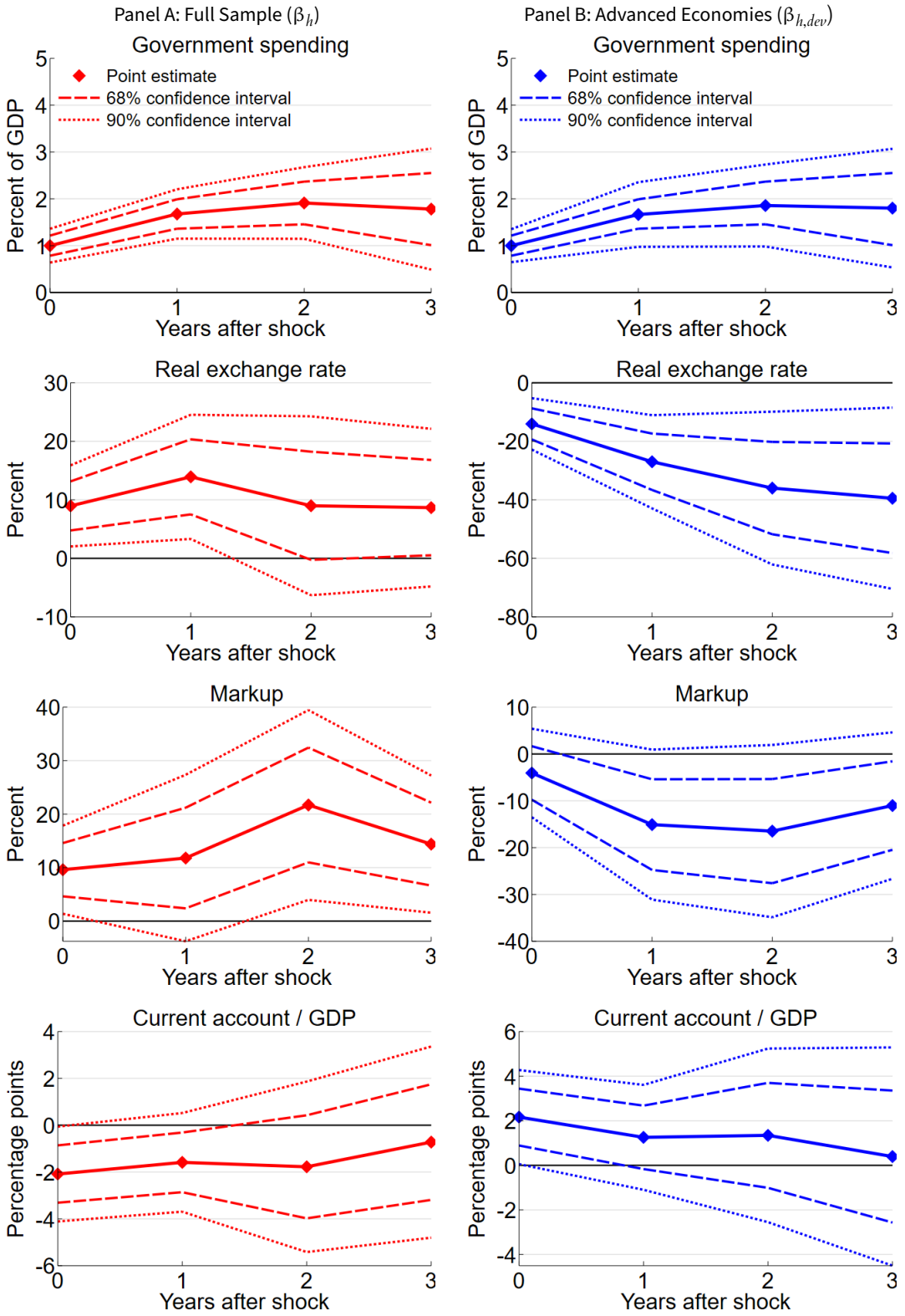
Our empirical analysis emphasizes that a surge in markup leads to the real exchange rate appreciating, irrespective of a country's developmental status. Panel A shows a conspicuous appreciation in the real exchange rate in the full sample. A similar appreciation response is observed when the data are adjusted using an interaction dummy, meaning that the markup shock is positively related with the appreciation of markup regardless of development status.

