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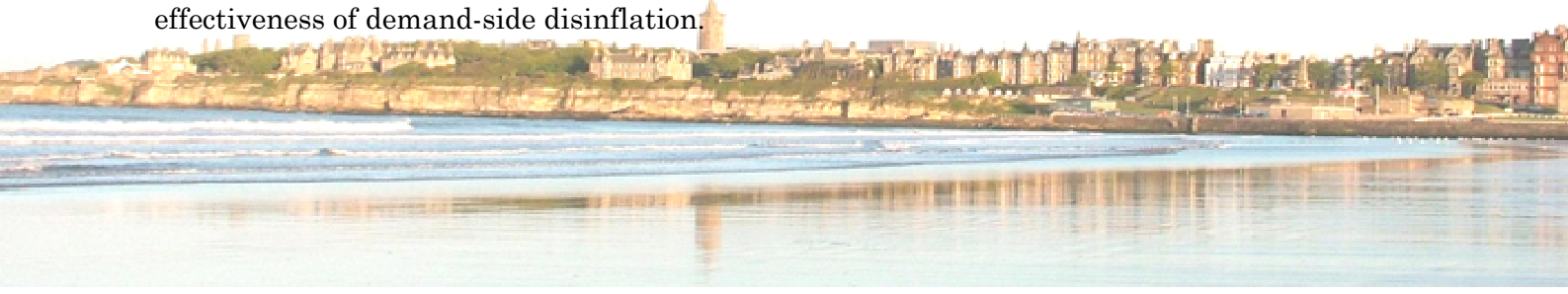
Cyclical Sensitivity of Firm Sales: The Role of Financial and Structural Frictions

By *Oguzhan Cepni, Mehmet Selman Colak, Abdullah Kazdal, Selcuk Gul, Muhammed Hasan Yılmaz*

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Abstract

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JEL classification: E32; E51; D22; G32; L11

Keywords: Output gap, firm sales, financial frictions, market power, business cycle transmission

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1 Introduction

How do the sales of individual firms respond to the business cycle, and why are some more exposed than others? Cyclical conditions reach the real economy through the revenues of heterogeneous firms, whose financial circumstances and competitive positions influence their capacity to adjust. Sales provide a timely measure of operating performance and connect demand conditions to firms' decisions about production, employment and investment. Understanding differences in sales sensitivity therefore matters for assessing how changes in economic conditions are distributed across firms and which characteristics are associated with greater resilience during downturns.

The first strand of related literature examines financial heterogeneity and firm cyclicality. Financial-accelerator models emphasize how balance sheets and borrowing capacity amplify aggregate fluctuations (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Bernanke et al., 1999). Gertler and Gilchrist (1994) document disproportionate adjustment among small manufacturing firms after monetary tightening, while Kashyap et al. (1994) connect inventory adjustment to credit conditions. Evidence on financing constraints and credit market disruptions extends this discussion to investment and employment (Campello et al., 2010; Chodorow-Reich, 2014). The relationship between firm characteristics and cyclical exposure is nevertheless nuanced. Crouzet and Mehrotra (2020) directly examine sales cyclicality and find that the largest firms are less sensitive to the cycle, with the differences largely unrelated to proxies for financial strength. In the investment literature, Ottonello and Winberry (2020) find greater monetary-policy sensitivity among firms with low default risk, whereas Cloyne et al. (2023) document stronger responses among younger firms that do not pay dividends, operating through collateral and borrowing. These findings motivate examining observed financing behaviour alongside firm size. Our analysis brings linked quarterly sales and loan records to this question, distinguishing credit users from non-users and examining borrowing amounts among users, together with variation in the credit-user relationship across size categories.

A second strand examines markups, price setting and cyclical adjustment. Research on the comovement of prices, marginal costs and activity highlights the importance of

markup behaviour over the cycle (Bils, 1987; Rotemberg and Woodford, 1999; Nekarda and Ramey, 2020). Models of variable markups connect market structure to pricing responses (Atkeson and Burstein, 2008), while firm-level markup estimates and pricing evidence document heterogeneity across producers (De Loecker and Warzynski, 2012; Amiti et al., 2019). More recently, Burstein et al. (2025) examine how markups comove with output at the firm, sectoral and aggregate levels, combining an oligopolistic model with French administrative data. Research linking financial conditions to pricing decisions further connects the financing and product-market dimensions of adjustment (Chevalier and Scharfstein, 1996; Gilchrist et al., 2017). The present paper complements this literature by asking how the sensitivity of sales to sectoral cyclical conditions varies with firms' preceding-quarter gross price-cost margins. We examine this relationship across firm sizes and cyclical regimes, alongside the heterogeneity associated with observed credit utilization. This focus places the financing and pricing characteristics of firms within a common empirical setting for studying differences in sales exposure.

We study these relationships in Turkish manufacturing using a quarterly panel of approximately 182,000 firms over 2009–2023, comprising roughly 5.7 million firm-quarter observations. Linking administrative income statements, annual financial statements and loan-level credit records provides extensive coverage of micro and small firms alongside larger producers. Cyclical conditions are measured by output gaps constructed from sectoral capacity utilization rates and, alternatively, industrial production. The baseline uses the regression filter of Hamilton (2018). Firm and year by quarter fixed effects absorb permanent firm heterogeneity and aggregate movements common to manufacturing, so the estimates draw on differences in the timing and amplitude of the cycle across sectors. The combination of broad coverage and detailed financing information allows us to examine borrowing participation, borrowing amounts and pricing margins in the same institutional setting.

Four findings emerge. First, firm sales are positively and significantly associated with the sectoral output gap. This relationship holds across twelve gap measures combining two activity indicators with six detrending procedures, and survives an extensive set of

checks on the fixed-effects structure, sample composition, treatment of zero sales and weighting.

Second, firms observed drawing credit during the sample display weaker sales sensitivity than non-users. Among borrowers, larger amounts drawn in the preceding quarter are also associated with lower sensitivity. The credit-user relationship is clearest among small and medium-sized firms, while the estimates for micro and large firms provide no clear evidence of comparable attenuation. The pattern is consistent with borrowing providing a buffer that helps firms sustain working capital and operations when receipts weaken.

Third, firms with higher preceding-quarter gross price-cost margins exhibit lower cyclical sensitivity. This relationship is present across micro, small, medium and large firms, indicating that heterogeneity associated with pricing margins extends throughout the size distribution. The result is consistent with firms having greater scope to absorb demand fluctuations through adjustments in their margins.

Fourth, the estimated sensitivity of sales is substantially greater in episodes with negative sectoral output gaps than in those with positive gaps. Both credit and markup interactions remain negative in each regime. These estimates indicate that average cyclical relationships conceal a larger underlying exposure during downturns, when the ability to sustain sales is particularly relevant.

The paper makes three contributions. First, it adds evidence on firm sales cyclicality from a broad administrative panel in an emerging economy, with linked loan records that allow observed credit utilization to be examined alongside firm size. Second, it studies financing and pricing characteristics within a common empirical framework, documenting how each relates to differences in sales sensitivity. Third, it documents size heterogeneity and examines whether the relationships persist in both positive and negative output gap episodes. Together, these contributions connect detailed information on firms' borrowing and pricing margins to the distribution of cyclical adjustment.

