Market polarization and the Phillips curve

JAVIER ANDRÉS, ÓSCAR ARCE AND PABLO BURRIEL

Summary of Banco de España Working Paper no. 2106

The Phillips curve has flattened out over the last decades. We develop a model that rationalizes this phenomenon as a result of the observed increase in polarization in many industries, a process along which a few top firms gain an increasing share of their industry market. In the model, firms compete à la Bertrand and there is exit and endogenous market entry, as well as optimal up and downgrading of technology. Firms with larger market shares find optimal to dampen the response of their price changes, thus cushioning the shocks to their marginal costs through endogenous countercyclical markups. Thus, regardless of its causes (technology, competition, barriers to entry, etc.), the recent increase in polarization in many industries emerges in the model as the key factor in explaining the muted responses of inflation to movements in the output gap witnessed recently.

SUMMARY FOR THE APRIL RESEARCH UPDATE

In this paper we set up a model consistent with many of the features highlighted by the empirical industrial organization literature, to argue that these changes might be behind the muted response of inflation to shocks to the marginal costs that has been observed lately. The flattening of the Phillips curve that has taken place over the last twenty years poses a challenge for monetary authorities. On the other hand, the availability of large data sets containing firm level information on a number of relevant variables has uncovered a series of facts that speak of profound changes in the distribution of firms in many industries with repercussion in the response of macroeconomic variables to exogenous shocks.

The pattern of inflation rates across most advanced economies in recent years defies the traditional explanations based on the Phillips curve relation between inflation and the output gap. In spite of the implementation of an unprecedented set of non-conventional monetary policy measures after the global financial crisis (GFC), inflation and inflation expectations in most advanced economies remained chronically subdued even before the Covid-19 crisis. Some argue that this comes from afar and potentially well before the GFC (Blanchard, 2016). Prominent among the potential explanations for the weak reaction of prices to cyclical conditions are the decline of labor power, the rise of globalization and international trade, and the impact of positive supply shocks caused by new technologies.

These factors do not exhaust the list of possible causes behind the diminishing effect of cyclical fluctuations on prices. A related strand of literature is placing increasing attention on some ongoing significant changes in the industrial structure in advanced economies. These changes include, among others, the rise in market shares in many industries, industrial polarization along different dimensions (e.g. firm size, productivity, etc.), the rise in markups, intensification of competition spurred by technology and the decline of the labor share. In particular, the case for market concentration over the last decades has been forcefully established on empirical grounds (Covarrubias, Gutiérrez and Philippon, 2019). Yet, so far little consensus can be found about the likely effect of these factors on the inflation rate or, more precisely, on the link between inflation and the economic slack (Van Reenen, 2018). The importance of the new technological giants in shaping the way economies respond to shocks, the archetypal case being the disinflationary impact of Amazon, is in stark contrast with the long held view in mainstream macroeconomics, according to which market concentration has been considered a source of inflationary pressure.

Our model sheds light on the connection between the rise in market polarization (increase in market shares and widening gap in size and productivity across firms in the same industry) and the flattening of the Phillips curve. Contrary to the previous standard view, in our model the rise in market shares is neither inflationary nor deflationary per se, but it reduces the slope of the Phillips curve, which is consistent with the recent empirical literature (Del Negro, Lenza, Primiceri, and Tambalotti, 2020). In particular, the slope of the Phillips curve derived in conventional New

Keynesian DSGE models (regardless of whether price inertia is of the Calvo or the Rotemberg type) gets augmented in our model by a factor that decreases with the market share of the firm, as shown in equation (1).

$$\pi_t^s = \underbrace{\beta E_t \pi_{t+1}^s + \frac{\left(1-\theta_p^s\right)\left(1-\beta\theta_p^s\right)}{\theta_p^s} mc_t^s}_{\text{Standard NKPC}} + \underbrace{\frac{s^s\left(1-\theta_p^s\right)}{\left(1-s^s\right)\left(\varepsilon\left(1-s^s\right)-1\right)\theta_p^s}\left(s_t^s - \beta\theta_p^s E_t s_{t+1}^s\right)}_{\text{heterogeneity effect}} \quad (1)$$

where π_t^s, represents inflation of firms of size s, mc_t^s, their real marginal costs and s_t^s, their market share.[1]

