The labour market in Colombia: trends, cyclical patterns and the role of wages in the recent inflationary surge

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In this note we discuss some structural aspects of the Colombian labour market and its condition in the aftermath of the pandemic. We also describe the wage-setting process in Colombia, highlighting the long-run relationship between wages, prices and labour productivity. We divide this note into four sections. The first one describes the long-run trends and the cyclical properties of key labour market indicators. We also survey the main impacts of the Covid-19 pandemic on the Colombian labour market, as documented in the literature. The second section focuses on wages and their role in the recent inflationary escalation. We describe the main drivers of inflation in the wake of the pandemic, some features of the wage-setting process in Colombia, and the long-run relationship between wages, prices and labour productivity. The latter exercise provides a measure of inflationary pressure from the labour market in the short run. Given the prominent role of the legal minimum wage (MW) in the wage-setting process, the third section summarises the main findings of a comprehensive study on the impacts of the MW in Colombia, recently published by the Central Bank of Colombia. Finally, the fourth section concludes.

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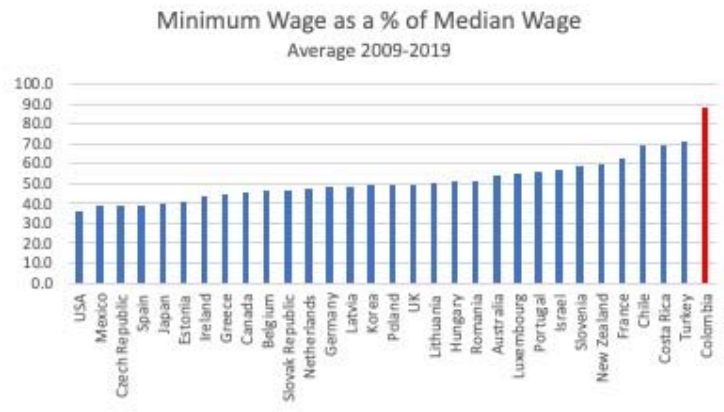
1. The labour market in Colombia

In this section we describe some features of the labour market in Colombia and provide an overview of its evolution during the Covid-19 pandemic. We first summarise the long-run trends of key labour market indicators. Next, we characterise the properties of those indicators in relation to the business cycle. Finally, we survey the main mechanisms of adjustment of the Colombian labour market during the pandemic, according to the recent literature.

1.1 Labour market trends before the pandemic

As in other developing countries, the labour market in Colombia is characterised by a high incidence of informal labour relationships, defined as those performed outside the scope of domestic regulation. Just before the pandemic broke out, informal workers accounted for almost half of the labour force.[2] Among the reasons for this informality is a relatively high MW coupled with high hiring/firing costs and payroll surcharges (Arango and Florez (2020a)). The MW as a percentage of the median wage in Colombia was the highest in a sample of OECD advanced and emerging economies in 2021 (Graph 1), while non-wage labour cost surcharges represent 50% of wages (Graph 2).

Minimum Wage as a % of Median Wage — Graph 1



Sources: OECD.stat; authors' calculations.

[2] Here, we use a definition of informality that categorises workers as informal if they are either salaried employees working in firms with fewer than five employees or self-employed individuals without higher educational qualifications. This was the prevailing official definition before the pandemic. More recently, the definition of informality has evolved to encompass additional criteria such as whether firms are registered with the Chamber of Commerce. However, during the period in which both definitions overlap, the two definitions result in data that show very similar levels of informal work.

Non-wage labor cost

Graph 2

Non-wage labour costs are defined as the expenses that employers must bear in addition to an employee's salary or wages. In Colombia, it includes employers' contributions to social security (health insurance, pension and occupational hazards), payroll taxes (including payments to Family Welfare Funds (Cajas de Compensación) and different public agencies – SENA, ICBF – depending on the year, severance payments and paid leave.

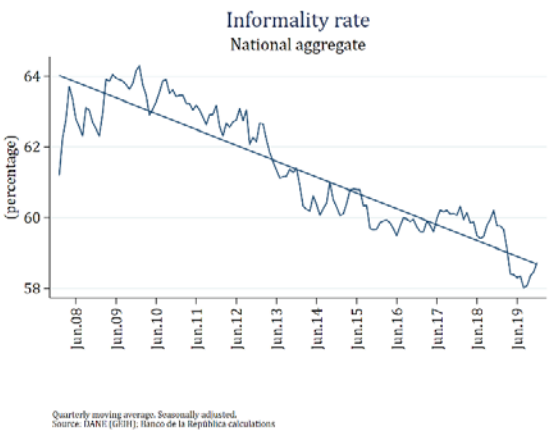
Sources: DANE; authors' calculations

Nevertheless, in the decade before the Covid-19 crisis, the Colombian labour market showed an increasing trend in favour of salaried employment, resulting in a trend of decreasing informality. The ratio of salaried workers to working age population increased by 3 percentage points until 2016, while the informal working rate dropped 5 percentage points from 2009 to 2019 (Graphs 3 and 4). The drop in informal working resulted in an improvement in the average quality of jobs in the Colombian economy. Rising labour productivity, supported by physical and human capital accumulation in a period of high commodity prices and an improved business investment climate (tax incentives and better security conditions), seem to be at the root of this trend (Graphs 5 and 6).[3] The increased demand for labour resulted in a declining share of workers whose earnings are less than the minimum wage between 2010 and 2017 (Graph 7).

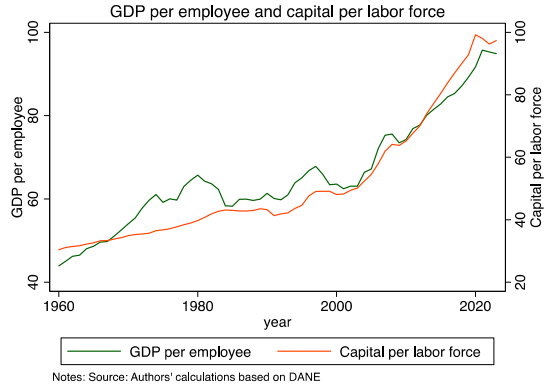
[3] In Appendix A we show, through the lens of a stylized model of a segmented labour market with a binding minimum wage, how increases in formal labour productivity growth, which may be associated with expanding human or physical capital, unambiguously decrease the informality rate. However, their effects on unemployment are ambiguous (please refer to footnote 6 for a detailed explanation of the effects on unemployment) and depend non-linearly upon the level of the MW relative to the unconstrained market wage.

Graph 3

Graph 4

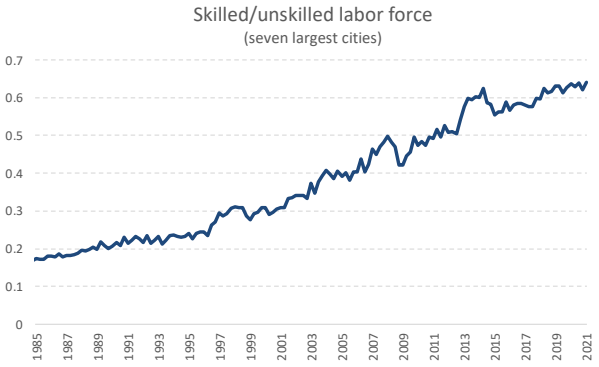


Graph 5



Notes: Source: Authors' calculations based on DANE

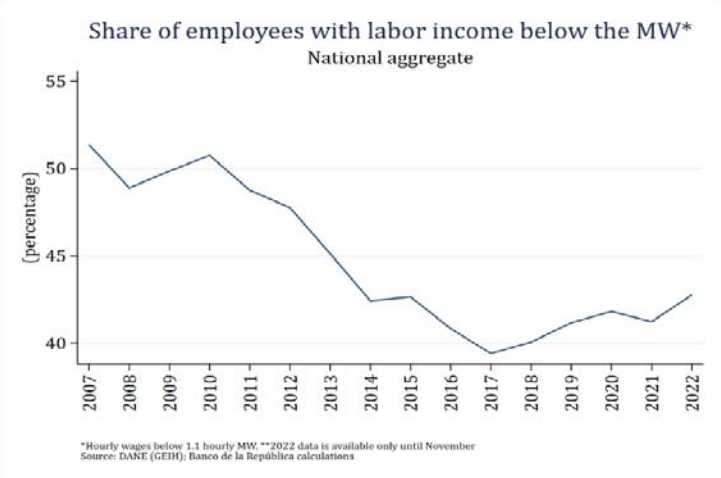
Graph 6



Skilled workers are defined as those with more than 11 years of education.

Sources: DANE; authors' calculations.

Graph 7



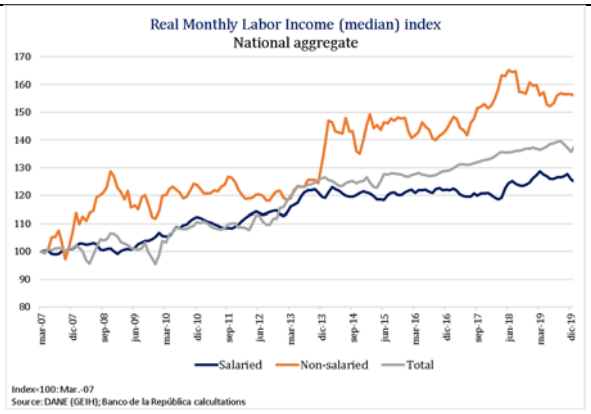
Moreover, there is also ample evidence that the formalisation process has been bolstered by multiple reforms reducing payroll taxes. One such reform, that has been extensively documented, is a reduction in payroll taxes by 13.5 percentage points in 2013, which explains the large drop in non-wage costs shown in Graph 2. Several studies have found that this reform increased formal employment and reduced the rate of informal working. The magnitude of the fall in the rate of informal working varies between 2.3 and 3.6% depending on the study (see Fernández and Villar (2017); Morales and Medina (2017); Osorio (2016)).[4]

Worker earning dynamics are consistent with the above-mentioned trend of formalisation. As the share of employees with labour incomes below the MW decreased (Graph 7), non-salaried workers' unit labour income rose faster than wages, an indication of increasing absorption of workers by the formal sector. We focus here on the trends of median wages for the salaried segment and median labour income for informal workers. Graph 8 shows their evolution in real terms before the pandemic.[5] The accumulated growth rate of median monthly income between 2007 and 2019 was 27% for salaried workers and 55% for non-salaried ones. The heterogeneous behaviour of earnings is more noticeable since 2013, and it is present even when accounting for differences in the median worked hours (Graph 9).

