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Do Employment Subsidies Have an Impact on Skill Intensity and Technological Level of Production?

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DO EMPLOYMENT SUBSIDIES HAVE AN IMPACT ON SKILL INTENSITY AND TECHNOLOGICAL LEVEL OF PRODUCTION?

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PRELIMINARY

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Abstract

This study investigates the impact of employment subsidies on the dynamics of labor markets and production technologies in Turkey's manufacturing sector, with a focus on the additional 6-point subsidy introduced in 2016. Leveraging a difference-in-differences approach, we examine the effects of the policy on employment, capital investment, and capital intensity across firms of varying sizes. Our findings reveal that the subsidy significantly increased employment and capital accumulation, particularly for micro and small firms, while fostering greater capital intensity in small and large firms. These results suggest that employment subsidies not only alleviate labor market inefficiencies but also encourage investment in production capabilities, dispelling concerns about potential trade-offs between labor and capital. The analysis is supported by robust sensitivity checks, ensuring the validity of the findings across different specifications. By extending the evaluation of employment subsidies beyond job creation, this study contributes to the broader discourse on active labor market policies and their role in promoting sustainable growth and technological development in emerging economies.

Keywords: Employment subsidy, capital intensity, firm-level analysis, difference-in-differences

JEL Classification: J23, J38, R58

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INTRODUCTION

Active labor market policies (ALMPs) offer a wide range of strategies for addressing the challenges in modern labor markets such as rising inequality, technological disruptions, and changing nature of work. These policies include job guarantees, universal basic income, work-sharing, retraining and reskilling programs, employment subsidies and cooperative business models. The main goals of these policies are to complement or replace traditional mechanisms like minimum wage laws, collective bargaining, and unemployment insurance, and to offer strategies to promote both flexibility and security in a rapidly changing economic landscape. By implementing such policies, governments can enhance economic resilience, reduce inequality, and create more inclusive labor markets that better serve the needs of workers and employers alike.

One of the prominent ALMPs is the “employment (or wage) subsidy” scheme, which is a financial incentive provided by governments to employers with the objective of increasing employment, particularly for disadvantaged groups such as long-term unemployed individuals, young people, low-skilled workers, and marginalized populations. These subsidies can take various forms, including direct wage subsidies, tax credits, or reductions in employer social security contributions.

The primary aim of employment subsidies is to encourage employers to hire workers they might not otherwise employ due to perceived or real risks, such as lower productivity or higher training costs. Employment subsidies are especially useful in times of economic downturns or recessions, where the demand for labor weakens, leading to increased unemployment. The goals of these policies typically include i) reducing unemployment by lowering the cost of hiring, as subsidies incentivize employers to expand their workforce, ii) promoting labor market inclusion, as subsidies often target vulnerable or disadvantaged groups to help integrate them into the labor market, iii) stimulating economic growth by increasing employment, as subsidies help economies recover more quickly by boosting household income and spending, iv) alleviating poverty and income inequality by providing employment opportunities, especially for low-income groups, as subsidies help reduce poverty and income inequality v) formalizing the already employed workers in countries, particularly developing countries, with high informality.

Besides these expected benefits, such schemes arguably have some pitfalls. For instance, a significant portion of subsidized jobs may have been created anyway, without the subsidy. This inefficiency, known as deadweight loss, means that the subsidy funds are not always targeted effectively. Employers might also replace unsubsidized workers with subsidized ones, especially if the subsidy is temporary, creating substitution effects. Further, such schemes may create dependence on subsidies and refrain employers from hiring workers without the incentive, undermining the sustainability of job creation in the long-term. Finally, employment subsidies can be expensive for governments, leading to significant budgetary costs, especially if the policy is widely implemented or used for extended periods.

Employment subsidies have long been on the toolset of the Turkish government too in different forms, i.e. targeting first-time recruitment, a specific sector, a specific group in population like women or youth, a specific type of firm (e.g. small, exporters), or a specific region/province/county. Regardless of the

main target group, the subsidies, in general, have aimed reducing labor cost for employer rather than benefits to employees (Aşık et al., 2022).

In Turkey, the tax and social security contribution burden on labor costs is high at around 40 percent, which is higher than the OECD average (OECD, 2019). Accordingly, from the firms' side, any significant reduction in labor cost has the potential to influence i) hiring decisions, as the decrease in labor cost increases the demand for labor, ii) production decisions, as new hires can increase the capacity, iii) pricing decisions, as the marginal cost of labor decreases, iv) marketing decisions, as the gains in competitiveness due to the fall in labor cost may allow penetration to new domestic or export markets, and v) human capital decisions, i.e. whether to employ more skilled or less-skilled workers and vi) capital accumulation and technological adoption.

For the last two, the expected outcomes are not as clear as for the others and sometimes may be interrelated, which would have implications for the productivity of the firm. On the human capital side, there are findings in the literature that employment subsidies, which generally target low skilled labor, lead to increase in low-skilled labor employment and reduce incentives to acquire human capital (Oskamp and Snower, 2006). But, theoretically it is also possible that firms may take advantage of the subsidy to hire higher skilled workers at a lower cost. Consequently, subsidies may change the skill composition of the employment in either direction. On the investment side, cheaper labor may encourage firms to hire more workers in order to substitute capital to produce a certain level of output. On the other hand, some firms may choose to invest more in capital either in response to higher employment in order to maintain the marginal productivity of labor, or as a result of the extra funds generated by the cost gains of the subsidy. In fact, classical and neoclassical theory backs the complementarity of the factors of production under subsidy schemes. For instance, Judd (1987), Shi and Wen (1999), and Fuest and Huber (2000), Daveri and Tabellini (2000) find positive impact on capital accumulation as a response to labor subsidies for close economies. On the other hand, Petrucci and Phelps (2005) find that subsidies and incentives support only the subsidized factor and affect negatively the non-subsidized one, indicating a trade-off between the factors of production.

