Research Statement

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Economies are populated by vastly heterogeneous firms whose individual decisions not only shape their own growth prospects but also those of the entire economy. Understanding how firm-level decisions depend not only on firms' fundamental characteristics, but also on the economic context in which these decisions are made, is key for the design of welfare-promoting policies. My research agenda aims to understand the endogenous mechanisms that bind together firm behavior and macroeconomic dynamics, with the goal of quantifying the impact that firms' decisions may have on aggregate welfare. The ultimate goal of my research is to provide guidance for the design of industrial policies that are based on microeconomic-level incentives and that promote long-run growth and welfare.

My work spans a number of topics, which can be loosely grouped into three areas: (i) Firm Growth and Intangibles; (ii) Market Structure and Intangibles; and (iii) Other Topics related to firms. The common research approach across these areas is the use of quantitative macroeconomic models that put an emphasis on firm heterogeneity at the microeconomic level and have quantitative implications at the macroeconomic level. To complement this quantitative work, I also make extensive use of microdata, allowing me to document empirical regularities that can both motivate the assumptions of the theory as well as serve as a meaningful benchmark for policy counterfactuals.

1 Firm Growth and Intangibles

Beside making choices on physical capital and labor, firms routinely make decisions on *intangible assets*, namely capital that is not physical in nature but that can nevertheless significantly affect firm profitability. Notable examples that feature heavily in my work are research and development (R&D), advertising and customer capital.

In this area, I argue that intangibles may critically impact firms' future growth prospects and, consequently, have implications for aggregate dynamics and welfare. In a series of papers, I study what motivates firms to make use of such intangibles, how these may interact both within and across firms, and the implications for industry and aggregate dynamics.

In **"Firm Dynamics and Pricing under Customer Capital Accumulation"** (Journal of Monetary Economics, 2021), joint work with Sonia Gilbukh (CUNY Baruch College), we study how the pricing behavior of firms influences macroeconomic dynamics when businesses need to build up their stock of demand through the accumulation of customers. Motivated by the well-established empirical observation that idiosyncratic demand components are key to understanding heterogeneity in firm growth, the paper develops an equilibrium search-and-matching model in which firms of different sizes and productivities post prices in a frictional product market in order to attract new potential buyers. In this context, demand accumulation becomes an important source of firm growth and, at the

same time, has relevant implications for the aggregate dynamics of markups. Using highly granular pricing scanner data from the U.S. retail sector to estimate the model, we quantitatively assess the macroeconomic implications of customer capital accumulation for the markup response to aggregate demand shocks. Our emphasis is on how heterogeneity among firms shapes these results: while the average markup responds procyclically to the aggregate demand shock, there is a large degree of cross-sectional heterogeneity in its dynamics, with smaller firms contributing a disproportionate amount to the overall response.

In this paper, demand-driven firm growth is the result of price-setting strategies. A different view may suggest, instead, that demand accumulation occurs through non-pecuniary instruments. To explore this alternative channel, in **"Advertising, Innovation and Economic Growth"** (American Economic Journal: Macroeconomics, 2021), joint work with Laurent Cavenaile (University of Toronto, Rotman), we study the interaction between innovation and advertising, two key intangibles that each make up for, on average, around 2.5% of U.S. GDP every year. While innovation introduces goods of higher quality into the economy and raises standards of living over time, advertising is used by firms to bring those products into the market and raise their perceived quality among the public without directly impacting technology. Yet, as we argue, advertising affects economic growth and welfare indirectly as it inexorably interacts with R&D at the firm level. In particular, through spillover effects across the different products of a firm, raising advertising expenditures on a single product increases the sales of other products within the same brand (a phenomenon known as "umbrella branding" for which there is ample evidence in the data). Crucially, however, this spillover effect vanishes as the product portfolio of a firm increases in size. Therefore, larger firms face lower incentives to introduce new products as the marginal gain from advertising them becomes ever smaller. Building this mechanism into an endogenous growth model with multi-product firms, we are able to rationalize empirically observed deviations from constant firm growth (Gibrat's law) and constant R&D intensity across innovative firms of different sizes. Moreover, using a difference-in-difference approach that exploits the staggered introduction of R&D credits to firms in the United States across time and space, we uncover that R&D and advertising expenditures are substitutable at the firm level, a relationship that our calibrated model is able to replicate. In light of these results, we find that a tax on advertising would induce innovation and promote growth, and therefore be desirable from a social welfare perspective.