The observed positive correlation between markup and the real exchange rate underscores that the real exchange rate's response is predominantly driven by the markup's responsiveness to a fiscal expenditure shock. This situation translates to a scenario where a declining markup in advanced economies leads to the real exchange rate depreciating. In contrast, an augmenting markup in developing economies results in a corresponding appreciation.

5.2 Underlying Mechanisms

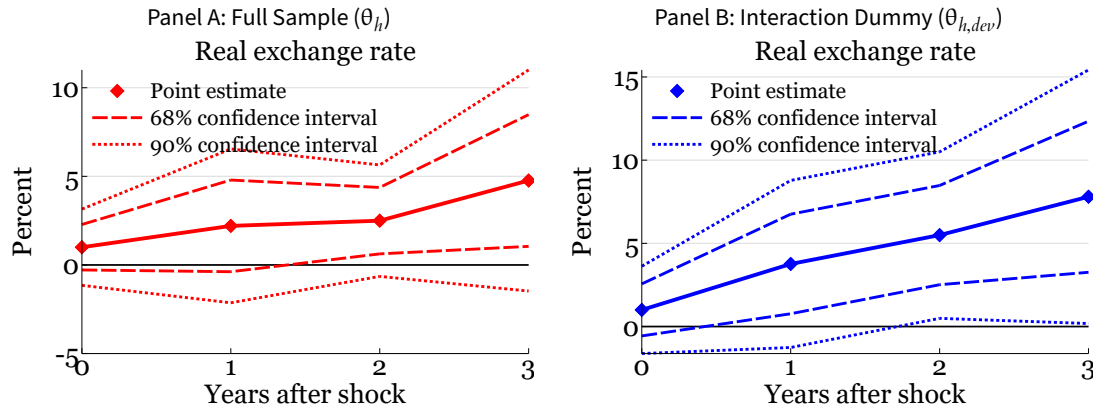
In this section, we present the underlying mechanisms and aim to discuss the variance in markup responses to fiscal policy shocks between developing and advanced countries. We propose that differences in institutional quality might be the driving force behind these distinct markup dynamics. We first show that the ease of

Figure 2
Impulse Response Analysis



NOTE: The figure shows the responses of government spending, real exchange rates, current account to GDP, and markup to a 1-percentage-point increase in the ratio of government spending to GDP within a timeframe of zero to three years. Dashed lines represent 68 percent confidence interval limits, while dotted lines represent 90 percent confidence interval limits.

Figure 3
Impulse Response Analysis



NOTE: The figure shows the responses of real exchange rates to markup shocks at horizons from zero to three years. Dotted lines represent 90 percent confidence interval bounds, and dashed lines represent 68 percent confidence interval bounds.

market entry for firms and superior institutional quality typically translates into diminished market power. Subsequently, we illustrate that in instances where institutional quality is elevated, the effect of fiscal expenditure shocks on markups is more subdued compared with scenarios with lower institutional quality.

5.2.1 Market Power and Institutional Quality

The different response of markup dynamics to fiscal policy shocks in developing and advanced economies highlights the importance of examining the roles played by entry and institutional conditions for firms. These conditions have a significant effect on market power, where low entry barriers and favorable institutional conditions facilitate new firms' entry and intensify competition, reducing incumbent firms' market power. Conversely, high entry barriers and unfavorable institutional conditions allow existing firms to maintain or increase their market power (Bain, 1956; Tirole, 1988; North, 1990; Sutton, 1991; Shleifer and Vishny, 1993; Cabral, 2000; Djankov et al., 2002).

Expansionary fiscal policy shocks that increase aggregate demand can encourage new firms to enter the market and intensify competition if favorable entry and institutional conditions are present. Incumbent firms try to incentivize to lower their prices or enhance their product quality to maintain their market share, leading to a decrease in the markup. However, limited competition resulting from unfavorable entry and institutional conditions may allow these firms to maintain or increase their market power. In this case, expansionary fiscal policy shocks might lead to less competitive pressure from new entrants, allowing incumbent firms to exploit the increased demand by raising their prices, resulting in an increase in the markup.