In the literature, studies on the effectiveness of employment subsidies focus mostly on their impact on the level of employment, the majority of which concentrate on developed countries (Crepon et al., 2003; Blundell et al., 2004; Deidda et al., 2015; Goos and Konnings, 2007; Huttunen et al., 2013). These studies have diverging results from each other. Some studies show that they have no significant effects, while some point out positive effects for older women and youth and some indicate positive overall effects but only for short-periods. Studies for developing countries are lower in number but has similar diversification in conclusions. Some point out no positive effects in overall, while some indicate positive effect for formal employment (Gruber, 1997; Kugler and Kugler, 2009; Cruces et al. 2010).[3]

There are examples of similar studies for Turkey. Among them, Betcherman et al. (2010) found a positive formal employment effect for two regional subsidy programmes in 2004 and 2005, which targeted new hires in firms with more than 10 employees, using aggregate regional employment data. For the impact

[3] See Almeida et al. (2014) for a review for developing economies.

of the 2011 employment subsidy, which targeted young people and women, there are three different studies using the Household Labour Force Survey (Ayhan, 2013; Uysal, 2013; Balkan et al., 2016). The last one found no effects, while the others found positive effects, especially for women, but the longevity of the effect is a concern. Basbuga et al. (2022), which looked at several subsidy schemes, also found positive employment effects. Finally, in the most recent study, Aşık et al. (2022) examine the effects of a geographically targeted subsidy in 2016 that covered part of employers' social security costs on registered employment between 2012 and 2018, using firm-level data from the Social Security Institution. They find that the subsidy significantly increased registered employment in small firms and that the effects are persistent over time. However, they claim that the increase in registered employment is likely due to the formalization of informal workers rather than an increase at the extensive margin.

However, evaluating the effectiveness of these subsidies only on the level employment is insufficient for an ideal policy making. The change in the skill level of the workforce due to the application of the subsidy, and whether such subsidies affect the technological level of production and the investment propensity of firms are equally important issues, in particular for productivity gains and the sustainability of growth.

Against this background, in this study, we extend the impact analysis of employment subsidies beyond its impact on the level of employment. In this regard, we aim to identify the causal effect of employment subsidies on the skill composition of employment, on the technological level of production and on the capital formation of the manufacturing firms in Turkey, by utilizing firm data at county level. We restrict our analysis only to manufacturing firms because technology level of production[4] is only determined for manufacturing firms.

To this end, we explore the impact of the subsidy granted on a geographical basis, which brought an additional 6% reduction in employers' social security costs (Law 6846) for registered employment, on top of the already existing subsidy of 5% of social security contributions. This subsidy has been in force since 2013, but its coverage has changed over time. Until 2016, only firms with more than 10 employees in the selected 51 provinces and 2 other districts could benefit from the subsidy. The selection of provinces was based on the level of development of the regions. Among the 6 different regions, the subsidy was available to regions 4, 5 and 6, which are the three least developed regions of Turkey. In March 2016, the subsidy was extended to all enterprises, regardless of the level of employment. A further change took place in August 2020, when subsidy regions were no longer defined at the level of provinces, but at the level of counties. As a result, 99 counties that were previously considered ineligible because of the province to which they belong became eligible because of their low level of development, as in Region 4 (Table A6). This change makes it possible to establish a credible control group for identifying the causal effect of the legislative change in 2016.

We utilize a difference-in-differences setting for the empiricial analyses as the change in the eligibility for subsidy creates an opportunity to design a diff-in-diff framework to estimate a causal relationship. Like Aşık et al. (2022), we use the regulation change in 2016 as the treatment. The firms located in one of the 99 counties that were reclassified as Region 4 counties in 2020 are considered as the **control**

[4] Technological level of production classification has 4 categories: low technology, medium-low technology, medium-high tecnology and high technology

group, while firms at counties with similar development level and has been eligible for the subsidy since 2016 will be the **treatment group**. We focus on the period between 2006 and 2019 to ensure that control units remain untreated during our sample period. The underlying assumption is that the firms in treated regions would follow similar trends in the absence of the legislation change in 2016. The causal effect of the policy change is estimated as the difference in the variable of interest (e.g. skill-based employment, the technological level of production, capital investment) in manufacturing firms in eligible counties before and after 2016 relative to the change in the variable of interest in manufacturing firms that were later assigned eligible in 2020.

In this regard, our contribution to the literature will be the following. First of all, we will add to the relatively scarce literature in Turkey and developing economies on the effect of employment subsidies. Second, it will be one of the few studies that investigate the relationship between employment subsidies and skill composition of employment. Such effects in general were studied for other factors, e.g. migration, that led to fall in labor costs (Clemens et al., 2018). Third the studies on the impact of subsidies on capital investment are unsuprisingly based on capital subsidies. To the best of our knowledge, our study will be the first, or one of the very few, if there is any, to link employment subsidies to the technological progress of the production and to the new capital formation.

