The Heterogeneous Impact of Firm-Provided Training Subsidies on Firm Outcomes*

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1. Introduction

Advancing technologies as AI and machine learning are increasingly able to replace specific tasks in production (Bessen et al., 2023). This may further increase the existing polarization between low- and high-skilled labor (Autor and Dorn, 2013; Goos et al., 2009, 2014). A possible solution is to update the skills of at-risk workers through firm-provided training. However, firms do not have the incentive to pay for such training. The reason is that employees then can leave the firm looking for a better-paid job that compensates them for the increased productivity they acquired through the training (Becker, 1964), suggesting the need for some government subsidy. Indeed, many OECD countries provide subsidies for training to alleviate the risk for firms, and over the last two decades, these subsidies have grown increasingly popular (OECD, 2022).

But do firm-provided training subsidies really improve firm-level training initiatives? And if so, does this increased training lead to improved firm outcomes? In this paper, we identify the causal effects of firm-provided training subsidies by exploiting a policy that provides subsidies under which Flanders-based SMEs can finance training programs organized by external service providers. We assemble a dataset that links balance sheet information of firms to administrative data on received training subsidies which contains information on the value of the subsidy and own expenditures on training. The long time horizon of the policy allows us to implement a staggered Difference-In-Differences design.

An important advantage of our firm-level dataset is that it allows us to evaluate the effect of training

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subsidies on training hours and expenditures (an input), but also on the number of trained and skilled employees (an output). It is a long-standing concern that subsidy programs could increase observed training expenditures without having much effect on the skills of their employees because firms relabel existing training initiatives to take advantage of the subsidy program. We can directly examine the output effects of the training programs by looking at the effect on the number of trained and skilled employees.

Related Literature. This paper contributes to the literature on employer-provided training and firm-level outcomes. Using industry-level data, Dearden et al. (2006) find a positive association between work-related training and productivity and wages. They find that a 1 percent point increase in training is associated with an increase in labor productivity of 0.6 percent and an increase in wages of 0.3 percent. Konings and Vanormelingen (2015) investigate this relationship at the firm level. They find that an increase in the share of trained workers by 1 percentage points is associated with 0.17 percent to 0.32 percent higher productivity. The average wage per worker increases by 0.1 percent to 0.17 percent in response to the same increase in training. Although insightful, these studies do not imply a causal relationship. We, however, provide causal evidence of the effects of training on firm outcomes.

Our paper is the closest related to Martins (2021). In a similar setting, Martins (2021) studies the wage and productivity effects of a large training grants program in Portugal. The subpopulation targeted in our design is composed of smaller firms than in Martins (2021).[1] This is an important contribution since smaller firms are more likely to be financially constrained and therefore more responsive to on-the-job training subsidies. Moreover, smaller firms have less skilled labor, and hence, are more in need of training (Oi and Idson, 1999; Song et al., 2019).

Secondly, this paper contributes to the literature on economic policy evaluation where both input and output additionality are evaluated. For instance, Chen et al. (2021) and Dechezleprêtre et al. (2023), look at the input (R&D expenditures) and output additionality (number of patents) for R&D tax incentives schemes. To the best of our knowledge, this is the only paper that looks at the input additionality (training expenditures and hours) and output additionality (number of trained and skilled employees) of training subsidies, which provides crucial information on the effectiveness of the policy.

2. Institutional Framework: Description of the SME e-Wallet

The SME e-Wallet, launched in 2009 by the Flanders Innovation and Entrepreneurship Agency (VLAIO), is a subsidy program aiding small and medium-sized firms in training investments. The attended training sessions must be geared towards improving the current or future operational effectiveness of the firm. Firms receive financial support to purchase services that can improve the quality of the business. Specifically, these are training services such as learning a new software program. Small companies receive a subsidy of

[1] The employment size of the average firm equals 110 in Martins (2021).