2 Market Structure and Intangibles

The papers described above emphasize the potential role that intangibles may have on economic aggregates via their effects on firm growth. Over and above these effects, intangibles can also impact welfare through their effect on the competitive structure in which firms operate.

In **"Style Over Substance? Advertising, Innovation, and Endogenous Market Structure"** (working paper), joint work with Laurent Cavenaile, Murat Alp Celik (University of Toronto) and Xu Tian (University of Georgia, Terry), we study how the interaction between intangibles shapes markups, competition, and misallocation. To study this question, we build an endogenous growth

model with an endogenous oligopolistic structure within each industry. Within each industry, an endogenously determined number of firms compete in output, advertising and R&D decisions. In this set-up, intangibles are used strategically by firms to increase their market share and profits, and both have static and dynamic effects on allocative efficiency. In the context of the calibrated model, we find that prohibiting advertising would increase innovation and economic growth (via a substitution effect with R&D that is reminiscent of our previous work in this area), making markups decrease and competition improve. However, counteracting these effects, some resources would be reallocated away from the most productive firms, causing a fall in output and overshadowing the positive effects of the advertising ban. In short, advertising ameliorates static efficiency losses from input misallocation, and this positive force for welfare quantitatively dominates dynamic losses coming from depressed innovation incentives, weaker competition and higher markups. Yet, we find that the optimal advertising tax is positive and indeed quite high. The reason is that a tax on advertising increases dynamic efficiency by diverting resources toward innovation, with limited adverse effects on static efficiency and large gains in revenue, thereby reducing excessive spending on wasteful advertising.

The approaches to modeling advertising described thus far take the view that advertising improves the perceived quality of already known products. An alternative role of advertising is to make consumers aware of the existence of those products. This is the view we adopt in **"A Theory of Dynamic Product Awareness and Targeted Advertising"** (revise and resubmit at the Journal of Political Economy), joint work with Laurent Cavenaile, Murat Alp Celik and Jesse Perla (University of British Columbia). In this paper, we explore the consequences for consumer sorting, competition and misallocation of technological changes in advertising. Particularly, the advent of targeted advertising (e.g. digital marketing) has enabled firms to better target those consumers most likely to buy their products. While more efficient than traditional methods, targeting may limit product market competition and raise markups. To discern the net effects on welfare, the paper develops a new framework of demand as a network, where heterogenous consumers dynamically become "aware" of differentiated products, expanding their choice sets and improving on their possible matches thanks to advertising. As networks become denser, customer misallocation decreases due to better sorting. However, though more intensive targeting can efficiently sort with fewer network connections, it also increases market power by segmenting consumers. In an application to the case of the United States, we find that the rise in digital advertising led to substantially better consumer-firm matches. However, if the targeting technology had not improved during this period, markups would have been lower and welfare higher despite worse sorting. These results suggest that policy-makers should consider the role of digital advertising on market power beyond the usual privacy concerns.

Another way in which intangibles and market structure can interact is in the context of the acquisitions of firms. In **"The Effects of Startup Acquisitions on Innovation and Economic Growth"** (CEPR Discussion Paper 17752), joint work with Christian Fons-Rosen (UC Merced) and Tom Schmitz (Queen Mary University of London), we study the implications of the acquisition of innovative startups by large incumbents for aggregate innovation and economic growth. Startup acquisitions have ambiguous effects on innovation and growth. On the one hand, the acquisition of