The findings also bear on policy. Differences in borrowing relationships and pricing margins can influence how the real adjustment associated with demand-side disinflation

is distributed across firms. Monitoring these characteristics alongside sales and aggregate measures of slack can help identify groups facing greater adjustment pressures and inform assessments of cyclical transmission.

The remainder of the paper is organized as follows. Section 2 describes the data and sample construction. Section 3 sets out the empirical framework. Section 4 presents the baseline estimates, robustness checks, heterogeneity analyses and asymmetric effects. Section 5 concludes.

2 Data

The analysis draws on four administrative sources covering the near-universe of Turkish manufacturing firms over the period 2009–2023. Quarterly sales and the components of the markup measure come from corporate income statements filed with the Revenue Administration (accessed via CBRT), balance sheet characteristics from the annual financial statements filed with the same authority, credit variables from the loan-level Credit Registry, and the sectoral output gap from survey-based capacity utilization rates collected by the CBRT.

We obtain quarterly sales figures from the income statements that firms submit as part of the prepaid corporate tax declaration. Given that filings are cumulative within the calendar year, we recover quarterly flows by first-differencing within each firm-year and treating the first-quarter filing as the flow for that quarter.[1] A small number of filings report negative sales, which arise when returns and corrections exceed gross receipts within the quarter; we set these to zero. Moreover, positive values are capped at the ninety-ninth percentile to limit the influence of the upper tail, and nominal figures are deflated by the producer price index collected from Turkish Statistical Institute (TurkStat) for the firm's NACE two-digit sector.

The baseline measure of cyclical conditions is a sectoral output gap constructed from capacity utilization rates, which the CBRT collects monthly through its Business Ten-

[1]Firm-years whose first observed filing falls after the opening quarter yield no recoverable flow for that filing, since the reported figure already aggregates unobserved earlier quarters, and we drop those observations rather than treat a partial-year cumulative figure as a quarterly one.

dency Survey and reports separately for each NACE two-digit manufacturing sector. Capacity utilization recommends itself over industrial production on two grounds. It is expressed relative to installed capacity, so its level carries information about slack without further normalization, and as a survey measure it is not subject to subsequent revision. We extract the cyclical component using the regression filter of Hamilton (2018), which projects the current value of a series on its own lags at a fixed horizon and treats the residual as the gap. The resulting series are standardized within each sector, so that a unit change corresponds to a one-standard-deviation movement in that sector's own cyclical position.[2] We construct eleven further gap series by pairing a second input, the industrial production index, with several additional detrending procedures, and report estimates from all alternative measures in Section 4.

We retrieve balance sheet controls from the annual financial statements filed with the Revenue Administration. Total assets, current assets and equity yield the logarithm of assets, the leverage ratio and the cash ratio, where leverage is total liabilities over total assets with liabilities computed as assets net of equity. Since these items are reported annually, each firm-year value is carried across the four quarters of that year. The same source records the official KOSGEB size classification, which assigns firms to micro, small, medium and large categories and which we use to split the sample when examining how the moderating effects vary with firm size.

Regarding our first moderating variable, credit indicators are built from the loan-level registry maintained by the Banking Regulation and Supervision Agency (BRSA), which records every loan extended by a supervised institution. We restrict attention to cash loans to non-financial firms, dropping consumer lending, factoring, financial leasing, letters of credit and letters of guarantee. Non-performing loans are excluded, as are records with a missing borrower identifier, a non-positive principal or a non-positive interest rate. The registry reports outstanding balances, but the object of interest here is new borrowing rather than the accumulated stock, so we retain only those loans whose opening date falls in the month of observation. Loans are classified as lira or foreign currency according to

[2] Section 3 sets out the standardization in full.

the currency of denomination and the indexation flag, aggregated to the firm-month level, and summed within the quarter. [3]

In terms of the construction of second moderating variable (firm markup), the required inputs such as net sales, the cost of goods sold and operating expenses are reported in the same quarterly income statements as total sales, again obtained from Revenue Administration. Our preferred markup measure used throughout the analysis is the gross price-cost margin computed as net sales less the cost of goods sold, scaled by net sales. Firm-quarters with non-positive net sales are dropped, since the ratio is undefined or uninterpretable in those cases, and values above unity are treated as reporting errors and set to missing. The measure is winsorized at the first and ninety-ninth percentiles.

The four sources share a common masked tax identifier, which allows an exact firm-level match. We merge the quarterly sales panel with the sectoral gap series on the sector-quarter pair, and with the markup, credit and balance sheet variables on the firm-quarter pair. The sample is restricted to manufacturing firms in NACE two-digit sector codes 10–33, which yields 24 sectors, and to the period 2009–2023. We retain firms observed for at least twelve quarters so that the within-firm variation used for identification is not drawn from very short spells; the results are reported for stricter thresholds in Section 4. Table 1 lists each variable, its construction and its source.

These steps leave an estimation sample of approximately 5.7 million firm-quarter observations on roughly 182,000 firms. Figure 1 plots the cross-sectional distribution of the standardized gap across sectors over the sample period. The dispersion is wide throughout and does not collapse in any period, which is the variation the fixed effects specification exploits: at any point in the sample some manufacturing sectors operate above their own cyclical average while others operate below it.

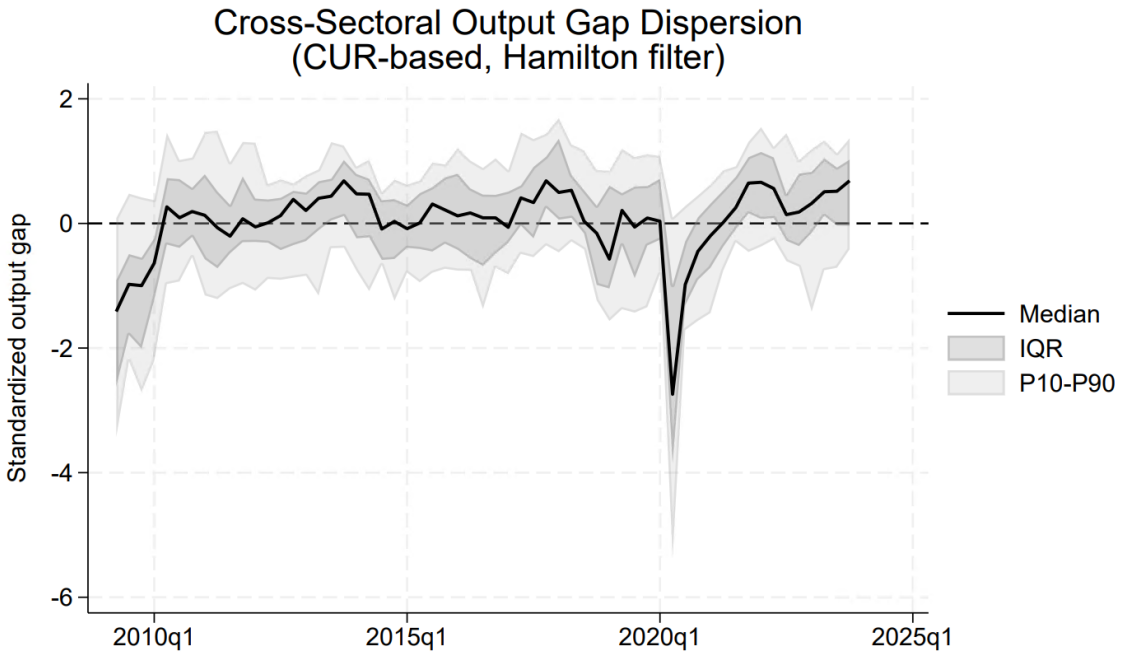
[3] Firms with no credit relationship in a given month do not appear in the registry at all. After merging with the sales-panel we therefore assign a value of zero to firm-quarters that appear in the sales data but not in the credit data, since these represent an absence of borrowing rather than a missing record.