To examine the relationship between markups and institutional and firm entry conditions, we employ an empirical framework that uses data from GEDI. We use the institutional score and opportunity on startup score to test our plausible mechanism. The institutional score measures the quality and strength of the institutional environment for entrepreneurship, considering factors such as corruption levels, the legal system's effectiveness, and the ease of starting and registering a business. The opportunity on startup indicator measures the level of entrepreneurial opportunities available in a country, based on aspects such as market openness, competition levels, and innovative activity. By using these indicators, we try to gain insight into how institutional and firm entry conditions affect market competition and the potential for businesses.

Our baseline empirical framework is as follows:

$$ln(markup_{it}) = \alpha_0 + \alpha_1 Z_{it} + X_{it}T + \kappa_i + \Psi_t + \varepsilon_{it}, \quad (3)$$

where $ln(markup_{it})$ represents the natural log transformation of the markups attributed to country i in year t. Z_{it} represents our variables of interest, which include log of institutional scores and opportunity on startup scores. X_{it} is a vector of the control variables, which include the log of real GDP, inflation rates, unemployment rates, oil prices, and trade openness (sum of import and export to GDP). κ_i and Ψ_t denote country and year fixed effects, respectively, and ε_{it} represents the i.i.d error term.[1]

1. We use GEDI data from 2006 to 2016. We omit Pakistan, Austria, the Philippines, Indonesia, Brazil, China, and Canada due to their

Table 4
Panel Empirical Results: Institutional Quality and Markup

	Dependent variable: $log(Markup)$		
	(1)		(2)
log(Institutional Scores)	-0.392**	log(Opportunity on Startup)	-0.0417*
	(0.167)		(0.0211)
log(GDP)	-0.126	log(GDP)	-0.153
	(0.109)		(0.145)
Inflation	-1.098***	Inflation	-1.211***
	(0.310)		(0.303)
WTI	-1.269***	WTI	-1.320**
	(0.455)		(0.486)
Trade openness	0.189**	Trade openness	0.189**
	(0.0711)		(0.0702)
Unemployment rate	-0.325	Unemployment rate	-0.308
	(0.357)		(0.401)
R^2	0.413	R^2	0.399
Obs.	247	Obs.	247

NOTE: Robust errors are in parentheses. *, **, and *** denote significance levels at 10 percent, 5 percent, and 1 percent, respectively. The constant is included but not reported.

Table 4 presents the results of the panel estimation, focusing on the relationship between institutional scores, opportunity on startup, and markups. As the institutional environment becomes more favorable for the firm and more opportunities for startups become available, the aggregate markup decreases, meaning the competition among firms intensifies. We find a statistically significant negative association between institutional scores and markups, which becomes more significant as we add control variables. Additionally, the negative relationship between opportunity on startup and markups is also statistically significant. These results support our earlier argument that a competitive business landscape, facilitated by favorable institutional and entry conditions, reduces markups. Conversely, high entry barriers and unfavorable institutional conditions can hinder new firms from entering the market, allowing existing firms to maintain or increase their market power, leading to higher markups.

In our exploration of the effect of fiscal policy shocks on markup dynamics, we notice some distinct patterns between advanced and developing economies. We believe that these differences might be deeply influenced by their individual institutional and firm entry conditions. Advanced economies with a robust infrastructure, skilled labor, and a culture that values innovation seem to provide a more welcoming environment for businesses. This favorable environment for business and firm entry fosters competition, which could lead to a decrease in markup during economic booms. However, in developing countries, where the competitive landscape might be less intense, dominant firms might take advantage of their position during economic booms, possibly leading to an increase in markup.

Our t-test results further underscore these observations. Specifically, advanced economies have a notably higher mean institutional score of 0.83 compared with 0.52 for developing countries, with a significant t-statistic of 24.65 and a p-value of less than 0.0001. Similarly, the opportunity on startup score averages at 0.75 for advanced countries, contrasting with 0.31 for developing countries, backed by a t-statistic of 18.24 and a p-value of less than 0.0001. While these findings are compelling, they must be interpreted with caution, recognizing the intricate nuances that shape each region's economic landscape.

