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Are Executives in Short Supply? Evidence from Death Events

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Using exhaustive administrative data on Italian social security records, we construct measures of local labour market thickness for executives that vary by industry and location. We show that firm performance is strongly and persistently affected by executive death, but only in thin local labour markets. The new executives hired after death events in thin local labour markets have lower education levels and are more likely to be replaced. These predictions are consistent with a simple model of executive search in which market thickness determines the arrival rate of applications for executive positions.

Key words: Executive supply, Firm performance, Local growth

JEL codes: J24, M51, R11

1. INTRODUCTION

Recent research shows that differences in performance between firms are substantial, persistent over time and largely unexplained (Syverson, 2011). As a potential explanation, a growing body of work highlights the quality of top executives in shaping firm outcomes (Bertrand and Schoar, 2003; Bender *et al.*, 2018). However, we still have a poor understanding of the factors that determine the differences in managerial quality across firms. In particular, what are the frictions that account for the fact that some firms allocate control to inferior managerial talent, hurting firm performance and, through this, aggregate productivity?

This paper focuses on the role of the local supply of managerial skills and provides evidence on the causal role that the thickness of local markets for executives plays for firm performance. Empirically, the main challenge is to set up an identification strategy that addresses the joint endogeneity of firm productivity and labour market thickness to unobserved features of localities. One also needs rich micro data on both firms and workers in order to understand empirically

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the mechanism through which the supply of executives in a given labour market affects firm performance. Our approach satisfies both requirements and allows us to isolate the causal effect of the local supply of executives on firm performance.

We use employer–employee administrative data from the Italian social security records covering the entire population of Italian workers in the private sector over the period 2005–15, matched with firm balance sheet and income statement information. We first document that firms and executives direct disproportionately their searches within the same industry and geographical area, arguably due to mobility costs and industry-specific human capital. We therefore define the relevant market for executives at the industry-location level and construct measures of local labour market thickness for executives that vary by industry and location (the market in what follows).

Our empirical design exploits negative exogenous shocks to the executive team and traces their impact on firm performance according to executive local labour market thickness. This allows us to isolate causal mechanisms through which executive market thickness has an impact on firm performance. As the main source of shocks to the executive team, we exploit executive death, thus circumventing the endogeneity of executive exits. We focus on premature deaths, and check that these death events are random to firm characteristics. Deaths are rare events: the probability of death for an executive younger than sixty is 0.10% per year. Despite this, the size of the Italian labour market and the coverage of our dataset (around 14 million workers and 123,000 executives in 2015) generates a number of executive deaths sufficiently large to allow for reliable inference.

To guide our empirical investigation, we formulate a simple model of executive search building on the seminal contribution of labour search with on-the-job offers of Burdett (1978). After an executive death, a firm (the worker in a labour search model) searches for an executive, who delivers a certain stream of profits (the wage in a labour search model) which depends on their quality. Relative to the literature, we introduce a fixed cost of replacing an executive to capture a monetary severance payment and/or a disruption cost generated by executive turnover. We assume that the arrival rate of executive applications increases with market thickness. We characterize how, after the death of the incumbent executive, the quality of the newly hired executives, and therefore firm performance, varies with market thickness. The model delivers two key empirical predictions. First, after the death of an executive, firms in thin markets on average appoint executives of lower quality compared with firms in thick markets and therefore experience a larger drop in performance relative to their pre-death levels. Second, executive turnover after death is higher in thin markets, as firms will replace low quality executives when they receive better job applications, gradually returning to their pre-death levels.

These predictions are fully borne out in the data. We start by documenting that death events have a substantial negative and long-lasting impact on firm performance. Using returns on assets (ROA) as our preferred measure, we find that ROA drops by around 0.8 percentage points on average in the year of death and in the following three, an economically large effect when compared with a sample mean of 4%. However, the estimated decline in firm performance is not per se evidence that the local supply of executives matters. After all, executives are likely to have accumulated a certain level of firm-specific capital, which gets destroyed when the executive dies, possibly inducing a deterioration in performance, irrespective of the external supply of executives. To estimate whether local supply matters, we leverage the research design and estimate heterogeneity in firm response to executive death depending on the thickness of the local labour markets for executives. Consistent with the idea that it takes more time for firms to find a good replacement in thin markets, we find that firm performance drops significantly after the death of one of their executives, but only in thin markets, in which case the effect is significantly larger (−1.8 percentage points). Dynamic specifications show the absence of any pre-trend and that, in thin markets, ROA returns to its pre-death level only 4 years after the death event. These results are confirmed when using a stacked event study approach, which accounts for the possibility of negative weighting of certain groups and periods in the presence of heterogeneous treatment effects (see, *e.g.* Cengiz *et al.*, 2019).

We assess the robustness of our results along a large series of dimensions. We experiment with different market definitions along the geographical and the industry component. To exclude that our estimates reflect the heterogeneous response to death events of some types of firms which are differentially present in markets with different levels of thickness, we augment our specification with controls for firm and executive characteristics interacted with the deceased executive dummy. To assess if the results are driven by specific types of firms, we consider different subsamples and control groups. We find that our results are remarkably consistent across these different exercises. We also consider the effect of executive death on other corporate outcomes. First, we show that our results are robust to using productivity instead of ROA as an alternative measure of performance. Then, we decompose the effect on ROA into its components, finding that its drop following the death of an executive is driven by a substantial decline in sales.

We also look at the elasticity of peer wages to executive death in the same market. If firms hit by death events search for a replacement locally, their demand for executives will generate an upward pressure on executive pay, whose intensity depends on the thickness of executive supply. We find evidence of spillovers on the compensation of existing executives in other firms in the same market, but only in thin markets.

Finally, we exploit the richness of our micro data to investigate the specific channels through which the effects of executive deaths are magnified in thin markets. The model predicts that, after death, firms in thin markets appoint lower quality executives and experience more executive turnover. Consistently, we show that new executives hired following death events in thin local markets have lower education and experience levels. They are also more likely to leave the firm over the next few years, consistent with the idea that executive short supply on the external labour market generates lower quality firm-executive matches.

Overall, our findings highlight that the local supply of executives is an important driver of firm performance. Our work has important implications for the design of location-based policies to foster growth (see *e.g.* Glaeser and Gottlieb, 2008; Kline, 2010). In particular, the results suggest that local policies aiming at boosting growth should take into consideration the supply of executive skills.

Our work relates to several strands of literature. We first contribute to the literature on the consequences of frictional workers' mobility and the associated agglomeration effects. Our analysis rests on Marshall's (1890) idea that firms and workers in thicker labour markets face fewer frictions in finding a suitable match, and particularly so for skilled workers (Abowd and Kramarz, 2003; Blatter *et al.*, 2012). Better worker-firm matches resulting from larger labour pools increase firm productivity (Diamond and Simon, 1990; Helsley and Strange, 1990; Combes and Duranton, 2006), also due to knowledge flows through workers mobility (Greenstone *et al.*, 2010; Bloom *et al.*, 2019; Serafinelli, 2019). A recent body of work suggests that the local supply of executives might play a key role (Gennaioli *et al.*, 2013; Bloom *et al.*, 2019), but, to the best of our knowledge, no causal evidence is available yet. We fill this gap. Local labour markets matter because workers' mobility is costly (Artuç *et al.*, 2010; Dix-Carneiro, 2014). Consistently, Marinescu and Rathelot (2018) and Manning and Petrongolo (2017) find that job search behaviour is quite local. There is also evidence that labour mobility has declined significantly in the U.S. Moretti (2011), Molloy *et al.* (2011, 2016, 2017), Kaplan and Schulhofer-Wohl (2017). The richness of our data allows us to present descriptive statistics on mobility patterns across both industries and space for the complete labour market for executives. We show that a large fraction of executive mobility tends to occur within commuting zones and industry: we find that 54.5% are from the same industry, 58.4% from the same CZ and 35.3% from the same industry-CZ combination. The patterns indicate that executives deploy significant industry-specific knowledge, and face significant costs of moving from one area to the other.

Our results also relate to the body of work in management economics that emphasize the key role of top executives in shaping firm outcomes. Bertrand and Schoar (2003) find that executive fixed effects matter for a wide range of corporate decisions. Bloom and Van Reenen (2007, 2010) and Schivardi and Schmitz (2020) focus on measurable management practices, and find a strong association between these practices and firm productivity. Bender *et al.* (2018) use matched employer–employee data to show that firm performance is disproportionately dependent on the human capital of the executives, rather than of the average worker. More directly related to our work, several studies rely on the occurrence of exogenous events such as CEO deaths or hospitalizations to shed light on the importance of executives for firm outcomes (see *e.g.* Johnson *et al.*, 1985; Bennedsen *et al.*, 2007; Holland and Lel, 2015; Jenter *et al.*, 2018; Choi *et al.*, 2019; Smith *et al.*, 2019; Bennedsen *et al.*, 2020; Becker and Hvide, 2021; Huber *et al.*, 2021). Compared with these papers, we estimate the causal impact of the thickness of local labour markets for executives on firm performance. Using U.S. listed firms, Cziraki and Jenter (2021) supply evidence of large frictions in the assignment of CEOs to firms while Fee *et al.* (2013) show that endogenous CEO replacements—*i.e.* decided by the board—are more effective in changing the firm's policies when the firm's headquarters are in thick markets, where frictions are arguably lower. Our analysis includes all private firms, for which the executive market is more likely to be local. Moreover, we consider exogenous executive changes following death events. Our work isolates a supply side friction that can explain why some firms allocate control to inferior managerial talent, hurting their performance and, through this, aggregate productivity. In doing so, our results speak to previous work in corporate finance on the performance effects of managerial turnover (see for instance, Denis and Denis, 1995; Huson *et al.*, 2004). We also contribute to recent research showing that differences in productivity between firms are substantial, persistent over time and remain large even after controlling for differences in the quality of production inputs (Syverson, 2004; Foster *et al.*, 2008).

We also add to the literature that studies the effects of labour supply shocks on firm performance and employees' compensation. Prior work focuses on large, market-wide labour supply shocks, *e.g.* due to immigration or changes in the college graduation rate (Katz and Murphy, 1992; Card, 2009; Dustmann *et al.*, 2009). More recent studies provide evidence on peer effects and wage spillovers among workers within the firm (Falk and Ichino, 2006; Azoulay *et al.*, 2010; Waldinger, 2010, 2011; Cornelissen *et al.*, 2017; Herkenhoff *et al.*, 2018; Jarosch *et al.*, 2021). Isen (2013) uses worker deaths to show that workers are paid less than their marginal product. The paper that is closest to ours is Jäger and Heining (2019), who show that workers' exits on average raise co-workers' wages and retention probabilities, and the more so in thin markets. We share the general conclusion that replacing workers is more difficult in thin markets. Differently from them, who study workers complementarity/substitutability, we look at firm performance and focus on executives, a category particularly relevant for it—in fact, we find no evidence that the death of other (non-executive) workers has any impact on performance. Moreover, we offer direct evidence that matches formed in thin markets after death are of lower quality, a dimension unexplored in Jäger and Heining (2019). Our results on wages in other firms are related to a recent literature that looks at the spillovers of changes in large firms employment policies on wages in neighbouring firms (Arnold, 2019; Derenoncourt *et al.*, 2021).

The remainder of the paper is organized as follows. Section 2 presents a simple model of executive search. Section 3 describes our empirical strategy. Section 4 presents the data and some motivating evidence. Section 5 describes the results on firm performance and Section 6 those on outcomes at the executive level. Section 7 discusses the external validity and economic significance of the results. Section 8 concludes.

2. A MODEL OF EXECUTIVE SEARCH AND REPLACEMENT

To guide the interpretation of our empirical findings presented below, we construct a simple model of executive search building on the seminal contribution of labour search with on-the-job offers of Burdett (1978). A firm (the worker in a labour search model) searches for an executive, who delivers a certain stream of profits (the wage in a labour search model) which depends on her quality. The model is partial equilibrium, i.e. the executive quality distribution is given. Relative to the literature, we introduce a fixed cost of replacing an executive to capture a monetary severance payment and/or a disruption cost generated by executive turnover. We assume that the arrival rate of executive applications depends on market thickness: the thicker the market for executives, the higher the arrival rate of executive applications. We characterize how, after the death of the incumbent executive, the quality of hired executives, and therefore firm performance, vary with market thickness. All proofs are relegated to Online Appendix A.1.

2.1. *The model*

Time is continuous. A firm can operate without an executive, in which case it generates a profit flow y, or with one executive of quality b, in which case it generates a profit flow $y+b$.[1] Job applications arrive at Poisson rate λ, with quality drawn from a cumulative density function $F(b)$ with bounded support over $[0, B]$. If the firm is currently without an executive, when it receives an application it can hire the executive at no cost. Once hired, the executive dies at Poisson rate δ. The flow equation for a firm without an executive is:

$$rD = y + \lambda \int_0^B \max[V(b) - D, 0] dF(b), \tag{1}$$

where D is the value of a firm without an executive, $V(b)$ is the value of a firm with an executive of quality b and r is the discount rate. Equation (1) states that the flow value of a firm without an executive is the profit flow y plus the expected gain from receiving a job application from new executives. When receiving an application, the firm decides whether to accept or decline it.

The firm keeps receiving job applications even after having hired an executive. For simplicity, we assume that the arrival rate of executives and their quality distribution is the same as when the firm has no executive. When receiving an application, the firm must decide whether to replace the current executive of quality b with the applicant, in which case it pays a fixed cost $C > 0$. We focus on the case in which the replacement cost C is not too large, that is: $C < V(B) - D$.[2]

1. b represents the additional impact of executive quality on firm profits (net of executive compensation). One could interpret b as either the intrinsic quality of the executive or the quality of the executive-firm match. In Online Appendix A.2 we discuss the predictions of the model when the average quality of executives is higher in thicker markets. In that case, everything else equal, we show that the drop in the quality of the first hired executive (relative to the pre-death average quality level) and therefore in firm performance, following death events would be higher in thick markets, the opposite of what we find in the data.

2. When $C > V(B) - D$, a firm never replaces an incumbent executive, an unrealistic situation which is not borne by the data.

The flow equation for a firm with an incumbent executive of quality b is:

$$rV(b) = y + b + \lambda \int_0^B \max[V(s) - C - V(b), 0]dF(s) + \delta[D - V(b)]. \tag{2}$$

The flow value of the firm with an executive is the profit flow $y+b$ plus the expected gain associated with the possible arrival of job applications from new executives, in which case the firm might optimally decide to replace the incumbent with a new applicant of higher quality after paying the replacement cost C, minus the expected loss associated with the possible death of the incumbent executive.