30 percent of the cost of the training, and 20 percent for medium-sized companies. There is a maximum of 7.500 Euros aid per year.

Applying firms must fulfill several criteria to be eligible for assistance. (i) The firm should qualify as an SME according to the European SME definition[2]. This means that firms should have fewer than 250 employees, an annual turnover less than 50 million Euros, or a balance sheet total not surpassing 43 million Euros. (ii) The firm must have a legal structure that meets the acceptable standards. (iii) It should have a physical presence in the Flemish Region, where the employees seeking training support are employed. (iv) The firm must operate within the private sector, with the participation of administrative government being less than 25 percent. (v) The firm has an "acceptable principal activity"[3].

Figure 1 shows an overview of the application process to receive subsidies. The application entails following steps:

(i) The SME seeks training and enrolls with the service provider.

(ii) The SME submits a digital support application for the subsidy.

(iii) The service provider checks the application.

(iv) The SME follows the training and the SME and VLAIO deposit into the SME's e-Wallet account.

(v) The service provider makes an invoice and the SME pays the provider through the SME e-Wallet.

3. Data

We combine four administrative datasets to analyze the impact of firm-level on-the-job training subsidies on firm outcomes. Across these datasets, all enterprises are identified by a unique VAT number, allowing for unambiguous merging. First, we use information on all Flemish firms that applied for VLAIO training subsidies from 2009-2022. This dataset is confidential, and courtesy of VLAIO, the Flanders Innovation and Entrepreneurship Agency that administered and distributed these subsidies. The dataset contains information on each application submitted by an enterprise, with the date of application, the sector of economic activity that applies to the support mechanism, whether or not the application was approved, and if granted, the date and amount of the payment. Second, We use employment data from the National Social Security Office of Belgium. The dataset reports the firm-level employment (in fulltime equivalents (FTE) and number of workers), firm-level gross wage bill, and industry code (NACE Rev. 2). We combine this data with the firm's company accounts provided by Belfirst. This dataset provides comprehensive information on value added, NACE sector, and tangible fixed capital. Finally, we add 'social accounts' data, which are a supplement to the annual financial accounts and contain additional information on the employees of the firm. We use the number of employees, by level of education (primary education, secondary education, higher education, and university) and firm-provided training information (training hours, training

[2]We refer to the VLAIO website for more information.

[3]A list has been established by the Flemish Government, based on NACE codes, of which main activities qualify for the SME portfolio.

expenditures, and trained employees) to evaluate the effect of the subsidy program.

Figure 2 shows the evolution of the distributed training subsidies over the period 2009-2022. The value of administered subsidies and the total project value (Panel A) increased steadily over the period 2009-2022. What is clearly noticeable is the effect of COVID-19 on the demand for grants. The value of the subsidies dropped from 56 Million Euros to 28 Million Euros (approx. -50 percent) and the total project value dropped from 148 Million Euros to 100 Million Euros (approx. -33 percent). The number of receiving firms (Panel B), also experienced a decline in 2020. However, the drop in the number of firms was less significant than the drop in value indicated by the fact that the subsidy value per firm also experienced a clear decrease.

4. Empirical Strategy

We implemented a stacked Difference-in-Differences design inspired by Cengiz et al. (2019), Deshpande and Li (2019), and Cassidy et al. (2024). Specifically, we generated distinct datasets for each cohort of firms receiving their first subsidy in a given year, denoted as c (ranging from 2012 to 2016)[4]. The variable τ represents event time, calculated as the calendar year t minus the year c in which the subsidy event occurred (τ = t - c). Within each dataset, we retained observations where τ varies from -3 to 3, defining our event window. As an additional requirement, we ensure that firms are present at least one year before the start of the event window. Subsequently, we include observations for firms with subsidy events in the calendar years c + 4 or later as controls for each dataset. For instance, the first cohort comprises firms receiving a subsidy in 2012, with the event window spanning from 2009 to 2015. Control firms for the 2012 cohort are those observed over the same event window, having their first subsidy after 2015. These firms serve as "clean controls" by avoiding subsidy events during the event window. This process was iterated for each cohort, and ultimately, we stacked the cohort-specific datasets to align them based on the event time (τ ranging from -3 to 3).