Our (preliminary) findings indicate that the additional 6-point subsidy introduced in 2016 had significant and differentiated impacts on firms in Turkey's manufacturing sector. Micro firms experienced the most substantial employment growth, with the subsidy increasing formal job creation by approximately 10-15%, depending on the regional classification. Small firms also benefited from increased capital accumulation and capital intensity, while medium-sized firms showed mixed effects with no significant employment impact and some evidence of reduced capital intensity. Large firms demonstrated limited employment growth but significant increases in capital intensity, particularly through machinery and equipment investments. These results are robust across various specifications and sensitivity checks, highlighting the effectiveness of the subsidy in addressing labor market challenges and supporting investment in smaller enterprises.

The paper proceeds as follows: Section II introduces the characteristics of Turkish labor market and the subsidy schemes in Turkey. Section III describes the data set. Section IV presents the methodology and identification strategy. In Section V, we share the result of the empirical analyses. Section VI concludes.

II. Labor Market and Subsidy Schemes in Turkey

Although the Turkish labor market has undergone changes over the decades, influenced by structural challenges, regional disparities, economic policies and demographic trends, it can be characterized briefly as having a low labor force participation (LFP) rate, a dual labor market structure, high unemployment rates, a highly compressed wage distribution around the minimum wage, a significant low educated and low skilled labor force, and regional disparities.

To give more insight into the Turkish labor market, the LFP rate is relatively low compared to OECD averages, especially for women. The LFP for men is over 70%, while for women it is around 35-40%, reflecting traditional gender roles and socio-cultural factors. The economy has shifted from agriculture

to industry and services over the years. According to the latest Turkstat figures, services dominate employment (around 58%), followed by industry (around 20%), agriculture (around 15%) and construction (around 5%). Youth unemployment is persistently high, often above 15%, and women face significant barriers to entry due to limited access to formal employment opportunities and childcare facilities (Yeldan, 2017). In terms of regional disparities, unemployment rates are significantly higher in eastern and southeastern Turkey than in the more industrialised western regions, reflecting uneven economic development (Betcherman et al., 2010). A significant portion of the labor force (around 25%) works informally, especially in agriculture, construction, and small businesses. Informal employment limits access to social security and labor rights. Turkey has a high minimum wage relative to its GDP per capita, which is generally adjusted annually. While it supports low-income households, it poses challenges for small and medium-sized enterprises. Income disparities are significant, particularly between urban and rural areas, as well as across regions (Yeldan, 2017). Despite improvements in education, skill mismatches persist. Employers often cite a lack of adequately trained workers in technology and high-skilled sectors, while vocational training programs have yet to fully address these gaps. Labor laws are criticized for being rigid, making it difficult for employers to adjust to economic fluctuations. These laws include stringent hiring and firing regulations and high social security costs. The government has introduced numerous employment subsidies, vocational training programs, and social security incentives to stimulate job creation and reduce informality (e.g., subsidies targeting women, youth, and regional development).

Turkey has a relatively young population, with a median age of 34, which creates potential for a demographic dividend but also poses challenges in terms of providing sufficient job opportunities. Rapid urbanization has shifted labor dynamics, increasing demand in industrial and service sectors while reducing agricultural employment. The pandemic exacerbated existing vulnerabilities, especially in informal employment and tourism-related jobs. Recovery has been uneven, with some sectors recovering faster than others

The Turkish labor market is a mix of opportunities and challenges. While its young population and strategic location offer potential for growth, persistent issues like informality, regional inequalities, and gender disparities hinder progress. Policies aimed at fostering formal employment, improving education and skills, and addressing regional imbalances are crucial for sustainable development. Turkey has implemented several active labor market policies (ALMPs) to address such challenges. We can classify them in the following manner:

Vocational Training and Skill Development: Programs like the Specialized Vocational Skills Training Centers, On-the-Job Training Programs, and other vocational courses aim to improve employability by enhancing skills tailored to labor market needs. These programs often target disadvantaged groups, including women and youth, to integrate them into formal employment.

Employment Subsidies and Incentives: Subsidies under laws such as 5510 and 6111 have been used to incentivize employers to hire specific demographics, reduce labor costs, and formalize employment. These include tax deductions and social security premium reductions.

Entrepreneurship Support: Training programs and grants for entrepreneurship have been implemented to encourage self-employment, especially among women.

Public Works and Social Benefit Programs: Programs such as “Working for the Benefit of Society” provide temporary employment opportunities, primarily for unskilled workers, while also aiming to meet community needs.

Youth and Women-Specific Programs: Focused initiatives like internships and mentorship schemes help young people transition from education to employment. Women-specific courses aim to reduce gender disparities in the labor market.

Turkey provides a fitting context for analyzing the effects of employment subsidies due to its high labor tax burden. On average, almost 40% of the gross wage is allocated to taxes and social security contributions, among the highest in OECD countries (Aşık et al, 2022). Employers bear a significant share, contributing 21.5%-27% of gross wages toward social security, covering items such as disability, old age, death insurance, unemployment insurance, and health insurance. Additionally, informal employment remains prevalent, with 20% of non-agricultural workers and over one-third of agricultural workers operating without social security registration. Informality stems from high tax burdens, low productivity, and limited enforcement. Over the past decade, Turkey has implemented employment subsidies to address these challenges, aiming to reduce informality and promote formal job creation.