Consider a firm with an executive in place of quality b. When receiving a new application, the firm will replace the incumbent executive if the new one is sufficiently better to make it worthwhile paying the replacement cost C. Formally, we define $T(b)$ as the threshold value at which it is optimal to replace an incumbent executive of quality b if the quality of the new applicant is greater or equal than $T(b)$,[3] with $T(b)$ defined by the following condition:

$$V(T(b)) - C = V(b). \tag{3}$$

Define b^* as the quality of the incumbent executive such that $V(b^*) = V(B) - C$. By construction, $T(b^*) = B$. It follows that, when the incumbent executive is of quality $b \geq b^*$, the firm stops searching, given that, even if it receives an application from a candidate with the highest possible quality B, the associated increase in firm value (equal to $V(B) - V(b)$) is lower than the replacement cost C. When the quality of the incumbent executive b is lower than b^*, the firm keeps searching, using the threshold $T(b)$ to decide when to hire a new applicant.

Given that the firm continuously receives new applications, the firm eventually receives an application of a candidate with quality $b \geq b^*$. We define $\bar{b} \equiv E[b \mid b \geq b^*]$ as the average quality of incumbent executives when firms do not find it optimal anymore to replace them with new applicants. Importantly, b^*, and thus $\bar{b}$, does not depend on the arrival rate λ. To see this, suppose a firm has an incumbent executive with quality $b \geq b^*$. As it is never optimal for the firm to replace the incumbent in that case, equation (2) for $b \geq b^*$ simplifies to:

$$rV(b) = y + b + \delta[D - V(b)] \tag{4}$$

Replacing b by, respectively, b^* and B in equation (4) and using the equality $V(b^*) = V(B) - C$ above yields $b^* = B - (r+\delta)C$, which is independent from λ.

After the death of an executive, the firm does not incur the replacement cost when hiring a new executive. Therefore, in that case, the firm hires a new applicant if her quality is larger than b^D, where the threshold value b^D is given by $V(b^D) = D$.[4] We show in Online Appendix A.1 that the threshold value b^D for hiring a new applicant when the firm has no executive is implicitly given by the following equation:

$$b^D = \lambda \int_{b^D}^{T(b^D)} \frac{1 - F(s)}{r + \delta + \lambda[1 - F(T(s))]} ds. \tag{5}$$

3. In Online Appendix A.1, we show that $V(s)$ is increasing and continuous in s. In equation (2), since $V(s)$ is increasing in s and $C + V(b)$ is independent from s, there exists a unique threshold denoted $T(b)$ satisfying $V(T(b)) - C = V(b)$, such that $s < T(b)$ implies $V(s) - C < V(b)$ and so the incumbent of quality b should not be replaced by a new applicant with quality s, and $s > T(b)$ implies $V(s) - C > V(b)$ and so the incumbent of quality b should be replaced.

4. We show in Online Appendix A.1 that the assumption $C < V(B) - D$ implies that $b^D < b^*$.

2.2. *Results*

We now derive four key results that will form the basis for our empirical analysis.

Result 1. The hiring threshold for the executive quality of a firm with no executive, b^D, increases with market thickness:

$$\frac{db^D}{d\lambda} > 0.$$

Even though, after death events, hiring a new executive does not require firms to pay a replacement cost, firms still optimally take into account that it will be costly to replace an incumbent in the future, which creates an option value of waiting. When the arrival rate of applications is higher, the firm becomes "choosier," setting a higher hiring threshold after the death of an incumbent executive. In fact, higher arrival rates increase the option value of waiting for applications of executives with higher quality.[5]

Result 2. After a death event, the average drop in the quality of the first new hired executive (and therefore in profits) relative to the pre-death average executive level is smaller the thicker the market:

$$\frac{d\{\bar{b} - E[b \mid b > b^D]\}}{d\lambda} < 0.$$

This result follows from two facts. First, we have shown above that the average quality of incumbent executives when firms do not search anymore, $\bar{b}$, is independent from market thickness. Second, as established in Result 1, after the death of an executive, the average quality of the first hire is lower in thinner markets. Therefore, following a death event, firms in thin markets experience on average a larger drop in profits relative to pre-death levels.

Result 3. After a death event, the probability that a firm experiences executive turnover—*i.e.* it replaces the first executive hired—decreases with market thickness:

$$\frac{d\Pr\left(b < b^* \mid b > b^D\right)}{d\lambda} < 0.$$

This result reflects the fact that executives of lower quality are more likely to be replaced in the future. Given that the threshold value for hiring a new executive after death events, b^D, increases with λ, the probability that the first hire has quality above b^*, the threshold above which the firm does not replace incumbents, increases with λ.

Result 4. The sign of the effect of market thickness on the expected duration before hiring a new executive after death events is ambiguous and depends, in particular, on the shape of the quality density function F.

The expected duration before hiring a new executive after death events is equal to $\frac{1}{\lambda[1-F(b^D)]}$. Market thickness has two contrasting effects on the probability of hiring a new executive after death events. On the one hand, a higher arrival rate λ mechanically implies a higher frequency of receiving new applications and therefore of potentially hiring a new executive. On the other hand, Result 1 indicates that the hiring threshold b^D increases (and therefore the acceptance rate $1 - F(b^D)$ decreases) with λ: the firm receives more applications but is less likely to accept them.

5. It is immediate to show that, when $C = 0$, the firm hires the first executive who applies for the job and replaces the incumbent executive whenever a better application is received.

Summing up, this simple model predicts that, after an executive's death, firms in thin markets experience a larger drop in profits because they tend to subsequently hire executives of lower quality. Whereas the effect of market thickness on the expected duration before hiring a new executive after death events is ambiguous, the new executives hired following death events are more likely to be subsequently replaced in thin markets. In both thin and thick markets, profits eventually revert to pre-death levels.

3. IDENTIFICATION STRATEGY

Our goal is to determine if the local supply of top managerial skills is a determinant of firm performance. Ideally, one would use random variation in the supply of executives to determine its effects on firm performance. In practice, finding exogenous shocks to the supply of managerial skills is very difficult. We propose an alternative identification strategy based on the occurrence of executive deaths. Specifically, we use premature death as a random shock for executive exit at the firm level and check if it affects firm performance. To tease out the effects of executive supply from the disruption due to the loss of firm-specific human capital, we distinguish the effects according to the thickness of the local market for executives.

The model presented above predicts differential effects of executive deaths on firm performance depending on the thickness of the executive labour supply a firm faces. We therefore need to first define the firm's relevant market for managerial skills. Below, we show that executive mobility across industries and space is limited. We therefore define the combination of the commuting zone and industry as the relevant labour market for executives ("the market" in what follows) and the executives working in other firms in this market as the pool from which each firm is likely to hire executives. Our preferred measure of market thickness is the logarithm of the number of executives in the market at $t-1$. We experiment with alternative definitions below.

Our identification strategy closely approximates the following example. Assume that an executive dies prematurely in, say, a textile firm located in Prato, a thick textile cluster. We will estimate the impact on firm performance in several years surrounding the event. We will then contrast the magnitude and duration of this impact with death events of executives occurring at firms located in thin local labour markets, such as for instance another firm in Prato operating in the Chemicals industry, for which the local pool of executives is thin. If the probability of finding good executives is lower in this case, we expect a larger and more persistent negative effect of executive exit on performance. Conditional on other controls, differences in the effect of a premature death according to executive market thickness indicate that executive supply matters for firm performance.

To implement our identification strategy, we leverage a matched and exhaustive employee-firm panel, which provides us with precise information on the working address of all executives, as well as on the firms they work for. Specifically, we run the following OLS regression at the firm-year level:

$$\mathrm{ROA}_{i,j,t} = (\beta_0 + \beta_1 \mathrm{MktTkn}_{j,t-1}) \times \mathrm{DecEx}_{i,\tau} + \beta_2 \mathrm{MktTkn}_{j,t-1} + \beta_X X_{i,j,t} + \eta_{i,j,t} \tag{6}$$

where $\mathrm{ROA}_{i,j,t}$ is return on assets of firm i in market j at time t and the market is defined as the combination of the commuting zone and the industry in which the firm operates; $\mathrm{DecEx}_{i,\tau}$ is a dummy taking the value of one if at least one of the firm's executives dies in period τ, where τ can be a single year or, in our preferred specification, the years from $t-3$ to t; $\mathrm{MktTkn}_{j,t-1}$ is the log of the number of executives in market j at $t-1$; and $X_{i,j,t}$ are additional controls, including a rich set of dummies. The parameter β_0 measures the impact of an executive death for a firm in a market with no outside executives, and we expect it to be negative. If the local supply of executives matters, β_1 should be positive: a relatively larger local pool of replacements reduces the negative effects of a death. Finally, given that we always include firm fixed effects and that the shock is firm specific, we cluster standard error at the firm level.

Formally, identification rests on the assumption that, conditional on controls, the interaction between market thickness and the premature death event is orthogonal to the error term: $E(\eta_{i,j,t} \,|\, \text{MktTkn}_{j,t-1} \times \text{DecEx}_{i,\tau}, X_{i,j,t}) = 0$. Next, we discuss potential threats to this assumption and how we address them. A first possibility is that firms in thin markets are different from those in thick ones for reasons unrelated to executive supply. To account for this, in all specifications, we include firm fixed effects, so that $\beta_0 + \beta_1 \text{MktTkn}_{j,t-1}$ captures the effects of deaths in different markets in deviation from the firm's "normal" performance. This also controls for the possibility that firms hit by a death event are low-performing in general. To account for time-varying shocks related to market thickness, we always include the indicator of market thickness itself, so that the effect we measure is in deviation from any general correlation between thickness and performance. In our preferred specification, we include industry $\times$ year and commuting zone $\times$ year fixed effects, to account for shocks at the location and industry level. When the empirical design allows it, we also estimate a specification with market $\times$ year fixed effect to account for any shock at the market level. In this specification, identification comes from comparing the performance of treated (*i.e.* hit by a death event) and control firms *within* the same market and time period, addressing the concern that local market thickness interacted with the death event could spuriously correlate with market shocks driving the differential firm response to executive exit.[6]

Still, differential responses to deaths might be generated by differences in firm characteristics across thin and thick markets, above and beyond the fixed attributes captured by firm fixed effects. To control for this, we introduce lagged controls for size, age, and profitability, interacted with year fixed effects. Including these controls ensures that the estimates are not driven by heterogeneous trends among large, old, or profitable firms. We also augment some specifications with dummies indicating terciles of the number of firm executives interacted with year dummies, in order to make sure that the results are driven by the treatment—the death of an executive—rather than indirectly by the number of firm executives. A further concern is that there might be firm and executive characteristics correlated with market thickness which imply a differential response to executive deaths. For example, small firms might suffer more from executive death and be more common in thin markets. To control for this, in robustness tests we include the interactions of firm and deceased executive characteristics with the death dummy. We also run additional robustness checks discussed in detail in Section 5.2.

One might worry that firms endogenously select their location by taking into account the fact that executive turnover might have a negative impact on performance, especially in thin labour markets. This is not a threat to the identification strategy: if anything, this should bias the results against finding larger effects in thin labour markets, given that the most vulnerable firms to executive exits are likely to endogenously select their location in thick labour markets.

Finally, the model predicts both that newly appointed executives after death are on average of lower quality and that they are more likely to separate the thinner the market. To test these predictions, we will also estimate a set of regressions in which the dependent variables

6. We do not use this as our preferred specification for two reasons. First, while addressing market level shocks, this specification is vulnerable to the bias coming from within market spillovers, if the death of a firm's executive propagates to other local firms. Second, in some specifications that we introduce below, the independent variable varies at the market $\times$ year level, making the inclusion of market $\times$ year effects unfeasible.

will be measures of executives quality (*e.g.* education and experience) and of the separation rate of the new hires following the death event, using the same set of control variables as in equation (6).

4. DATA

In this section, we describe our data sources, provide summary statistics, and establish some facts about executive mobility that motivate our definition of local markets for executives.

4.1. *Data description and summary statistics*

We leverage restricted-access administrative data available at the Italian Social Security Institute (INPS, Istituto Nazionale Previdenza Sociale). We have access to matched employer–employee records for all private firms with at least one employee. The dataset contains longitudinal information on all workers' job position, compensation, and employer since they joined the labour force. The data start in 1984, but the information on the municipality in which each firm is located is available only from 2005. We therefore focus on the period 2005–15. All monetary values are in 2015 constant euros. We exclude financial firms from the sample.

The Italian economy features large heterogeneity in the thickness of labour markets across areas. We consider Commuting Zones (hereafter CZs)—around 600—defined by the Italian National Institute of Statistics (Istat) as the relevant geographical unit for computing measures of labour market thickness. These areas are aggregated as clusters of municipalities that are characterized by strong within-cluster and weak between-cluster commuting ties. We then measure thickness at the CZ $\times$ (2-digit) industry level with the total number of executives in a CZ $\times$ industry in the previous year.[7] As a result, a given labour market can be classified as thick in one set of industries, and thin in others.

The INPS data allow us to precisely identify firm *executives*. The job title of executives ("dirigente" in Italian) applies only to the set of workers that have an executive collective contract, a fact that is recorded by social security data as the job title matters to determine social security contributions and entitlements. Legally, executives are defined as employees that manage a firm or a part of it and exert their role with some discretionary decision power. Executives therefore constitute the workers that take the strategic decisions within the firm: in fact, they represent around 1% of the Italian workforce. The next category in the firm hierarchy is that of "managers" ("quadro" in Italian), who are hierarchically below executives and have limited or no autonomous decision power, followed by "clericals" ("impiegati" in Italian). We refer to the superset of "managers" and "clericals" as *white-collars*.[8] The hierarchical structure is clearly reflected in compensation: The average (median) executive gross wage in 2015 is 135,000 euros (111,000 euros), against 61,000 euros for managers and 28,000 for clericals.

Information on the year of death is known from Social security records. The cause of death is unknown. As in Jaravel *et al.* (2018), in order to reduce the likelihood that death results from a lingering health condition, we consider executives passing away before or at the age of sixty.[9] We identify 1,076 such events. Figure 1 shows the set of Italian CZs for which we observe

7. The 19 2-digit industries are Agriculture and Fishing, Mining, Wood and Furniture, Food and Tobacco, Basic Metals, Mechanics, Textile, Chemicals, Shoes, Non-Metallic Minerals, Paper and Publishing, Construction, Utilities, Transport, Personal Services, Trade, Real Estate, Hotel and Restaurant, and Professional Services.