Using this stacked dataset, we estimate the following Difference-in-Differences specification:

$$y_{it} = \alpha + \sum_{\tau \neq -1; \tau = -3}^{3} \beta_\tau \times I_\tau \times Treat_j + \lambda_{st} + \eta_j + \varepsilon_{jt}, \tag{1}$$

where j indexes firms by cohort (since individual firms can appear multiple times in the dataset). I_t are the leads and lags in event time, with τ=-1 as the reference category. $Treat_j$ is the dummy variable indicating treatment, which equals to one for firms that receive a subsidy in the event window. λ_{st} are a set of four-digit sector $\times$ calendar year fixed effects and η_j are a set of cohort by firm fixed effects. y_{it} is the (log) outcome variable of interest.

[4]We leave out some treatment years due to their overlap with the Great Recession of the Covid-19 outbreak.

5. Results

Baseline Results. Our baseline results are presented graphically in Figure 3. The first panel of Figure 3 plots the regression coefficients from Equation 1, with log FTE (employment in full-time equivalents) as the dependent variable. There are no significant coefficients prior to treatment, so no evidence of pre-event trends. We see a significant rise in employment of around 1.3 percent in the year of treatment, which increases to nearly five percent by the end of our event window (i.e. three years after receiving the first subsidy).

We also consider the effect of receiving training subsidies on a number of other outcome variables in the subsequent panels (B)-(D), again plotting the coefficients in Equation 1, but replacing the dependent variable for added value, wage bill, and number of workers. Panels (B)-(D) indicate that firms not only increase their employment in FTE, but also increase their added value, wage bill, and the number of workers. The fact that the number of workers increases more than FTE employment indicates that firms increase their size by employing new employees instead of providing more working hours for half-time labor.

Panels (E) and (F) look at the average wage (wage bill over FTE) and labor productivity (added value over FTE) effects of the subsidy. Average wages increase by 1.9 percent on average, while labor productivity increases by 2.7 percent. The finding that labor productivity increases more than the average wage relates to the findings of Konings and Vanormelingen (2015) and Dearden et al. (2006) indicating a certain degree of monopsony power in the labor markets (Lamadon et al., 2022).

Results by Size. Figure 4 shows the results for two groups of firms: those with more than 5 employees, and firms with 5 employees or less (where firm size is determined at τ = -1). First, we find that firms with more than 5 employees experience virtually no effects on firm size and performance. Second, this figure shows that the results presented in Figure 3 are driven by very small firms (average wages go up by 2.1 percent and labor productivity by 3.3 percent). The reason behind this is that small firms are more financially constraint and hence more responsive to such policy programs (Criscuolo et al., 2019; Dechezleprêtre et al., 2023). Moreover, larger firms generally have more skilled labor (Oi and Idson, 1999; Song et al., 2019) decreasing the demand and effectiveness of the subsidy.

This finding is also reflected in Figure 5, where we look at the input and output additionality of the program. Firms with an employment size larger than 5 experience virtually no increase in training expenditures and training hours. Moreover, there are no significant results visible for training output (trained and high-skilled workers). For small firms, on the other hand, we see a clear spike in training expenditures and hours at the year of treatment. As a result, they experience an increase in their trained and high-skilled (college or university degree) workforce. A possible explanation for the lack of results for firms with an employment larger than 5 FTE may be that these firms relabel existing training activities to benefit from the subsidy program.