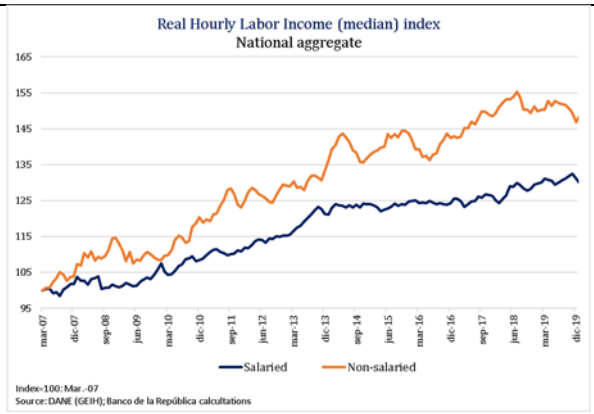
[4] The latter studies complement Kugler and Kugler (2009), who evaluate how the rise in payroll tax rates over the 1980s and 1990s affected the labour market. Their study finds that a 10% increase in payroll taxes lowered formal employment by between 4 and 5%.

[5] The graph shows their indices. Of course, there is a significant income premium between the formal and informal sectors that is present even when controlling for the composition of the workforce. For example, in a Mincerian regression controlling for the usual workers' observable characteristics (such as gender, work experience, years of education and location), the premium for working in the formal sector is around 0.33 logarithm points (or 39%) on average in the period 2009–19; while controlling in addition for the composition of the workforce across industries or occupations, the within-industry premium is around 0.27 logarithm points (31%).

Graph 8

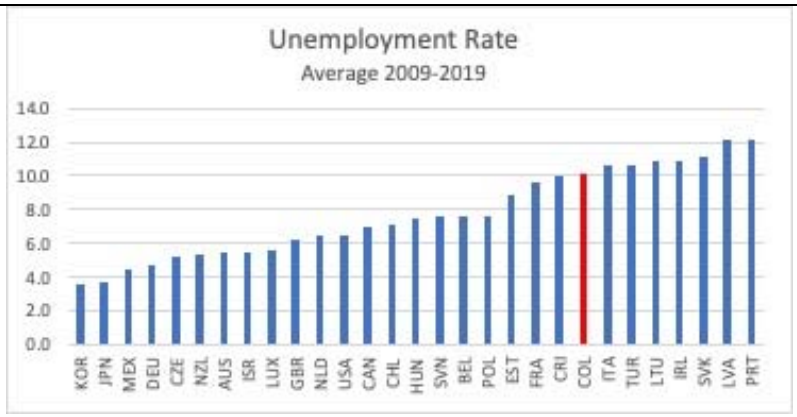


Graph 9



An additional structural feature of the Colombian labour market is a persistently high unemployment rate. The average unemployment rate since the 1980s has been 10.7% nationally (10.4% excluding the pandemic) and 12.1% in urban areas (11.8% excluding the pandemic). During the last three decades, the unemployment rate has fluctuated over the business cycle, but its levels have never dropped below 8%. These levels are high relative to those of other advanced and emerging economies (Graph 10), a feature that is also consistent with the combination of a relatively high MW and large payroll surcharges in the formal sector (Arango and Florez (2020b); Arango et al (2022)).[6]

Graph 10



Source: OECD data; authors' calculations.

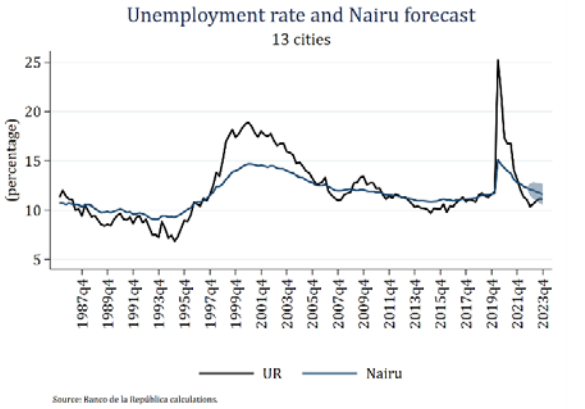
[6] According to Arango and Florez (2020b) and Arango et al (2022, p 16), there is a negative effect of the MW on structural unemployment. However, this effect seems to have decreased recently, while other studies reported by Arango et al (2022) do not find a statistically significant response of structural unemployment to the MW. A stylized model shown in Appendix A illustrates how increases in the MW reduce formality but have ambiguous effects on unemployment. This happens because a MW rise has two opposing impacts. On the one hand, it lowers *formal* labor demand and employment (increasing unemployment). On the other hand, decreasing formal employment reduces the perceived probability of getting a formal job and, thereby, diminishes the households´ incentives to supply labour in the formal market (reducing unemployment). For the same reasons, formal labour productivity growth associated with expanding human or physical capital decreases informality but has ambiguous effects on unemployment.

The unemployment rate rose sharply in the 1990s along with a hike in hiring costs (Graph 2) and the severe recession and financial crisis that the country went through at the end of the decade (Graph 11). It then came down, as the economy recovered from the crisis and a period of rapid physical and human capital accumulation took place. As in the case of the rate of informal working, the reduction of the payroll burden may have also contributed to the downward trend of unemployment until 2015. Unemployment increased after the pronounced drop in oil prices, a deterioration in the terms of trade of the country during the period 2014–16 and an ensuing slowdown of the economy.

The incidence of unemployment is higher among women, young workers, less educated individuals and household members other than those who receive the primary income. Further, persistently high unemployment levels, even during periods of economic expansion, imply that structural unemployment rates usually remain at high levels. For instance, different models to compute the non-accelerating unemployment rate (NAIRU), estimated by central bank staff, show a NAIRU that has fluctuated between 10 and 15% during the last 30 years (Graph 12).

Graph 11

Graph 12



Finally, one of the main factors that has shaped recent labour market trends in Colombia is the massive immigration from Venezuela that started in 2015 due to the neighbouring country's economic crisis. Before the migration wave, immigrants from Venezuela as a share of the working age population in Colombia were roughly 0.2%, and this share rose to 7% by 2022. Given the demographic profile of immigrants – mainly working age people – the massive inflow of migrants helped to slow down the population aging process in Colombia. Further, the migratory wave, particularly since 2018, modified the decreasing trend in population growth due to a secular drop in the birth rate. Interestingly, these immigration flows were not reflected in rising rates of informal working between 2007 and 2019 (Graph 4). Several studies on the impact of migration from Venezuela on the Colombian labour market show relatively minor displacement effects in terms of employment for native workers, and adverse hourly wage effects concentrated on the less educated (see Tribin et al (2020) and Lebow (2022) for comprehensive discussions). In addition, it is also documented that Venezuelan immigrants face more frictions in the labour market, producing a greater misallocation of this workforce across occupations (Pulido and Varón (2020)). It is

estimated that by removing the additional frictions that immigrants face, Colombian aggregate labour productivity could permanently increase by up to 0.4%.

1.2 The cyclical behaviour of the labour market

We now focus on the cyclical properties of the key market labour variables – occupation, participation, unemployment and informal working rates,[7] and median labour income of both the salaried and non-salaried segments. We extract the cyclical components of the quarterly series of these indicators for the period 1984–2023 using standard Hodrick-Prescott filters. Next, we compute the cross-correlogram of each series with respect to the cyclical component of the GDP. Table 1 shows the value of the highest correlation (in absolute values) found, its sign and the number of quarters that each series leads or lags the cyclical component of GDP. The full correlation matrix is shown in Table A1 in Appendix B.

Table 1

Order	Variable	Maximum correlation	Sign	Order of lag (–) or lead (+)
1	Unemployment rate	0.85***	–	0
2	Employment rate	0.73***	+	0
3	Non-salaried labour income (median)	0.58***	+	1
4	Informal working rate (as non-salaried share)	0.36***	–	1
5	Labour force participation rate	0.31***	+	0
6	Salaried wage (median)	0.25***	+	–1

Significance levels: *** p<0.01, ** p<0.05, * p<0.10.

As expected, the most synchronised labour indicator with the business cycle is the unemployment rate (maximum correlation of 0.85, significant at a 99% confidence level). The unemployment rate is countercyclical and contemporaneous to the GDP at the quarterly frequency, in contrast to the usual view that depicts unemployment responding to economic activity with a lag. Graph A1 in Appendix A shows the levels of the unemployment rate and marks recession periods identified by a standard chronology of the business cycle in Colombia (Alfonso et al (2013)).[8] Unemployment increases in all contractionary periods of the Colombian economy and its turning points are quite concordant with those suggested by the business cycle chronology.

The employment rate is the second most synchronised indicator with the business cycle (maximum correlation of 0.73, significant at a 99% confidence level). As expected, this rate is procyclical and contemporaneous. Graph A1 shows that the employment rate always decreases in identified recessions, but there are also periods in which it falls even when the economy is expanding (for instance, during the period

[7] Given the unavailability of a long series of informality rates, we approach this indicator with the share of non-salaried workers in the total number of employees. Further, only urban series are considered.

[8] We have updated the chronology to include the economic contraction induced by the Covid-19 pandemic.

2015–18). Regarding the formal/informal segmentation of employment, the share of informal workers is, as expected, countercyclical. The rate of informal working has a maximum correlation that is low (–0.36), although statistically significant, and responds with a one quarter lag. Graph A1 shows that recessions usually trigger increases in the rate of informal working, but the persistence of this rise is variable across the different contractionary periods.