8. The last category is that of blue collar workers ("operai" in Italian), which we do not use in our analysis.

9. In robustness checks, we repeat the analysis by excluding deceased executives with claims to the administration for paid-sick leave in any prior year (see Column 9 of Table 7.)

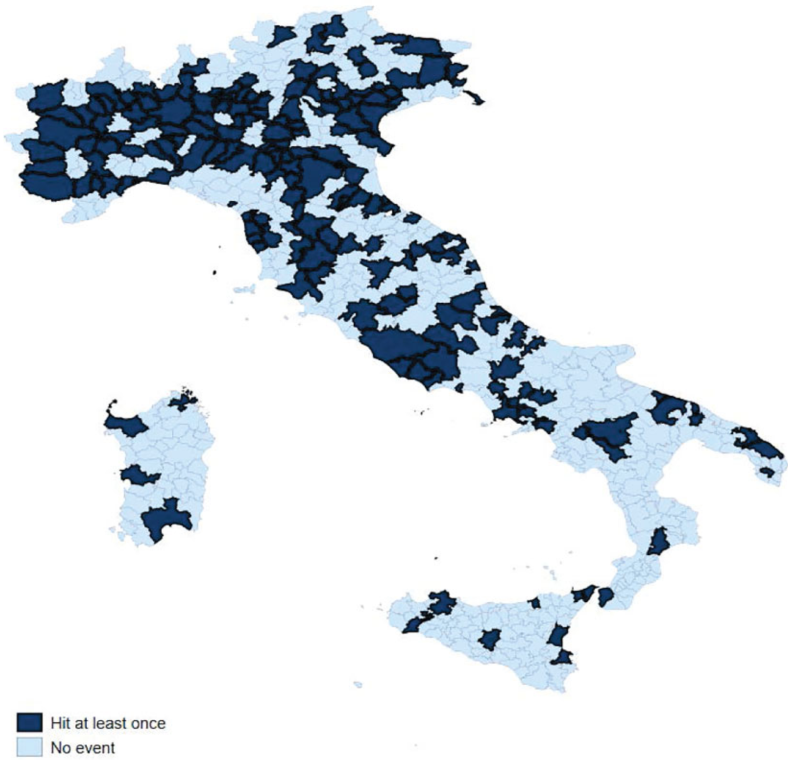

FIGURE 1
Location of executive death events

Notes: This map presents executive death events located in each Italian Commuting Zone over the sample period 2005–15.

at least one death of an executive over our sample period. As expected, we are more likely to observe death events in northern CZs, given that on average these local markets are larger. Note however that the set of death events spans the entire Italian territory. Importantly for us, we do observe death events both in thin and thick markets.

The INPS has some information on firms (location, industry, and all the information on employees), but no information on their economic and financial performance. We therefore match the INPS records with a firm database (referred to as CERVED, the data provider) that contains balance sheet information of all incorporated companies in Italy. These companies account for approximately two-thirds of private sector GDP. The matched executive-firm dataset provides us with a large sample of events hitting executives, allowing for precise estimates.

Following the literature on executive turnover (see, among others, Denis and Denis, 1995; Huson *et al.*, 2004; Bennedsen *et al.*, 2007, 2020), we use ROA as preferred measure of performance, defined as EBIT (Earnings Before Interest and Taxes) over lagged assets. ROA measures the average return on the capital immobilized by the firm, without distinguishing between its sources (debt versus equity). As such, it is a measure of profitability of the overall capital stock. If a firm suffers from the death of one of its executives, we expect this to show up in terms of ROA. An alternative would be to consider ROE, that more directly reflects returns to equity holders. The problem with ROE is that it depends on the firm's financial structure and it is more volatile than ROA.

Table 1 presents summary statistics for our sample.[10] Panel A describes the firm sample, which consists of 306,246 firm-year observations between 2005 and 2015. A firm is included in our sample if it appears as having at least one executive in the INPS files in any year over the sample period. ROA for the average (median) firm is around 4.1% (3.8%), and firm value-added per worker is equal to € 84,553 on average (66,940 at the median). The average firm in our sample has 3.2 executives.

The second part of Panel A compares the size, age, ROA, and number of executives of firms in thin versus thick markets for executives. In each year, we split the sample according to market thickness so that half of the firms are in markets classified as thin and the other half in markets classified as thick. Firms in thick markets tend to be on average more profitable, slightly smaller, younger, and employ more executives. The third part of Panel A compares instead the size, age, ROA, and number of executives of eventually treated and never treated firms. Eventually treated firms—those hit by the death of one of their executives at least once during the sample period—are larger, more profitable and employ more executives than never treated firms. These comparisons underline the importance of accounting for firm characteristics in the empirical analysis.

Panel B presents the executive-level sample, separately for deceased executives, taken in the year of death, and non-deceased executives. Executive characteristics are fairly similar across both samples, even though the average deceased executive tends to be older −52.8 years old compared with 48.4 for non-deceased executives—, has worked slightly more in the same firm—their tenure is 11.9 years at the time of the death versus 9.8 years for non-deceased executives, and is slightly less likely to be a woman (9.7 versus 13.2% for non-deceased executives). Note however that wages in the year preceding the death event are virtually identical to the average wage in the sample of non-deceased executives. This is consistent with the notion that the premature death events that we observe in the data are fairly unexpected, as the compensation should be lower in the year prior to the death if the executive had some health conditions that impaired the quality of her work. We also show these characteristics separately for thin and thick markets. Executives in thick markets have slightly shorter tenure (9.5 versus 10.6) and are 1 year younger. They are more likely to be female (15 versus 10%) and earn more (140,944 euros versus 123,192).

Next, we report the separation of new hires. Approximately one quarter of newly hired executives separate within a year, and almost half work for the firm less than 4 years, indicating that recently formed matches have a high hazard rate.

Since 2010, firms are required to report to the ministry of labour the educational attainment of new hires. We use the INPS codification in order to construct three dummies corresponding to the executive having less than a high school degree,[11] high school and a college degree. Even though reporting education attainment of all new hires is a legal obligation since 2010, firms have the possibility to report "not known." The consequence for our analysis is that we observe information on education for around 85% of the executives who changed firm after 2010. In the sample of executives changing firm after 2010, 5% have no high school degree, 21% have a high school degree, and 74% have a college degree.

10. To account for outliers, we winsorize all continuous variables below the 1st and above the 99th percentile to the value of the 1st and of the 99th percentile, respectively.

11. Note that in Italy compulsory schooling age is sixteen, while high school requires 3 more years of education. Differently from the U.S., therefore, a large part of the population does not hold a high school degree.

TABLE 1
Summary statistics

	Firm sample					
Panel A:	Obs.	Mean	Std. dev.	p1	p50	p99
ROA (%)	306,246	4.155	15.163	−52.103	3.796	54.034
Exit	306,246	0.034	0.180	0.000	0.000	1.000
Eventually exit	306,246	0.170	0.376	0.000	0.000	1.000
labour productivity ('000s euros)	290,617	84.553	78.901	−67.640	66.940	394.000
Firm size (log assets)	306,246	9.095	1.732	4.663	9.131	13.324
Firm age	306,246	17.687	12.458	1.000	14.000	48.000
Number of executives	306,246	3.201	18.255	0.000	1.000	38.000
Number of employees	306,246	136.363	1146.706	1.000	37.000	1398.000
DecEx ($t, t-3$) (%)	306,246	0.792	8.863	0.000	0.000	0.000
	Thin labour markets			Thick labour markets		
	Obs.	Mean	Std. dev.	Obs.	Mean	Std. Dev.
ROA (%)	153,550	3.542	13.200	152,696	4.772	16.885
Firm size (log assets)	153,550	9.305	1.603	152,696	8.885	1.828
Firm age	153,550	18.194	12.505	152,696	17.117	12.389
Number of executives	153,550	2.072	5.557	152,696	4.336	25.195
	Eventually treated			Never treated		
	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.
ROA (%)	8,727	5.794	12.317	297,519	4.107	15.236
Firm size	8,727	11.131	1.928	297,519	9.036	1.689
Firm age	8,727	16.872	11.825	297,519	17.711	12.475
Number of executives	8,727	31.881	95.319	297,519	2.360	7.192
	Obs.	Mean	Std. Dev.	p1	p50	p99
CZ × industry characteristics						
Number executives (CZ × industry)	32,643	29.532	224	1	4	340
At least one deceased executive (CZ × industry)	32,643	0.021	0.143	0.000	0.000	1.000
	Executive sample					
Panel B:	Obs.	Mean	Std. dev.	p1	p50	p99
Sample of deceased executives						
Executive tenure	1,076	11.908	8.017	1.000	10.000	30.000
Executive age	1,076	52.840	5.506	37.000	54.000	60.000
Female	1,076	0.097	0.296	0.000	0.000	1.000
Wage ($t-1$)	1,076	136.462	93.891	55.521	113.561	519.764
Sample of non-deceased executives						
Executive tenure	1,060,971	9.856	7.286	1.000	8.000	29.000
Executive age	1,060,971	48.461	6.600	34.000	49.000	60.000
Female	1,060,971	0.132	0.339	0.000	0.000	1.000
Wage ($t-1$)	1,060,971	134.992	114.357	55.001	110.630	498.250

(continued)

TABLE 1
(Continued)

	Thin labour markets			Thick labour markets		
Sample of executives—thin versus thick	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Executive tenure	355,974	10.637	7.696	706,073	9.465	7.039
Executive age	355,974	49.180	6.480	706,073	48.105	6.631
Female	355,974	0.101	0.302	706,073	0.148	0.355
Wage ($t-1$)	355,974	123.192	84.504	706,073	140.944	126.326
	Obs.	Mean	Std. Dev.	p1	p50	p99
Separation rates of new hires						
Remains employed for less than 1 year	51,185	0.256	0.436	0.000	0.000	1.000
Remains employed for less than 2 years	51,185	0.348	0.476	0.000	0.000	1.000
Remains employed for less than 3 years	51,185	0.411	0.492	0.000	0.000	1.000
Remains employed for less than 4 years	51,185	0.455	0.498	0.000	0.000	1.000
Education of new hires (since 2010)						
Below high-school	23,410	0.045	0.207	0.000	0.000	1.000
High-school	23,410	0.209	0.407	0.000	0.000	1.000
College	23,410	0.738	0.440	0.000	1.000	1.000

Notes: This table presents the summary statistics for our sample. Panel A presents the firm sample, which consists of 306,246 firm-years between 2005 and 2015. A firm is included in our sample if it appears as having at least one executive in the INPS files in any year over the sample period. We exclude financial firms, which follow different accounting rules. ROA is earnings before interest and taxes (EBIT) over lagged assets. Exit is a dummy that equals one if the firm exits the firm database in year t. Eventually, Exit is a dummy that equals one for a firm that exits the firm database in any year over our sample period. Labour productivity is value added divided by the number of employees at the end of the previous year. Firm Size is the logarithm of assets. Firm Age is the number of years since firm creation. DecEx is a dummy indicating the death of at least one executive of the firm in year t or any of the previous 3 years. The first part of Panel A is based on all firms. The second part distinguishes by labour market type. A labour market is defined at the CZ × industry level and is defined as thick (respectively, thin) if it lies above (respectively below) the level of market thickness that splits the number of firms equally in thin and thick labour markets. The third panel distinguishes between treated and untreated firms. Eventually, treated firms are those that are hit by the death of one executive at least once over the sample period, and never treated firms are those never hit by a death event. The last part reports characteristics at the market (commuting zones × industry) level, namely the lagged number of executives employed in all firms in a given market, and a dummy indicating whether at least one executive dies in a given market × year. Panel B presents the executives sample, separately for deceased and non-deceased executives. We *e* 50,000 in the previous year (around 2% of the sample). Executive tenure is the number of years since the individual has joined the firm as an executive. The first two panels distinguish between deceased and non-deceased executives and the third panel by labour market type. The fourth panel reports the separation rates of newly hired executives. The last panel reports the education of individuals joining a new firm to work as an executive. Information on education is available only for executives who changed job since 2010. All monetary values are in 2015 constant thousand euros, and all continuous variables are winsorized at the first and ninety-ninth percentiles.

4.2. *Stylized facts on executive mobility*

In this section, we present stylized facts on the mobility of executives to support our assumption that employees' industry specific human capital and geographical mobility costs direct job searches toward firms within the same industry and geographical area.

We first describe in Table 2 where newly appointed executives come from. Panel A shows that most of the newly appointed executives come from outside the firm: around one third are internal promotions, 9.4% are externally hired white collars and 51.4% externally hired executives.[12]

12. The INPS archives contain the universe of Italian private sector employees, so the category "Not in the sample at T-1" contains individuals working abroad, working for the public sector, self-employed, or not employed at T-1.

TABLE 2
Provenance of newly appointed executives

Panel A: All newly appointed executives

Same firm in T-1		Other firm in T-1			Not in sample in T-1
Blue-collar	White-collar	Blue-collar	White-collar	Executive	
<0.1%	32.2%	<0.1%	9.4%	51.4%	6.8%

Panel B: Newly appointed executives working in other firms in T-1

Same industry in T-1			Other industry in T-1		
Blue-collar	White-collar	Executive	Blue-collar	White-collar	Executive
<0.1%	7.1%	47.4%	<0.1%	8.3%	37.1%
Same CZ in T-1			**Other CZ in T-1**		
Blue-collar	White-collar	Executive	Blue-collar	White-collar	Executive
<0.1%	7.6%	50.8%	<0.1%	7.8%	33.7%
Same CZ $\times$ industry in T-1			**Other CZ $\times$ industry in T-1**		
Blue-collar	White-collar	Executive	Blue-collar	White-collar	Executive
<0.1%	3.7%	31.6%	<0.1%	11.7%	52.9%

Notes: This table presents statistics on all newly appointed executives across industries and areas in our sample. Panel A reports the number of hires that were previously blue-collar or white-collar in the same firm, or blue-collar, white-collar or executive in another firm (or previously not employed in a firm in our dataset). Panel B reports, for new hires working previously in another firm, the number of hires that were previously employed in the same industry versus other industries, in the same CZ versus other CZs, in the same market (CZ $\times$ industry) versus other markets. The sample period is 2005–15.