nascent firms by established corporations may stimulate startup creation, as acquisitions are a profitable exit strategy for many entrepreneurs. Moreover, acquisitions may allow the transfer of new ideas to more efficient users, and therefore increase the probability that startups' ideas end up being implemented. However, acquisitions may also have adverse effects of innovation. First, incumbents may acquire startups and subsequently shelve their ideas, driven simply by an incentive to eliminate new potentially threatening competitors (so-called "killer acquisitions"). In addition, acquisitions may provide a cheap substitute to innovation for protecting incumbents against entry, which may erode incumbents' own innovation incentives and in turn economic growth. To evaluate the relative strength of these various conflicting forces, we write an endogenous growth model with heterogeneous firms and acquisitions that incorporates all of the various forces described above. We calibrate the parameters of the model by matching micro-level evidence on startup acquisitions and patenting, specifically the causal impact of acquisitions on the citation count of startup patents (our proxy for idea implementation). We then study the effect of acquisitions on economic growth by decomposing it into changes in three components: (i) the startup rate; (ii) the percentage of startup ideas that are implemented; and (iii) the own innovation rate of incumbents. In our calibrated model, more frequent acquisitions lead to a rise in the startup rate, but also to a decrease in incumbents' own innovation efforts as well as to a decline in the percentage of startup ideas that are implemented. The net effect of these combined forces from increasing the frequency of acquisitions is a reduction in the growth rate of the economy. For example, we find that a complete ban on startup acquisitions would increase growth by 0.03 percentage points a year, and consumption-equivalent welfare by 1.7%.

Finally, in **"International Trade and Innovation Dynamics with Endogenous Markups"** (The Economic Journal, 2023), joint work with Laurent Cavenaile and Tom Schmitz, we shift our focus to international markets. In this paper, we take the view that the leading positions of global firms are critically intertwined with their innovation incentives. Particularly, we argue for the existence of an "innovation feedback" channel that operates against the traditional pro-competitive effects of trade. When trade costs decline, large firms increase their innovation efforts in order to seize larger export markets. The winners of the ensuing innovation races expand their technology gap against both their local and international competitors, enabling them to charge higher markups. To investigate the quantitative relevance of this feedback channel, we build a symmetric two-country model in which local and global competitors compete in prices and in R&D for market dominance. When calibrated to the U.S economy for two trade-cost regimes (loosely corresponding to the 1980s and present-day U.S.), we find that the increase in trade openness between these two time periods led to an increase in the aggregate markup by 3.5 percentage points. Without the innovation response, however, markups would have fallen by 4 percentage points.

3 Other Topics Related to Firms

The remainder of my research revolves around firm-level decisions as well, though not specifically related to intangibles: (i) the impact of dual labor markets for firm dynamics, productivity and

unemployment, and (ii) the analysis of price-setting behavior using micro-pricing data.

3.1 Dual labor markets

In **"Dual Labor Markets and the Equilibrium Distribution of Firms"** (CEPR Discussion Paper 17762), joint work with Josep Pijoan-Mas (CEMFI), we study the effects of dual labor markets, i.e. labor markets in which open-ended (OE) and fixed-term (FT) contracts co-exist, on firm dynamics, the firm size distribution, aggregate productivity and unemployment. Using rich administrative firm-level data for Spain, we find that (i) most variation in the temporary share within the firm (the ratio of the number of workers with an FT contract to the total number of workers) is explained by firm-specific factors, with (ii) the temporary share increasing (resp. decreasing) in firm size when looking at within-firm (resp. between-firm) variation. Motivated by this fact, we write a search-and-matching model in which multi-worker firms with different ex-ante permanent productivity types and operating under decreasing returns to scale offer and commit to dynamic long-term FT and OE contracts. Workers are ex-ante identical, but ex-post differ in the contract they obtain and in (firm-specific) human capital. Crucially, OE contracts are needed to ensure within-firm human capital accumulation. As more productive permanent firm types have higher demand for human capital, this generates a negative *between-firm* correlation between size and the temporary share, in line with the data. However, firms also face a trade-off between the lower costs of attracting workers to FT contracts and the higher turnover of FT vacancies. With decreasing returns to scale, the opportunity cost of unfilled vacancies is lower for larger firms, so these firms prefer to have a higher fraction of their workers employed in a temporary contract. This generates the positive *within-firm* correlation between firm size and the temporary share seen in the data. After calibrating the model to these empirical regularities, we explore policy counterfactuals in which we limit the duration of FT contracts. We find that this policy is successful in decreasing the share of temporary employment and increasing the aggregate productivity of the economy, but at the expense of a higher unemployment rate. Unemployment goes up because employment-to-unemployment rates increase sharply as a result of the policy, especially among FT workers, and unemployment-to-employment rates decline as individuals that were previously employed under a FT contract struggle to find reemployment. Productivity increases particularly due to an increase in the number of firms per worker and a better selection of incumbent firms. This effect dominates in spite of there being negative reallocation effects, both between firms in the productivity space as well as due to the allocation of skills within the firm.