Key to this result is the fact that markups depend positively on the firm's market share. The endogeneity of markups hinges critically on the joint effect of two core features of the industrial structure of the economy. We assume that firms have access to different TFP levels and choose among them optimally taking into account the costs of moving up or down in the technology ladder. Furthermore, as in Etro and Rossi (2015), Andrés and Burriel (2018), and, more recently, Wang and Werning (2020), we assume that firms compete à la Bertrand taking into account the expected reaction of other competitors when setting their prices. Thus, substituting for the endogenous market shares in equation (1) and solving, we get a Phillips Curve with the usual drivers of inflation, expected inflation and marginal costs, pre-multiplied by a factor smaller than 1, which depends on the firms' steady state market shares (s^s), as shown in equation (2).

$$\pi_t^s = \left(\frac{1+\theta_p^s\xi_N^s}{1+\xi_N^s}\right)\beta E_t\pi_{t+1}^s + \left(\frac{1}{1+\xi_N^s}\right)\frac{\left(1-\theta_p^s\right)\left(1-\beta\theta_p^s\right)}{\theta_p^s} mc_t^s \quad (2)$$

where $\xi_N^s = \frac{s^s\left(\varepsilon-1\right)}{\left(1-s^s\right)\left(\varepsilon\left(1-s^s\right)-1\right)} > 0, \frac{\partial\xi_N^s}{\partial s^s} > 0.$

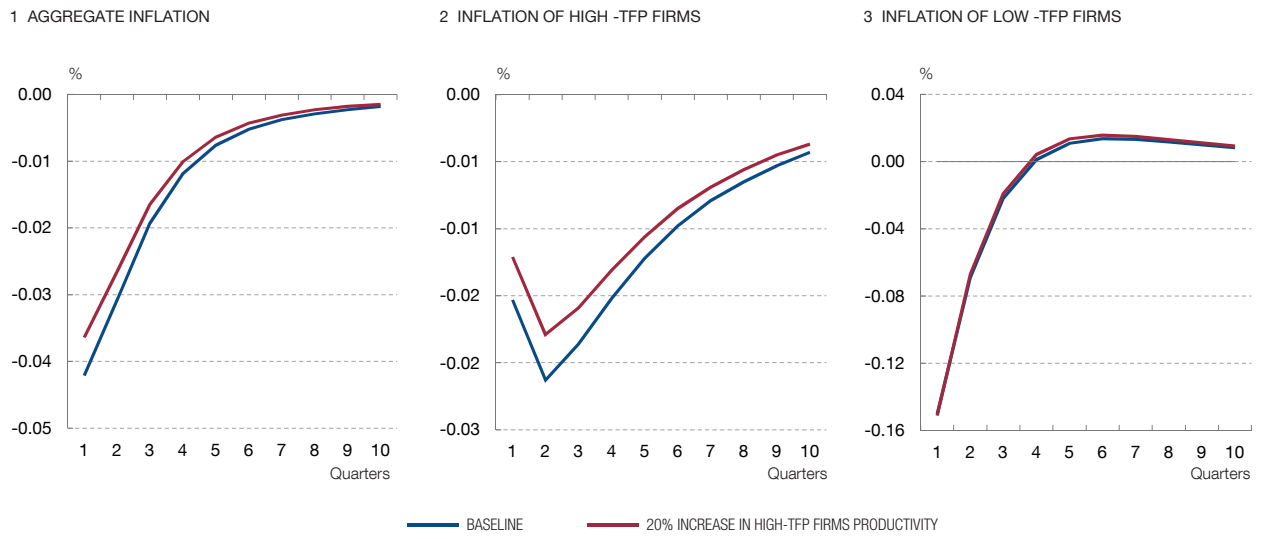
Therefore, when a firm faces a positive shock to its marginal cost it raises prices, which in turn undermines its market share and hence its desired markup; this dampens the inflationary effect of the shock. The strength of this effect increases with the firm's market share. Hence, in an economy featuring highly polarized industrial structures, with a few large and many small competitors in each industry, much in line with the aforementioned recent evidence, the response of inflation to shocks becomes more muted than it would be in a similar economy with a more balanced distribution of firms. In our simulations, small variations in the drivers of market concentration deliver significant changes in the slope of the Phillips curve. While strategic price interactions barely affect the markup of smallish firms, they do condition the desired markup of large firms in a material manner (Amiti, Itskhoki, and Konings, 2019). This moderates the response of prices set by the latter to shocks, which in turn (upon aggregation) exerts a significant dampening effect on the volatility of aggregate inflation. In fact, in the chart below we show how a 20% increase in the productivity of larger firms, which increases their market share, reduces the response of their inflation to a negative TFP shock significantly (by 28%), while the response of smaller firms to the same TFP shock remains unaltered. As a consequence, the response of aggregate inflation is also more moderate (by 26%). A similar result is obtained after an increase in the degree of competition as measured by the elasticity of demand. Moreover, these findings are also found for other standard shocks, like an increase in policy rates, or negative preference or labour supply shocks.