Panel B focuses on external hires and distinguishes between newly appointed executives from the same industry, the same CZ, and the same industry-CZ combination. Importantly for our identification strategy presented above, a large fraction of executive mobility tends to occur within CZ and industry: we find that 54.5% are from the same industry, 58.4% from the same CZ, and 35.3% from the same industry-CZ combination. Online Appendix Table A.1 shows that, when assuming random mobility, these numbers are much smaller. In particular, hires within the same industry-CZ would be less than 2%. These patterns suggest that executives in our sample deploy significant industry-specific knowledge, and face significant costs of moving from one area to the other.

One may wonder whether the Italian economy is an outlier in terms of executive mobility. As a first comparison, we reproduce in Panel B of Online Appendix Table A.1 the same computations for the French economy, for which we have similar matched employer–employee records from a random sample of 1/12th of the French workforce (provided by the French statistical office, INSEE). We use an industry classification with a similar granularity (17 industries instead of 19), and the list of CZs as defined by the French statistical office. The pattern of executive moves within industry and CZ is remarkably similar to the one in Italy: 71% percent of French executive moves are within the same CZ, 66% per cent within the same industry, and 50% per cent within the same CZ $\times$ industry, against, respectively, 15%, 13%, and 3% in counterfactuals with random moves. We do not have similar matched employer–employee data for the U.S. However, the same computations using alternatively Execucomp data which covers the top five highest-paid executives of a large sample of U.S. listed firms also indicate that even (the tail of)

U.S. listed firms' top executives tend to move disproportionately more within the same area and industry (see Panel C of Online Appendix Table A.1).

In Table 3, we illustrate in a regression framework how the executives hiring process is related to market thickness.[13] An implication of the fact that a thicker local supply of executives is more likely to satisfy a firm's managerial needs is that, when a firm hires an executive, the probability of hiring locally should be higher the thicker the market. Consistently, Columns (1–3) of Table 3 show that the probability of hiring external executives from the same CZ, industry and market is positively correlated with market thickness. For example, for the market regression (Column 3), the coefficient is equal to 0.053 (and highly statistically significant), which implies that doubling the number of executives goes together with an increase in the share of locally hired executives of approximately 5.3%. Given that the average share of locally hired executives is 35% (see Table 2), this represents an increase of 15% over such average.

Next, we consider the "quality" of executives hired. For this, we first exploit the education data, available for a majority of executives who changed job since 2010. Columns (4–6) show that, the thicker the market, the less likely it is that a newly hired executive has a high-school degree and the more likely that she is a college graduate. Next, we use different measures of experience. Column (7) shows that local experience, defined as the number of years employed in the same province as the hiring firm,[14] increases with market thickness. The same holds for industry experience, defined as the number of years employed in the same industry of the hiring firm (Column 8), while no significant effect emerges for experience as executive (Column 9). Finally, the wage in the previous job increases with market thickness (Column 10).

Overall, this evidence is consistent with the idea that the thickness of the local executive market has a positive impact both on the likelihood to hire locally and on the quality of new executive hires. Of course, this correlation cannot be interpreted in a causal sense. In particular, it might be that firms located in thicker markets are "better" firms, that is, more productive, more innovative or export oriented, and therefore they might express a demand for executives of higher quality. To take a step towards a causal interpretation of the correlation between executive supply and firm performance, we now move on to our main identification strategy: firm performance after an executive death in markets with different degrees of thickness.

5. RESULTS

In this section, we estimate the effect of executive exit on firm ROA. Before doing so, we document the evolution of the number of executives following a death event. Figure 2, Panel A plots the change in the number of executives following a death event, separately for thin and thick markets. The patterns are very similar: in both market types, the number of firm executives drops by virtually 1 on the year of the death, and then it recovers in the following 2 years, by around 0.30 each year. The coefficients are virtually zero in years 3 and 4. This evidence is consistent with the prediction of the model, according to which the effects of market thickness on the expected time to fill a vacancy is ambiguous. Moreover, the fact that the patterns are very similar in thin and thick markets is a first indication that any difference in the effects of deaths

13. We always control for industry $\times$ year and CZ $\times$ year fixed effects to account for industry and location specific fixed and time-varying attributes and cluster standard errors at the CZ level.

14. Provinces are administrative units roughly comparable to U.S. counties and larger than CZ. As of 2021, there are 107 provinces in Italy. We use provinces rather than CZs to construct the local experience measure as the province information is available since 1984 rather than 2005.

TABLE 3
Market thickness and new hires characteristics

	(1) Same CZ	(2) Same Ind	(3) Same market	(4) No schooling	(5) High school	(6) College	(7) Local Exp.	(8) Industry Exp.	(9) Exec. Exp.	(10) Previous Ln(Wage)
MktTkn	0.032^{***}	0.053^{***}	0.051^{***}	−0.004	-0.017^{**}	0.020^{***}	0.420^{***}	0.932^{***}	0.036	0.031^{***}
	(0.007)	(0.008)	(0.008)	(0.003)	(0.007)	(0.006)	(0.092)	(0.090)	(0.062)	(0.006)
Industry-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CZ-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	51,185	51,185	51,185	23,410	23,410	23,410	51,185	51,185	51,185	51,185
R^2	0.224	0.152	0.155	0.077	0.098	0.100	0.144	0.194	0.075	0.083

Notes: This table presents estimates from regressions of a series of characteristics for all new hires into an executive position on the previous year thickness of the executive labour market. All regressions include industry dummies interacted with year dummies, and CZ dummies interacted with year dummies. labour market thickness is defined at the CZ $\times$ industry level and is constructed as the logarithm of the total number of executives in the firm's CZ $\times$ industry in year $t-1$. The dependent variables are dummies for, respectively, whether newly hired executives were previously employed in another firm from the same CZ, from the same industry, or from the same market (Columns 1, 2, and 3), dummies for three education levels of newly hired executives (Columns 4, 5, and 6), local experience measured as the number of years employed in the same province as the location of the firm from 1984 to year $t-1$ (Column 7), industry experience measured as the number of years employed in the same industry as the industry of the firm from 1984 to year $t-1$ (Column 8), executive experience measured as the number of years employed as executive from 1984 to year $t-1$ (Column 9), and the previous wage of the newly hired executive (Column 10). The sample period is 2010–15 in Columns (4) to (6), and 2005–15 in Columns (1) to (3) and (7) to (10). Standard errors are clustered at the CZ level. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

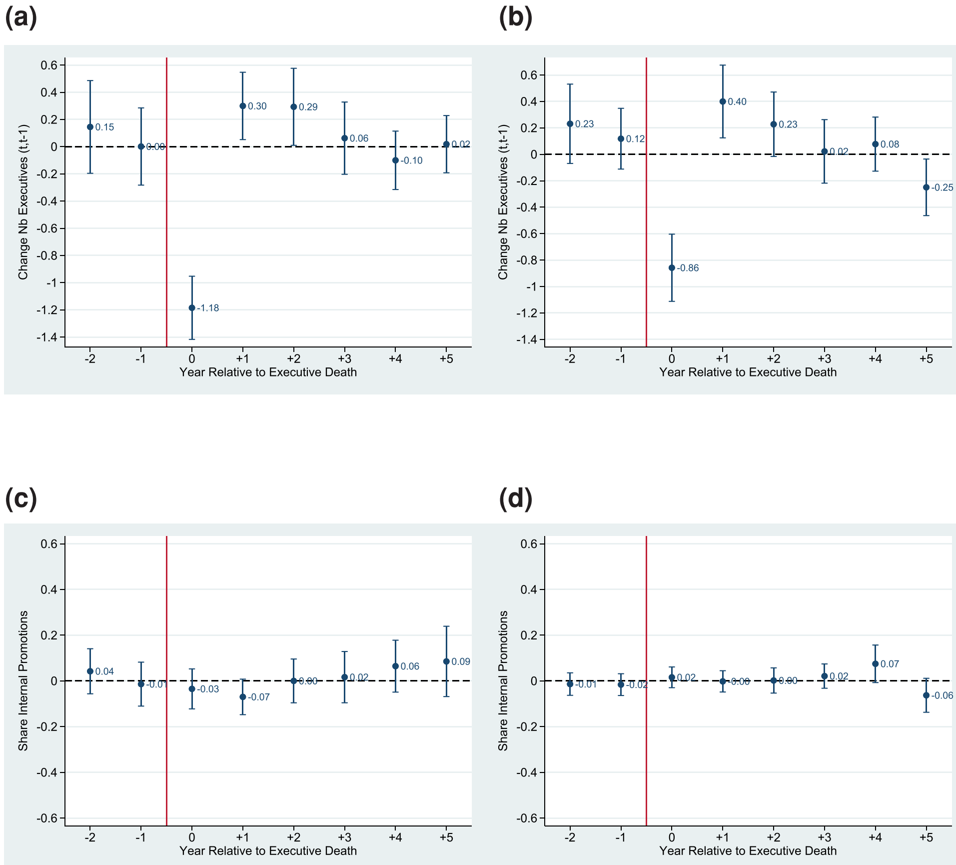

FIGURE 2

Death shocks and external versus internal hiring in thin versus thick labour markets. Panel A. Change in number of executives. (a) Thin markets and (b) Thick markets. Panel B. Share internal promotions among newly appointed executives. (c) Thin markets and (d) Thick markets

Notes: This Figure presents estimates from regressions of the change in the number of executives and the share of internal promotions in the 2 years before and 5 years after the occurrence of a deceased executive in, respectively, thin and thick labour markets. In Panel A, each graph plots estimated coefficients, β_τ, as well as the associated 95% confidence interval, of the following set of regressions: $\Delta\#Exec_{i,j,t} = \beta_\tau \,\mathrm{DecEx}_{i,t-\tau} + \beta_X X_{i,j,t} + \eta_{i,j,t}$, where $\Delta\#Exec_{i,j,t}$ is the change in the number of executives of firm i in market j between t and $t-1$ and $\mathrm{DecEx}_{i,t-\tau}$ is a dummy equal to one if the death of an executive hits firm i in year $t-\tau$ in a thin labour market (respectively, in a thick labour market). In Panel B, the dependent variable is replaced by the share of firm workers previously employed in the same firm in non-executive occupations and promoted to executives in year t among the total number of individuals appointed as new executives in the same year (including both internal promotions and external hires). The specifications include firm fixed effects and year fixed effects. The sample period is 2005–15. Standard errors are clustered at the firm level.

on performance is likely to come from differences in the quality of managers hired after the death event rather than from differences in the probability of appointing new executives. We further show in Panel B that the change in the number of executives is not driven by any abnormal behaviour of internal promotions: both in thin and thick markets, death events are not associated with a significant change in the share of newly appointed executives that are internally promoted.

5.1. *Baseline results*

To check for the effects of executive deaths, we first run a simplified version of equation (6) without controlling for market thickness, and present the results in Panel A of Table 4. We consider performance on the year of the event and the three following ones: in the notation of equation (6), $\tau = [t-3, t]$. Given that we always include firm fixed effects and that the shock is firm specific, we cluster standard error at the firm level. The estimate in Column (1), where we only control for firm and year fixed effects, indicates that ROA drops by an average of approximately 0.9 percentage points, significant at the 1% level.[15] Relative to the sample mean of 4%, the effect implies a drop of ROA by almost a quarter. In Column (2), we include industry $\times$ year and CZ $\times$ year fixed effects. The estimate remains virtually the same. Not surprisingly, this confirms that the effect on firm performance is not related to shocks at the industry or geographical levels correlated with executive deaths. In Column (3), we add firm characteristics (dummies for tercile of assets, age, ROA interacted with year dummies, all measured at $t-3$) and dummies for terciles of the total number of firm executives interacted with year dummies. Again, the results are unchanged. This addresses the concern that the results could be driven by diverging trends between firms with different characteristics or with a small versus large number of executives. Finally, in Column (4) we add market $\times$ year fixed effects. In this specification, we absorb any shock that hits the firm's executive market and that could be correlated with executive death, including natural disasters and the like. The effect is slightly reduced, at -0.72%, and significant at 5%.

The results of our basic estimation indicate that executive deaths have a large impact on profitability. This regression is a useful starting point in our analysis but arguably a negative effect of death on performance can result independently from executive supply: an executive is likely to have some firm-specific capital that gets destroyed by death and, in the process of rebuilding it, firm performance might suffer. To implement our identification strategy, we now bring into the picture the effect of executive market thickness. We begin by estimating equation (6), but replacing the continuous indicator of market thickness with a dummy equal to one if the market is above the median in terms of number of executives (a "thick" market). The results of Panel B in Table 4 are clear cut: all the aggregate effect comes from deaths in thin markets. In fact, we find that, across specifications, the drop of ROA in thin markets is large and stable—between 1.7 and 2 percentage points—and highly statistically significant. This means that, compared with the sample mean, ROA drops approximately by half. Instead, in thick markets, we find virtually no effect: β_1, the coefficient of the variable DecEx $\times$ Thick market is positive, statistically significant and only slightly smaller in absolute value than the coefficient in thin markets β_0, so that we fail to reject the hypothesis that $\beta_0 + \beta_1 = 0$ in all specifications. The estimates imply that the firm-specific human capital channel finds little support in the data. In thick markets, where it is easier to find a replacement, firm performance is hardly affected by the death event. Instead, in thin markets, the drop is large and precisely estimated. This is consistent with the hypothesis that the (local) supply of top management skills affects firm performance. The high degree of stability of the coefficients as we increase the controls is an indication that our death event is indeed orthogonal to the observed and unobserved heterogeneity we control for, supporting our identification framework.

Panel C of Table 4 reports the estimate of equation (6) using the continuous indicator of labour market thickness. The estimates of β_0 vary between -3.1 and -3.6, implying that, when

15. In terms of comparison, Bennedsen *et al.* (2020) find a stronger effect in their Danish data (-1.86%, see the fourth column in their Table VI), arguably because they only consider the year of death and focus on CEOs only rather than all executives.