5.2.2 Institutional Quality: A Key Determinant in Fiscal Policy's Effect on Markup

To substantiate our mechanism, we use the local projections approach to discern the effect of fiscal expenditure shocks on markup, emphasizing the mediating role of institutional quality. We estimate the following equations:

$$\frac{\mu_{i,t+h} - \mu_{i,t-1}}{\mu_{i,t-1}} = \beta_h \frac{\triangle g_{i,t}}{y_{i,t-1}} + \beta_{h,int} \frac{\triangle g_{i,t}}{y_{i,t-1}} int_i + \phi_h(L) w_{i,t-1} + \alpha_{i,h} + \gamma_h z_{i,t} + \delta_{t,h} + \varepsilon_{i,t+h} \quad \text{for } h = 0, 1, 2, \ldots \tag{4}$$

insufficient sample size.

Table 5
Results of Local Projection

		On Effect	1 Year	2 Years	3 Years	Obs.
All	(1)	7.18*	6.35	13.07**	10.39*	1,098
		(3.69)	(5.72)	(3.84)	(6.13)	
Institutional Dummy	(2)	-2.18	-7.40	-3.84	-2.25	1,065
		(4.65)	(6.43)	(7.11)	(8.75)	

NOTE: Robust errors are in parentheses. *, **, and *** denote significance levels at 10 percent, 5 percent, and 1 percent, respectively. The constant is included but not reported.

The research explores the fluctuations in the real exchange rate for country i in year t. Principal variables include markup μ_{it}, government spending g_{it}, and military expenditure $g^m_{i,t}$. The institutional quality is symbolized by a dummy variable, *int*. Countries with scores surpassing the average instantaneous score for the period are deemed to have "high institutional quality," suggesting favorable conditions for businesses. They are assigned a value of 1. In contrast, countries scoring below the average are labeled as having "low institutional quality" and are given a value of 0. The nation's real GDP is captured by y_{it}. The vectors $w_{i,t-1}$ and z_{it} account for lagged and contemporaneous controls, respectively. Country and year effects are represented by $\alpha_{i,h}$ and $\delta_{t,h}$, respectively, and $\varepsilon_{i,t}$ denotes the error term. In terms of interpretation, β_h indicates the impulse response for the complete dataset, whereas $\beta_{h,int}$ denotes the differential response for countries with high institutional quality.

Table 5 presents the analysis results, showing that as institutional quality increases, the markup's response to a fiscal policy shock decreases. As column (1) shows, the markup increases for the full sample. Excluding the response after one year, all the results are statistically significant. Conversely, in column (2), the markup decreases, indicating that it diminishes as the institutional quality improves.

To ensure robustness, we incorporate an interaction dummy variable for institutional quality. In our empirical methodology, using equation (Appendix 1.2), we substitute the level of development dummy with the institutional quality dummy. The results of our empirical analysis are in Appendix Appendix 1.3. These findings validate our main argument: In countries with strong institutional frameworks (i.e., high institutional quality), expansionary fiscal policy shocks are correlated with a decrease in markup and a depreciation in the real exchange rate. Such insights amplify the principal conclusions of our study, emphasizing the linkage between institutional conditions and the cyclicality of markup.

6. CONCLUSION

In this study, we analyze the effects of government spending on markups and external sectors, such as the real exchange rate and current accounts, in 32 countries from 1980 to 2016, accounting for the distinction between advanced and developing economies. We find that the responses of these variables to fiscal policy shocks vary significantly across these two categories of countries. The markup dynamics among advanced and developing countries contribute to the distinct behavior of real exchange rates in response to fiscal policy shocks. In developing countries, the markup increases following fiscal policy shocks, leading to real exchange rate appreciation. Conversely, in advanced economies, the markup decreases after positive fiscal policy shocks, leading to a depreciation of the real exchange rate. The current account declines in developing countries due to real exchange rate appreciation, while it increases in advanced economies.

We argue that favorable institutional and entry conditions in advanced economies contribute to the reduction in markup, while unfavorable conditions in developing countries enable incumbent firms to maintain or increase their market power. Consequently, the dynamics of markup in response to fiscal policy shocks are significantly influenced by the prevailing institutional and firm entry conditions in both advanced and developing economies.