Table 1: Variable Definitions and Data Sources

Variable	(1) Definition	(2) Source
Panel A: Dependent Variable		
Sales	Inverse hyperbolic sine of real quarterly sales, obtained by converting year-to-date figures to quarterly flows and deflating by the sector-level producer price index.	Revenue Administration
Panel B: Explanatory Variable of Interest		
Output Gap	Sectoral output gap constructed by applying the Hamilton filter to sector-level capacity utilization rates and standardizing within each NACE two-digit sector. Denoted $\text{gap}^{\text{std}}_{j,t}$.	CBRT
Positive Gap	Output gap in quarters where the unstandardized sectoral gap is above zero, and zero otherwise. Denoted $\text{gap}^{+}_{j,t}$.	CBRT
Negative Gap	Output gap in quarters where the unstandardized sectoral gap is below zero, and zero otherwise. Denoted $\text{gap}^{-}_{j,t}$.	CBRT
Panel C: Moderating Variables		
Credit User	Indicator equal to one for firms observed drawing credit at any point during the sample period. Denoted D_i^{credit}.	Credit Registry
Credit ($t-1$)	Inverse hyperbolic sine of total credit drawn in the preceding quarter, demeaned across credit users. Denoted $\widetilde{C}_{i,t-1}$.	Credit Registry
Markup ($t-1$)	Gross price-cost margin in the preceding quarter, defined as net sales less cost of goods sold divided by net sales, demeaned across the sample. Denoted $\widetilde{\mu}_{i,t-1}$.	Revenue Administration
Panel D: Firm Controls		
Log Assets	Natural logarithm of total assets.	Revenue Administration
Leverage	Total liabilities divided by total assets, where liabilities are total assets less equity.	Revenue Administration
Cash Ratio	Current assets divided by total assets.	Revenue Administration
Firm Size	Classification into micro, small, medium and large categories following the official KOSGEB definition.	Revenue Administration

Notes: This table reports definitions and sources for the variables used in the empirical analysis. The estimation sample covers firm-quarter observations for Turkish manufacturing firms in NACE two-digit sectors 10 through 33 over 2009–2023. Sales, markup components and balance sheet items are drawn from the quarterly income statements and annual financial statements maintained by the Revenue Administration. Credit variables are constructed from the loan-level credit registry, restricted to cash loans extended in the observation month and aggregated to the firm-quarter level. Capacity utilization rates are collected by the CBRT through its Business Tendency Survey. The industrial production index used in the alternative gap measures of Table 3 is published by TurkStat. Subscript i indexes firms, j sectors and t quarters.

Figure 1: Cross-Sectoral Dispersion of the Output Gap



Notes: This figure plots the cross-sectional distribution of the standardized sectoral output gap across the 24 NACE two-digit manufacturing sectors over the 2009–2023 sample period. The solid line denotes the median across sectors, the darker shaded band the interquartile range, and the lighter shaded band the range between the 10th and 90th percentiles. The dashed horizontal line marks a standardized gap of zero, which corresponds to a sector operating at its own sample average rather than at potential output. The underlying gap measure is obtained by applying the Hamilton filter to sector-level capacity utilization rates and standardizing the resulting series within each sector.

3 Empirical Design

Our empirical model is specified as follows:

$$\text{Sales}_{i,t} = \alpha_i + \gamma_t + \beta\, \text{gap}^{\text{std}}_{j(i),t} + \mathbf{X}_{i,t}\boldsymbol{\delta} + \varepsilon_{i,t}, \tag{1}$$

where i indexes firms, t indexes quarters and $j(i)$ denotes the NACE two-digit sector in which firm i operates.

The dependent variable $\text{Sales}_{i,t}$ is the inverse hyperbolic sine of real quarterly sales. The variable of interest, $\text{gap}^{\text{std}}_{j(i),t}$, is the standardized output gap of the firm's own sector, so that β measures the response of firm sales to a one-standard-deviation improvement in sectoral cyclical conditions. The term α_i denotes firm fixed effects, which absorb any time-invariant firm attribute, including scale, location, ownership and the fixed component of productivity, together with sector membership itself. The term γ_t denotes year by quarter fixed effects, which absorb aggregate conditions common to all firms in a given quarter, including the stance of monetary policy, the exchange rate, aggregate demand and the seasonal pattern in sales. The vector $\mathbf{X}_{i,t}$ collects a set of firm controls drawn from annual financial statements, namely the logarithm of total assets, the leverage ratio and the cash ratio. Standard errors are clustered at the firm level.

The choice of the inverse hyperbolic sine over the logarithm is dictated by the incidence of zero sales. Roughly a fifth of firm-quarters record no sales, and these are neither exits nor missing filings. Firms report zero in isolated quarters and resume positive sales afterwards, which is what one would expect of lumpy order books rather than of dormancy. Taking logarithms would discard these observations and select the sample toward continuously active firms, removing the margin along which weak demand is most likely to operate. The inverse hyperbolic sine is defined at zero and approximates the logarithm for large values, so the coefficient retains an approximate semi-elasticity interpretation over most of the distribution while the zero-sales quarters remain in the sample (Bellemare and Wichman, 2020). We report estimates using the logarithm of positive sales as an alternative dependent variable, which isolates the intensive margin.

The gap enters equation (1) in standardized form. For each sector we compute:

$$\text{gap}^{\text{std}}_{j,t} = \frac{\text{gap}_{j,t} - \overline{\text{gap}}_j}{\sigma_j}, \tag{2}$$

where $\overline{\text{gap}}_j$ and σ_j are the mean and standard deviation of the unstandardized gap in sector j over the full sample period. Standardization serves two purposes. It places the alternative gap series on a common scale, so that coefficients estimated with different inputs and different detrending procedures can be compared directly rather than reflecting differences in the units of the underlying series. It also makes the coefficient interpretable in terms of a sector's own cyclical range, which matters because sectors differ substantially in the amplitude of their fluctuations. One consequence deserves note. A positive value of $\text{gap}^{\text{std}}_{j,t}$ indicates that sector j stands above its own sample average in quarter t, not that it operates above potential in the level sense. Where the distinction matters, as in the decomposition into expansionary and contractionary episodes reported in Section 4, we assign regimes using the sign of the unstandardized series.