TABLE 4
Executive exits and firm ROA

	(1)	(2)	(3)	(4)
Panel A:	ROA (× 100)			
DecEx $(t, t-3)$	-0.883^{***}	-0.971^{***}	-0.812^{***}	-0.719^{**}
	(0.321)	(0.322)	(0.304)	(0.323)
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Industry-year FE		Y	Y	Y
CZ-year FE		Y	Y	Y
Nb executives, age, size, ROA $(t-3)$ × year FE			Y	Y
Market(CZ × industry)—year FE				Y
Observations	306,246	306,246	306,246	306,246
R^2	0.520	0.530	0.553	0.579
Panel B:	ROA (× 100)			
DecEx $(t, t-3)$	-1.690^{***}	-1.945^{***}	-1.807^{***}	-1.825^{***}
	(0.475)	(0.467)	(0.469)	(0.514)
DecEx $(t, t-3)$ × thick market	1.382^{**}	1.645^{***}	1.688^{***}	1.709^{***}
	(0.628)	(0.626)	(0.604)	(0.649)
Thick market	−0.414	−0.291	0.093	
	(0.266)	(0.302)	(0.290)	
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Industry-year FE		Y	Y	Y
CZ-year FE		Y	Y	Y
Nb executives, age, size, ROA $(t-3)$ × year FE			Y	Y
Market(CZ × industry)—year FE				Y
Test DecEx $(t, t-3)$ (1+thick market) = 0				
P-value	0.466	0.482	0.759	0.775
Observations	306,246	306,246	306,246	306,246
R^2	0.520	0.530	0.553	0.579
Panel C:	ROA (× 100)			
DecEx $(t, t-3)$	-3.118^{***}	-3.574^{***}	-3.360^{***}	-3.524^{***}
	(0.796)	(0.801)	(0.783)	(0.865)
DecEx $(t, t-3)$ × MktTkn	0.408^{***}	0.474^{***}	0.464^{***}	0.490^{***}
	(0.134)	(0.137)	(0.127)	(0.139)
MktTkn	-0.340^{***}	-0.224^{*}	−0.083	
	(0.119)	(0.126)	(0.122)	
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Industry-year FE		Y	Y	Y
CZ-year FE		Y	Y	Y
Nb executives, age, size, ROA $(t-3)$ × year FE			Y	Y
Market(CZ × industry)—year FE				Y
Observations	306,246	306,246	306,246	306,246
R^2	0.523	0.532	0.555	0.578

Notes: This table presents estimates from regressions of firm ROA on, respectively, one dummy indicating whether the firm is hit by the death of (at least) one executive in the same or previous 3 years in Panel A, its interaction with a dummy indicating a thick labour market in Panel B, and its interaction with the logarithm of the number of executives working in the same CZ × industry in the previous year in Panel C. A labour market is defined at the CZ × industry level and is defined as thick (respectively, thin) if it lies above (respectively, below) the level of market thickness that splits the number of firms equally in thin and thick labour markets. All regressions include firm and year fixed effects. In Column (2), we add industry and CZ dummies interacted with year dummies, in Column (3) firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) as well as terciles of the number of executives interacted with year dummies. In Column (4), we include market (CZ × industry) dummies interacted with year dummies. The sample period is 2005–15. Standard errors are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

no other executives are present in the market, following a death event the firm ROA drops almost to zero compared with the sample mean. The estimate of β_1 is positive, highly significant and stable across specifications, with a value of around 0.4, indicating that, as thickness increases, the negative effects of executive deaths are attenuated. Using the estimates of our preferred specification of Column (3), we obtain that the effect of a death is zero in markets with almost 1,400 executives. Given that the 99th percentile is 340 (see Table 1), these estimates imply that the negative effect of a death event completely disappears only in very large markets. Finally, we find some evidence of a negative effect of thickness in itself in the first two columns. Note however that this should not be interpreted in a cross sectional sense, that is, firms in thicker markets having lower ROA. Given that we always include firm fixed effects, and given that firms do not change markets, the coefficient is only identified by the time series variation in the number of executives within market. In fact, when we add more controls at the level of the firm (Column 3), the effect disappears (in Column (4) market thickness is absorbed by market × year effects).

Our baseline specification delivers an average effect over the period of the year of the death and the following three ones. We next examine the dynamics of the effect by estimating the following equation separately for thin and thick markets:

$$\text{ROA}_{i,j,t} = \sum_{\tau=-2}^{5} \beta_\tau \text{DecEx}_{i,t-\tau} + \beta_X X_{i,j,t} + \eta_{i,j,t} \tag{7}$$

where $X_{i,j,t}$ includes firm fixed effects, industry and CZ dummies interacted with year dummies, and firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) as well as terciles of the number of executives interacted with year dummies. The coefficients β_τ trace the dynamics of the death event from 2 periods before to 5 periods after its occurrence. The results of this exercise are plotted in Figure 3, based on our preferred specification of Column (3) in Table 4. First, for our identification strategy to hold, ROA should show no prior trend. Reassuringly, the coefficients on DecEx_{t+1} and DecEx_{t+2} are small and not statistically different from zero both in thin and in thick markets. Second, in thick markets, we observe a drop in the year of the event (−0.8%), and values very close to zero in all the following years. None of the coefficients is statistically significant, indicating that for these firms there is no departure from the firm-level average ROA (recall that all regressions include firm fixed effects). On the contrary, in thin markets ROA drops substantially on the year of the event, with an estimated value of −2.1%, and remains below −1.5% and highly significant in the three following years. It marginally loses significance after 4 years (−1.16%), and the effect clearly disappears only after 5 years.

A number of recent studies show that, in the presence of heterogeneous treatment effects, the coefficients on the leads and lags of the treatment variable in an event study might place negative weights on the average treatment effect for certain groups and periods (see *e.g.* de Chaisemartin and D'Haultfœuille, 2020; Goodman-Bacon, 2021; Sun and Abraham, 2021; Baker *et al.*, 2022). To address this concern, we apply the stacked event study approach used for instance by Cengiz *et al.* (2019). Specifically, for each death event, we stack together treated firms and all firms that have never been treated over the sample period, but with the exact same number of executives in their respective market (that is, the same market thickness) in the year before the death. The match is conducted year by year. We keep all exact matches, that is, all never treated firms in the same year operating in a market with exactly the same number of executives as the treated

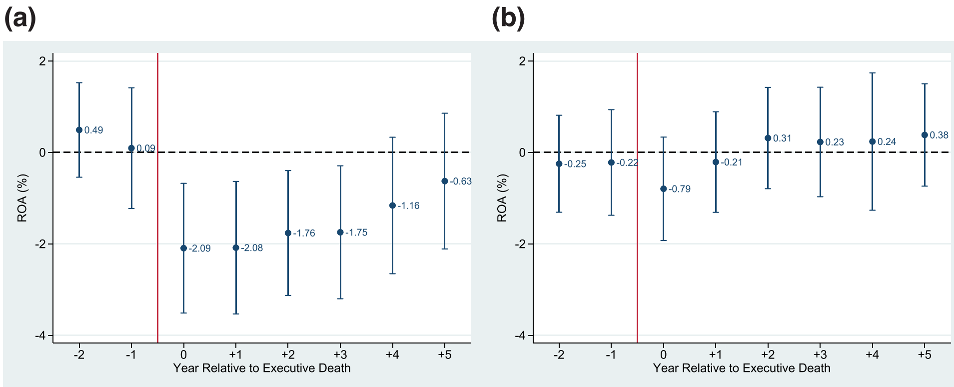

FIGURE 3

Executive exits and firm ROA in thin versus thick labour markets. (a) Thin markets and (b) Thick markets

Notes: This Figure presents estimates of return on assets in the 2 years before and 5 years after the occurrence of a deceased executive in, respectively, thin and thick labour markets. Return on assets (ROA) is earnings before interest and taxes, over the value of assets in the previous year. Each graph plots estimated coefficients, β_τ, as well as the associated 95% confidence interval, of the following regression: $\mathrm{ROA}_{i,j,t} = \sum_{\tau=-2}^{5} \beta_\tau \mathrm{DecEx}_{i,t-\tau} + \beta_X X_{i,j,t} + \eta_{i,j,t}$, where $\mathrm{DecEx}_{i,t-\tau}$ is a dummy equal to one if the death of an executive hits firm i in market j in year $t-\tau$ in a thin labour market (respectively, in a thick labour market). The specification includes firm fixed effects, industry and CZ dummies interacted with year dummies, and firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) as well as terciles of the number of executives interacted with year dummies. The sample period is 2005–15. Standard errors are clustered at the firm level.

firm. When there is no exact match, the treated firm is removed from the estimation.[16] We align events by event year (and not calendar year) with event year $t=0$ indicating the time of the death event, and then run the event study estimates on this stacked data separately in thin and thick labour markets (based on market thickness in the year before death events). We include firm fixed effects and event year dummies. Standard errors are clustered at the firm level. Figure 4 shows that estimates are very similar to our panel regression-based event study. This indicates that issues of negative weighting are unlikely to affect our results.

We also use the stacked data to investigate in more details the heterogeneity of the effects of death events according to market thickness, in specifications in which the market thickness definition is held constant over time. For this, we run a similar regression as the one in Table 4, Panel A (where return on assets is regressed on a death dummy taking the value of one in the event time of the death, or the previous 3 years) but on the stacked data, separately for each quintile of market thickness fixed in the year before death events. Online Appendix Figure A.1 plots the coefficients in each market thickness quintile, along with 95% confidence intervals. We find that the effect of deaths on performance is the largest in absolute value and highly statistically significant in the lowest quintile (representing the thinnest markets, in which the coefficient on the DecEx dummy equals -2.7.), is lower but still negative and statistically significant in the second quintile, while the effect becomes small and indistinguishable from zero in the third, fourth, and fifth quintiles.

Overall, we conclude that, consistently with the model's predictions, the effects of executive deaths are both larger and longer lasting in thin markets.

16. This provides an alternative to our baseline panel specification using a more stringent criteria for admissible control groups, and is more robust to possible problems with a staggered treatment design in the presence of heterogeneous treatment effects. By aligning events by event year (and not calendar year), this is equivalent to a setting where the events happen all at once and are not staggered. This prevents negative weighting of some events that may occur with a staggered design. Moreover, by dropping all control firms that were sooner or later hit by a death event over the sample period, we further guard against bias due to heterogeneous treatment effects.

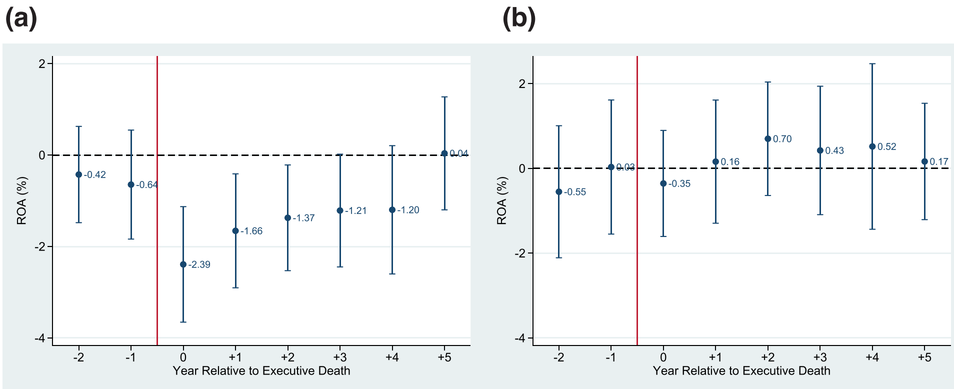

FIGURE 4
Executive exits and firm ROA in thin versus thick labour markets—stacked event-study approach. (a) Thin markets and (b) Thick markets

Notes: This Figure presents stacked event-study estimates of return on assets in the two event years before and five event years after the occurrence of a deceased executive in, respectively, thin and thick labour markets on the stacked dataset (in which $t=0$ indicates the time of the death). Return on assets (ROA) is earnings before interest and taxes, over the value of assets in the previous year. Each graph plots estimated coefficients, β_τ, as well as the associated 95% confidence interval, of the following regression: $\text{ROA}_{i,j,t} = \sum_{\tau=-2}^{5} \beta_\tau \text{DecEx}_{i,t-\tau} + \beta_X X_{i,j,t} + \eta_{i,j,t}$, where $\text{DecEx}_{i,t-\tau}$ is a dummy equal to one if the death of an executive hits firm i in market j in event year $t-\tau$ in a thin labour market (respectively, in a thick labour market). The specification includes firm fixed effects and event year dummies. The sample period is 2005–15. Standard errors are clustered at the firm level.

5.2. *Robustness and extensions*

We now exploit our granular data to explore in detail the robustness of the results, to perform heterogeneity analysis, and to estimate the effects of death events on executive wages in other firms.

Performance measure. We explore the robustness to using alternative performance measures in Table 5. In Column (1), we use productivity, defined as value added (in 2015 constant thousand euros) per worker. Productivity is a more comprehensive measure of the firm's efficiency, as it also accounts for the number and the compensation of employees. The results fully confirm those obtained with ROA: the coefficient of DecEx is -10 and that on its interaction with market thickness is 1.5, both statistically significant at conventional levels. Next, we consider the probability that a firm exits the market following the death event. In fact, disruptions caused by the death could, in the most extreme cases, lead to firm exit. In Column (2), we report the results of a regression in which the dependent variable is a dummy equal to 1 if the firm exits the market in year t. While the signs are as expected—the DecEx dummy has a positive and its interaction with MktTkn a negative coefficient–, the estimates are imprecise and we cannot reject the null hypothesis of no effect of deaths on firm exit.