6. Conclusion

We estimate the impact of a firm-level subsidy program that provides financial support in training activities of SMEs. We assemble a dataset that links balance sheet information of firms to administrative data on received training subsidies which contains information on the value of the subsidy and own expenditures on training. Exploiting a stacked Difference-In-Differences event-study design, we show that training subsidies significantly increase firm size, wages, and labor productivity. However, we show that these positive and significant effects are driven by small firms (less than 5 full-time equivalent employees). This is not surprising since these firms are more financially constrained and less skilled on average.

Specifically, on average, these firms experience a 4-year cumulative employment gain of 11.7 percent. Added value and labor costs increase by 21 and 11 percent respectively. Average wages and labor productivity experience a cumulative growth of 7.6 and 9 percent respectively. The fact that labor productivity increases more than the average wage indicates a certain degree of monopsony power in the labor market. We document that these effects are driven by very small firms. In contrast, we do not find any evidence that larger firms experience positive significant effects from receiving training subsidies. This is reflected by the finding that larger firms (in contrast to smaller firms) do not experience positive effects on training expenditures, training hours, trained employment, and high-skilled employment. This is likely due to the fact that bigger firms would also do the training without the subsidy and relabel existing activities to take advantage of the subsidy.

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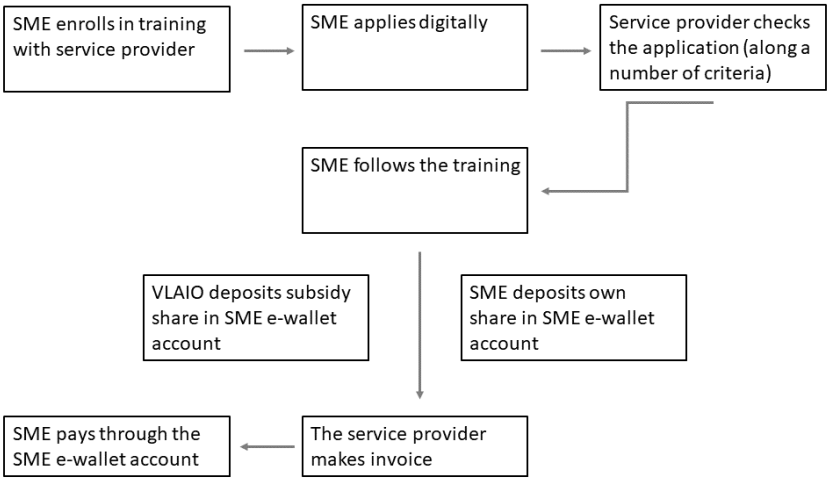
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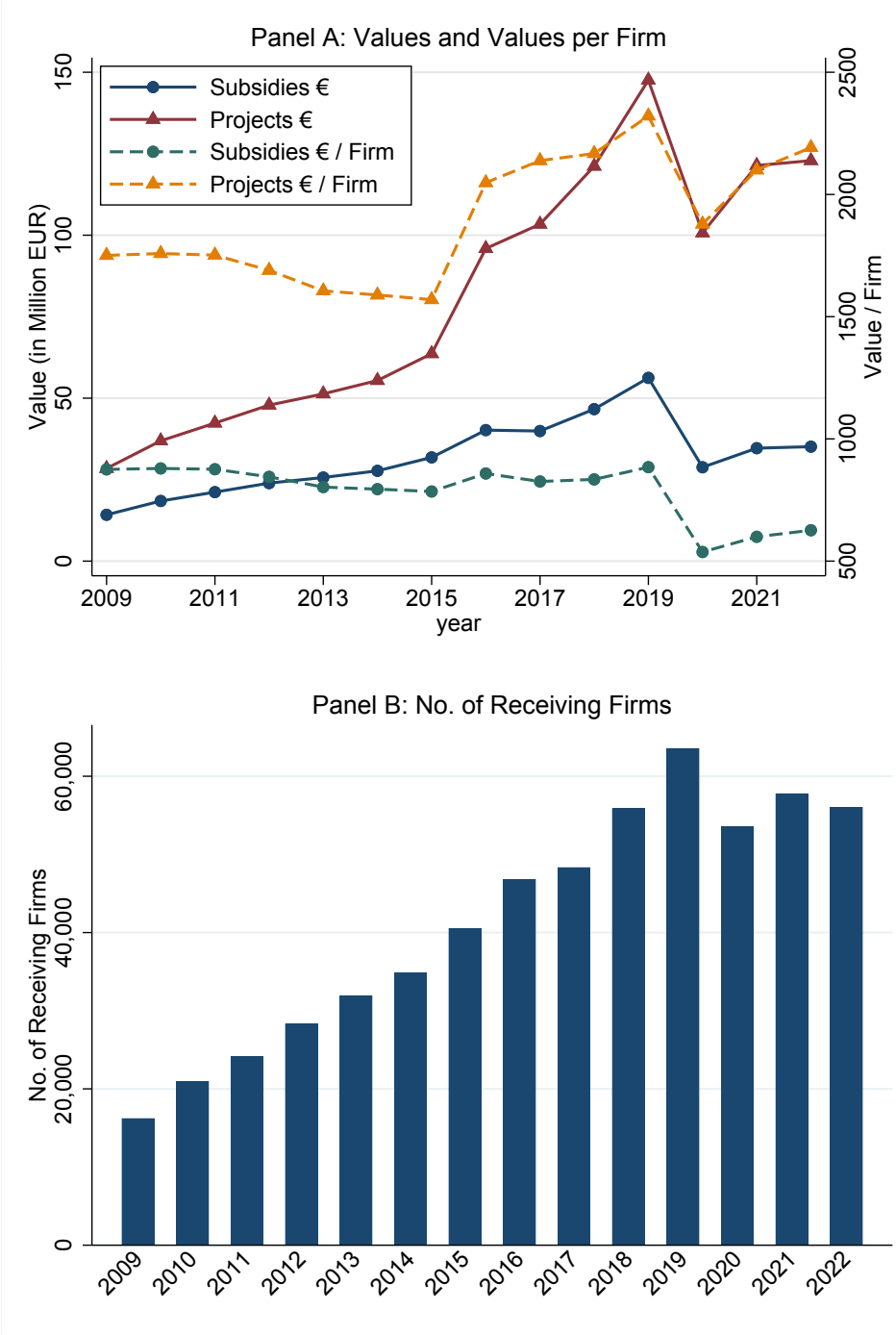
Figures and Tables