Employment subsidies in Turkey often offset registration costs for formal employment by covering a portion of employers' social security contributions. By the end of 2018, Turkey had over a dozen active subsidy programs, targeting various groups or regions. The most significant program is the "5-Point Reduction" under Law No. 5510, which lowers the employer’s share of disability, old age, and death insurance from 11% to 6%. Firms meeting basic compliance conditions automatically benefit from this subsidy. Additionally, firms can combine compatible subsidies, using up to two per worker per month.

The "Additional 6-Point Subsidy," introduced in 2013, expanded prior initiatives targeting economically disadvantaged regions. Initially, the program focused on 51 provinces and two counties, offering a 6-percentage-point reduction in the employer's disability, old age, and death insurance premiums. This translated to a 22%-28% reduction in employers' social security contributions, lowering total labor costs by about 6% for minimum-wage employees. Firms could benefit from both the 5-point and 6-point subsidies, effectively halving their social security contribution burden.

Eligibility for the 6-point subsidy requires firms to meet stricter conditions than for the 5-point subsidy. These include operating in eligible regions, maintaining timely payments, and ensuring compliance across all branches. Initially, the 6-point subsidy applied only to firms with at least 10 employees and covered only new hires. However, these restrictions were lifted in 2016, broadening the program to small firms and all employees.

Initially, eligibility for the 6-point subsidy was determined at the provincial level, with targeted regions classified into six tiers based on socio-economic development. Regions 4, 5, and 6, representing the least developed areas, were the primary beneficiaries. However, in 2020, eligibility criteria shifted to the county level, allowing underdeveloped counties within wealthier provinces to qualify. This policy

adjustment aimed to refine subsidy targeting by recognizing socio-economic disparities at a more localized level.

The Additional 6-Point Subsidy represents a significant intervention in Turkey's labor market, addressing both employment creation and the formalization of informal jobs. By lowering labor costs, it incentivizes small firms to formalize employment, enhancing job security and increasing government revenue through reduced informality. Furthermore, the shift to county-level targeting improves the program's precision, ensuring subsidies reach the regions most in need.

III. Data

In this study, we rely on administrative micro data, retrieved from the Entrepreneurship Information System (EIS) of Ministry of Industry and Technology. The EIS is a significant data integration initiative designed to consolidate, standardize, and analyze economic activity data from various public institutions in Turkey. Its primary objective is to serve as a centralized database that aids in data-driven policymaking, research, and economic analysis.

EIS integrates data from numerous institutions, ensuring a wide-ranging and holistic dataset. Key contributors and their respective data types include:

- Financial declarations such as balance sheets and income statements from Revenue Administration (GİB)
- Employment-related data, including workplace registrations and employee demographics from Social Security Institution (SGK)
- Foreign trade data from the Ministry of Trade
- Data on SME supports and loans from Small and Medium Enterprises Development Organisation (KOSGEB)
- Information on R&D supports and intellectual property data, including patent applications and registrations from Turkish Patent and Trademark Office
- Data on actual production quantities reported in annual operating statements from the Ministry of Industry and Technology

It covers enterprises subject to corporate and income taxes, focusing on those deriving income from commercial and industrial activities and workplaces employing mandatory insured workers under the Social Security Institution (SGK). Certain non-commercial entities, such as residential managements and freelance professionals (e.g., lawyers, engineers), are excluded from the database. Banking activities and joint ventures with separate reporting requirements are not included too.

This database contains administrative information for all registered firms (exceeding 3 million firms) and workers outside the finance and defense sectors in Turkey, at provincial and district levels, with detailed insights into individual enterprises. Temporal coverage varies by data source, with records extending back to 2006 for most data categories. The firms can be classified across regions, counties and subsidy regions, sectors, firm-size, and technology level.

Enterprises are categorized as micro, small, medium, or large based on employee numbers and financial thresholds, as per official regulations. Firms with 0–9 employees and up to 3 million TRY revenue are

classified as micro-scale, firms with 10–49 employees and up to 25 million TRY revenue are classified as small-scale, firms with 50–249 employees and up to 125 million TRY revenue are classified as medium-scale and the rest are classified as large-scale firms.

The database has information on employment at firm level in terms of age, sex, wage level and occupation. For the skill level of employment, there is no direct information about the education level of the employee. However, we use the occupation classification (ISCO) in EIS as an indicator for the skill level of employment since in ESCO classification, which distinguishes between skill/competence concepts, each occupation is mapped to exactly one ISCO code.The technological level of production is categorized into 4 types for manufacturing firms: low technology, medium-low technology, medium-high technology and high technology.

EIS employs standardized classification frameworks to ensure consistency and comparability of data: NACE Rev. 2 for classifying economic activities, PRODTR 2010 for industrial products, GTIP, BEC and SITC for trade goods classification.

Enterprise-level data is matched across multiple sources using tax identification numbers, ensuring comprehensive and accurate integration. Enterprise-level financial figures are distributed across workplaces based on the number of insured employees, enabling sectoral and regional financial analyses. Data on enterprise purchases and sales is aggregated and analyzed using mandatory tax forms. The system provides detailed insights into economic activities at regional and sectoral levels, facilitating targeted analyses and decision-making.

We will restrict our analysis to manufacturing industry only as technological level is only defined for manufacturing industry.