Identification rests on within-firm variation in sectoral cyclical conditions after aggregate movements have been removed. The firm fixed effects mean that β is estimated from changes in a firm's own sales relative to its own average, and the year by quarter fixed effects mean that only the component of the sectoral gap that departs from the manufacturing-wide cycle contributes to the estimate. What remains is the differential timing and amplitude of the cycle across sectors, which Figure 1 shows to be substantial in every quarter of the sample. The identifying assumption is that, conditional on firm and time effects and the controls, the relative cyclical position of a firm's sector is unrelated to firm-specific shocks to sales. This is weaker than it would be with a firm-level regressor, since an individual manufacturer takes the cyclical position of its sector as given, but it is not innocuous, and Section 4 reports a set of checks addressing the most plausible violations.

4 Empirical Findings

4.1 Baseline Estimates

Table 2 reports estimates of equation (1), in an incremental way by building the specification up in stages. Column (1) is the most general specification, regressing firm sales on the sectoral output gap with no fixed effects and no controls. Column (2) adds firm fixed effects, while column (3) introduces time fixed effects. Column (4) adds the firm controls and constitutes our preferred specification.

Table 2: Baseline Results

	(1) Sales	(2) Sales	(3) Sales	(4) Sales
Output Gap	0.0604***	0.0646***	0.0353***	0.0303***
	(0.0016)	(0.0014)	(0.0019)	(0.0017)
Obs.	5,851,180	5,851,180	5,851,180	5,739,944
Firm FE		✓	✓	✓
Year × Quarter FE			✓	✓
Firm Controls				✓
Adjusted R^2	0.000	0.594	0.680	0.734

Notes: This table reports estimates of the relationship between firm sales and the sectoral output gap. The sample covers firm-quarter observations for Turkish manufacturing firms operating in NACE two-digit sectors 10 through 33 over the period 2009–2023. The dependent variable *Sales* is the inverse hyperbolic sine of real quarterly sales, deflated by the sector-level producer price index. *Output Gap* is the sectoral output gap obtained by applying the Hamilton filter to sector-level capacity utilization rates and standardized within each sector. Column (1) reports a pooled specification with no fixed effects. Column (2) adds firm fixed effects, which absorb time-invariant differences in firm scale and productivity. Column (3) further includes year by quarter fixed effects, so that identification rests on within-firm variation in sectoral cyclical conditions after aggregate shocks common to all firms have been removed. Column (4) adds the firm controls, comprising the logarithm of total assets, the leverage ratio and the cash ratio, all measured contemporaneously from annual financial statements. The reduction in the number of observations between columns (3) and (4) reflects firm-quarters for which balance sheet information is unavailable. Standard errors clustered at the firm level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The estimated coefficient in the preferred specification is 0.0303, significant at the one percent level. That the point estimate barely moves between columns (3) and (4) indicates that the balance sheet controls are not absorbing the cyclical response.[4] Turning to mag-

[4]The observation count falls by about 111,000 across those two columns because annual financial state-

nitude, a one-standard-deviation improvement in a sector's cyclical position raises the transformed sales variable by roughly 0.028, or about 0.8 percent of a standard deviation of the sales distribution.

Three features of the design bear on what this number represents. The specification absorbs aggregate conditions in full, so the coefficient measures only the differential exposure of firms to their own sector's cycle relative to the manufacturing-wide cycle, and not the response to demand conditions in the aggregate. Cyclical positions are assigned at the NACE two-digit level, so firms within a sector share a single value regardless of their sub-sector or customer base, and the resulting measurement error pulls the estimate toward zero. Quarterly sales are also noisy relative to the smooth movements of the sectoral cycle.

Read against these features, the estimate is economically non-negligible. Sectoral gaps move considerably more than one standard deviation over a full cycle. Figure 1 shows an interquartile range across sectors of between one and two units in most quarters, so the difference between a sector in the lower quartile of its cyclical position and one in the upper quartile translates into a sales differential that persists over the several quarters such episodes typically last. The relevant benchmark for the magnitude is also not the unconditional dispersion of sales, which reflects permanent firm heterogeneity that the fixed effects remove, but the within-firm variation that survives their inclusion. Against that narrower benchmark the cyclical component accounts for a meaningful share of the quarter-to-quarter movement in a given firm's sales.

The substantive content of the result lies in what it establishes for the analysis that follows. Firm sales move with the cyclical position of the sector in which the firm operates, and the relationship survives the removal of all time-invariant firm heterogeneity and all aggregate movement in demand.

ments are unavailable for a small number of firm-years.

4.2 Alternative Measures of the Output Gap

The output gap is a latent construct rather than an observed quantity. It is obtained as the residual component of an observed series once a trend has been extracted, and both the selection of the input series and the choice of detrending procedure involve a degree of discretion. An estimated coefficient obtained under one such construction may therefore reflect properties of the specific filter (or the input series proxying for sectoral demand conditions) rather than of the underlying economic relationship. To address this concern, we re-estimate the preferred specification using alternative measures of the gap, formed by combining two input series with six different detrending procedures. The results are presented in Table 3.

The chosen input series are the capacity utilization rate, which underlies the baseline measure, and the industrial production index. Both are available at the NACE two-digit level, but they capture distinct dimensions of sectoral activity. Capacity utilization is a survey-based measure of the intensity with which installed capital is employed, whereas industrial production records realized output volume and consequently reflects both demand conditions and changes in productive capacity.

The six detrending procedures encompass the approaches most commonly employed in the literature. The Hodrick–Prescott filter penalizes the second difference of the estimated trend and remains the most widely applied method in empirical macroeconomics (Hodrick and Prescott, 1997). We implement it in both its conventional two-sided form and a one-sided variant that conditions only on information available up to each date. The band-pass filter developed by Christiano and Fitzgerald (2003) isolates the component of a series falling within a specified frequency band, thereby removing both high-frequency noise and low-frequency trend movements. The ℓ_1 trend filter proposed by Kim et al. (2009) substitutes a sum of absolute deviations for the quadratic penalty employed in the Hodrick–Prescott approach, yielding a piecewise linear trend that accommodates discrete breaks in the underlying growth rate. A deterministic linear trend provides the simplest benchmark. The Hamilton regression filter, which is previously employed for baseline analyses, completes the set.