To further assess the relevance of the mechanism analyzed in the paper, we investigate the medium term response of the industrial structure to increases in technological divergences, the elasticity of substitution among goods and barriers to entry, three factors that Covarrubias, Gutiérrez and Philippon (2019) identify as the main drivers of market concentration in recent decades. The model predictions are consistent with the main facts reported by

1 In the model size and productivity level are interchangeable. The parameter $1-\theta_p^s$ represents the share of firms that are allowed to change their prices every period according to the Calvo price-setting mechanism, β is the discount factor and ε the elasticity of substitution between intermediate goods.

Chart 1

IMPULSE RESPONSE OF INFLATION AFTER AN INCREASE IN TFP UNDER DIFFERENT PRODUCTIVITY SCENARIOS



a The variables are presented as percentage differences with respect to the steady state.

the empirical literature: (1) Sustained increase in concentration in most industries (Bajgar, Berlingieri, Calligaris, Criscuolo, and Timmis, 2019); (2) concentration in employment but less intense than in sales (Autor, Dorn, Katz, Patterson, and Van Reenen, 2019); (3) increase in polarization along other dimensions like productivity (Berlingueri, Blanchenay and Criscuolo (2017); (4) sustained increase of markups, mostly at the top of the markup distribution (De Loecker, Eeckhout, and Unger (2020); (5) steady decline in firm entry in most industries (Akcigit and Ates, 2019); (6) generalized fall in investment rates in many advanced economies (Eggertsson, Robbins, and Wold (2018); and (7) decline in the labor share accompanied by a fall in capital share in most industries too (Barkai, 2019).

REFERENCES

Akcigit, U, and S T Ates (2019), "Ten Facts on Declining Business Dynamism and Lessons from Endogenous Growth Theory," NBER Working Paper 25755.

Amiti, M., O. Itskhoki, and J. Konings, 2019: "International Shocks, Variable Markups, and Domestic Prices," The Review of Economic Studies, 02.

Andrés, J. and P. Burriel, 2018): "Inflation and optimal monetary policy in a model with firm heterogeneity and Bertrand competition". European Economic Review, 103, 2018, Pages 18-38

Autor, D., D. Dorn, L. Katz, C. Patterson, and J. Van Reenen (2019): "The Fall of the Labor Share and the Rise of Superstar Firms", Quarterly Journal of Economics (forthcoming)

Bajgar, M., G. Berlingieri, S.Calligaris, C. Criscuolo, and J. Timmis (2019): "Industry Concentration in Europe and North America," CEP Discussion Papers dp1654, Centre for Economic Performance, LSE.

Barkai, S. 2019: "Declining labor and capital shares", Journal of Finance (forthcoming)

Blanchard, O. (2016): "The US Phillips Curve: Back to the 60s?", American Economic Review: Papers & Proceedings 106(5): 31--34.

Covarrubias, M., G. Gutiérrez and T. Philippon (2019): "From Good to Bad Concentration? U.S. Industries Over the Past 30 Years", NBER, Working Paper 25983.

De Loecker, J., J. Eeckhout, G. Unger, 2020. "The Rise of Market Power and the Macroeconomic Implications", Quarterly Journal of Economics 135(2), 2020, 561-644.

Del Negro, M., M. Lenza, G. E. Primiceri, and A. Tambalotti (2020): "What's up with the Phillips Curve?," NBER Working Papers 27003

Eggertsson, G., J. Robbins, and E. Wold, 2018: "Kaldor and Piketty's Facts: The Rise of Monopoly Power in the United States", NBER Working Paper No. 24287

Etro, F. and L. Rossi, 2015. "New-Keynesian Phillips curve with Bertrand competition and endogenous entry", Journal of Economic Dynamics & Control, vol. 51(3), pp. 318--340.

Van Reenen, J., 2018. "Increasing Differences Between Firms: Market Power and the Macro-Economy," CEP Discussion Papers DP1576, Centre for Economic Performance, LSE.

Wang, O. and I. Werning, 2020. "Dynamic Oligopoly and Price Stickiness," NBER Working Papers 27536, National Bureau of Economic Research, Inc.