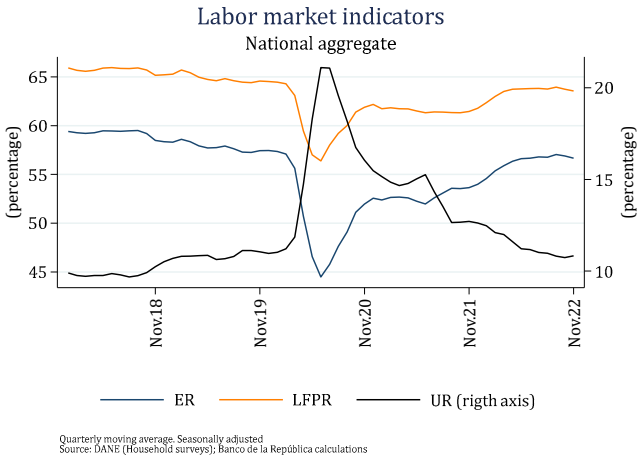
With respect to labour income, wages in the salaried segment are almost acyclical, with the maximum correlation at barely 0.25 (but statistically significant), leading the GDP by one quarter. As discussed in Section 2, this is the result of a significant degree of stickiness of formal wages in Colombia, given that their adjustments occur regularly (usually once a year) and are downwardly rigid (firms usually do not make wage cuts). By contrast, the labour income in the non-salaried segment is procyclical (maximum correlation of 0.58, significant at a 99% confidence level) but lagged one quarter relative to economic activity. This points towards greater flexibility in the informal labour market than in the formal one.

Finally, regarding labour participation, it has a maximum correlation of only 0.31; that is contemporaneous and statistically significant. The fact that this indicator has a low degree of procyclicality is not at odds with economic theory, which predicts that two opposite forces influence participation decisions over the business cycle: in recessions, current jobseekers are discouraged, but, at the same time, additional members of a household enter the job market to compensate for the income losses of a family's primary earner. Therefore, it seems that there is no clear force dominating the other, and the movements of the participation rate respond more to structural factors (demographic change, the entry of women into the labour force etc).

1.3 The labour market in the wake of the pandemic

In March 2020, as in many other countries, the Colombian government declared the Covid-19 pandemic a public health emergency and imposed a national lockdown that excluded some essential economic activities. This had abrupt, substantial short-term impacts on the labour market. The employment rate (ER) contracted by approximately 12 percentage points between February and May 2020, while the labour force participation rate (LFPR) decreased from 63.1% to 55.4% (Graph 13). Moreover, despite the significant contraction in labour supply, unemployment peaked at 20.6% in May 2020. After May 2020, the labour market began to gradually recover, albeit at a slower rate than the recovery of economic activity. It was not until the end of 2022 that key labour market indicators exhibited levels comparable to those observed before the onset of the pandemic.

Graph 13



The sectoral restrictions imposed by the national government between March and August 2020 partly explain the sudden labour market deterioration. Taking advantage of sectoral variation implied by the sectors excluded from the restrictions, Morales et al (2022a) estimate that the effect of the sectoral restrictions on employment accounted for approximately a quarter of job losses. Other aggregate factors explain the rest of the fall, such as the general lockdown or the contraction of aggregate demand. Moreover, it is also documented that in the short term, the most significant job losses occurred in small- and medium-sized companies belonging to sectors with fewer teleworking possibilities and more physical proximity between workers (Central Bank of Colombia (2020); Morales et al (2022b)). Likewise, firm-level estimates based on administrative records show that the pandemic led to the exit of numerous small- and medium-sized firms. While there were few bankruptcies among large companies, significant payroll cuts were observed in this segment. These staff cuts were substantial in companies with lower productivity, liquidity and profit margins before the pandemic (Central Bank of Colombia (2021c)).

On the labour supply side, the drop in labour participation was considerably more prominent for women and low-skilled workers. Remarkably, the differential effect on women was mainly driven by those belonging to households with children (Central Bank of Colombia (2021a)). The latter findings reflect that women were particularly affected by the school closures, which were considerably prolonged in Colombia. With the reopening of schools by the beginning of 2022, the labour force participation rate significantly recovered. However, even in 2022, there was still a non-negligible difference in participation by gender relative to the pre-pandemic period. The gender gap in participation at the end of 2022 was around 0.8 percentage points higher than before the pandemic.

Interestingly, the rate of informal working did not significantly increase during the pandemic (Graph A1 in Appendix B), in contrast with the empirical regularity reported previously regarding its countercyclical nature. This could be the result of mobility restrictions and social distancing measures, adopted to prevent contagion, that discouraged informal activities that tend to be contact-intensive. Afterwards, the

strong recovery of the economy pushed formal labour demand up and reinforced the declining trend of the informal working rate.

Another effect of the pandemic that has been documented by the literature is the differential behaviour of labour demand across occupations. For example, once the lockdowns were eased, it was observed that there was faster growth in vacancies for occupations with high skills and low potential for automation – such as professional and technical workers – compared with those that are more prone to automation – such as elementary occupations, clerical support and sales work, among others (Bonilla et al (2022)). This could be a structural shift in labour demand in a country with high levels of informal work and unemployment, and could imply the rise of structural mismatches between current workers' skills and those required by the labour market, with potential effects on long-term informal work and unemployment rates, and the location of the Beveridge curve (Central Bank of Colombia (2021b)).

Finally, there is evidence that policy measures designed to reduce job losses and compensate for income reductions due to the pandemic had mixed impacts on labour market outcomes. On the supply side, the government notably increased the coverage and number of direct subsidies granted to the most vulnerable households: subsidies grew from 0.3% of GDP in 2019 to 1.3% in 2021. The available literature found that there were no persistent changes in labour participation in the groups most likely to receive additional subsidies during the pandemic (Central Bank of Colombia (2022); Gallego et al (2021)) and that there were positive (albeit modest) effects on measures of households' well-being, such as access to food or financial inclusion (Londoño-Vélez and Querubín (2022); Gallego et al (2021)). On the demand side, the government introduced a programme for employment protection including a number of payroll subsidies to the most affected firms during the pandemic. Recent impact assessments show positive, sizable and persistent effects among firms eligible for the subsidy (Central Bank of Colombia (2023)). The average effect for eligible firms was an increase in employment of 4 percentage points compared with non-eligible firms.[9]

2. The contribution of wages in the recent inflationary surge

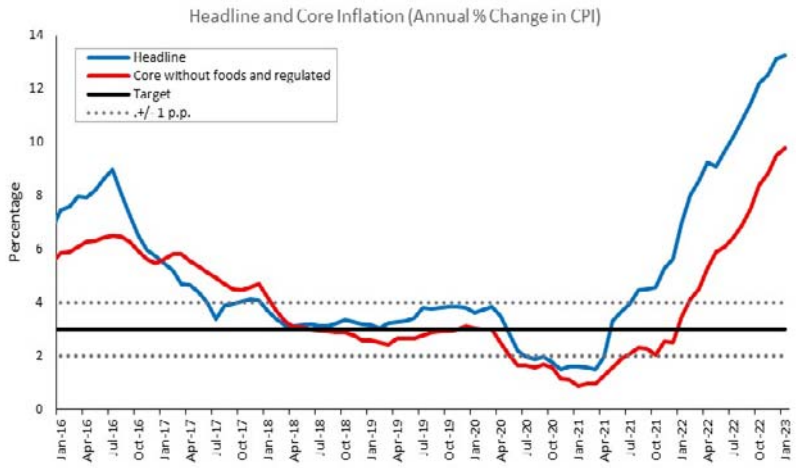
In this section, we focus on the wage-setting process in Colombia and the role of wages in the recent inflationary escalation. We first summarise the main drivers of inflation in the aftermath of the pandemic. Next, we describe the major features of the wage-setting process in Colombia, highlighting the critical incidence of the MW both in the distribution of wages and in its annual adjustments. Finally, we estimate the long-run relationship between wages, prices and productivity. This exercise allows us to gauge the current and prospective inflationary pressures stemming from the labour market.

[9] To achieve this impact, the policy cost COP 715 billion, equivalent to 0.1% of the GDP.

2.1 Main drivers of the current inflation escalation

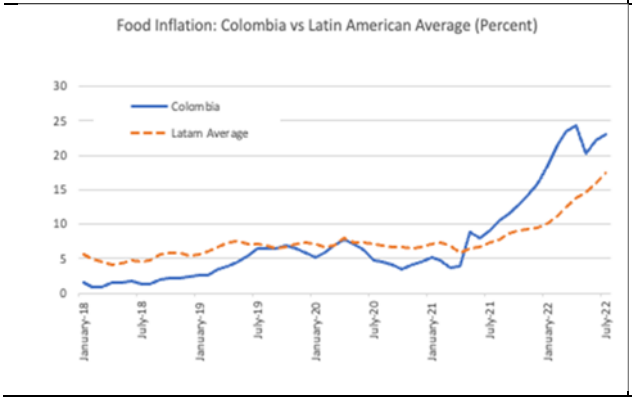
Inflation in Colombia fell below the 3% target during the pandemic in 2020 and 2021, and it bottomed out at 1.51% in March 2021, its second lowest level in history. In the second quarter of 2021, inflation started to increase and in January 2023 both headline and core inflation reached their highest points (13.1% and 9.8%, respectively) since 1999, and, unlike in other countries, they have not peaked (Graph 14).