Figure 1: Overview of Application and Use of SME e-Wallet



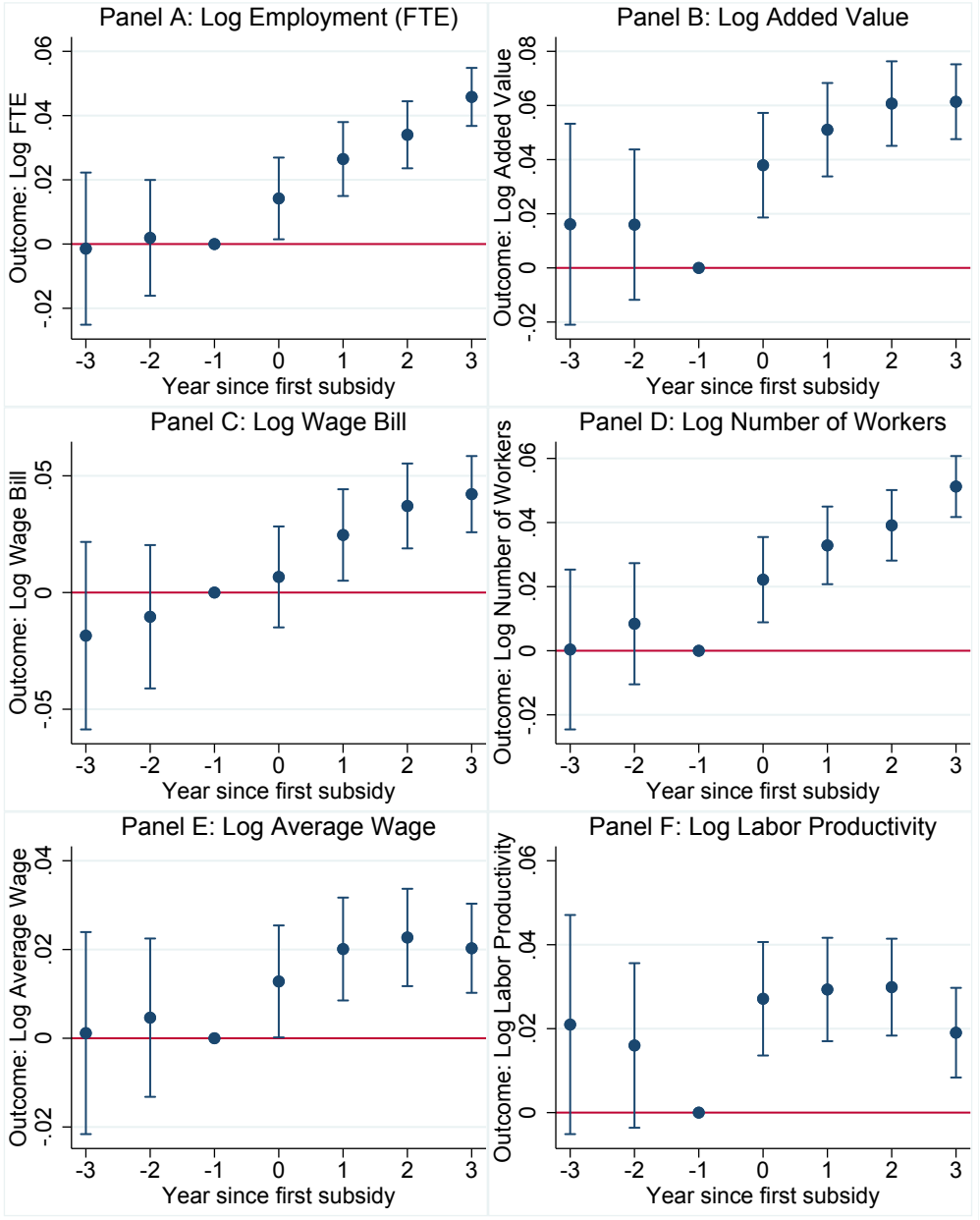
Notes: This Figure shows the overview of application and use of SME e-Wallet.