Table 3: Alternative Output Gap Indicators

Panel A: Capacity Utilization Rate						
	(1)	(2)	(3)	(4)	(5)	(6)
	Sales	Sales	Sales	Sales	Sales	Sales
Output Gap	0.0303***	0.0302***	0.0334***	0.0316***	0.0294***	0.0364***
	(0.0017)	(0.0018)	(0.0015)	(0.0016)	(0.0015)	(0.0019)
Filter	Hamilton	HP (1S)	HP (2S)	CF	L1	Linear
Obs.	5,739,944	5,739,944	5,739,944	5,739,944	5,739,944	5,739,944
Firm FE	✓	✓	✓	✓	✓	✓
Year × Qtr FE	✓	✓	✓	✓	✓	✓
Firm Controls	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.734	0.734	0.734	0.734	0.734	0.734
Panel B: Industrial Production Index						
	(7)	(8)	(9)	(10)	(11)	(12)
	Sales	Sales	Sales	Sales	Sales	Sales
Output Gap	0.0551***	0.0404***	0.0524***	0.0309***	0.0413***	0.0689***
	(0.0021)	(0.0020)	(0.0018)	(0.0017)	(0.0015)	(0.0025)
Filter	Hamilton	HP (1S)	HP (2S)	CF	L1	Linear
Obs.	5,739,944	5,739,944	5,739,944	5,739,944	5,739,944	5,739,944
Firm FE	✓	✓	✓	✓	✓	✓
Year × Qtr FE	✓	✓	✓	✓	✓	✓
Firm Controls	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.734	0.734	0.734	0.734	0.734	0.734

Notes: This table reports estimates of the relationship between firm sales and the sectoral output gap across twelve alternative constructions of the gap measure. The sample covers firm-quarter observations for Turkish manufacturing firms operating in NACE two-digit sectors 10 through 33 over the period 2009–2023. The dependent variable *Sales* is the inverse hyperbolic sine of real quarterly sales, deflated by the sector-level producer price index. Panel A reports specifications in which the gap is constructed from sector-level capacity utilization rates, and Panel B those in which it is constructed from the sector-level industrial production index. Within each panel the six columns correspond to alternative detrending procedures, namely the Hamilton regression filter, the one-sided and two-sided Hodrick–Prescott filters, the Christiano–Fitzgerald band-pass filter, the L1 trend filter and a deterministic linear trend. Every gap series is standardized within its own sector before estimation, so the coefficients are directly comparable across columns despite differences in the scale of the underlying series. The specification in column (1) corresponds to the baseline reported in column (4) of Table 2. Firm controls comprise the logarithm of total assets, the leverage ratio and the cash ratio. Standard errors clustered at the firm level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

As observed in Table 3, our analyses show that all twelve estimates are positive and statistically significant at the one percent level. The relationship documented in Section 4.1 does not therefore arise from the particular manner in which the gap has been measured.

4.3 Robustness Checks

Table 4 reports estimates of the output gap coefficient across fifteen alternative specifications of the baseline model. Each row corresponds to a separate regression, and all specifications retain the firm and year by quarter fixed effects together with the firm controls unless the row indicates otherwise. The coefficient remains positive and significant in every case.

Row (1) clusters standard errors two-way by firm and by sector-quarter, which allows for correlation across firms exposed to the same sectoral shock within a given quarter. Row (2) adds sector fixed effects to the baseline specification, and row (3) replaces the year by quarter fixed effects with sector by year fixed effects, which absorbs slow-moving sectoral trends and identifies the coefficient from within-year variation across quarters. Neither alteration to the fixed effects structure disturbs the sign or the significance of the estimate.

Rows (4) and (5) address sample composition. The former restricts attention to firms observed in every quarter of the sample period, removing any influence of entry and exit on the estimate. The latter confines the sample to observations before 2020, so that the pandemic and its aftermath, during which sectoral cyclical positions diverged sharply, do not contribute to identification. The relationship survives both restrictions.

Row (6) augments the specification with lagged credit and lagged markup as additional controls. Both variables serve as moderators in the analysis that follows, so their inclusion absorbs part of the cyclical response attributed to them. Row (7) includes the first and second lags of the output gap alongside its contemporaneous value, which distinguishes a within-quarter relationship from delayed adjustment. The contemporaneous coefficient remains positive and significant, and the lagged terms are small.

Row (8) employs the gap in unstandardized units. The magnitude is not comparable

Table 4: Robustness Checks

	(1) Output Gap
(1) Standard errors clustered at firm and sector-time level	0.0303***
(2) Sector fixed effects included	0.0306***
(3) Sector × year fixed effects	0.1109***
(4) Balanced panel	0.0285***
(5) Pre-pandemic sample	0.0209***
(6) Additional firm controls	0.0189***
(7) Controlling for lagged output gap	0.0281***
(8) Unstandardized gap measure	0.0055***
(9) Logarithm of sales as dependent variable	0.0194***
(10) Alternative winsorization of firm sales	0.0287***
(11) Controlling for sector-level input cost pressures	0.0335***
(12) Firms with frequent zero-sales quarters excluded	0.0334***
(13) Asset-weighted estimation	0.0323***
(14) Firms observed for at least five years	0.0331***
(15) Firms without foreign sales	0.0189***
Firm FE	✓
Year × Quarter FE	✓
Firm Controls	✓

Notes: This table reports the estimated coefficient on the sectoral output gap across alternative specifications of the baseline model in column (4) of Table 2. The dependent variable is the inverse hyperbolic sine of real quarterly sales unless otherwise indicated. Each row reports a separate regression. Row (1) clusters standard errors two-way by firm and by sector-quarter. Row (2) adds sector fixed effects to the baseline specification and row (3) replaces the year by quarter fixed effects with sector by year fixed effects. Row (4) restricts the sample to firms observed in every quarter of the sample period and row (5) to observations before 2020. Row (6) augments the baseline with lagged credit and lagged markup as additional controls. Row (7) includes the first and second lags of the output gap alongside its contemporaneous value. Row (8) uses the gap in its raw units rather than standardized within sector, so the coefficient is not directly comparable in magnitude to the remaining rows. Row (9) restricts attention to the intensive margin by using the logarithm of sales, which is defined only for firm-quarters with positive sales. Row (10) winsorizes the dependent variable at the fifth and ninety-fifth percentiles rather than the first and ninety-ninth. Row (11) controls for the quarterly growth rate of the sector-level producer price index. Row (12) excludes firms for which more than twenty percent of observed quarters record zero sales. Row (13) weights observations by firm assets. Row (14) restricts the sample to firms observed for at least twenty quarters. Row (15) restricts the sample to firms reporting no foreign sales, for which domestic cyclical conditions are the sole source of demand variation. All specifications include firm and year by quarter fixed effects and the firm controls unless the row indicates otherwise. Standard errors are clustered at the firm level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

to the remaining rows, since the units of the underlying series differ from those of the standardized measure, but the sign and significance are preserved. Row (9) replaces the inverse hyperbolic sine with the logarithm of positive sales, restricting attention to the intensive margin and excluding zero-sales quarters from the estimation. The result confirms that the baseline relationship does not rest solely on movements into and out of zero sales. Row (10) winsorizes the dependent variable at the fifth and ninety-fifth percentiles rather than the first and ninety-ninth, and the estimate is unaffected.

Rows (11) through (13) address three further concerns. Row (11) controls for the growth rate of the sector-level producer price index, absorbing input cost pressures that moved sharply over the sample period. Row (12) excludes firms for which more than a fifth of observed quarters record zero sales. Row (13) weights observations by (logarithm of) firm assets, so that the estimate is not governed by the numerical predominance of small firms in an unweighted sample. Row (14) requires firms to be observed for at least twenty quarters, a stricter threshold than the twelve imposed in constructing the estimation sample.

Row (15) restricts the sample to firms reporting no foreign sales. For these firms domestic conditions constitute the sole source of demand variation, so the specification removes the measurement error introduced by exporters whose sales respond in part to cyclical conditions abroad rather than at home. The coefficient remains positive and significant on this restricted sample.