Graph 14

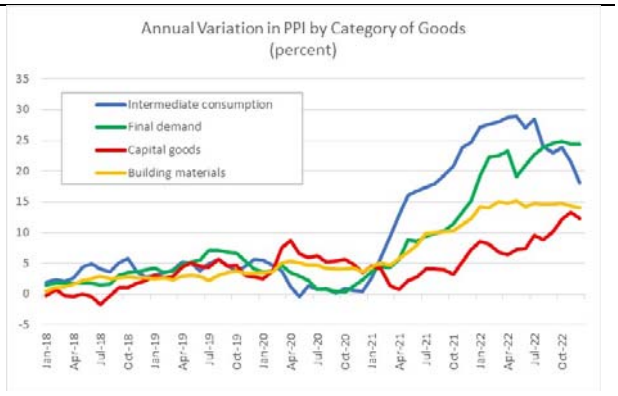


There are multiple factors and shocks that explain the behaviour of inflation. First, several relief measures during the pandemic were implemented through prices. These measures included temporary reductions in the price of public utilities, persistent decreases in the price of fuels, and the temporary elimination of VAT and consumption taxes on mobile telephone plans, hygiene products, restaurants and hotels. The timing of the reversion of these measures has been spread over time and continues to affect measured inflation as price levels recover. Second, the increase in inflation has been led by food and goods prices. On the one hand, food prices started increasing sharply in May 2021, as road blockades, amid two months of social unrest and protests, affected the production cycle and the productive capacity of several products. A year later, food inflation in Colombia was higher than in most countries in Latin America, with the blockades explaining approximately 9 percentage points of the difference (Graph 15). This shock was followed by other negative supply shocks, including the Russian invasion of Ukraine that affected input prices (eg fertilisers) and excess rain over the last two years, as well as a sustained local currency depreciation that mainly affects processed foods. With all this, food inflation was at 28% at the end of 2022. In the case of goods, initially the supply chain disruptions that affected production and trade globally were behind the surge. Cost increases have been widespread (Graph 16) and have been passed through to prices (Graph 17). More recently, the sustained and relatively high depreciation of the currency (Graphs 18 and 19) has also been passed through to goods and food prices, which have continued to rise despite the fall in transport and logistics costs, and the reduction in the growth of these prices globally.

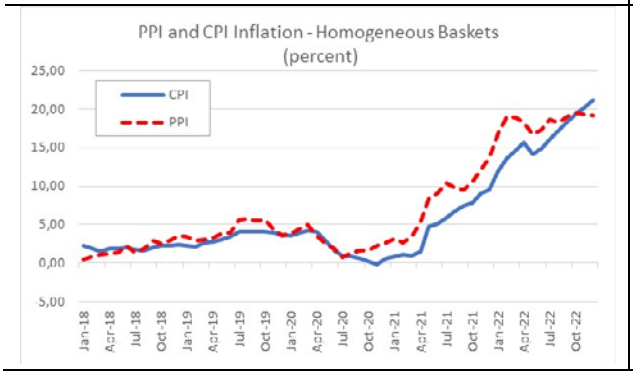
Graph 15



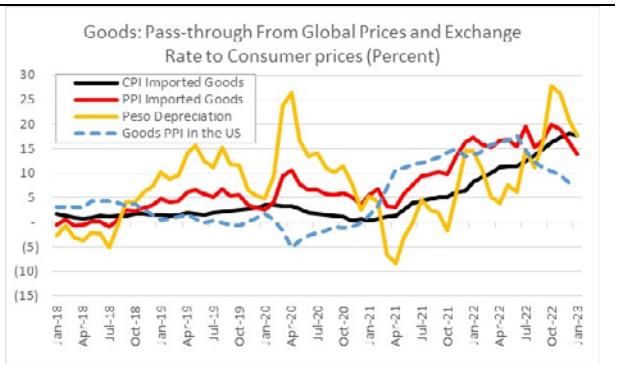
Graph 16



Graph 17

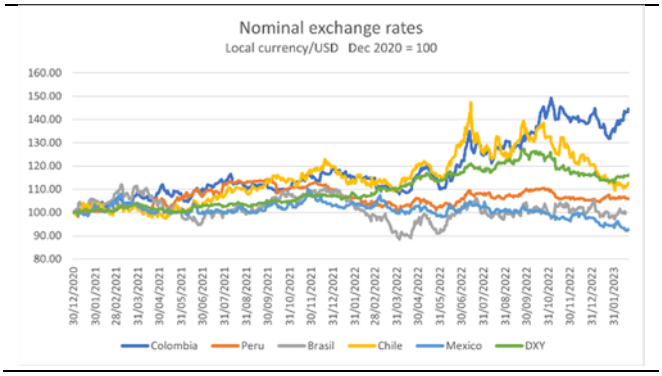


Graph 18

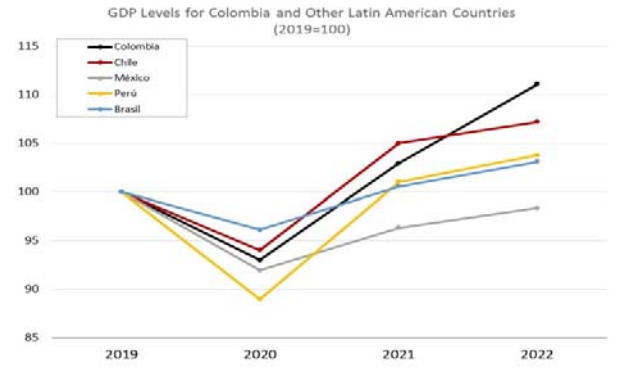


Demand factors have also played a role. The recovery of the Colombian economy after the pandemic has been remarkable (Graph 20) with GDP reaching levels above pre-pandemic trends, led by private consumption (Graph 21) supported by a fall in savings, credit growth and the recovery of the labour market, but also against the backdrop of sustained fiscal deficits (7.2% of GDP in 2020, 7.1% in 2021 and 6.4% in 2022).

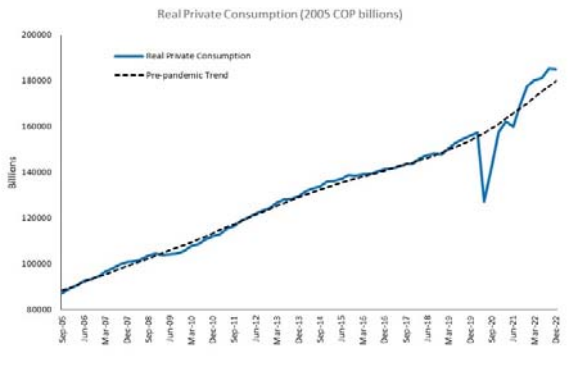
Graph 19



Graph 20

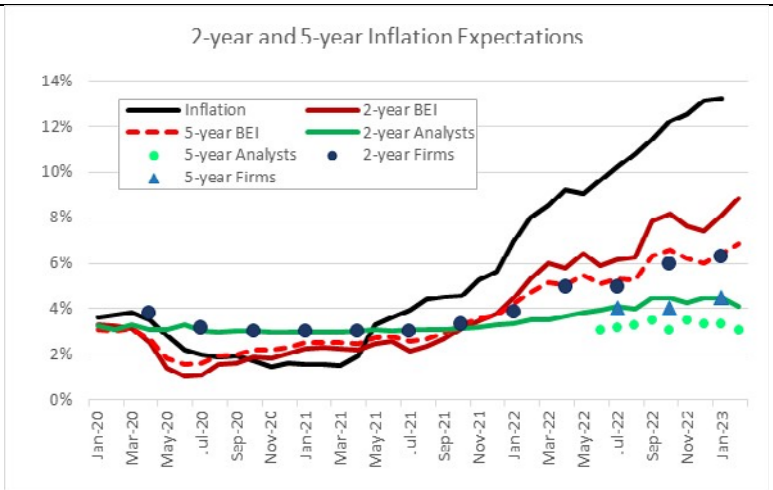


Graph 21



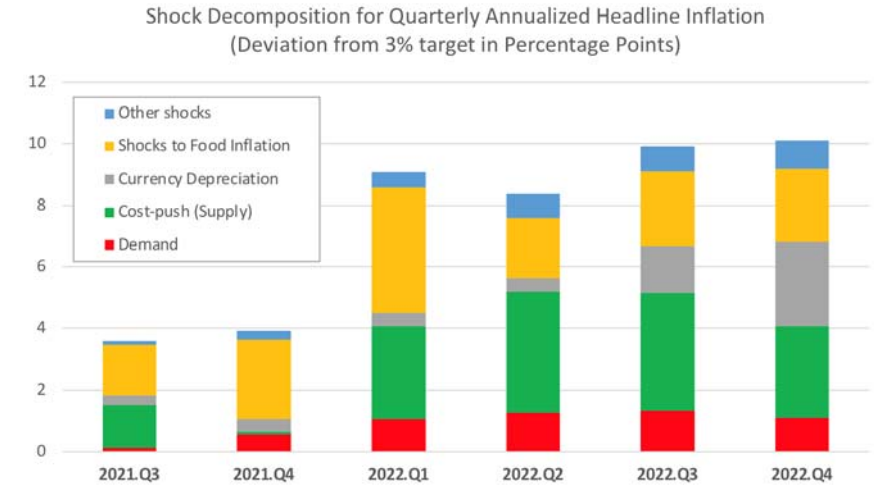
More recently, two additional factors have been playing a role in inflation dynamics – imprinting persistence in inflation and potentially making the disinflationary process longer and more costly. First, as price increases well above the inflation target have become widespread, inflation expectations have risen (Graph 22), with all expectation measures lying well above target at all horizons. This may be underlying generalised and relatively large price increases. Second, as inflation has risen, indexation mechanisms are playing a greater role and the risk of a higher degree of indexation in the economy has become more prominent. These indexation mechanisms affect some important prices, such as those of public utilities and rents, and even the MW, as will be explained below.

Graph 22



All the factors mentioned above have been important in terms of the behaviour of inflation. Using a semi-structural model for monetary policy, we decompose inflation to gauge the contribution of different shocks to inflation (Graph 23). Cost-push shocks, that were the main driver of inflation at the end of 2021 and in the first half of 2022 they have started to vanish. Nevertheless, as of the end of 2022 they still accounted for approximately 30% of inflation. Shocks to food prices that at the beginning of 2022 accounted for approximately half of inflation now account for approximately 25%, whereas shocks that affected the exchange rate contributed little at the beginning of 2022, but now account for approximately 30%. Finally, aggregate demand shocks contribute approximately 10% of inflation, and gained in importance in absolute terms as 2022 progressed. A similar picture emerges from the shock decomposition of core inflation, but with a greater contribution from aggregate demand shocks, which explain 15% of the surge, and a greater contribution (40%) from the depreciation of the Colombian peso (see Graph A2 in Appendix B).