An important question relates to what causes the drop in ROA. By definition, ROA is sales minus intermediate and labour costs over assets. In the next three columns, we use as dependent variable each component of ROA separately, that is, sales, intermediates expenditure and labour costs, each divided by lagged assets. We find that the drop in ROA is caused by a large drop in sales over asset (Column 3), not compensated by a corresponding drop in intermediates costs (Column 4, the coefficients are significant but smaller than those of sales) or labour costs (Column 5, the coefficients are not significantly different from zero). Finally, in Column (6), we use the log of assets as the dependent variable, to account for the possibility that the death event disrupts firm assets. The estimates do not lend support to this hypothesis, indicating that changes in ROA are dictated by changes in profits rather than assets. The picture that emerges

TABLE 5
Executive exits and other firm outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
			Outcome X scaled by lagged assets			
	labour Prod. (K€ per emp)	Firm exit (× 100)	X=Sales (× 100)	X=Int. costs (× 100)	X=labour costs (× 100)	Ln(assets)
DecEx $(t,t-3)$	-10.314^{***}	1.051	-8.785^{**}	-5.744^{**}	-1.181	-0.036
	(3.553)	(1.148)	(4.032)	(2.772)	(0.995)	(0.057)
DecEx $(t,t-3)$ × MktTkn	1.470^{**}	-0.133	1.531^{**}	1.104^{**}	0.138	0.008
	(0.602)	(0.179)	(0.744)	(0.504)	(0.179)	(0.009)
MktTkn	-1.185^{*}	0.174	0.608	0.168	0.010	0.013
	(0.705)	(0.164)	(0.717)	(0.421)	(0.180)	(0.008)
Firm FE	Y	Y	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y	Y	Y
CZ-year FE	Y	Y	Y	Y	Y	Y
Nb executives, age, size, ROA $(t-3)$ × year FE	Y	Y	Y	Y	Y	Y
Observations	290,617	306,246	306,246	306,246	306,246	306,246
R^2	0.713	0.263	0.722	0.833	0.810	0.941

Notes: This table presents variants of the specification presented in Column (3) of Panel C of Table 4, in which we replace firm ROA with other firm outcomes as dependent variable. All regressions include firm fixed effects, industry and CZ dummies interacted with year dummies, firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) interacted with year dummies and dummies indicating terciles of the number of executives interacted with year dummies. We consider the following firm outcomes: labour productivity in Column (1), firm exit in Column (2), sales over lagged assets in Column (3), cost of intermediates over lagged assets in Column (4), labour expenses over lagged assets in Column (5), and the logarithm of assets in Column (6). The sample period is 2005–15. Standard errors are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

from this exercise is one in which a death event causes a drop in sales that is not compensated by a corresponding drop in costs: in particular, labour costs do not move, consistently with the large evidence of a low elasticity of employment to firm shocks, both in terms of number of employees and of wages (see, for example, Guiso *et al.*, 2005; Ellul *et al.*, 2018).

Thickness measure. Our preferred measure of market thickness is the logarithm of the number of executives in the market at $t-1$. We explore the robustness of the results with respect to this measure in the first three columns of Table 6. In column (1), we use the number of firms and in Column (2) the number of executives working for other firms (that is, excluding own executives). The estimates are very similar to those based on our preferred measure. A possible concern relates to the fact that market thickness, even though lagged in our specifications, could be affected by the death of an executive itself. The estimates of Columns (1) and (2) go against this hypothesis: our results do not change when we define thickness using only the number of executives in other firms and the number of firms, not directly affected by the death. Still, one could argue that the number of executives in other firms could be indirectly affected by death via executive poaching. We therefore address this concern directly running our baseline specification using a time-invariant measure of market thickness. To do so, we fix market thickness in 2005, the first year of our sample period. As shown in Column (3) of Table 6, the estimates are virtually unchanged. The same holds when we use the average number of executives over the sample period (unreported for brevity).

Market definition. Next, we experiment with the sectoral and geographical components of the market definition, using CZ and 1-digit Industry in Column (4), province and 2-digit Industry in Column (5), and province and 1-digit Industry in Column (6). The next two columns experiment with a different notion of the geographical component of the market definition, based only on geographical distance: We use municipalities within a radius of 10 miles around the firm, together with 2-digit Industry in Column (7) and 1-digit Industry in Column (8).[17] In this case, the geographical component of the market definition is basically different for each municipality.

The algorithm used by the National Statistical Institute to define CZ is based on home-to-work commuting patterns and it is the standard definition of labour markets in the labour literature (see, for example, David *et al.*, 2013; Dustmann *et al.*, 2017; Acemoglu and Restrepo, 2020). Nimczik (2018) proposes an alternative definition that leverages on matched employer-employee data and uses observed worker flows across firms. We follow his procedure and compute an alternative measure of market thickness based on observed executive flows across each pair of markets (Industry $\times$ CZ cells). Specifically, consider a square matrix T in which $T_{l,m}$ denotes the total number of executive transitions from market l to market m within the sample period. For a firm located in market m, we then compute market thickness as $\log\left(\frac{\sum_l T_{l,m}\times N_{l,t-1}}{\sum_l T_{l,m}}\right)$ where $N_{l,t-1}$ is the number of executives working for firms in market l in year $t-1$. We present the results when the data-driven local labour markets are computed based on executive flows across 2-digit Industry $\times$ CZ pairs in Column (9) and across 1-digit Industry $\times$ pairs in Column (10).

The estimates of the coefficient of DecEx and of its interaction with MktTkn are stable across all these different specifications, indicating that our results are robust to the market definition.

Firm and executive characteristics. Our regressions already control for firm characteristics. However, one further concern is that our estimates of market thickness might reflect the heterogeneous responses to death events of some types of firms which are differentially present in markets with different levels of thickness, as opposed to the true causal impact of labour market thickness itself. For example, firms with many executives might be both more present in thick markets and less adversely affected by death events than firms with few executives, irrespective of the thickness of their labour market. To control for this possibility, we augment our specification with firm characteristics (number of executives, assets, age and ROA, all measured 3 years before the death event), and their interactions with the death dummy, as well as with market thickness. The result of this augmented specification is reported in Column (1) of Table 7. Reassuringly, the estimate of the interaction of interest between the deceased executive dummy and market thickness remains remarkably stable at 0.49.

A similar argument can be made regarding the characteristics of the deceased executives. For example, older executives might be more common in thin markets, and their death might have a stronger impact on performance. To gauge the relevance of these concerns, we include the interactions between age, tenure, gender and wage of the deceased executive in the year prior to death with the deceased executive dummy.[18] Column (2) of Table 7 shows that the estimate on the main interaction term between the deceased executive dummy and market thickness remains stable when adding these additional controls.

Taken together, the results presented in Columns (1) and (2) address the concern that potential differences in firm characteristics or executive characteristics across thin and thick markets could confound our findings.

Different subsamples. Next, we check if the results change when using different subsamples to run the regressions. The Italian economy is characterized by a large heterogeneity in economic development, with a clear negative gradient from the North to the South. One might be concerned that our effects are induced by some specific area, for example the South, where markets are thin and firms are generally weaker in terms of performance. This concern is greatly mitigated by the

17. The distance of 10 miles is similar to the average distance between pairs of municipalities of the same CZ.

18. In the unlikely event in which two executives of the same firm died in the same year, we take the average of each executive characteristic. Note that we do not include neither the (non-interacted) deceased executive characteristics, nor their interaction with market thickness, as they are only defined for firms hit by death events.

TABLE 6
Robustness—alternative market thickness definitions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Alternative thickness measures			Alternative market definitions						
				Other industry/area definition			Distance around firm		Exec-flow based across all pairs of	
	# Firms	# Exec in other firms	# Exec in 2005	CZ 1-digit Ind	Province 2-digit Ind	Province 1-digit Ind	<10 miles 2-digit Ind	<10 miles 1-digit Ind	CZ 2-digit Ind	CZ 1-digit Ind
DecEx $(t, t-3)$	-2.916^{***}	-3.479^{***}	-3.462^{***}	-3.893^{***}	-3.237^{***}	-3.985^{***}	-3.420^{***}	-2.557^{***}	-2.344^{**}	-4.290^{***}
	(0.682)	(0.785)	(0.786)	(0.823)	(0.937)	(1.023)	(0.979)	(0.893)	(0.913)	(1.018)
DecEx $(t, t-3) \times$ MktTkn	0.497^{***}	0.483^{***}	0.476^{***}	0.478^{***}	0.414^{***}	0.459^{***}	0.409^{***}	0.342^{**}	0.245^{*}	0.475^{***}
	(0.141)	(0.127)	(0.126)	(0.119)	(0.148)	(0.143)	(0.142)	(0.146)	(0.141)	(0.141)
ktTkn	0.002	−0.050		0.205	−0.112	0.114	0.193	-0.253^{*}	0.023	0.116
	(0.153)	(0.118)		(0.170)	(0.153)	(0.213)	(0.193)	(0.146)	(0.269)	(0.513)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CZ-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Nb exec age, size, ROA $(t-3) \times$ year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	306,246	306,246	306,246	306,246	306,246	306,246	306,246	306,246	306,246	306,246
R^2	0.555	0.555	0.553	0.554	0.554	0.553	0.557	0.561	0.553	0.553

Notes: This table presents variants of the specification presented in Column (3) of Panel C of Table 4, in which we use alternative ways of measuring labour market thickness. All regressions include firm fixed effects, industry and CZ dummies interacted with year dummies, firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) interacted with year dummies and dummies indicating terciles of the number of executives interacted with year dummies. labour market thickness is defined as the logarithm of the number of firms in the same 2-digit Industry × CZ in year $t-1$ in Column (1), the number of executives working for other firms in the same 2-digit Industry × CZ in year $t-1$ in Column (2), the number of executives in the same 2-digit Industry × CZ in year 2005 in Column (3), the number of executives in the same 1-digit Industry × CZ in year $t-1$ in Column (4), the number of executives in the same 2-digit Industry × Province in year $t-1$ in Column (5), the number of executives in the same 1-digit Industry × Province in year $t-1$ in Column (6), the number of executives in the same 2-digit Industry located in municipalities within a radius of 10 miles around the firm in Column (7), the number of executives in the same 1-digit Industry located in municipalities within a radius of 10 miles around the firm in Column (8). We compute market thickness based on observed executive flows across 2-digit Industry × CZ in Column (9), and based on observed executive flows across 1-digit Industry × CZ in Column (10). The sample period is 2005–15. Standard errors are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

TABLE 7

Executive exits and firm ROA—additional robustness checks

	(1) Control for DecEx × Firm Char.	(2) Control for DecEx × Exec Char.	(3) South+center +Islands only	(4) North only	(5) Eventually treated	(6) # Exec in T-1 = 1	(7) # Exec in T-1 > 1	(8) At least 2 firms in market	(9) Excl. death with prior Sick Leave
DecEx $(t, t-3)$	-6.807^{***}	-3.016^{***}	-3.910^{**}	-3.023^{***}	-4.028^{***}	-6.422^{**}	-2.026^{***}	-3.551^{***}	-3.444^{***}
	(2.481)	(0.796)	(1.556)	(0.896)	(0.986)	(2.618)	(0.755)	(0.858)	(0.816)
DecEx $(t, t-3)$ × MktTkn	0.486^{***}	0.472^{***}	0.552^{**}	0.416^{***}	0.542^{***}	0.826^{**}	0.309^{**}	0.492^{***}	0.478^{***}
	(0.130)	(0.128)	(0.265)	(0.143)	(0.152)	(0.419)	(0.123)	(0.137)	(0.132)
MktTkn	0.168	−0.082	−0.239	0.013	−0.631	0.178	-0.353^{*}	−0.041	−0.083
	(0.400)	(0.122)	(0.211)	(0.150)	(0.774)	(0.230)	(0.200)	(0.131)	(0.122)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
CZ-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Nb executives, age, size, ROA $(t-3)$ × year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
DecEx $(t, t-3)$ × Nb exec, age, size, ROA $(t-3)$	Y								
MktTkn × Nb exec, age, size, ROA $(t-3)$	Y								
DecEx $(t, t-3)$ × tenure, age, gender, wage $(t-1)$		Y							
Observations	306,246	306,246	77,171	229,075	8,727	81,947	108,321	289,422	305,788
R^2	0.555	0.555	0.542	0.559	0.712	0.675	0.643	0.554	0.555

Notes: This table presents estimates from regressions of firm ROA on one dummy indicating whether the firm is hit by the death of (at least) one executive in the same or previous 3 years and its interaction term with the logarithm of the number of executives working in the same CZ × industry in the previous year. All regressions include firm fixed effects, industry and CZ dummies interacted with year dummies, firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) interacted with year dummies and dummies indicating terciles of the number of executives interacted with year dummies. Column (1) further controls for firm size, age, ROA, and the number of executives, and their interaction with the dummy indicating whether the firm is hit by the death of (at least) one executive in the same or previous 3 years, and with market thickness. Column (2) further controls for the interaction of the dummy indicating whether the firm is hit by the death of (at least) one executive in the same or previous 3 years, with the following characteristics of the deceased executive: Tenure, Gender, Age and the logarithm of her/his wage in the previous year. The sample is restricted to firms located in the Center-South regions in Column (3) (Tuscany, Umbria, Marche, Lazio, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicily, Sardinia), to firms located in the North in Column (4) (all the other regions), to eventually treated firms only in Column (5), to firms with only one executive in year $t-1$ in Column (6), to firms with two or more executives in year $t-1$ in Column (7), to firms operating in markets with at least another firm in Column (8). We exclude all firms with events for deceased executives with paid-sick leave in any prior year in Column (9). The sample period is 2005–15. Standard errors are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

fact that, as shown in Figure 1, death events are spread across Italy, and that our specifications exploit within CZ variation only. In any case, we have estimated our regressions separately for the North and the Center-South. Columns (3) and (4) of Table 7 show that the estimates are similar across areas, indicating that our effects apply generally and go beyond the territorial differences that characterize the Italian economy.

Another issue is that eventually treated firms and never treated firms are different in terms of characteristics, as, by construction, a firm is more likely to be treated the larger the number of executives it employs (see the descriptive statistics in Table 1). We address this issue with the inclusion of firm fixed effects and a large number of controls in our specifications. However, to dispel any further concern we also estimated our model only keeping eventually treated firms, so that the control group is only composed of eventually treated firms themselves in the periods in which they are not classified as treated. Despite a large drop in observations (from 306,246 to 8,727), Column (5) of Table 7 shows again stable results.

In yet another check, following Jaravel *et al.* (2018) we have also employed an exact matching technique to construct a balanced control sample. Online Appendix Table A.2 reports the results using eight different firm characteristics to perform the match (the matching procedure is described in detail in the note to the table). This matching procedure delivers similar estimates for both the death dummy and its interaction term with labour thickness across all specifications, supporting the robustness of our results and in particular the adequacy of our controls.[19]

Another concern is that the results might be driven by firms with only one executive, which might be more likely to operate in thin markets. The specification presented in Column (1) of Table 7, in which we add firm characteristics and their interaction with the death dummy, including the number of firm executives, largely alleviates this concern. In any case, we directly address it in Columns (6) and (7), which report the results when running the baseline estimation separately for the sub-samples of firms with only 1 executive and with more than 1 executive in $t-1$. Perhaps not surprisingly, the effect of death events is substantially stronger for firms with only one executive. Moreover, market thickness bears a larger coefficient in this sample, arguably because finding a good replacement is more important when the firm has only one executive, and this is more difficult in thin markets. However, the coefficient on the interaction term is positive and statistically significant also in the sub-sample of firms with more than one executive, indicating that market thickness matters in general for the impact of an executive's death on firm performance. Online Appendix Figure A.2 reports the event study relative to death events hitting firms with either 1 or more than 1 executive (in the year before death), confirming the results.[20]

Below, we run regressions of executive wages that require at least another firm besides the firm hit by the death of an executive. To check that our baseline results on firm performance are not different in this sub-sample, we report in Column (8) the results from the restricted sample with at least two firms in a given market. The estimates are virtually unchanged compared with our baseline specification.