4.4 Heterogeneity based on Credit Utilization

The relationship between credit and cyclical exposure admits two readings that carry opposite empirical predictions. In the financial accelerator tradition, firms constrained in their access to external finance absorb adverse shocks less easily, since a deterioration in demand erodes net worth and collateral values at precisely the moment when external funds are most needed (Bernanke et al., 1999). On this account, firms with weaker balance sheet positions should display greater rather than lesser cyclical sensitivity, and the early micro evidence supports the prediction. Gertler and Gilchrist (1994) document that small

manufacturing firms bear a disproportionate share of the decline in sales and inventories following monetary tightening, and Kashyap et al. (1994) show that inventory behavior is more sensitive to credit conditions among firms without access to public debt markets.

A second reading treats credit as a source of liquidity insurance rather than as a constraint. Firms maintaining active borrowing relationships hold the capacity to finance working capital, sustain inventories and meet payroll when receipts fall short, and the literature on corporate liquidity management interprets these arrangements precisely as a hedge against future income shortfalls (Acharya et al., 2007). Greenwald et al. (2025) document that firms draw on committed credit lines following adverse macroeconomic shocks, and that the drawdowns are concentrated among firms with the greatest borrowing capacity. Under this interpretation the firms observed borrowing are not the constrained ones but those whose creditworthiness has already been established, and their access to funds should attenuate rather than amplify the pass-through of demand conditions to realized sales. Recent evidence on monetary transmission is consistent with the distinction. Ottonello and Winberry (2020) find that firms with low default risk respond most strongly to monetary shocks, a pattern that runs against the textbook accelerator prediction, and Cloyne et al. (2023) report that the investment response to monetary policy is concentrated among younger firms whose borrowing is most sensitive to collateral values.

Which reading applies is an empirical matter, and it depends on what observed borrowing measures in a given setting. In our case, we examine two margins in a consecutive manner. The extensive margin distinguishes firms that borrow from those that do not, and is estimated as follows:

$$\text{Sales}_{i,t} = \alpha_i + \gamma_t + \beta_1 \, \text{gap}^{\text{std}}_{j(i),t} + \beta_2 \, \text{gap}^{\text{std}}_{j(i),t} \times D_i^{\text{credit}} + \mathbf{X}_{i,t}\boldsymbol{\delta} + \varepsilon_{i,t}, \tag{3}$$

where D_i^{credit} equals one for firms observed drawing credit at any point during the sample period. Its main effect is absorbed by the firm fixed effects, since the indicator is constant within firm.

On the other hand, the intensive margin analysis conditions on borrowing and asks whether the quantity borrowed matters in shielding against fluctuations in sectoral de-

mand as follows:

$$\text{Sales}_{i,t} = \alpha_i + \gamma_t + \beta_1 \, \text{gap}^{\text{std}}_{j(i),t} + \beta_2 \, \text{gap}^{\text{std}}_{j(i),t} \times \widetilde{C}_{i,t-1} + \beta_3 \widetilde{C}_{i,t-1} + \mathbf{X}_{i,t}\boldsymbol{\delta} + \varepsilon_{i,t}, \tag{4}$$

where $\widetilde{C}_{i,t-1}$ is the inverse hyperbolic sine of credit drawn in the preceding quarter, demeaned across credit users. Equation (4) is estimated on the subsample of firms that borrow. Demeaning the moderator leaves β_1 interpretable as the cyclical response of a firm holding the average level of credit, and a negative β_2 indicates that credit dampens the transmission of sectoral conditions to sales.

Table 5 reports the estimates. In column (1) the interaction between the output gap and the credit user indicator is negative and significant at the one percent level. Firms that borrow display a weaker sales response to sectoral cyclical conditions than firms that do not, which favors the liquidity insurance and buffer interpretation over the accelerator prediction. Column (2) turns to the intensive margin and finds the same sign. Among firms that borrow, those drawing larger amounts in the preceding quarter exhibit a smaller cyclical response, and the interaction is again significant at the one percent level. The two margins therefore point in the same direction. Access to credit dampens cyclical sensitivity, and the dampening increases in the quantity of credit drawn.

The remaining columns estimate the extensive margin separately by firm size and reveal that the average effect masks considerable variation. The interaction is significant for small firms at the one percent level and for medium firms at the ten percent level, but is indistinguishable from zero for micro firms and for large firms. This pattern bears on the interpretation of the result. Were the dampening a matter of firm quality rather than credit access, with borrowers simply being the more resilient firms, the effect should be strongest among large firms, which are the most established and the most creditworthy. However, our estimations imply that the concentration of the effect among small and medium firms is instead in line with what the liquidity insurance mechanism predicts. Bank credit is the principal source of external finance for firms of this size, so the presence or absence of a borrowing relationship materially alters their capacity to sustain operations through a downturn. Large firms possess alternative buffers, including internal funds and access to non-bank finance, so the marginal contribution of a bank borrowing relationship to their

Table 5: Heterogeneity Based on Firm Credit Utilization

	(1) Sales	(2) Sales	(3) Sales	(4) Sales	(5) Sales	(6) Sales
Output Gap	0.0345***	0.0328***	0.0158***	0.0371***	0.0363***	0.0164
	(0.0022)	(0.0023)	(0.0025)	(0.0032)	(0.0066)	(0.0161)
Output Gap × Credit User	−0.0080***		−0.0019	−0.0096***	−0.0123*	−0.0176
	(0.0024)		(0.0034)	(0.0033)	(0.0067)	(0.0159)
Output Gap × Credit ($t-1$)		−0.0056***				
		(0.0004)				
Credit ($t-1$)		0.0821***				
		(0.0011)				
Sample	Full	Credit users	Micro	Small	Medium	Large
Margin	Extensive	Intensive	Extensive	Extensive	Extensive	Extensive
Obs.	5,739,944	2,606,474	3,030,732	1,904,956	621,882	180,302
Firm FE	✓	✓	✓	✓	✓	✓
Year × Qtr FE	✓	✓	✓	✓	✓	✓
Firm Controls	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.734	0.708	0.632	0.647	0.742	0.809

Notes: This table reports estimates of how firm credit utilization moderates the relationship between firm sales and the sectoral output gap. The sample covers firm-quarter observations for Turkish manufacturing firms operating in NACE two-digit sectors 10 through 33 over the period 2009–2023. The dependent variable *Sales* is the inverse hyperbolic sine of real quarterly sales. *Output Gap* is the sectoral output gap constructed from capacity utilization rates using the Hamilton filter and standardized within sector. *Credit User* is an indicator equal to one for firms observed drawing credit at any point in the sample, and the associated interaction identifies the extensive margin of credit utilization. Its main effect is absorbed by the firm fixed effects and is therefore not reported. *Credit* ($t-1$) is the inverse hyperbolic sine of the firm's credit drawn in the preceding quarter, demeaned across credit users, and the associated interaction identifies the intensive margin. Column (1) reports the extensive margin over the full sample and column (2) the intensive margin among credit users only. Columns (3) through (6) reproduce the extensive margin specification separately for micro, small, medium and large firms, where size categories follow the official KOSGEB classification. Firm controls comprise the logarithm of total assets, the leverage ratio and the cash ratio. Standard errors clustered at the firm level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

cyclical resilience is correspondingly smaller. At the other end of the distribution, micro firms borrow in amounts that are small relative to their operating requirements, which limits the buffering capacity that a borrowing relationship confers.