Graph 23



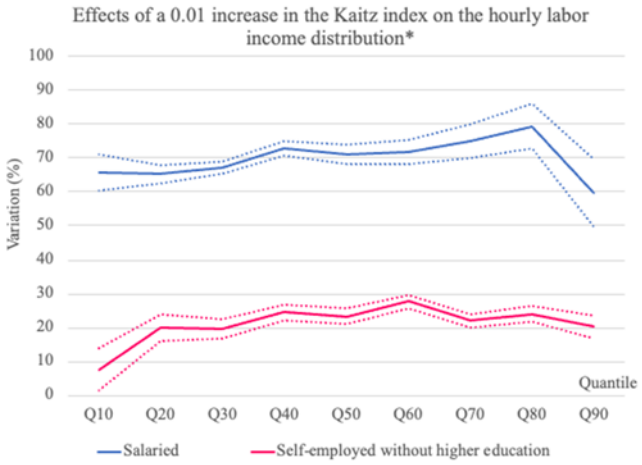
2.2 The wage-setting process in Colombia

One of the main features of the wage-setting process in Colombia is the critical influence that the mandatory legal MW has both on the observed distribution of wages and on the adjustments of other wages and prices (indexation mechanism). As mentioned above, the ratio of the MW to the median wage in Colombia is high compared with other advanced and emerging economies (Graph 1). The current pervasiveness of the MW in the distribution of wages in Colombia is the result of initially high values and the accumulation of significant positive annual real increases experienced in the last two decades. Graph 24 shows two real MW indices from 2005 to 2023. The MW deflated by the CPI grew by approximately 27.4% between June 2005 and June 2022; using the implicit GDP deflator this is 16.5%. These dynamics are supported by a constitutional court ruling that prevents MW annual increases from being lower than past CPI inflation. It is worth noting that in the aftermath of the pandemic, real minimum wage growth rate reached its highest level of 4.5% and 2.8% in 2022 and 2023, respectively, when deflated with the CPI. These growth rates have been higher than other measures of labour productivity, possibly contributing to the recent rise in inflation, an issue that we explore below.

Graph 24

The influence of the MW is evident not only in the high share of workers earning it, but also in how MW hikes could affect other salary increases in the market. Rises in the Kaitz index (the ratio of the MW to the 70th percentile of the wage distribution) in Colombian cities were associated with increases in virtually all quantiles of the earnings distribution, controlling for fixed time effects, and individual and city characteristics (see Graph 25, and for more details, Appendix C). Moreover, the impacts of rises in the Kaitz index are substantially stronger in the distribution of the earnings of salaried workers than in the distribution of labour income for the non-salaried segment. These observations suggest a possible impact of the MW in the determination of other salaries in the formal sector.

Graph 25



Graph plots the estimated coefficients of equation (B1) in Appendix C that indicate the percentage increase in the value of the corresponding quantile of hourly labour income due to a 0.01 increase in the Kaitz index. See Appendix C for more details.

Source: Arango et al (2022).

Beyond the critical importance of the MW, the literature has explored some microeconomic features of the wage-setting process in Colombia using different firms' surveys. For example, Iregui et al (2012) document that firms adjust wages less frequently than prices, that time-dependent wage adjustments are more common than time-dependent price changes, and that firms usually do not cut wages (suggesting downward wage rigidity). This latter fact is explained by the observed Colombian practice of adjusting wages in line either with the previous year's inflation rate or with the increase in the MW. This result, coupled with the low frequency of wage changes, provides evidence of noticeable wage stickiness in the formal labour market.

Finally, there is evidence of considerable heterogeneity of the pass-through from wages to prices across industries. Iregui et al (2012) find that, when asked about the importance of past wage increases for price changes, 37% of the firms responded that they were not important at all, whereas 20% considered them to be very important. Part of the variation in the answers is explained by the industry to which the firms belong. Accordingly, although the relationship between wage and price changes does not generally seem to be exceptionally strong, the pass-through of wages to prices is particularly high in some sectors, especially those in which the labour cost share is high.[10] The evidence also indicates that the pass-through is mediated by industry-level dimensions, such as the sectoral aggregate labour productivity (Iregui et al (2012)) or market concentration (Heise et al (2021)).

[10] For example, wage increases are very important in setting prices for around 60% of the firms surveyed in the education and health sectors, and in other services.

2.3 Assessing inflationary pressures from the labour market

In order to gauge current and prospective inflationary pressures stemming from wages, a long-run relationship between prices, wages and labour productivity is estimated for Colombia. More specifically, we aim to answer these questions:

- Are wages significantly above their long-term relationship with productivity and prices, thereby contributing to the observed rise in inflation (eg through increasing unit labour costs or high inflation expectations)?
- Do their expected dynamics imply serious inflationary risks in the future?

A simple framework to address these questions acknowledges that consumer prices in a small open economy are made up of domestic and imported components,[11] so that the following relationship is posited:

$$w_t = \beta_0 + \beta_1 p_t + \beta_2 lp_t + \beta_3 p^*_t + \beta_4 e_t + \varepsilon_t \quad (1)$$

In which w_t is nominal wages, p_t is the CPI, lp_t is output per worker, p^*_t is foreign consumption goods prices and e_t is the nominal exchange rate (all in logarithms). We estimate equation (1) using a Johansen cointegration methodology. The estimated Johansen's VEC long-run and short-term error-correction coefficients are presented in Table 2, and the cointegration error is shown in Graph 26.[12] The latter indicates that wages in 2022 were *below* their long-term level, given the values of the other macro variables included in the system. This is consistent with the documented formal wage rigidity in the midst of the inflationary and exchange rate shocks mentioned above. Hence, up until the third quarter of 2022, there is no evidence of wage growth in excess of labour productivity significantly contributing to the sharp increase in inflation.

Table 2

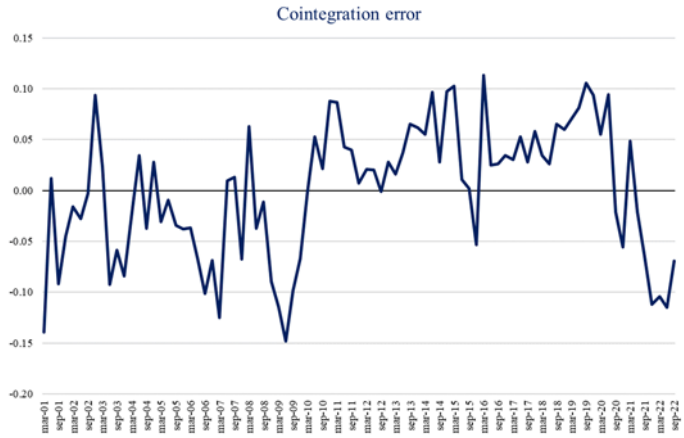
	β LT coefficient	α ST error correction
w	1	-0.39***
p	0.94***	-0.032**
lp	1.36***	0.028
p^*	0.30	-0.027
e	0.09	0.310***

The table shows the estimated coefficients of the cointegrating vector (equation (1)) and the short-term adjustment mechanism of a VECM model with three lags and one cointegrating equation. Significance levels *** p < 0.01, ** p < 0.05, * p < 0.1.

11 Let P be the CPI. Then $P = (P^D)^a (P^M)^{1-a}$ where P^D and P^M are the domestic and imported components of consumer prices, respectively. P^M can be approximated by the product of foreign prices (P^*) and the exchange rate (E): $P^M = P^*E$. Further, P^D is driven by nominal wages (W) and the marginal product of labour (MPL): $P^D = W / MPL$. Therefore, we obtain $P = (W/MPL)^a (P^*E)^{1-a}$ that in logs corresponds to equation (1). The five series (in logs) have unit roots (see Table A2 in Appendix B), so a cointegration relationship is estimated using Johansen's method.

12 The Johansen trace test, shown in Table A3 in Appendix B, indicates that there is only one cointegration vector for this system in the Q1 2000–Q3 2022 sample.

Graph 26



Source: authors' calculations.

Going forward, however, the evolution of wages does represent a risk for the convergence of inflation towards the 3% target. Starting from levels below their long-term "equilibrium" level, a correction of the current deviation would imply large upward adjustments of wages, *ceteris paribus*. As implied by the significant and relatively large value of the short-term error correction coefficient (*a*) in Table 2, wages have typically been one of the main ways in which the long-run equilibrium is restored in the estimated system (the other being the exchange rate movements). Indexation of formal wages is a mechanism through which such an adjustment takes place.[13] Hence, if the inflationary shocks persist for a protracted period, demand pressures remain, or the currency depreciates further, wage increases would likely be large and could delay convergence of inflation to target, requiring a tighter monetary policy stance. [14]

3. Macroeconomic effects of the MW

Given the prominent influence that the MW has on the labour market, the observed distribution of wages and on the indexation of other salaries and prices, in what follows we briefly summarise some findings of a comprehensive study on the macroeconomic effects of the MW in Colombia, recently published by the Central Bank of Colombia (Arango et al (2022)). We focus our summary on the effects on three dimensions: inflation, employment (informal work and formal employment) and the adjustment of macroeconomic variables to changes in the MW.

13 Suppose, for example, the following "error correction" mechanism for wages: $Dw_t = (p_{t-1} - w_{t-1} - lp)$, with constant labour productivity, lp. Then, $Dw_{t+1} = (p_t - w_t - lp) = (p_{t-1} + Dp_t - w_{t-1} - Dw_t - lp) = Dp_t$, which corresponds to a case of complete backward indexation of wages.

14 Based on a sample of advanced economies, Alvarez et al. (2022) find that episodes with macro features similar to those of the post-Covid-19 (accelerating inflation, declining real wages and tight labour markets) are followed by nominal wage rises to catch-up with prices, supported by low unemployment.