19. To maximize comparability with the main specification, Online Appendix Table A.2 includes CZ and Industry fixed effects interacted with year dummies. One could argue that the matching procedure makes these dummies somehow redundant. We have therefore also estimated the matched sample without these dummies. As expected, the results, unreported for brevity, are similar.

20. We provide more evidence on the heterogeneity of our effects according to firm characteristics below.

Next, we check the sensitivity of the results to restricting the sample to a more conservative set of unexpected executive deaths. For this, we repeat the analysis by excluding deceased executives with claims to the social security administration for paid-sick leave in any prior year, and present the results in Column (9), finding again very similar coefficients.

We conclude that our results are extremely robust to changes in the sample definition and in the selection of controls.

Firms attrition. Another possibility is that our results are driven by the firms that eventually exit the market. It might be that in thin markets some firms do not find a suitable replacement and therefore, after a deterioration in performance, they exit, while firms that find a replacement do as well as those in thick markets. In particular, we might also wrongly interpret the dynamics presented in Figure 3 as evidence that firms gradually absorb death shocks while it might simply reflect the fact that the most-severely affected firms exit first. While this hypothesis confirms that executive market thickness affects performance, it implies that the average effect we measure is actually concentrated in a few low-performing firms. Note that the results on firm exit suggest that this should not be the case, as we do not find significant effects of thickness on exit (see Column (2) of Table 5). However, we can directly test its validity by repeating the dynamic regressions of Figure 3 on the closed sample, that is, excluding firms that exit the sample at some point. Online Appendix Figure A.3 reports these estimates, showing that the results are similar to those obtained with the full sample. This indicates that the results are not driven by eventually exiting firms.

Non-executive white-collar. We analyse if the effect is specific to executives by considering the evolution of ROA when at least one (non-executive) white-collar dies. Online Appendix Table A.3 repeats the regressions of our preferred specification of Table 4, panel C, substituting the Deceased executive dummy with a Deceased white-collar dummy. We find no significant effect of a white-collar death and of its interaction with market thickness. This can be due both to the fact that one white-collar worker other than an executive is not a key asset for firms, and that there is no shortage of white collar workers: they are not in short supply in any market. Either way, this placebo test rejects the concern that differences in firm characteristics between thin and thick markets could drive both worker deaths and performance.

Firm ownership and management. Another concern is that market thickness could be related to different ownership structures, in particular in terms of presence of family owned and managed firms, which might have a large degree of firm-specific human capital and for which it could be particularly problematic to find a replacement after an executive death.[21] We use data on firm ownership and control to gauge the severity of this concern.[22] Due to privacy reasons, we cannot link this information to our firm data, but we can aggregate them at the market-period level. We find that the average share of family owned and managed firms is 55.2% in thin and 56.7% in thick markets. While this indicates that a large fraction of firms in our sample is family owned and managed, this fraction is almost identical in both market types. We confirm this result in a regression of the share of family owned and managed firms on our measure of labour market

21. Consistently with this hypothesis, Smith *et al.* (2019) show that a large share of closely held business income is attributable to owners' specific human capital. This result might seem at odds with our finding that, when an executive dies in a thick market, the firm ROA is not affected. Note however that the two exercises are not directly comparable. Smith *et al.* (2019) focus on business *owners* in pass-through corporations, while we focus on executives, who are paid employees in traditional incorporated businesses, and we cannot determine if they are also business owners.

22. Data on firm ownership and control are from the Chamber of Commerce, to which all incorporated firms must report both ownership and board composition. We assume that individuals are part of a family if they share the same last name or the same home address. We define a firm as family owned and managed if one or more individuals belonging to the same family own at least 50% of shares and one of them also has the most important position in the board (CEO or President).

thickness, after including both industry-year and CZ-year fixed effects, following the empirical framework used in our analysis. As shown in Panel A of Online Appendix Table A.4, we fail to find any significant correlation between the two variables.

A direct way of assessing whether differences in firm ownership and management across thin versus thick markets could confound our results is to analyse whether the impact of death events and its interaction with market thickness on ROA varies by the market-year share in family owned and manager firms. The results of this regression are reported in Panel B of Online Appendix Table A.4, where we augment our basic specification with the share of family owned and manager firms in the same market in year $t-1$, as well as its interaction with the death dummy. Reassuringly, the estimate of the interaction of interest between the deceased executive dummy and market thickness remains remarkably stable. This directly addresses the concern that the larger drop in profits that we observe in thin labour markets following death events could be driven by the fact that, in these markets, the deceased executive might be more likely to also be the owner of the affected firm.

Heterogeneity of the effects. We now turn to heterogeneity analysis of our baseline findings depending on firm characteristics, executive characteristics, and sector of firm operations. To do so, we use the same firm and executive characteristics introduced as controls in Columns (1) and (2) of robustness Table 7, in which we further augment the specification with the triple interaction of the death dummy, market thickness and the firm (and respectively executive) characteristics.

Panel A of Table 8 presents the results separately for each of the following firm characteristics: Number of executives, log of assets, age, and ROA, all measured 3 years before the death event. In a similar way as in Column (1) of Table 7, we also include all the pairwise interaction terms between DecEx, MktTkn and the firm characteristic of interest. We find that firm size, measured both in terms of the number of executives and of total assets, is an important mediator of the impact of an executive death and of the effect of market thickness. Specifically, firms with more executives or larger assets are less impacted by the executive death (the interaction between the size indicator and the death dummy is positive) and benefit less from the mitigating effect of market thickness (the triple interaction is negative). This is consistent with the hypothesis that large firms are less reliant on a single executive. These results also imply that the negative impact of operating in thin labour markets when hit by a death event is magnified for small firms. Next, we introduce firm age (Column 3) and lagged ROA (Column 4), finding that none of the interactions is significant.

Panel B of Table 8 repeatsthe same exercise using the following characteristics of the deceased executives: tenure, age, gender, and wage in the year prior to death. Differently from firm characteristics, we find no significant heterogeneity along these dimensions.

The last dimension of heterogeneity we consider is sectoral.[23] We estimate the model repeatedly, singling out each one digit sector at a time (Agriculture, Manufacturing, Construction, Utilities, Retail, Food and Accommodation, and Services) and check if the estimates are statistically different from those of the other sectors. The results, reported in Online Appendix Table A.5, show no significant cross sectoral heterogeneity. Moreover, the estimates of the coefficient of the main interaction term DecEx $\times$ MktTkn are remarkably stable across specifications, and indicate that our baseline findings do not depend on any particular sector.

Executive wage response in other firms. To further corroborate the importance of the local supply of executives, we look at spillovers on executives working at other firms in the market where a death occurred, and focus on their wages. For firms hit by death events, their search for

23. We have already shown in Table 7 that the estimates are stable when splitting the sample geographically.

TABLE 8
Heterogeneity analysis—interacting with firm and executive characteristics

	(1)	(2)	(3)	(4)
	ROA ($\times$ 100)			
Panel A: firm charac.	Nb exec	Ln assets	Firm age	ROA
DecEx $(t, t-3)$	-3.879^{***}	-15.649^{***}	-3.307^{**}	-2.771^{***}
	(0.828)	(5.929)	(1.353)	(0.804)
DecEx $(t, t-3) \times$ MktTkn	0.527^{***}	2.097^{**}	0.473^{**}	0.375^{***}
	(0.132)	(0.928)	(0.227)	(0.132)
DecEx $(t, t-3) \times$ Firm charac. $(t-3)$	0.043^{***}	1.168^{**}	-0.003	-11.646
	(0.017)	(0.526)	(0.057)	(8.808)
DecEx $(t, t-3) \times$ MktTkn $\times$ Firm charac. $(t-3)$	-0.005^{***}	-0.156^{*}	-0.001	1.662
	(0.002)	(0.082)	(0.009)	(1.267)
MktTkn $\times$ firm charac. $(t-3)$	-0.001	-0.031	0.002	0.138
	(0.004)	(0.037)	(0.008)	(0.167)
MktTkn	-0.080	0.207	-0.117	-0.082
	(0.122)	(0.376)	(0.204)	(0.123)
Firm charac. $(t-3)$	-0.003	-1.003^{***}		-3.826^{***}
	(0.031)	(0.232)		(1.015)
Firm FE	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y
CZ-year FE	Y	Y	Y	Y
Nb executives, size, age, ROA $(t-3) \times$ year FE	Y	Y	Y	Y
Observations	306,246	306,246	306,246	306,246
R^2	0.555	0.556	0.555	0.555
Panel B: deceased exec charac.	Tenure	Age	Female	Ln wage $(t-1)$
DecEx $(t, t-3)$	-3.418^{***}	-2.975^{***}	-3.368^{***}	-3.089^{***}
	(0.936)	(0.924)	(0.803)	(0.940)
DecEx $(t, t-3) \times$ MktTkn	0.497^{***}	0.468^{***}	0.466^{***}	0.483^{***}
	(0.155)	(0.157)	(0.132)	(0.159)
DecEx $(t, t-3) \times$ exec charac.	0.009	-0.013	0.137	-0.105
	(0.065)	(0.019)	(2.552)	(0.209)
DecEx $(t, t-3) \times$ MktTkn $\times$ exec charac.	-0.005	-0.000	-0.030	-0.006
	(0.011)	(0.003)	(0.353)	(0.035)
MktTkn	-0.083	-0.081	-0.083	-0.082
	(0.122)	(0.122)	(0.122)	(0.122)
Firm FE	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y
CZ-year FE	Y	Y	Y	Y
Nb executives, size, age, ROA $(t-3) \times$ year FE	Y	Y	Y	Y
Observations	306,246	306,246	306,246	306,246
R^2	0.555	0.555	0.555	0.555

Notes: This table presents estimates from regressions of firm ROA on a dummy indicating whether the firm is hit by the death of (at least) one executive in the same or previous 3 years, and its interaction term with the logarithm of the number of executives working in the same CZ $\times$ industry, augmented with additional interaction terms with firm and executive characteristics. Panel A focuses on firm characteristics. We consider the following firm characteristics: the number of executives in the firm (Column 1), the logarithm of firm assets (Column 2), firm age (Column 3), and ROA (Column 4), all measured 3 years before the death events. Panel B focuses on executive characteristics. We consider the following executive characteristics: executive tenure upon death (Column 1), age (Column 2), sex (Column 3), log wage in the year prior to death (Column 4). All regressions include lower level interactions, firm fixed effects, industry and CZ dummies interacted with year dummies, firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) interacted with year dummies and dummies indicating terciles of the number of executives interacted with year dummies. The sample period is 2005–15. Standard errors are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

new executives should generate an upward pressure on executive pay in the same market, whose intensity depends on the thickness of executive supply. Accordingly, we estimate the following equation at the executive (rather than at the firm) level:

$$\text{Ln(Wage)}_{k,-i,j,t} = (\gamma_0 + \gamma_1 \text{MktTkn}_{j,t-1}) \times \text{DecEx}_{j,t-1} + \gamma_X X_{k,-i,j,t} + u_{k,-i,j,t}, \tag{8}$$

where $\text{Ln(Wage)}_{k,-i,j,t}$ is the logarithm of the wage of executive k working in firm $-i$ never hit by a death event (firms ever hit by an executive death are excluded from the sample) and $\text{DecEx}_{j,t-1}$ is a dummy taking the value of one if at least one executive died in the previous year in market j. This regression is at the executive rather than at the firm level, so that, in addition to year fixed effects, in all regressions we include executive fixed effects,[24] and we progressively add commuting zone × year and industry × year fixed effects, as well as controls for executive gender, age and tenure, interacted with year fixed effects. In these wage specifications, standard errors are clustered at the commuting zone level to account for serial correlation of the error term within executives of the same commuting zone.[25] We expect γ_0 to be positive and γ_1 to be negative: the pressure exerted on executive wages by the extra demand from the affected firm decreases with market thickness. We only use one lag of the death shock, as the hiring pressure on the local executive market should be concentrated in the year following the death event (we test this hypothesis below).

Online Appendix Table A.6 presents the results. When only controlling for year and executive fixed effects, we find that the coefficient of the deceased executive dummy is positive (2.72) while that of the interaction with market thickness is negative (−0.42), both statistically significant at 1%. Both estimates decrease in absolute value when we gradually include industry × year and CZ × year fixed effects, and when we control for potential diverging trends between young and old executives, male and female executives, and executives with short and long tenure, to approximately 1.7 and −0.27, but remain significant at 1%.

A possible concern is that affected and non-affected firms are already on different trends before the death event, and that such trends differ according to market thickness. We check for this possibility by estimating a dynamic version of the wage equation (8) separately for thin and thick markets, and plot the coefficients and the associated 95% confidence intervals in Online Appendix Figure A.4. First, we find no evidence of pre-trends both in thin and in thick markets. Second, in thin markets, wages increase by 0.5% in the year following the event whereas we do not find statistically significant wage effects in the following years. Instead, in thick markets, wages do not respond to death events hitting other firms in any year.

While wage spillovers are consistent with the idea that executive deaths are associated with an increase in the demand for executives, there is another potential explanation. In fact, the disruption caused by executive deaths in affected firms might benefit competitors in the product market and, consequently, their employees. We address this possibility in three ways. First, we present the dynamics of the effects on firm performance around the executive death, but focusing on the neighbouring firms. Online Appendix Figure A.5 shows that firm performance is not significantly affected by a death event hitting another firm located in the same market. Next, we show in Panel B of Online Appendix Table A.6 that other white-collars in the firm hierarchy do not experience an increase in wages, as we would expect if wage increases simply reflect firm performance improvement. Finally, we estimate equation (8) excluding from the sample

24. Note that in this specification we cannot add market × year fixed effects, as the DecEx dummy is fixed at the market-year level.

25. This choice is more conservative than clustering standard errors at the commuting zone × industry level, and takes into account that the "treatment" could spill over to executives of other industries in the same location.

executives working in non-tradable industries, for which product market competition is local, and higher performance of non-affected firms in the same local market could in principle explain the increase in wages that we observe. As shown in Online Appendix Table A.7, the estimates on executive wages employed at neighbouring firms are still strongly statistically significant, and, if anything, larger.