IV. Methodology

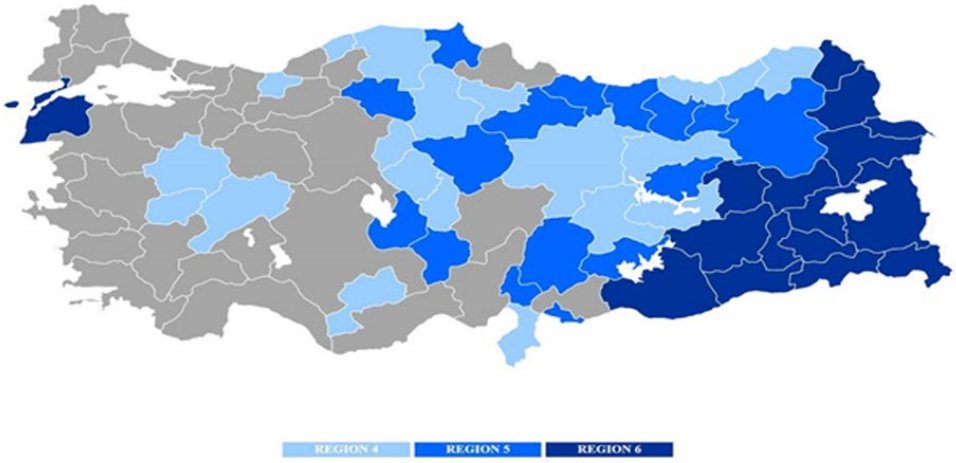
We estimate the causal effect of the subsidy policy change in Turkey that occurred in 2016, which expanded eligibility for an additional 6-point subsidy on employer social security contributions to small firms (up to 10 employees). This expansion provides a quasi-natural experiment setting that we exploit using a difference-in-differences (DiD) approach, which necessitates credible treatment and control groups.

We determine the treatment and control groups according to the eligibility for the subsidy in terms of regions, based on the socio-economic development. The government categorizes the regions into 6, where region 1 is the most developed one and region 6 is the least developed one. In our case, the additional 6-point subsidy has been granted to regions 4, 5 and 6, which implies that the firms in treatment group has to be operating within these regions. In 2016, these regions were determined on province basis, which means that a province may contain a county having a different economic development than itself (Chart 1).

In August 2020, a legislation change amended the regional subsidy classifications from province level to county level. As a result of this change, 99 counties, which were previously classified under regions 1,2 and 3 due to the province they administratively belonged to, were classified as Region 4. This reclassification provides a credible opportunity to form a control group, because although these newly

treated counties were similar in terms of economic development to previously treated counties, they were exempt from benefiting the employment subsidy during our sample period of 2006-2019. To summarize, treatment group contains the firms in eligible provinces that began receiving the additional 6-point subsidy after the 2016 policy change, whereas the control group contains firms in provinces that became eligible for additional 6-point subsidy after 2020 but were benefiting from the existing 5-point subsidy. We don't put any restriction on the firm-scale, but since the policy change in 2016 brought an extension to firms with less than 10 employees, we would expect the policy to be more effective on micro scale and small scale firms.

Chart 1. Provinces that are eligible for the 6 additional points reduction



Note: For the west, most province in Region 6, Canakkale, the only eligible districts are two islands, Gokceada and Bozcaada.

Source: Aşık et al (2022)

It should be highlighted that our difference in differences results provide Intention-To-Treat (ITT) effects as the EIS data does not show which firms actually receive the treatment, but shows the location of the firms. Therefore, our approach in fact captures exposure to treatment. Intention to Treat analysis is commonly used in the program evaluation literature because the identification is still based on a randomized variable. Bloom (2006) argues that intention to treat analysis is more relevant for policy makers because voluntary programs can offer treatment, but they cannot enforce take-up.

We acknowledge potential challenges in our identification strategy: The validity of the DiD approach rests on the assumption that, absent the policy change, the treatment and control groups would have followed similar employment trends. To ensure the robustness of our findings, we perform additional analysis by restricting control firms to those in adjacent counties as in Card and Krueger (1994), reducing the likelihood of unobserved regional factors driving the results (not included here, forthcoming).

Against this background, the core identification strategy relies on comparing the changes in employment (L), capital stock (K) and capital-labor ratio (K/L) in treated regions (treatment group) before and after

the implementation of the policy with corresponding changes in untreated regions (control group) over the same period.

Accordingly, we run the following regressions to attain empirical results:

(1) $Ln(Y_{i,t}) = \beta_0 + \beta_1 Treated_{i,t} * D2016_t + \phi_i + \phi_s + \tau_t + \epsilon_{i,t}$

Where i, t, r stand for firm, year, region. For the dependent variable, we use employment, capital stock and capital/labor ratio. To account for firm-specific and technology-level specific factors, which do not vary over time, the specifications include firm and technology-level fixed effects, denoted by ϕ_i and ϕ_s. We also include dummies to year effects, denoted by τ_t. In addition, we also include province-specific time trends and industry-specific time effects to relax the common trends assumption. β_1, which we call later as DiD coefficient in the Tables is the coefficient of interest to evaluate the causal effect of the additional 6-point subsidy.

IV. EMPIRICAL RESULTS

IV.1. Employment

We first start with firm level employment in the manufacturing sector as the main goal of the 6 point subsidy was to increase employment in under-developed regions of Turkey. In this section, we shut down firm entry and focus on firms that were already established before the policy change in 2016. In particular, we focus on firms which were classified as micro, small, medium or large during the period 2006 and 2015.