First, regarding inflation, the study uses different methodologies to assess the impact of MW hikes on prices, exploiting both aggregate and micro-level data. With aggregate data, two methodologies (an IV approach that uses variation over time and an accounting exercise that uses an input-output matrix and the distribution of value added across factors remunerations) find similar results: a rise of 10 percentage points in the MW causes an increase of up to 1.4 percentage points in total CPI inflation and up to 1 percentage point in core inflation. It should be noted, however, that these estimates only cover a period characterised by low inflation (2010–19) and that the input-output analysis finds variable impacts depending on the year evaluated. Regarding the exercise with microdata, the results suggest a considerable heterogeneity of the pass-through of the MW to prices across different price baskets, with food and food away from home showing the greatest transmissions. Excluding regulated goods and services, the median rise in prices following an increase of 10 percentage points in the MW is 1.6 percentage points, a transmission that occurs mainly during the four months after the MW hike.

Regarding employment, the study begins by summarising the literature on the effects of the MW on the informal working rate in Colombia. The tested mechanism in most of those studies is well known: when the rise in the MW is higher than the increase in labour productivity, hiring slows down and job seekers are pushed into the informal sector. This mechanism is particularly relevant in Colombia, where productivity growth is heterogeneous across different regions or labour market segments, but there is a single national MW. For instance, by exploiting regional variation, Arango and Florez (2020a) find that a rise of 10 percentage points in the MW relative to the wage in the 70th percentile of the wage distribution, increases the informal working rate by 1.4 percentage points on average in the main cities. However, there are noticeable heterogeneous effects across cities, with the largest impact for a given city being 6.2 percentage points. Using variation across demographic groups instead, Arango et al (2020) find that the same rise in the relative MW increases the informal working rate by 2.1 percentage points on average. The effect is larger for young, female and less skilled workers. These results confirm the impacts previously estimated in the literature for Colombia, in which rises in the Kaitz index led to higher probabilities of informal working (Mondragón et al (2013); Mora and Muro (2014)).

The study also estimates the impact of the MW on formal employment by considering the effects on formal job creation and destruction separately. The results suggest that a 1% increase in the real MW reduces formal employment by 1%. The drop in formal employment is accounted for by an increase of 44 basis points in formal job destruction and a decrease of 56 basis points in formal job creation. It is worth stating that the destruction of formal employment does not necessarily imply a direct impact on the rate of informal working, since workers could move not only towards the informal sector but also into unemployment or inactivity.

Finally, the study includes an analysis of the adjustments of some macroeconomic variables to unanticipated shocks to the MW through the lenses of two DSGE models. The first model assumes flexible prices, incomplete financial markets and a segmented labour market between the formal and informal sectors. The second model adds price rigidities and a central bank acting to stabilise prices. Regarding the adjustments within the flexible price model, an unanticipated increase of 1% of the MW reduces the share of formal employment by 1% due to the larger

threshold that formal firms face to hire skilled workers. Also, it reduces the capital-labour ratio by 0.78% and aggregate consumption by 0.37%. These effects are due to lower precautionary savings resulting from the insurance provided by the MW, lower savings of workers displaced from formal to informal jobs and a decrease in the marginal product of capital stemming from reduced formal employment. Regarding the adjustments with sticky prices, the same increase in the MW generates a similar recomposition towards informal work and a reduction in GDP, investment and consumption, especially of unskilled workers. The reduction in GDP is more prominent in the short run (0.12%) than in the long run (0.08%) and generates a negative output gap with respect to output under flexible prices. With respect to prices, the cost-push shock induced by the MW hike dominates the impact on the output gap and thus headline inflation rises (8 basis points). Finally, given that the monetary authority reacts to both the output gap and inflation, the calibrated policy rule suggests that the response of monetary policy is mild.

4. Conclusions

This note provides a brief characterisation of the labour market and the connection between wages and prices in Colombia. To accomplish this, we depict the performance of the key labour market indicators, and link this to the main findings of the recent literature on topics such as the impact of the Covid-19 pandemic, the roots of labour informality and the macroeconomic effects of the MW, among others. We document a highly segmented labour market with a significant incidence of informal working and unemployment, although with improvements in both indicators in the decade before the pandemic. Regarding labour income, while we observe procyclical informal labour earnings, salaries in the formal sector are sticky and heavily influenced by the MW. The proportion of the workforce in respect of which the MW is binding in Colombia is high relative to other economies, and there is evidence that increases in the real MW relative to productivity have adverse macroeconomic impacts. The pass-through of wages to prices is not very strong, but there are noticeable heterogeneities in transmission across sectors. Further, based on an estimation of a long-run relationship between aggregate prices, wages and labour productivity, we conclude that, up until the third quarter of 2022, wages were below their "long-term" level, given the shocks to prices and the exchange rate. Thus, wage increases above labour productivity growth were not among the main drivers of the observed inflation escalation. However, their adjustment towards their long-term "equilibrium level" (possibly through indexation) could imply risks for the convergence of inflation to target, especially if inflationary shocks persist, aggregate demand remains strong or the currency depreciates further.

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Appendix A: A stylized model of the labour market under a real minimum wage

Main assumptions:

Consider a closed economy with one good and flexible prices in a static setting. The good is produced by a formal competitive firm that uses a constant returns to scale (CRS) technology that employs formal labour and capital, and is subject to a binding real minimum wage regulation. The good can also be produced with a less productive technology, in which workers use their informal labour input only. The workers earn the totality of the output produced in the informal sector.

The workers are made up by households that do not own capital and decide how much labour to supply in the formal market and how much labour use in the informal production. There are *N* worker-households of this type. The stock of capital is pre-determined and owned by a capitalist household, who does not work and inelastically supplies capital, earning a competitive rental price.

The assumption of a binding real minimum wage is a reasonable approximation to the MW regulation in Colombia, which establishes that the nominal MW growth cannot be lower than past inflation.

Equilibrium:

The labour supply decision is based on an intra-temporal optimization problem in which households know that, due to the binding real minimum wage, there is unemployment in equilibrium. Thus, they maximize an expected utility function that is computed on the basis of the probability of getting a formal job. The possibility of being unemployed prompts households to allocate time to informal production.

In equilibrium, the rental price of capital clears the capital market, formal labour is determined on the demand side by the binding real MW, formal labour supply may be greater than demand (there may be equilibrium unemployment), informal production is positive and the subjective probability of finding a formal employment coincides with the ratio of formal labour demand to total formal labour supply.

Workers´ decision problem:

All households are identical ex-ante. They estimate a subjective probability of formal employment equal to *p*. They solve the following problem:

$$Max\ \ p\,U\left(c_L^f, l^f + l^i\right) + (1-p)\,U\left(c_L^i, l^f + l^i\right)$$

$$c_L^f, c_L^i, l^f, l^i$$

Subject to

$$c_L^f = w^{min} l^f + G\left(l^i\right) \tag{A1}$$

$$c_L^i = G\left(l^i\right) \tag{A2}$$

l^f, l^i, c_L^f, c_L^i and $G(l^i)$ are formal labour supply, informal labour supply, household consumption when formal, household consumption when informal and the informal production function, respectively. The FONC for this optimization problem imply:

$$w^{min} = -\frac{E[U_l(.)]}{p\, U_c\left(c_L^f, l^f + l^i\right)} \quad \text{(A3)}$$

$$G'\left(l^i\right) = -\frac{E[U_l(.)]}{E[U_c(.)]} \quad \textit{(A4)}$$

Formal firm´s decision problem:

$$Max\ F\left(L^f, K\right) - w^{min} L^f - r\, K$$

$$Lf, K$$

$F(.)$, L^f , K and r are the formal firm´s technology, demand for labour, demand for capital and the rental price of capital, respectively. FONCs are conventional in this case:

$$F_L\left(L^f, K\right) = w^{min} \quad \text{(A5)}$$

$$F_K\left(L^f, K\right) = r \quad \text{(A6)}$$

Capital owner´s decision:

Capital owners inelastically supply of a pre-determined capital stock and consume the proceeds from its rent:

$$K = \overline{K} \quad \text{(A7)}$$

$$c_K = r\,\overline{K} \quad \text{(A8)}$$

Competitive equilibrium:

Equilibrium values for c_L^f, c_L^i, c_K, l^f, l^i, L^f, K and r satisfy equations (A1) through (A8) and ensure that the subjective probability of formal employment equals the actual ratio of formal labour demand to formal labour supply:

$$p = \frac{L^f}{N l^f} \quad \text{(A9)}$$

Thus, formal labour demand will be determined by the fixed stock of capital and the minimum wage and can be lower than formal labour supply, ie there may be unemployment in equilibrium. Good market equilibrium holds by Walras Law, since the capital market clears, informal output is totally consumed by workers, formal employment is determined as previously described and there is a CRS technology in the formal sector (there are no economic profits).

Comparative statics:

The model above is used to explore the effects of changes to the MW on unemployment and informality. It is also used to study the impact of rising physical and human capital, which, as stated in this note, may be behind the declining trend of informality observed in Colombia, despite high MW and formal payroll surcharges.