4.5 Heterogeneity based on Firm Markup

Credit access operates on the financing side of the firm. A second mechanism operates on the pricing side and rests on the firm's position in its product market. When sectoral demand weakens, a firm must decide how to allocate the adjustment between price and quantity. A firm operating close to marginal cost has little room to compress its margin and must absorb the shock through volume, so its revenue falls roughly in proportion to the decline in demand. A firm charging a substantial markup can lower its price, retain a larger share of its customers, and register a smaller decline in sales at the cost of a narrower margin. Pricing power thus functions as a buffer against demand fluctuations in much the same way that liquidity does, but through the product market rather than the credit market.

The theoretical basis for this asymmetry lies in models of imperfect competition with variable markups. In the oligopolistic framework of Atkeson and Burstein (2008), desired markups increase in a firm's within-sector market share, and firms with larger shares adjust prices more and quantities less in response to a given shock. Burstein et al. (2025) bring this framework to firm-level administrative data and show that the co-movement between markups and output varies systematically across firms according to market share and competitive structure, so that the cyclical behavior of markups at the firm level differs from what aggregate series suggest. The relevance of the mechanism has grown alongside the secular rise in market power documented by De Loecker et al. (2020), who report a substantial increase in average markups in the United States since 1980 concentrated in the upper tail of the distribution. If high-markup firms are systematically less exposed to demand conditions, and if the share of activity accounted for by such firms is rising, then the transmission of cyclical conditions to the real economy weakens over time.

We measure pricing power by the gross price-cost margin defined as follows:

$$\mu_{i,t} = \frac{\text{Net Sales}_{i,t} - \text{COGS}_{i,t}}{\text{Net Sales}_{i,t}}, \tag{5}$$

computed from the quarterly income statements described in Section 2. The measure is imperfect as a proxy for market power, since it reflects the composition of costs as well

as the ability to price above them, but it has the advantage of being observed directly at quarterly frequency for the near-universe of firms rather than recovered from a production function estimated on a smaller sample. Therefore, the moderating specification is formed as follows:

$$\text{Sales}_{i,t} = \alpha_i + \gamma_t + \beta_1 \, \text{gap}^{\text{std}}_{j(i),t} + \beta_2 \, \text{gap}^{\text{std}}_{j(i),t} \times \widetilde{\mu}_{i,t-1} + \beta_3 \widetilde{\mu}_{i,t-1} + \mathbf{X}_{i,t}\boldsymbol{\delta} + \varepsilon_{i,t}, \tag{6}$$

where $\widetilde{\mu}_{i,t-1}$ denotes the markup of the preceding quarter, demeaned across the estimation sample. Lagging the moderator ensures that it is predetermined with respect to current sales, and demeaning leaves β_1 interpretable as the cyclical response of a firm with average pricing power. A negative β_2 indicates that markup dampens the transmission of sectoral conditions to sales.

Table 6 reports the estimates. The interaction in column (1) is negative and significant. Firms operating with higher margins in the preceding quarter display a weaker sales response to sectoral cyclical conditions, which is the pattern the pricing power mechanism predicts. The main effect of markup is also negative and significant, indicating that within a given firm, quarters following a period of elevated margins record lower sales. This is the margin-volume trade-off observed directly rather than through the interaction, and it reinforces rather than complicates the interpretation of β_2.

The size splits in columns (2) through (5) distinguish this result from the credit channel in an important respect. The interaction is negative in every size category and significant in each, at the one percent level for micro and small firms, at the ten percent level for medium firms and at the five percent level for large firms. Unlike the extensive credit margin, whose moderating role was confined to small and medium firms, the dampening effect of markup operates across the entire size distribution. In this context, empirical findings pave way for two important implications. First, the markup result is not proxying for firm size or for the financial characteristics correlated with it, since it survives conditioning on size in a way that the credit result does not. Second, pricing power constitutes an independent dimension of heterogeneity in cyclical exposure. A firm may be insulated from sectoral demand conditions through its access to finance, through its position in the

Table 6: Heterogeneity Based on Firm Markup

	(1) Sales	(2) Sales	(3) Sales	(4) Sales	(5) Sales
Output Gap	0.0190***	0.0131***	0.0224***	0.0197***	−0.0038
	(0.0009)	(0.0014)	(0.0012)	(0.0017)	(0.0031)
Output Gap × Markup $(t-1)$	−0.0125***	−0.0116***	−0.0157***	−0.0166*	−0.0439**
	(0.0028)	(0.0030)	(0.0050)	(0.0095)	(0.0182)
Markup $(t-1)$	−0.1221***	−0.0825***	−0.0368***	0.0127	−0.0546
	(0.0044)	(0.0042)	(0.0062)	(0.0132)	(0.0367)
Sample	Full	Micro	Small	Medium	Large
Obs.	4,439,053	1,972,754	1,718,276	574,428	168,218
Firm FE	✓	✓	✓	✓	✓
Year × Qtr FE	✓	✓	✓	✓	✓
Firm Controls	✓	✓	✓	✓	✓
Adjusted R^2	0.815	0.580	0.603	0.699	0.732

Notes: This table reports estimates of how firm markup moderates the relationship between firm sales and the sectoral output gap. The sample covers firm-quarter observations for Turkish manufacturing firms operating in NACE two-digit sectors 10 through 33 over the period 2009–2023. The dependent variable *Sales* is the inverse hyperbolic sine of real quarterly sales. *Output Gap* is the sectoral output gap constructed from capacity utilization rates using the Hamilton filter and standardized within sector. *Markup* $(t-1)$ is the gross price-cost margin, defined as net sales less the cost of goods sold divided by net sales, measured in the preceding quarter and demeaned across the estimation sample. Column (1) reports the full sample and columns (2) through (5) reproduce the specification separately for micro, small, medium and large firms, where size categories follow the official KOSGEB classification. The sample is smaller than in Table 2 because the markup measure requires positive net sales and non-missing cost of goods sold in the preceding quarter. Firm controls comprise the logarithm of total assets, the leverage ratio and the cash ratio. Standard errors clustered at the firm level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

product market, or through both, and the two channels are separable in the data.

4.6 Asymmetric Effects

The specifications estimated so far impose a symmetric response of sales to the cycle, so that a sector operating one unit above potential and one operating one unit below are treated as mirror images. There are reasons to expect the two to differ. When demand is strong, installed capacity and adjustment costs limit how far a firm can raise its sales within a quarter, whereas no comparable limit applies to the decline in sales when demand is weak. In addition, if the buffers examined in Sections 4.4 and 4.5 are used mainly to

protect sales against falling demand, their effect should be most visible in contractions. To allow for such differences, we decompose the standardized gap into a positive and a negative component. The regime is assigned by the sign of the unstandardized sectoral gap, so that the decomposition distinguishes operation above potential from operation below it rather than above or below the sector's own average. The specification becomes

$$Sales_{i,t} = \alpha_i + \gamma_t + \beta_1 \, gap^{+}_{j(i),t} + \beta_2 \, gap^{-}_{j(i),t} + X_{i,t}\delta + \varepsilon_{i,t}, \tag{7}$$

where gap^{+} equals the standardized gap in quarters in which the unstandardized gap is positive and zero otherwise, and gap^{-} is defined analogously for negative values. To examine the moderating channels, each component is interacted with lagged credit or lagged markup in the same manner as in equations (4) and (6). The credit specification is estimated on the subsample of borrowers and the markup specification on the sample for which the margin is defined.