Our research has important policy implications, highlighting the need for policymakers to consider institutional and market entry conditions when designing and implementing fiscal policies. Institutional conditions such as market entry conditions, which include barriers to entry and the overall business environment, can also shape how fiscal policy shocks affect the external side of the economy. By considering the unique institutional and market entry conditions, policymakers can better anticipate the potential effects of fiscal policy shocks on the current account balance and real exchange rate dynamics. This nuanced approach to fiscal policy design can

lead to more effective achievement of macroeconomic stability and sustainable economic growth. In particular, policymakers should be aware that in developing countries with high market entry barriers, expansionary fiscal policy shocks can lead to a decline in the current account balance.

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APPENDIX 1.

Section Appendix 1.1 provides a succinct explanation of the country-specific local projection method. In Section Appendix 1.2, we segment the sample based on the level of development and then use the local projection method to examine the effect of a fiscal expenditure shock on markups and the real exchange rate. Last, in Section Appendix 1.3 we further divide the sample according to institutional quality and conduct an analysis using the local projection method.

Appendix 1.1 Country-Specific Local Projection

In this section, we outline the equation used to analyze the effect of a fiscal expenditure shock on the real exchange rate for individual countries. Our empirical framework is

$$\frac{REER_{t+h} - REER_{t-1}}{REER_{t-1}} = \beta_h \frac{\triangle g_t}{y_{t-1}} + \phi_h(L) w_{t-1} + \alpha_h + \gamma_h z_t + \delta_{t,h} + \varepsilon_{t+h} \quad \text{for } h = 0, 1, 2, \ldots \tag{5}$$

The methodology and approach closely resemble that of equation (1): Both apply the 2SLS technique and use the same set of variables. Notably, in this analysis, the dependent variable is solely the real exchange rate and the level of interaction dummy is omitted. Furthermore, instead of dividing the sample, we estimate for each individual country and report the results accordingly.

Appendix 1.2 Local Projection Based on Development Level

We next segment the sample into two groups based on the development level and analyze the effect of a fiscal expenditure shock on markups, exchange rates, and current account balances for each group. We estimate the following equations:

$$\frac{x_{i,t+h} - x_{i,t-1}}{x_{i,t-1}} = \beta_h \frac{\triangle g_{i,t}}{y_{i,t-1}} + \phi_h(L) w_{i,t-1} + \alpha_{i,h} + \gamma_h z_{i,t} + \delta_{t,h} + \varepsilon_{i,t+h} \quad \text{for } h = 0, 1, 2, \ldots \tag{6}$$