Figure 2: Evolution of the Magnitude of the SME e-Wallet over Time



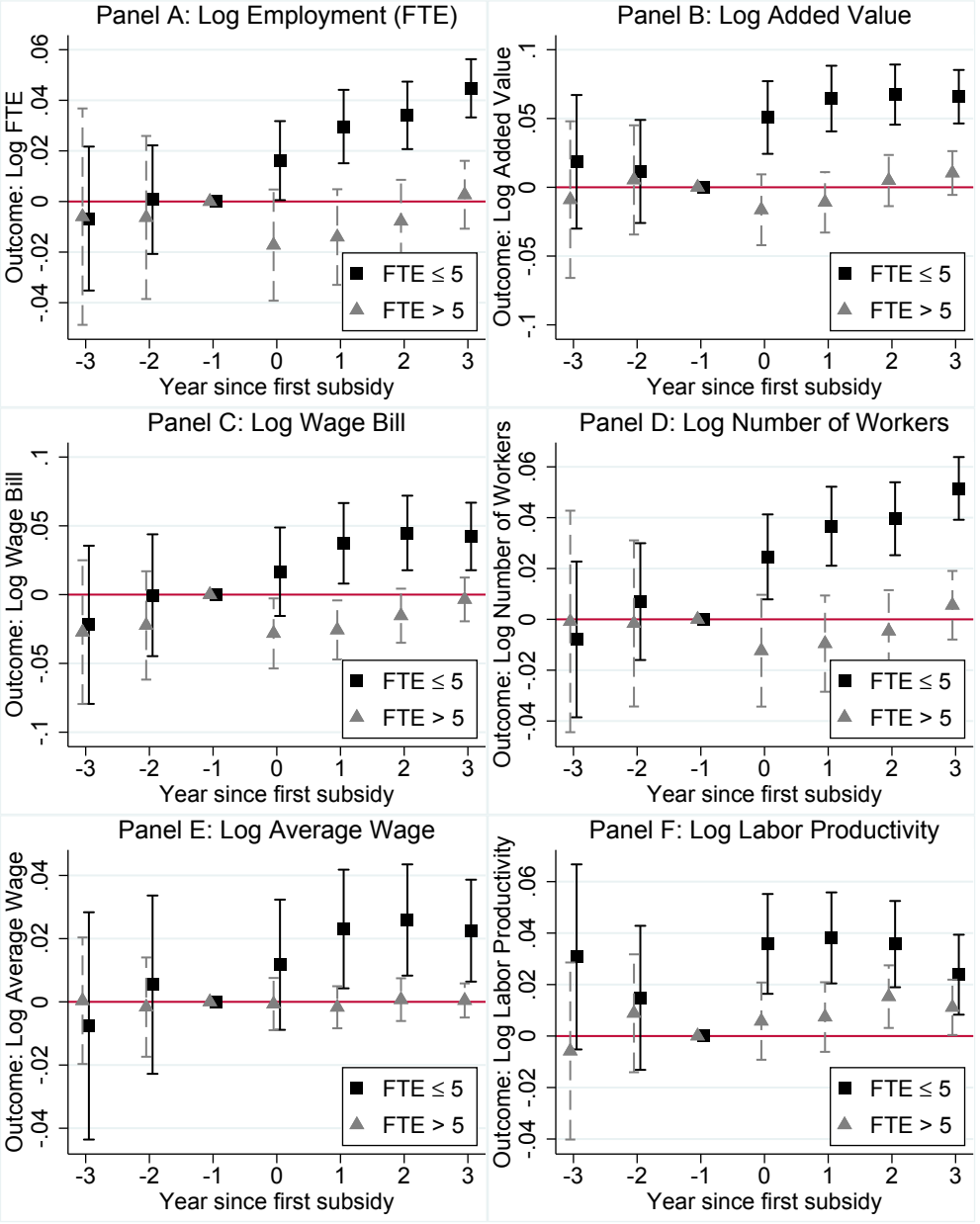
Notes: This Figure plots the evolution of the values of the subsidies, the values per firm and the number of receiving firms. Data are from the Flanders Innovation and Entrepreneurship Agency (VLAIO).

Figure 3: Firms Increase Their Size, Wages, and Productivity after Receiving Their First Subsidy