Table 1 presents the results of the employment growth analysis, which shows significant differences between firm sizes. The difference-in-differences (DiD) coefficient for pretreatment micro firms is positive and statistically significant. The coefficient size indicates a 9 percent employment growth in Region 4 firms, relative to later-treated Region 4 control firms. This indicates a significant increase in employment for micro firms following the implementation of the subsidy policy. The robustness of this effect suggests that the subsidy effectively incentivized job creation in this category. For pretreatment small firms, the DiD coefficient is negative but statistically insignificant, implying that there is no clear evidence that the subsidy affected employment growth in small firms. The coefficients for medium and large firms are positive but statistically insignificant, suggesting that the subsidy did not have a significant impact on employment in these larger firms either.

The robustness check presented in Appendix Table A1 is consistent with the main results and confirms the findings. In Appendix Table A1, we include firms in Regions 5 and 6 to the analysis. The statistical significance and sign of the DiD coefficients are the same as in the main analysis for all firm sizes, while the coefficient size increases for micro firms. Therefore, we can conclude that the application of the subsidy has increased the employment of micro enterprises by 9.6% in region 4 and by almost 15% if firms in regions 5 and 6 are also taken into account. These results seem to be in line with the design of the policy, which primarily targeted smaller enterprises.

Table 1. Employment Growth in Treated Firms

FIRM SCALE / VARIABLES	(1) MICRO	(2) SMALL	(3) MEDIUM	(4) LARGE
DID Coefficient	0.0962***	-0.0902	10.62	-24.80
	(0.0239)	(0.0577)	(6.732)	(73.35)
Observations	387,421	443,507	12,308	1,894
R-squared	0.605	0.765	0.632	0.846
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

IV.2 Capital Investment

Next, we examine the change in capital stock results under two metrics: total tangible assets and machinery and equipment that can be extracted from the Balance Sheet database of EIS. As before, we shut down firm entry and focus on the firms that were established before the legislation change in 2016.

Regarding the results for the tangible assets metric, micro and small enterprises show a significant positive growth in capital stock, with coefficients of 0.128 and 0.118, implying an increase in capital stock of 12.8% and 11.8%, respectively, after receiving the subsidy (Table 2). We find no statistical significance for medium-sized firms, while for large firms we find a positive coefficient, albeit at a lower level of significance. The high coefficient also raises concerns about the reliability of the result.

Table 2. Capital Stock Growth in Treated Firms (K: Total Tangible Assets, ln Logs)

FIRM SCALE / VARIABLES	(1) MICRO	(2) SMALL	(3) MEDIUM	(4) LARGE
DID Coefficient	0.128***	0.118***	0.191	1.200*
	(0.0192)	(0.0196)	(0.243)	(0.690)
Observations	380,317	435,686	12,242	1,892
R-squared	0.812	0.857	0.664	0.707
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

With regard to the results for the machinery and equipment metric, it can be observed that statistically significant and positive growth is evident in both micro and small firms (Table 3). However, the coefficients are smaller, with values of 0.0468 and 0.0614, respectively, in comparison to the estimated coefficients utilizing the total tangible asset metric. The results for medium and large firms are also similar.

The robustness analysis confirms the findings for capital investment. The estimated coefficients for micro and small firms are slightly lower than in the main analysis, but remain significant. This shows that the subsidy helps smaller firms to accumulate tangible assets. For medium and large firms, the coefficients are slightly negative for medium firms and remain positive for large firms, with low significance. This suggests the subsidy had a nuanced impact depending on firm size.

The robustness check shows that micro and small firms again exhibit significant positive impacts, consistent with the main results. The checks show that the subsidy encouraged smaller firms to invest in machinery and equipment. For medium-sized firms, the result is negative but not significant. For large firms, the result is positive but not significant. This confirms our concerns about the main analysis.

Table 3. Capital Stock Growth in Treated Firms (K: Machinery and Equipment, ln Logs)

	(1)	(2)	(3)	(4)
FIRM SCALE / VARIABLES	MICRO	SMALL	MEDIUM	LARGE
DID Coefficient	0.0468***	0.0614***	0.0363	1.211*
	(0.0128)	(0.0150)	(0.258)	(0.714)
Constant	30.93**	30.96***	-33.36	-1,207**
	(13.25)	(5.181)	(63.28)	(555.7)
Observations	378,481	433,494	12,183	1,892
R-squared	0.818	0.862	0.729	0.714
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

IV.3 Capital Intensity (K/L Ratio)

Previous estimations show significant labor and capital effects for some firm-types, but the relative impact of these changes on the capital-labor utilization is another important aspect for the effectiveness of the subsidy scheme. We again examine the change in the capital intensity outcomes, measured as the ratio of capital to labor, under two metrics: all tangible assets and machinery and equipment. Here are the insights:

The first metric for capital shows that micro and small firms had a statistically significant increase in capital intensity, with coefficients of 0.0997 and 0.120 (Table 4). The impact on medium-sized firms was

small and not statistically significant. Large firms showed a positive coefficient, suggesting an increase in capital intensity.

Table 4. Change in Capital Intensity (K/L) in Treated Firms (K: Total Tangible Assets, ln Logs)

	(1)	(2)	(3)	(4)
FIRM SCALE / VARIABLES	MICRO	SMALL	MEDIUM	LARGE
DID Coefficient	0.0997***	0.120***	-0.0222	1.649*
	(0.0183)	(0.0186)	(0.288)	(0.900)
Constant	83.36***	45.68***	-72.42*	979.7**
	(18.75)	(6.005)	(43.88)	(435.3)
Observations	377,647	432,535	12,132	1,884
R-squared	0.776	0.797	0.629	0.630
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The second metric for capital shows that small firms increased capital intensity, while micro firms stayed the same. Medium firms had a negative but insignificant impact, while large firms had a significant positive impact..