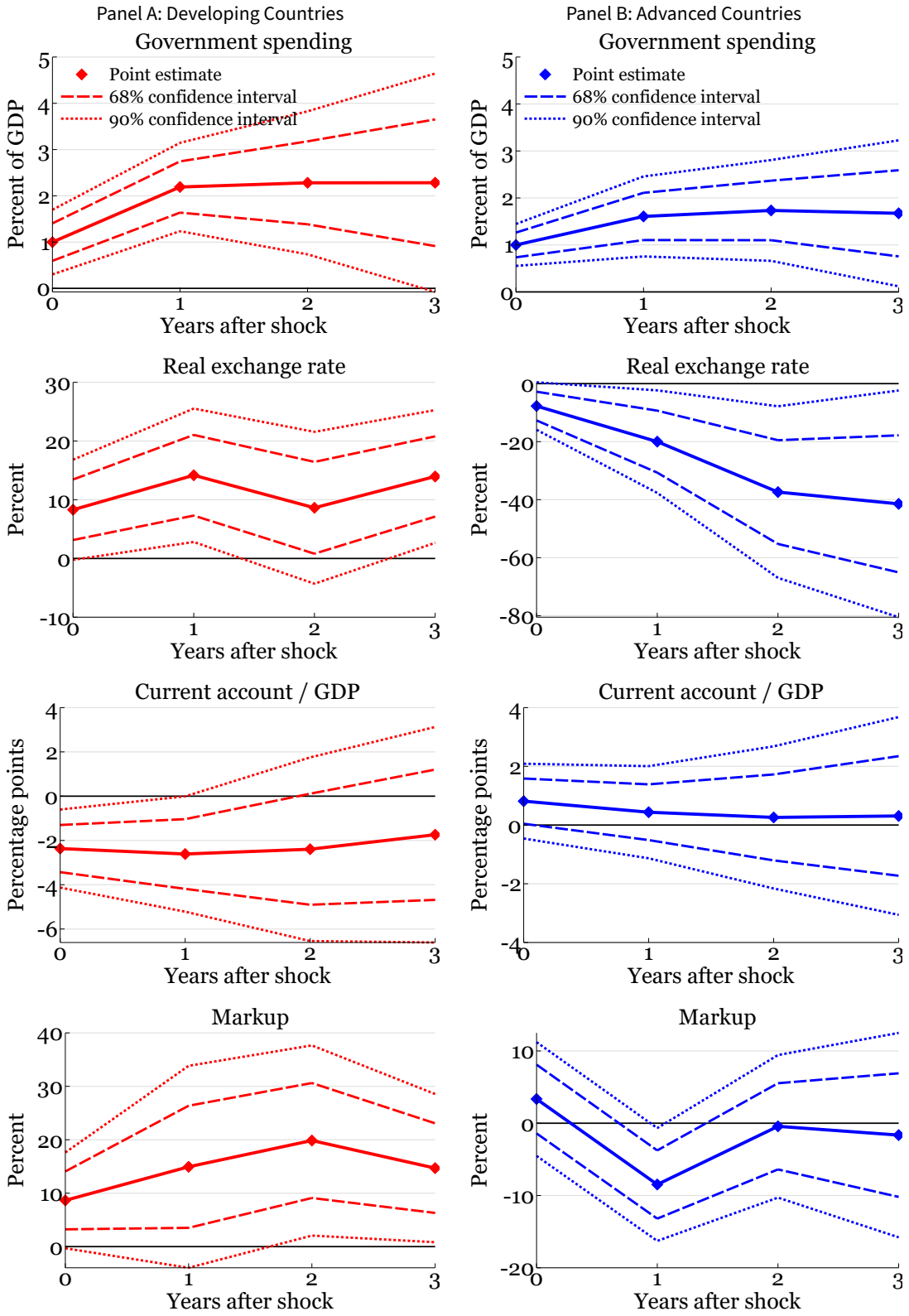
The methodology and approach are akin to equation (1): Both employ the 2SLS technique and use the same variables. However, in this analysis, we exclude the level of interaction dummy. Furthermore, we divide the sample into developing countries and advanced countries for separate analysis. Doing this allows us to analyze the effects of fiscal policy shocks on various aspects of the external sector in each group.

Figure 4 presents the results. Government spending exhibits persistence in response to government expenditure shocks up to a three-year horizon, with statistically significant estimates. The responses of the real exchange rate to positive government expenditure shocks differ between advanced and developing countries. In developing countries, the real exchange rate appreciates following fiscal policy implementation, while it depreciates in advanced economies. The current account responses to expansionary government consumption shocks also differ between the two groups. In developing countries, current accounts decline due to the appreciation of the real exchange rate, while in advanced economies, they increase due to depreciation.