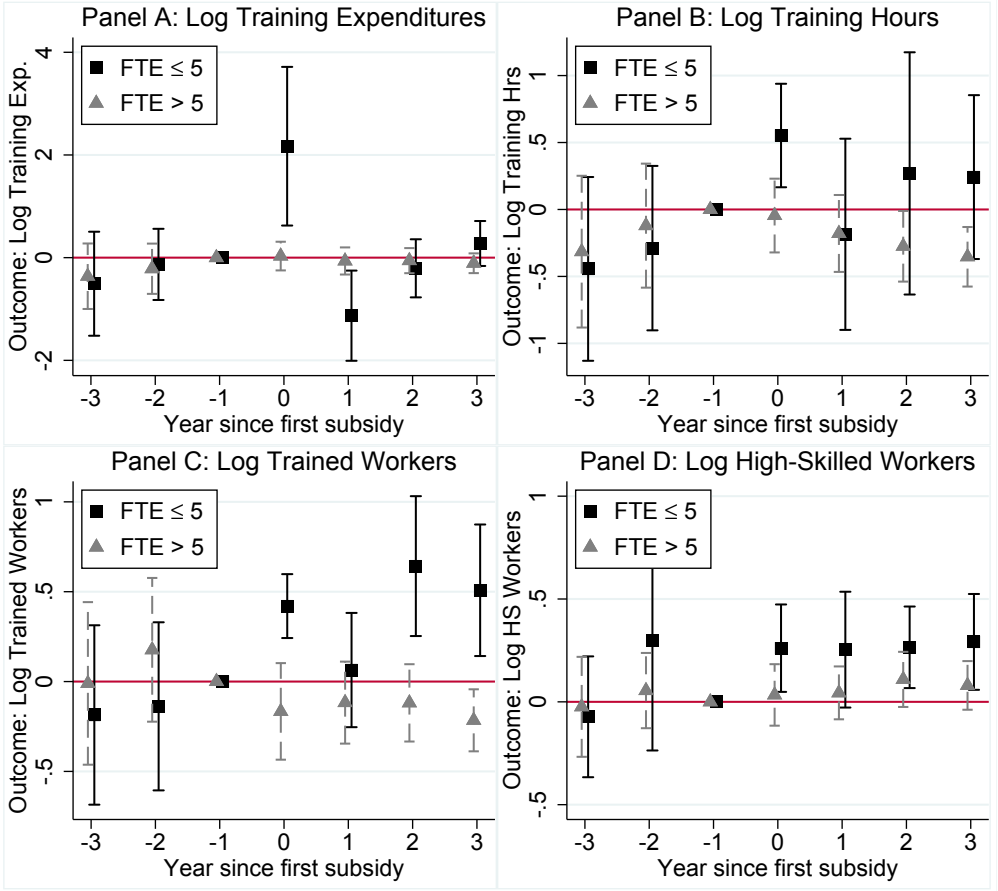
Notes: This Figure plots the estimated β_k event study coefficients from a regression of the form given in Equation 1, where the dependent variable is, in turn, log FTE (Panel A), log added value (Panel B), log wage bill (Panel C), log number of workers (Panel D), log average wage (Panel E), and log labor productivity (Panel F). The event is defined as a first-time training subsidy. β_{-1}, the coefficient of the year prior to a first subsidy, is normalized to zero. All regressions include firm and four-digit sector $\times$ calendar year fixed effects. The vertical lines reflect the 95 percent confidence intervals.

Figure 4: The Effects are Larger for Small Firms



Notes: This Figure plots the estimated β_k event study coefficients from a regression of the form given in Equation 1, where the dependent variable is, in turn, log FTE (Panel A), log added value (Panel B), log wage bill (Panel C), log number of workers (Panel D), log average wage (Panel E), and log labor productivity (Panel F). The event is defined as a first-time training subsidy. β_{-1}, the coefficient of the year prior to a first subsidy, is normalized to zero. All regressions include firm and four-digit sector $\times$ calendar year fixed effects. Squares indicate the coefficients for firms with less than 5 FTE, triangles indicate those for firms with more than 5 FTE. The vertical lines reflect the 95 percent confidence intervals.

Figure 5: Training Inputs and Outputs Only Increase within Small Firms



Notes: This Figure plots the estimated β_k event study coefficients from a regression of the form given in Equation 1, where the dependent variable is, in turn, log training expenditures (Panel A), log training hours (Panel B), log trained workers (Panel C), and log high-skilled workers (college and university education) (Panel D). The event is defined as a first-time training subsidy. β_{-1}, the coefficient of the year prior to a first subsidy, is normalized to zero. All regressions include firm and four-digit sector $\times$ calendar year fixed effects. Squares indicate the coefficients for firms with less than 5 FTE, triangles indicate those for firms with more than 5 FTE. The vertical lines reflect the 95 percent confidence intervals.