3.2 Empirical evidence on price setting behavior

I have two empirical papers that explore firm-level price setting decisions. **"New Facts on Consumer Price Rigidity in the Euro Area"** (conditionally accepted at the American Economic Journal: Macroeconomics), joint work with a number of authors from various national central banks in the Eurosystem, establishes new micro-pricing facts for the 2010-2019 period and 11 Euro Area countries using a large new dataset, the result of a collective effort that has involved economists from various Central Banks in the Eurosystem. The data contains micro pricing data (the same that is used

for calculating the Consumer Price Index) covering about 60% of the euro area consumption basket, and comprising some 135 million observations in total, by far the most comprehensive and up-to-date existing dataset yet on micro-level prices in Europe. Using these data, our main findings are: (i) prices are more rigid in Europe than in the United States, especially when including price changes due to sales; (ii) differences in price rigidity are more pronounced across sectors than between countries; (iii) the distribution of price changes is highly dispersed; and (iv) the overall frequency of price changes does not change much with inflation and does not react much to aggregate shocks. Moreover, we find that changes in inflation are mostly driven by movements in the overall size of price changes, but not by the frequency with which prices change, lending support to the predictions of a menu cost model in a low inflation environment where idiosyncratic shocks are a more relevant driver of price adjustment than aggregate shocks.

Finally, in **"Markups and Cost Structure: Small Spanish Firms during the Great Recession"** (Journal of Economic Behavior & Organization, 2021), joint work with Pilar Garcia-Perea and Aitor Lacuesta (both at Banco de España), we document empirically the behavior of markups in the Spanish economy for the period 2007-2014. Unlike previous firm-level balance-sheet datasets used for similar purposes, we have data on the cost structure of firms, and we are able to estimate markups against different variable inputs in the firm's balance sheet. This exercise uncovers interesting new patterns: the dynamics of markups in Spain during the Great Recession were driven by small and unproductive firms following an increase in their average costs due to a high and increasing share of fixed costs, especially overhead labor expenses. For smaller firms, fixed inputs (such as quasi-fixed operating expenses and labour costs from workers with open-ended contracts) represent a higher share of their total sales. Moreover, smaller firms experience stronger procyclical variation in their variable input use. Therefore, when estimating markups against such variable inputs (materials, in our baseline estimation), smaller firms appear to charge higher markups. All in all, our findings suggest that understanding the allocation of expenditures between variable and fixed inputs is key to understand how price markups respond to aggregate shocks.

List of Research Papers

Peer-reviewed publications

(1) *Firm Dynamics and Pricing under Customer Capital Accumulation*, with S. Gilbukh. **Journal of Monetary Economics**, 118, 99-119, March 2021.

(2) *Advertising, Innovation and Economic Growth*, with L. Cavenaile. **American Economic Journal: Macroeconomics**, 13 (3), 251-303, July 2021.

(3) *Markups and Cost Structure: Small Spanish Firms during the Great Recession*, with P. Garcia-Perea and A. Lacuesta. **Journal of Economic Behavior & Organization**, 192, 137-158, December 2021.

(4) *International Trade and Innovation Dynamics with Endogenous Markups*, with L. Cavenaile and T. Schmitz. **The Economic Journal**, 133 (651), 971-1004, April 2023.

(5) *New Facts on Consumer Price Rigidity in the Euro Area*, with E. Gautier, C. Conflitti, R. P. Faber, B. Fabo, L. Fadejeva, V. Jouvanceau, J.-O. Menz, T. Messner, P. Petroulas, F. Rumler, S. Santoro, E. Wieland and H. Zimmer. **American Economic Journal: Macroeconomics**, conditionally accepted.

Working papers

(6) *Dual Labor Markets and the Equilibrium Distribution of Firms*, with J. Pijoan-Mas. **CEPR Discussion Paper 17762**.

(7) *The Effects of Startup Acquisitions on Innovation and Economic Growth*, with C. Fons-Rosen and T. Schmitz. **CEPR Discussion Paper 17752**.

(8) *Style Over Substance? Advertising, Innovation, and Endogenous Market Structure*, with L. Cavenaile, M. Celik and X. Tian.

(9) *A Theory of Dynamic Product Awareness and Targeted Advertising*, with L. Cavenaile, M. Celik and J. Perla. **Journal of Political Economy**, revise and resubmit.