Appendix 1.3 Local Projection with Institutional Quality Dummy

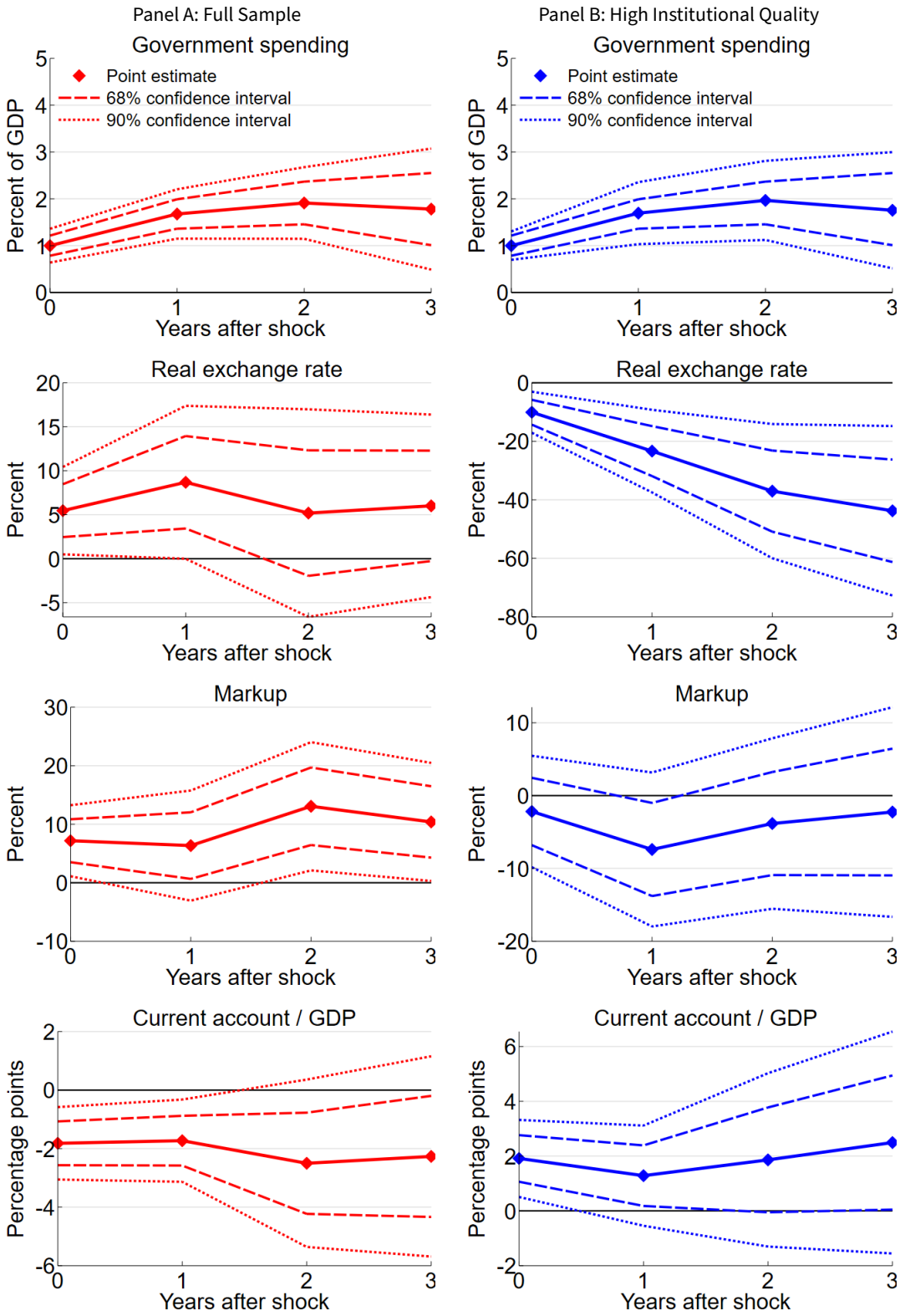
In this section, we use the interaction dummy for institutional quality. Our empirical method, paralleling equation (Appendix 1.2) in Section 4, previously determined the shock response function resulting from fiscal policies for each variable. However, here we substitute the level of development dummy with the institutional quality dummy. The results confirm our main findings: In countries with robust institutional frameworks (high institutional quality), expansionary fiscal policy shocks correlate with a reduction in markup and a depreciation in the real exchange rate. This analysis underscores the primary conclusions of our article, further cementing the relationship between institutional conditions and markup cyclicality.

Figure 4
Impulse Response Results



NOTE: The figure shows the responses of government spending, real exchange rates, current account to GDP, and markup to a 1-percentage-point increase in government spending to GDP within a timeframe of zero to three years. Dotted lines represent 90 percent confidence interval bounds, while dashed lines represent 68 percent confidence interval bounds.

Figure 5
Impulse Response Analysis



NOTE: The figure shows the responses of government spending, real exchange rates, current account to GDP, and markup to a 1-percentage-point increase in the ratio of government spending to GDP within a timeframe of zero to three years. Dotted lines represent 90 percent confidence interval bounds, while dashed lines represent 68 percent confidence interval bounds.