Table 7 reports the estimates. The response of sales to the cycle is markedly asymmetric. Both gap components carry positive coefficients, but the sign convention makes their interpretation opposite: because gap^{-} takes negative values in contractions, a positive coefficient on it means that sales fall as the sector moves further below potential, while the positive coefficient on gap^{+} means sales rise in expansions. The asymmetry therefore lies in the magnitudes. In both columns the coefficient on the negative gap is roughly six to eleven times the coefficient on the positive gap, and the latter is only marginally significant, so that per unit of cyclical movement sales fall in downturns considerably more than they rise in upturns. The average relationship documented in Section 4.1 is largely a contractionary phenomenon, and the single coefficient reported there masks a response that is concentrated on the downside. This pattern is consistent with capacity binding in expansions while weak demand faces little offsetting friction in contractions.

The moderating effects are preserved under the decomposition and appear in both regimes. In column (1) the interactions of credit with the positive and the negative gap are both negative and significant at the one percent level, so that borrowing dampens the sales response whether the sector operates above or below potential. In column (2) the interactions of markup with the two components are likewise negative and significant at the

Table 7: Asymmetric Moderating Effects

	(1) Sales	(2) Sales
Positive Gap	0.0053**	0.0029*
	(0.0023)	(0.0018)
Negative Gap	0.0310***	0.0318***
	(0.0019)	(0.0014)
Positive Gap × Credit ($t-1$)	−0.0024***	
	(0.0005)	
Negative Gap × Credit ($t-1$)	−0.0019***	
	(0.0003)	
Credit ($t-1$)	0.0315***	
	(0.0006)	
Positive Gap × Markup ($t-1$)		−0.0167**
		(0.0065)
Negative Gap × Markup ($t-1$)		−0.0098**
		(0.0041)
Markup ($t-1$)		−0.1197***
		(0.0053)
Sample	Credit users	Full
Obs.	2,264,281	4,439,053
Firm FE	✓	✓
Year × Quarter FE	✓	✓
Firm Controls	✓	✓
Adjusted R^2	0.816	0.815

Notes: This table reports estimates of the asymmetric relationship between firm sales and the sectoral output gap, and of how credit utilization and markup moderate this relationship separately in expansionary and contractionary episodes. The sample covers firm-quarter observations for Turkish manufacturing firms operating in NACE two-digit sectors 10 through 33 over the period 2009–2023. The dependent variable *Sales* is the inverse hyperbolic sine of real quarterly sales. *Positive Gap* and *Negative Gap* decompose the standardized sectoral output gap into episodes in which the underlying gap is above and below zero, with the regime assigned according to the sign of the unstandardized capacity utilization gap so that the classification reflects operation above or below potential rather than above or below the sector's own average. *Credit* ($t-1$) is the inverse hyperbolic sine of credit drawn in the preceding quarter, demeaned across credit users, and *Markup* ($t-1$) is the gross price-cost margin in the preceding quarter, demeaned across the estimation sample. Column (1) is estimated on the subsample of firms observed drawing credit at some point during the sample period and column (2) on the full sample for which the markup measure is available. Firm controls comprise the logarithm of total assets, the leverage ratio and the cash ratio. Standard errors clustered at the firm level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

five percent level. Relative to the corresponding main effects, the attenuation is sizeable in both regimes. Since the response of firms without these buffers is itself concentrated in downturns, however, the economically relevant role of both channels is to cushion sales when sectoral demand falls. That credit and pricing power weaken the transmission of the cycle particularly in contractions supports the liquidity insurance and margin adjustment interpretations advanced in the preceding sections, as both mechanisms operate when they are most needed.

5 Conclusion

This paper examines how firm sales vary with sectoral cyclical conditions and how this relationship differs with credit utilization and pricing power. Using quarterly administrative data on approximately 182,000 Turkish manufacturing firms over 2009–2023, we document a positive association between real sales and the sectoral output gap after accounting for firm fixed effects, common time effects and balance sheet characteristics. This finding is robust to alternative activity indicators, detrending procedures and a broad set of specification and sample checks. The evidence extends the analysis of firm heterogeneity over the business cycle to sales in an emerging economy, with extensive coverage of smaller firms that are often absent from conventional datasets.

Financial heterogeneity is systematically related to cyclical exposure. Firms observed borrowing during the sample exhibit a weaker relationship between sales and sectoral cyclical conditions than firms without observed borrowing. Among credit users, larger credit flows in the preceding quarter are also associated with lower cyclical sensitivity. The evidence for the credit-user relationship is clearest among small and medium-sized firms, while the estimates for micro and large firms provide no clear evidence of similar attenuation. These patterns are consistent with a liquidity-buffer interpretation, under which borrowing helps firms maintain working capital and operations when sales receipts weaken. They also underline the importance of distinguishing observed credit utilization from the financial constraints that firms may face.

Pricing power, proxied by the gross price-cost margin, provides a further dimension

of heterogeneity. Higher lagged margins are associated with lower cyclical sensitivity across all firm size categories. This pattern is consistent with greater scope to absorb demand fluctuations through margin adjustment, although the accounting measure does not directly reveal how firms adjust prices and quantities. Allowing for asymmetry further shows that the estimated sales response is substantially larger in periods with negative sectoral output gaps than in periods with positive gaps. The interactions involving credit and margins remain negative in both regimes. Together, these findings suggest that an average cyclical coefficient conceals both differences across firms and a greater underlying sensitivity during downturns, when access to financial and operating buffers is particularly relevant.

The findings have implications for assessing how the real adjustment associated with demand-side disinflation is distributed across firms. Aggregate measures of financial conditions and economic slack may provide an incomplete picture when firms differ in their borrowing relationships and pricing margins. Monitoring sales jointly with credit utilization, firm size and margins could complement aggregate indicators and help identify groups facing greater adjustment pressures. More broadly, assessments of cyclical transmission should consider both financing conditions and product-market characteristics. The evidence motivates attention to how these characteristics affect the distribution of sales adjustment, while quantifying their implications for aggregate inflation and the output cost of disinflation requires further analysis.

Future research could build on these findings by examining how differences in sales sensitivity translate into employment, investment and firm survival over the business cycle. Another promising direction is to study whether borrowing relationships and pricing power reinforce one another in shaping firms' responses to cyclical conditions. Loan-level information on maturity, currency denomination and lender relationships could help explain which financing arrangements provide the greatest resilience during downturns. Extending the analysis across sectors and economies with different financial and product-market structures would provide a comparative perspective on these patterns. Finally, incorporating the documented firm heterogeneity into aggregate models could shed light

on its implications for output and inflation dynamics.

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