Preferences and technology are specified as follows:

$$U\left(c, l^f + l^i\right) = Ln(c) - \frac{(l^f + l^i)^{1+\varphi}}{1+\varphi}$$

$$F\left(K, L^f\right) = A\left(\alpha\, K^{\rho} + (1-\alpha)\, L^{f\,\rho}\right)^{1/\rho}$$

$$G\left(l^i\right) = B\, l^{i\gamma}$$

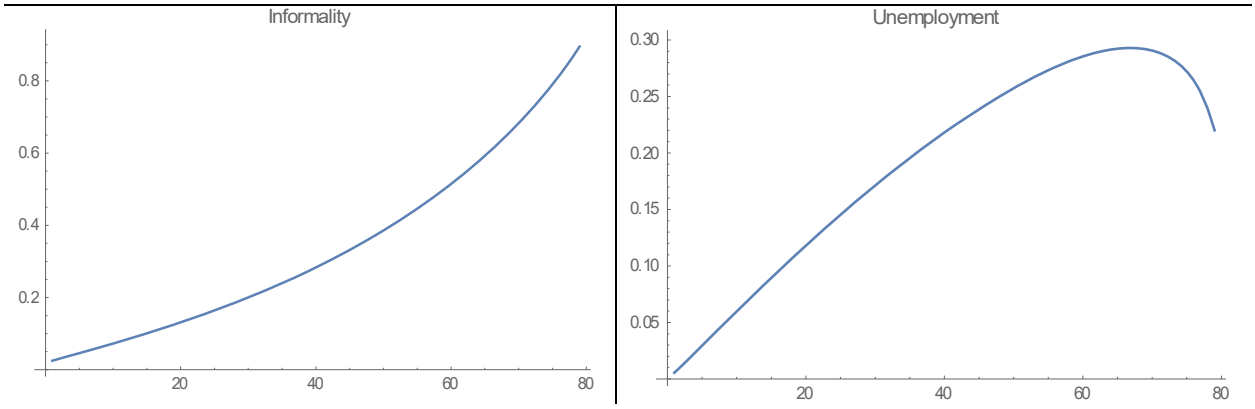
Given the nature of the model and the specification of preferences and technology, closed form solutions of equilibrium are difficult to obtain. Thus, numerical simulations are performed with the following parameterization:

$$\varphi = 0.4,\ \rho = -1.35,\ \alpha = 0.3\,,\ \gamma = 0.5,\ A = 1,\ B = 0.2\,A,\ N = 1$$

Effects of changes in the real MW on informality and unemployment

As the binding real MW increases, formal labor demand diminishes, reducing the probability of finding a formal job. Workers respond by raising informal labour to sustain consumption, thereby increasing informality (defined as the ratio of informal employment to total employment). Unemployment, on the other hand, may rise or fall following a higher real MW (Diagram 1)[15].

Diagram 1



Horizontal axis: (Real MW / Real flexible wage) -1

This happens because the rise in the MW decreases formal labour demand, but also discourage formal labour supply. The latter effect is the result of a decreasing ex ante perceived probability of finding a formal job. Thus, for not too high real minimum wages, a relatively high probability of finding formal work implies a small drop in labour supply with respect to the fall in labour demand. However, as the effects of higher real MW on formal employment accumulate, the probability of finding a formal job reaches low levels and formal labour supply drops become larger, while, at the same time, formal marginal labor productivity rises, dampening the impact of higher wages on formal labor demand. Consequently, a smaller unemployment rate is obtained in equilibrium.

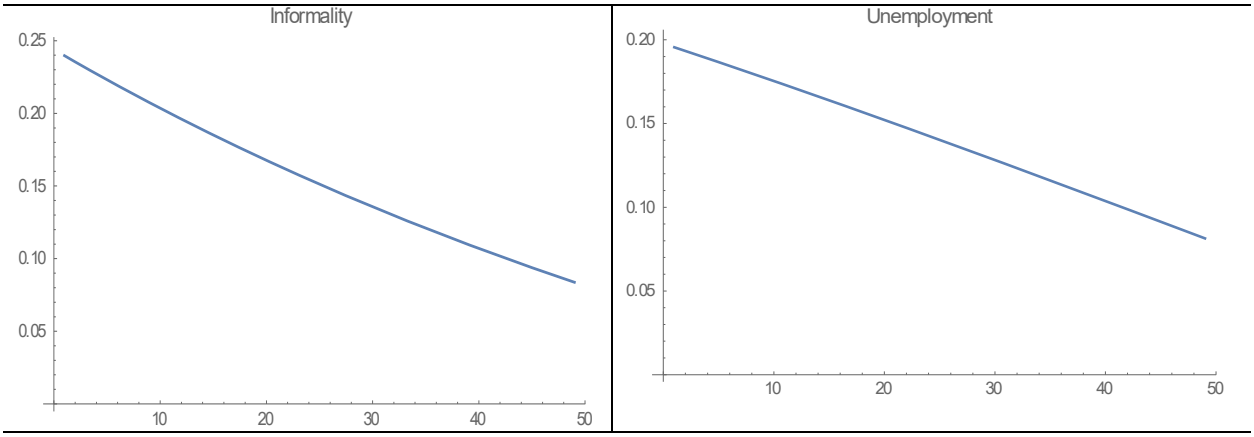
[15] The horizontal axes in Diagram 1 represent the percentage deviation of the real MW from the real wage that would prevail in the absence of minimum wage regulation.

Effects of changes in the capital stock on informality and unemployment

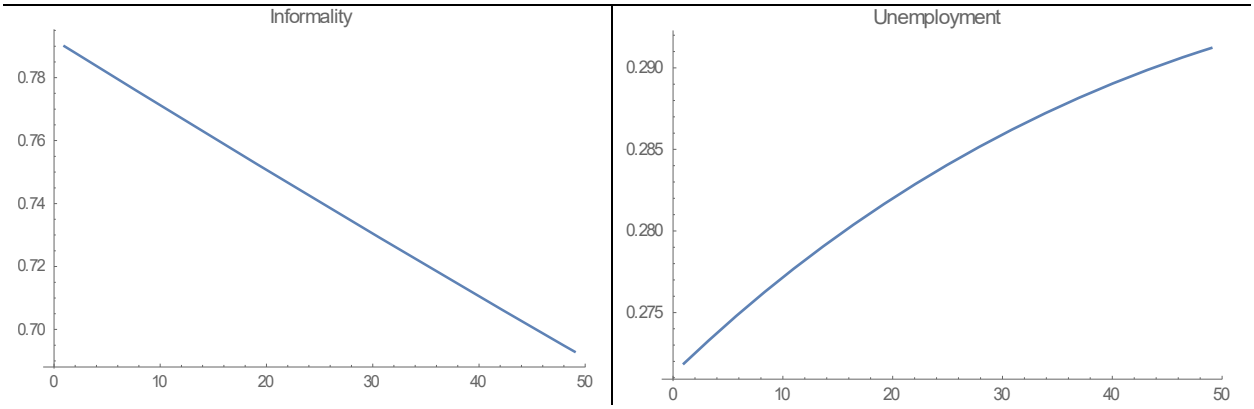
When the MW is relatively small (eg 1.35 times the real wage with no MW regulation), the probability of finding a formal job is high, so that increases in capital raise formal labour demand, but not so much formal labour supply (Diagram 2). By contrast, when the MW is relatively large (eg 1.75 times the real wage with no MW regulation), the probability of finding a formal job is low. Increases in capital raise formal employment and significantly upgrade the perceived probability of formal employment. As a result, formal labour supply jumps and unemployment rises. In all cases, informality drops (Diagram 2).

Diagram 2

Real MW = 1.35 Flexible real wage



Real MW = 1.75 Flexible real wage



Horizontal Axis: (Capital / Initial Capital) -1

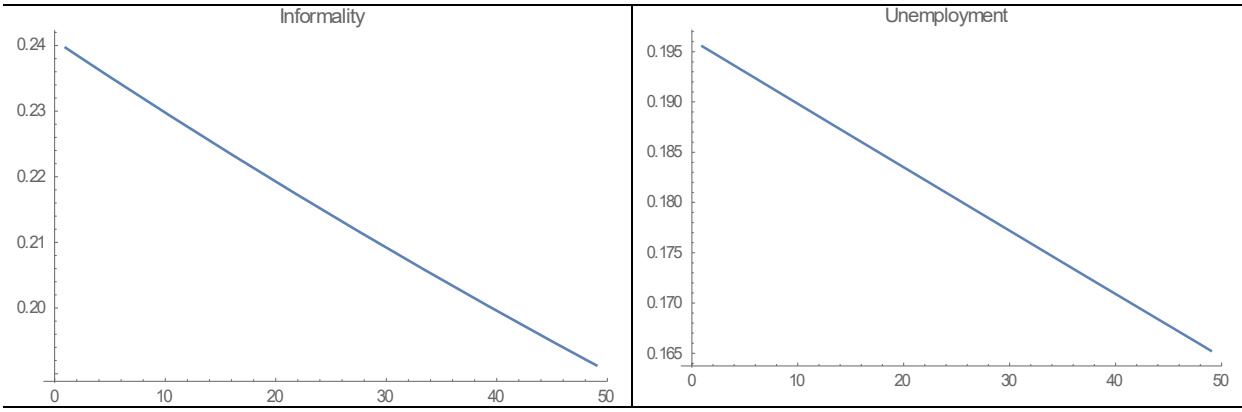
Effects of changes in total factor productivity on informality and unemployment:

As total productivity rises, informality generally drops, following an increase in formal employment and a decrease in the informal one (Diagram 3). Regarding unemployment, as in the exercises above, the effect is ambiguous and depends on

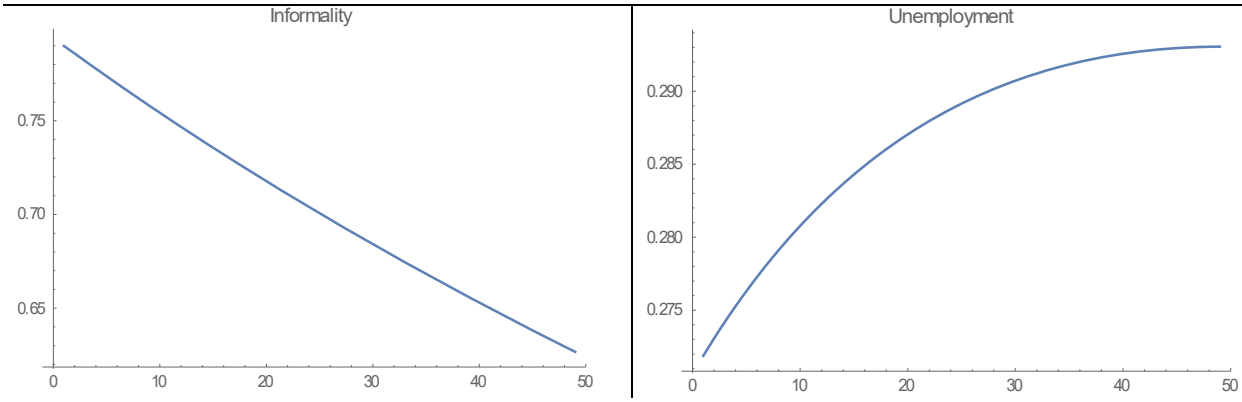
the level of the MW. For a low MW (1.35 times the real wage with no MW regulation), the initial probability of finding a formal job is high and, as consequence, total factor productivity increases raises formal labour demand by more than formal labour supply, thus reducing unemployment. For a higher MW (eg 1.75 times the real wage with no MW regulation), the productivity gains increase the probability of finding a formal job from low initial levels, raising labour supply relative to labour demand. Consequently, unemployment goes up (Diagram 3).