Table 5. Change in Capital Intensity (K/L) in Treated Firms (K: Machinery and Equipment, ln Logs)

	(1)	(2)	(3)	(4)
FIRM SCALE / VARIABLES	MICRO	SMALL	MEDIUM	LARGE
DID Coefficient	0.0175	0.0628***	-0.177	1.652*
	(0.0130)	(0.0148)	(0.290)	(0.909)
Constant	32.72***	29.05***	-45.06	421.0
	(12.21)	(5.095)	(52.56)	(481.3)
Observations	377,298	432,023	12,113	1,885
R-squared	0.774	0.792	0.715	0.649
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The tables on capital intensity show more details. For tangible assets, micro and small firms show higher capital intensity (0.0802 and 0.110), supporting the main findings. The subsidy helped smaller firms

improve their capital-to-labor ratios. For medium firms, the negative coefficient is still there but not significant. For large firms, the coefficient is slightly reduced but still positive and significant, indicating an increase in capital intensity.

The programme has a consistent impact on capital intensity through machinery and equipment for small firms. The coefficient for micro firms is close to zero, showing no change in capital intensity for machinery. Medium firms show a continued negative coefficient, suggesting that labor and capital are being used in different ways, but this is not statistically significant. Large firms maintain a significant positive impact implying increased capital intensity at this scale.

We check the robustness of our capital intensity results using different classifications for firm size. In particular, we group firms based on mean employment between 2006 and 2015; firms with mean employment between 1-4, between 5-7 and between 8-12 to understand which firms could be more likely to have increased capital intensity after the legislation change in 2016. Results in Table 6 suggest that the firms which increased capital intensity were the ones at the margin, i.e. firms with mean employment size between 8 to 12.

Table 6. Change in Capital Intensity (K/L) in Treated Firms (K: Machinery and Equipment, ln Logs)

	(1)	(2)	(3)	(4)	(5)	(6)
	K/L Ratio	Capital Stock	K/L Ratio	Capital Stock	K/L Ratio	Capital Stock
VARIABLES	Firm size: 1 to 4	Firm size: 1 to 4	Firm size: 5 to 7	Firm size: 5 to 7	Firm size: 8 to 12	Firm size: 8 to 12
DID Coefficient	-0.033	0.047	0.018	-0.124	0.421**	0.410**
	(0.043)	(0.042)	(0.109)	(0.118)	(0.182)	(0.187)
Observations	98,059	98,316	93,297	93,621	17,489	17,555
Firm Fixed Effects	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Overall, the empirical results highlight that the subsidy program had its strongest impact on micro and small firms, particularly in terms of employment growth and capital investment. The program's design appears to have effectively targeted smaller firms, which are typically more sensitive to cost reductions. For larger firms, the effects were more mixed, with some evidence of increased capital intensity but limited employment growth impacts. The subsidy consistently boosted tangible asset investment for micro and small firms, including machinery and equipment. Medium-sized firms saw some negative effects, while large firms experienced increases in capital intensity. These results show that the policy was effective in targeting smaller firms and promoting employment and capital formation. The robustness checks show these findings are reliable and explain the subsidy's impact better.

The fact that capital formation is not negatively affected by the application of labor subsidies is a positive outcome for maintaining long-term sustainable growth in Turkish economy. Further, it also shows that the significant reduction in labor cost is a significant booster for capital investment of firms which subject to more financial constraints.

Additional Analyses Forthcoming

- Skill composition at the firm level
- Firm entry-exit
- Firm level profits
- Firm level bank credits
- Worker level estimations on human capital investments

CONCLUSION

This study evaluates the impact of the 2016 subsidy expansion policy in Turkey, which introduced an additional 6-point reduction in employer social security contributions, on employment, capital investment, and capital intensity in the manufacturing sector. Using a robust difference-in-differences framework, we draw key insights into the policy's effectiveness.

The findings highlight that the subsidy program effectively stimulated employment growth and capital accumulation, particularly for micro and small firms. Micro firms experienced the most significant employment gains, while small firms benefited substantially from increased capital stock and intensity. These outcomes align with the policy's objectives to target smaller enterprises that are typically more sensitive to labor cost reductions. The policy also encouraged firms to enhance their capital intensity, suggesting a complementary relationship between labor subsidies and capital formation.

For medium-sized firms, the effects were mixed, with no significant employment impact and some evidence of reduced capital intensity. For large firms, the program demonstrated limited effectiveness in driving employment growth but supported increases in capital intensity, especially in machinery and equipment.

The robustness checks corroborate these findings, underscoring the reliability of the estimated effects across multiple specifications and control groups. The policy's design to alleviate financial constraints on smaller firms proved instrumental in achieving the desired outcomes.

These results provide important policy implications. First, targeted subsidies can be effective in addressing labor market challenges in developing countries, particularly for smaller firms. Second, labor subsidies need not lead to capital substitution; instead, they may foster a complementary relationship between labor and capital investment. Finally, refining eligibility criteria, as observed in the shift to county-level targeting in 2020, can further enhance the efficiency and precision of such programs.

In conclusion, the 2016 subsidy expansion policy represents a successful intervention in supporting employment and investment in Turkey's manufacturing sector. Future research should explore the long-term sustainability of these effects and the potential for spillovers to productivity and technological advancement, which are crucial for sustaining growth in developing economies.