Diagram 3

Real MW = 1.35 Flexible real wage



Real MW = 1.75 Flexible real wage



Horizontal Axis: (Total Factor Productivity / Initial Total Factor Productivity) -1

Appendix B: Additional tables and graphs

1. Additional tables

Full correlation matrix of the key market labour indicators with respect to the GDP

Table A1

	Lags and leads with respect to the GDP												
Variables	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6
Employment rate	-0.232***	-0.212***	-0.095	-0.058	0.092	0.388***	**0.732*** **	0.456***	0.195**	0.027	-0.12	-0.217***	-0.247***
Unemployment rate	0.197**	0.140*	-0.019	-0.116	-0.272***	-0.527***	**-0.851*** **	-0.644***	-0.377***	-0.189**	0.048	0.182**	0.201**
Labor force participation rate	-0.174**	-0.202**	-0.174**	-0.227***	-0.152*	0.063	**0.308*** **	0.039	-0.114	-0.189**	-0.162**	-0.173**	-0.201**
Informality rate	-0.143*	-0.211***	-0.274***	-0.286***	-0.358***	-0.330***	-0.349***	**-0.360*** **	-0.350***	-0.093	-0.074	-0.108	-0.053
Salaried wage (median)	-0.102	-0.079	0.007	0.101	0.202**	**0.252*** **	0.224***	0.183**	0.095	0.059	0.081	0.135*	0.208**
Non-salaried labor income (median)	-0.017	-0.031	0.057	0.155*	0.176**	0.284***	0.440***	**0.578*** **	0.400***	0.272***	0.098	0.03	0.098

Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Dickey-Fuller tests for unit root presence

Table A2

	Test statistic	Dickey-Fuller critical value (at 1%)
Log. wage	-1.29	-4.02
Log wage (first difference)	-17.28	-4.02
Log. labor productivity	-1.65	-4.02
Log. labor productivity (first difference)	-15.59	-4.02
Log. CPI	-3.32	-4.02
Log CPI (first difference)	-8.26	-4.02
Log. consumer goods price index	-1.53	-4.02
Log. consumer goods price index (first difference)	-6.93	-4.02
Log. Exchange rate USD/COP	-1.58	-4.02
Log. Exchange rate USD/COP (first difference)	-7.91	-4.02

Trend included.

Johanssen test for cointegration relations

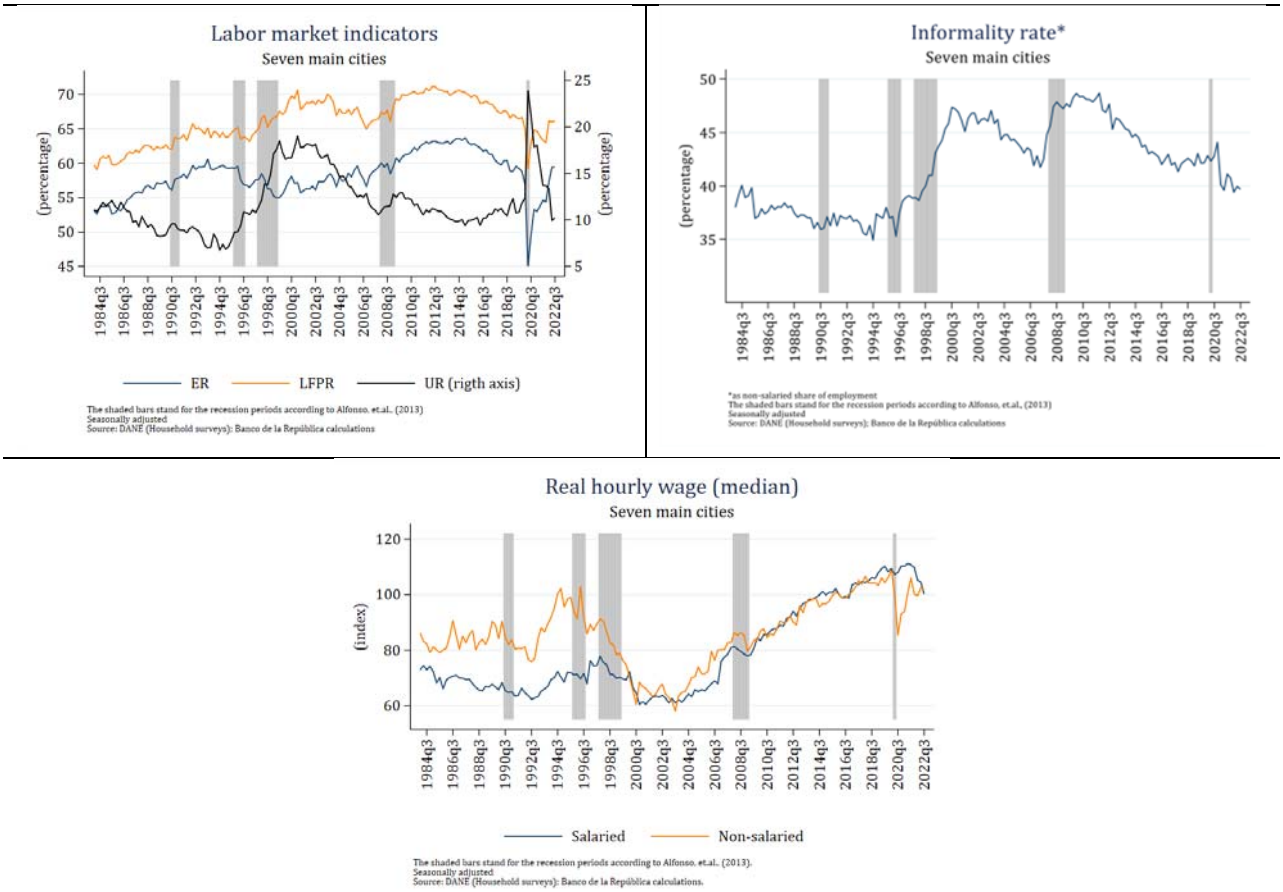
Table A3

Maximum Rank	Eigenvalue	Trace statistic	Critical value (5%)
0	.	76.5043	68.52
1	0.30461	43.4459*	47.21
2	0.23476	19.0974	29.68
3	0.10857	8.6389	15.41
4	0.08808	0.2488	3.76
5	0.00273	.	.

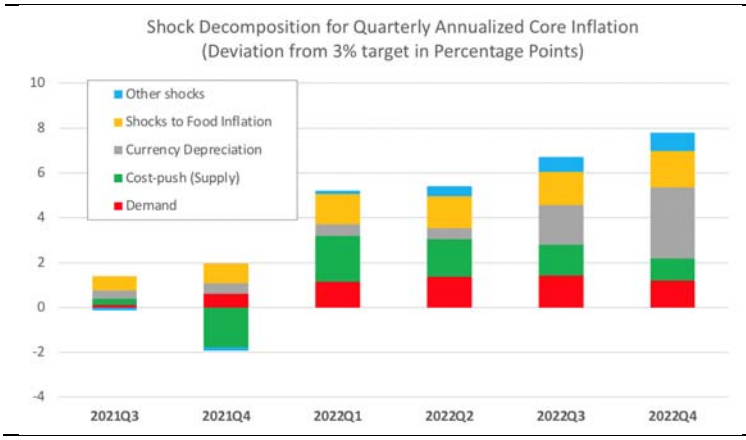
Number of lags in VAR: 4

2. Additional graphs

Graph A1



Graph A2


Shock Decomposition for Quarterly Annualized Core Inflation
(Deviation from 3% target in Percentage Points)
Other shocks
Shocks to Food Inflation
Currency Depreciation
Cost-push (Supply)
Demand
10
8
6
4
2
0
-2
-4
2021Q3
2021Q4
2022Q1
2022Q2
2022Q3
2022Q4

Appendix C: Effects of an increase in the Kaitz index in the earnings distribution

In this appendix we reproduce the methodology of Arango et al (2022) to assess the effects of changes in the Kaitz index (KI) on the distribution of earnings of salaried workers and self-employed workers with no higher education (as a proxy for informal workers), as displayed in Graph 14. Specifically, Graph 14 plots the estimated coefficients of a regression that quantifies how the quantiles of the earnings distribution of each group of interest, from the 10th to the 90th percentile, change due to increases in the KI of the city *c* where the person belongs. The method used is that of Firpo et al (2009), which allows for an estimation of the impact of changes in the distribution of the explanatory variable X on the distribution statistic $v(Y)$ of the outcome variable Y. In this case, the distribution statistic is the recentred influence function (RIF)[16] of the quantile τ of the logarithm of hourly labour income for each year t between 2008 and 2019. The estimated equation is thus:

$$RIF_{\tau}(y_{ict}) = \beta_{o,\tau} + \beta_{1,\tau}KI_{ct} + \beta_{2,\tau}KI_{ct-4} + X_{ict}B_{3,t} + Z_{ct}B_{4,t} + \partial_{c,\tau} + \partial_{t,\tau} + \varepsilon_{ijt,\tau} \qquad \text{(B1)}$$

where i represents an individual, X_{ict} contains usual individual characteristics, Z_{ct} contains city-level characteristics, and ∂_c and ∂_t are city- and time-fixed effects, respectively. The coefficients displayed in Graph 14 correspond to the sum of the estimated coefficients $\hat{\beta}_{1,\tau}$ and $\hat{\beta}_{2,\tau}$. For more details see Arango et al (2022).

[16] Influence functions measure the influence of a single observation on the statistics of a distribution (in this case the quantile τ). The recentred influence function is the statistic plus its influence function.