APPENDIX

Table A1. Employment Growth in Treated Firms - (Region 4, 5 and 6)

FIRM SCALE / VARIABLES	(1) MICRO	(2) SMALL	(3) MEDIUM	(4) LARGE
DID Coefficient	0.149***	-0.0447	6.055	3.646
	(0.0224)	(0.0567)	(6.240)	(61.07)
Constant	-7.436	9.129	-140.0	-55,405**
	(5.550)	(14.42)	(961.5)	(26,607)
Observations	689,617	793,525	21,614	3,451
R-squared	0.584	0.720	0.581	0.851
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A2. Capital Stock Growth in Treated Firms (K: All Tangible Assets) - (Region 4, 5 and 6)

FIRM SCALE / VARIABLES	(1) MICRO	(2) SMALL	(3) MEDIUM	(4) LARGE
DID Coefficient	0.117***	0.113***	-0.0528	1.163*
	(0.0176)	(0.0184)	(0.214)	(0.704)
Constant	49.61***	49.65***	62.01	-589.6*
	(4.908)	(4.963)	(40.84)	(338.6)
Observations	678,724	781,242	21,529	3,456
R-squared	0.807	0.853	0.640	0.713
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A3. Capital Stock Growth in Treated Firms (K: Machinery and Equipment) - (Region 4, 5 and 6)

FIRM SCALE / VARIABLES	(1) MICRO	(2) SMALL	(3) MEDIUM	(4) LARGE
DID Coefficient	0.0307**	0.0575***	-0.209	1.082
	(0.0119)	(0.0139)	(0.208)	(0.697)
Constant	18.90***	28.23***	77.68	-910.6***
	(3.055)	(3.941)	(51.40)	(335.6)
Observations	675,486	777,361	21,444	3,453
R-squared	0.812	0.854	0.713	0.743
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A4. Change in Capital Intensity (K/L) in Treated Firms (K: All Tangible Assets) - (Region 4, 5 and 6)

FIRM SCALE / VARIABLES	(1) MICRO	(2) SMALL	(3) MEDIUM	(4) LARGE
DID Coefficient	0.0802***	0.110***	-0.0609	0.0802***
	(0.0168)	(0.0175)	(0.247)	(0.0168)
Constant	47.60***	47.56***	18.90	47.60***
	(4.475)	(4.571)	(34.16)	(4.475)
Observations	674,259	776,001	21,349	674,259
R-squared	0.773	0.792	0.604	0.773
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A5. Change in Capital Intensity (K/L) in Treated Firms (K: Machinery and Equipment) - (Region 4, 5 and 6)

FIRM SCALE / VARIABLES	(1) MICRO	(2) SMALL	(3) MEDIUM	(4) LARGE
DID Coefficient	-0.00683	0.0549***	-0.218	1.484*
	(0.0120)	(0.0137)	(0.233)	(0.884)
Constant	17.34***	26.17***	39.82	-241.9
	(3.049)	(3.828)	(42.37)	(205.8)
Observations	673,671	775,119	21,322	3,437
R-squared	0.770	0.781	0.701	0.690
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Industry-Year Trends	YES	YES	YES	YES
Province-Year Trends	YES	YES	YES	YES

Notes: Industry-year trends are at 4-digit industry level. Standard errors are clustered at the firm level.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A6. Countries which were included under Region4 after 2020.

Province	Region	County	Subsidy region after 2020
Adana	3	Yumurtalık, İmamoğlu, Karataş, Karaisali	4
Bilecik	3	Gölpazarı, İnhisar, Yenipazar	4
Ankara	1	Haymana, Bala, Çamlıdere	4
Aydın	2	Kuyucak, Germencil, Karacasu, Sultanhisar, Köşk, Buharkent, Yenipazar, İncirliova, Bozdoğan	4
Balıkesir	2	Savaştepe, Dursunbey, Sındırgi Havran, Kepsut	4
Bolu	2	Yeniçağa, Mudurnu, Göynük	4
Burdur	3	Kemer, Ağlasun, Cavdır, Çeltikçi, Yeşilova, Altınyayla	4
Bursa	1	Haymancık, Keleş	4
Çanakkale	2	Bayramiç, Yenice	4
Gaziantep	3	Nizip, Islahiye, Oğuzeli, Nurdağı, Karkamış, Araban, Yavuzeli	4
Isparta	2	Şarkıkaraağaç, Aksu	4
Karabük	2	Eskipazar, Yenice	4
Kayseri	2	İncesu, Felahiye, Yahyalı, Bünyan, Yeşilhisar, Pınarbaşı	4
Konya	3	Kulu, Sarayönü, Hadim, Taşkent, Güneysınır, Kadınhanı, Doğanhisar, Tuzlukçu, Yalıhüyük, Bozkır, Derebucak	4
Denizli	2	Babadağ, Kale, Beyağaç, Baklan, Güney, Çameli	4
Edirne	2	Enez, İpsala, Meriç	4
Eskişehir	1	Alpu, Günyüzü	4
Kırklareli	2	Demirköy, Pehlivanköy	4
Manisa	2	Saruhanlı, Köprübaşı, Ahmetli, Gölmarmara, Selendi	4
Sakarya	2	Kaynarca, Ferizli	4
Mersin	3	Aydıncık, Mut, Gülnar	4
Samsun	3	Kavak, Havza, Alacam, Yakakent, Salıpazarı, Vezirköprü, Asarcık, Ayvacık	4
Zonguldak	3	Kilimli, Gökçebey	4

Source: Aşık et al. (2022)

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