6. DISRUPTION WITHIN AFFECTED FIRMS

Our model predicts that, after executive deaths, the quality of new hires is lower and their turnover higher, the thinner the market. We exploit these predictions and run a set of regressions to assess their validity.

First, we look at characteristics of new hires, replicating the regressions of Table 3 using DecEx and DecEx $\times$ MktTkn as additional regressors (instead of MktTkn only) together with all the controls of our preferred specification, including firm fixed effects. These estimates inform us about to what extent new hires differ after deaths relative to "normal" times within firms. The first three columns of Table 9 consider where executives come from, using as dependent variable a dummy equal to one if an executive hired in the year after death is from the same CZ (Column 1), the same Industry (Column 2), or the same market (Column 3). Note that the model does not offer any clear prediction along this dimension, as it is a model of a single market. The results indicate that, in terms of where externally hired executives come from, firms do not significantly change their hiring behaviour after a death event: for both Industry, CZ and CZ $\times$ Industry, the coefficient of DecEx and that of DecEx $\times$ MktTkn are not statistically different from zero.

Next, we consider the educational attainmentsof new hires, which Huber *et al.* (2021) show to be a particularly important managerial characteristic for firm performance.[26] We have seen in Table 3 that, in general, new hires are of lower "quality" in thinner markets. We now check if this is the case following a death event. Columns (4–6) use education as a quality measure. We find that the likelihood of hiring an executive with a college degree decreases in the year following a death event (the coefficient on the non-interacted coefficient DecEx $(t-1)$ is negative and statistically significant at the 5% level) and that this effect is mitigated by market thickness (the interaction term with MktTkn is positive and statistically significant at the 5% level). Symmetrically, the coefficients change sign when we look at executives with no education or a high school diploma (they are statistically significant only in the latter case, possibly because less than 5% of executives have no education, see Table 1). While these results are in line with the reduced form evidence of Table 3, we stress the difference in the data variation used to identify the coefficients: there, we show that higher education level of new hires is positively correlated with market thickness in the cross-section; here, given that we have firm fixed effects, we shows that, after being hit by an executive death, a firm in a thin market is less likely to hire executives with high education attainments compared with the hires of *the same firm* in "normal" periods. This indicates that, when facing an unexpected executive exit, firms in thin markets on average hire less educated executives compared with normal times, in line with the model's prediction.

In Column (7), we consider local labour market experience, finding that, after executive deaths, firms hire executives with lower local labour market experience and that this effect is mitigated by market thickness. The coefficients are large and highly statistically significant. We also look at industry experience (Column 8), experience as executive (Column 9) and

26. Huber *et al.* (2021) use the Nazi discriminatory laws as a source of exogenous separation of managers of Jewish origin from German corporations during the Nazi regime.

TABLE 9

Executive exits and new hires' characteristics

	(1) Same Ind	(2) Same CZ	(3) Same Market	(4) No Schooling	(5) High school	(6) College	(7) Local Exp.	(8) Industry Exp.	(9) Exec. Exp.	(10) Previous Ln(Wage)
DecEx ($t-1$)	0.009	−0.104	−0.070	0.113	0.139*	−0.266**	−4.420***	−1.813	−0.026	−0.056
	(0.100)	(0.093)	(0.106)	(0.071)	(0.084)	(0.114)	(1.438)	(1.325)	(0.963)	(0.104)
DecEx ($t-1$) × MktTkn	−0.006	0.012	0.003	−0.018	−0.020*	0.039**	0.555***	0.179	−0.011	0.011
	(0.016)	(0.013)	(0.017)	(0.013)	(0.011)	(0.017)	(0.208)	(0.193)	(0.124)	(0.015)
MktTkn	0.046*	−0.008	−0.007	0.030*	−0.020	−0.000	−1.166***	−0.215	−0.526*	−0.026
	(0.025)	(0.023)	(0.021)	(0.017)	(0.032)	(0.034)	(0.416)	(0.376)	(0.295)	(0.025)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CZ-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Nb exec, Age, Size, ROA ($t-3$) × year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	51,185	51,185	51,185	23,410	23,410	23,410	51,185	51,185	51,185	51,185
R^2	0.468	0.495	0.468	0.541	0.400	0.424	0.438	0.498	0.286	0.296

Notes: This table presents estimates from regressions of a series of characteristics for all new hires into an executive position on one dummy indicating whether the firm is hit by the death of (at least) one executive in the previous year and its interaction term with the logarithm of the number of executives working in the same CZ × industry in the previous year. All regressions include firm, industry and CZ dummies interacted with year dummies, and firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) as well as terciles of the number of executives interacted with year dummies. The dependent variables are dummies for, respectively, whether newly hired executives were previously employed in another firm from the same CZ, from the same industry, or from the same market (Columns 1, 2, and 3), dummies for three education levels of newly hired executives (Columns 4, 5, and 6), local experience measured as the number of years employed in the same province as the location of the firm from 1984 to year $t-1$ (Column 7), industry experience measured as the number of years employed in the same industry as the industry of the firm from 1984 to year $t-1$ (Column 8), executive experience measured as the number of years employed as executive from 1984 to year $t-1$ (Column 9), and the previous wage of the newly hired executive (Column 10). Standard errors are clustered at the firm level. The sample period is 2010–15 in Columns (4) to (6), and 2005–15 in Columns (1) to (3) and (7) to (10). *, **, and *** denote significance at the 10, 5, and 1%, respectively.

TABLE 10
Executive exits and new hires' future separations

	(1)	(2)	(3)	(4)
	New hire remains employed for less than:			
	1 year	2 years	3 years	4 years
DecEx ($t-1$)	0.089	0.109	0.164**	0.149**
	(0.079)	(0.083)	(0.081)	(0.073)
DecEx ($t-1$)× MktTkn	−0.016	−0.021*	−0.027**	−0.021**
	(0.011)	(0.011)	(0.011)	(0.010)
MktTkn	−0.018	−0.034	−0.012	0.001
	(0.021)	(0.024)	(0.023)	(0.022)
Firm FE	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y
CZ-year FE	Y	Y	Y	Y
Nb executives, age, size, ROA ($t-3$) × year FE	Y	Y	Y	Y
Observations	51,185	51,185	51,185	51,185
R^2	0.355	0.381	0.413	0.441

Notes: This table presents estimates from regressions of separation rates of new hires into an executive position on one dummy indicating whether the firm is hit by the death of (at least) one executive in the previous year and its interaction term with the logarithm of the number of executives working in the same CZ × industry in the previous year. All regressions include firm, industry and CZ dummies interacted with year dummies, and firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) as well as terciles of the number of executives interacted with year dummies. The dependent variables are dummies for whether the new hire remains employed in the firm for, respectively, less than 1 year (Column 1), 2 years (Column 2), 3 years (Column 3), and 4 years (Column 4). The sample period is 2005–15. Standard errors are clustered at the firm level. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

wage in the previous job (Column 10). For these measures, the estimates are not statistically significant.

The model also predicts that low quality appointments are replaced over time, and given that they are more likely to occur in thin markets, they should lead to an increase in subsequent separations of executives in affected firms. In Table 10, we test whether death events have a differential effect on the likelihood of separations for new hires depending on market thickness. Specifically, we run regressions in which each observation is a newly hired executive, and use as dependent variables dummies for whether she remains employed for less than, respectively, 1, 2, 3, or 4 years. We find that the coefficient on the DecEx dummy is always positive and turns statistically significant at 3 and 4 years, indicating that the duration of the new matches formed between firms and executives hired after a death event is significantly lower compared with normal times. Importantly, the coefficient on the interaction term between the death dummy and market thickness is always negative and significant at and after year 2, indicating that early separations of newly hired executives after death events are less likely in thicker local labour markets.

Putting all these results together, we conclude that market thickness positively affects the quality of newly hired executives after an executive death. This emerges both when we look at direct measures of quality, in particular education, and when we use the duration of the match as an indirect quality measure. Consistently with the model, this can explain the deterioration in performance for firms in thin markets documented above.

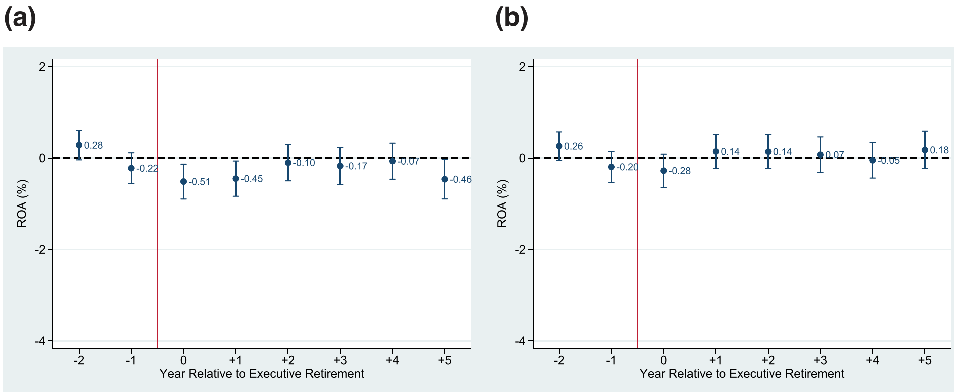

FIGURE 5

Executive planned exits and firm ROA in thin versus thick labour markets. (a) Thin markets and (b) Thick markets

Notes: This figure presents estimates of return on assets in the 2 years before and 5 years after a given executive of the firm retires in, respectively, thin and thick labour markets. Return on assets (ROA) is earnings before interest and taxes, over the value of assets in the previous year. Each graph plots estimated coefficients, β_τ, as well as the associated 95% confidence interval, of the following regression: $\text{ROA}_{i,j,t} = \sum_{\tau=-2}^{5} \beta_\tau \text{RetiredEx}_{i,t-\tau} + \beta_X X_{i,j,t} + \eta_{i,j,t}$, where $\text{RetiredEx}_{i,t-\tau}$ is a dummy equal to one if a given executive of firm i in market j retires in year $t-\tau$ in a thin labour market (respectively, in a thick labour market). The specification includes firm fixed effects, industry and CZ dummies interacted with year dummies, and firm-level characteristics (dummies indicating terciles of size, age, and ROA, respectively) as well as terciles of the number of executives interacted with year dummies. The sample period is 2005–15. Standard errors are clustered at the firm level.

7. DISCUSSION

In this section, we discuss the external validity of our results, propose an estimate of the costs of premature deaths and argue that these effects are not specific to Italy.

7.1. *External validity: planned exits*

Our results are informative about the effects of unexpected executive turnover on firm outcomes. Nonetheless, these results can plausibly be extended to other types of shocks that require firms to acquire quickly new types of skills on the market—for example, an unexpected, large business opportunity in China. If the firm does not respond quickly by hiring a new executive with the required skills (for instance, having experience with doing business in China), the opportunity is gone. Arguably, firms are continuously subject to a variety of similar shocks. How do our findings speak to the implications of labour market thickness for firm performance in “normal times,” that is, when firms might have more time to find a suitable match? Even if this remains outside the scope of this paper, one first pass to shed light on this question is to estimate the effect on firm performance of executive exits that are arguably more likely to be anticipated. For this, we present in Figure 5 the dynamics of the effects on performance using executive retirements as an anticipated exit. As for executive deaths, the effect of executive retirement on performance is negative and significant only in thin markets. Quantitatively, the effect is significantly weaker (-0.5 against -2 for unplanned exit, see Figure 3, Panel A) and lasts only for two periods. This is in line with the idea that a planned exit gives the firm the time to search for a replacement, reducing its disruption. Still, it represents a sizable drop in ROA. In thick markets, the effect is never statistically significant. Given that executive exits are common events in a firm’s life cycle, this result suggests that the scarcity of executive supply affects firm performance in a substantial way.

7.2. *Economic significance of the effects*

Is the negative effect of executive exit on firm ROA in thin markets reflected in market-level data, or is it offset in the aggregate? To answer this question, we first sum separately the earnings before interest and taxes (EBIT) and the assets of all firms operating in the same CZ $\times$ industry, and construct a measure of ROA at the market level, defined as the ratio of market-level EBIT over lagged market-level assets. For each market and year, we also compute a dummy indicating whether (at least) one firm in that market is hit by the death of (at least) one executive in the same or previous 3 years, and also interact this dummy with the logarithm of the number of executives working in the same market in the previous year. We then run similar regressions as those with firm-level data, here aggregated at the market level, and present the results in Panel A of Online Appendix Table A.8. While we find no significant effect of death events on a given market profitability in specifications in which we only include the DecEx dummy (Column 1), the same pattern as with the firm level data emerges once we also include the interaction of the DecEx dummy with market thickness: market-level profitability drops significantly after death events (the coefficient on the DecEx dummy is negative and statistically significant in Columns 2–4), and this effect is mitigated by market thickness (the coefficient on the interaction term is positive and statistically significant). Using the estimates of Column (4), the effect of death events on a local industry profitability becomes zero in a market with around 80 executives. Panel B repeats the exercise using value added per employee aggregated at the market level as dependent variable. We find similar results.

Finally, we use the stacked data to run event-by-event estimates, that is, running the same regressions as the one presented in Online Appendix Figure A.1 but for each death-year event stacked on all control firms with the exact same number of executives in their market in $t-1$. This allows us to directly calculate the actual profit loss (in yearly terms, averaged across the event year and following 3 years after death events) associated to death events by simply multiplying each event-by-event βs by the total assets of the affected firms in the event year before death. To reduce the weights of extreme values on our aggregate estimate, we exclude the most extreme (positive and negative) losses (below 5% and above 95%), and find that death events are associated with profit losses in 2015 constant euros on average of 759.000 per year.

7.3. *Are the results specific to Italy?*

One may wonder how these results extend beyond the case of Italy. First, how representative is Italy in terms of the role of executives for firm performance? Thanks to the World Management Survey (Bloom *et al.*, 2012), recent years have seen a substantial increase in our capacity to measure the quality of firm managerial practices and to compare them across countries. For example, Schivardi and Schmitz (2020) show that Italy ranks in the middle of the distribution of advanced economies, suggesting that it is a good benchmark in terms of comparability. A second question is how representative Italy is in terms of worker mobility. While international comparisons of labour market dynamics are difficult, due to data comparability issues, the available evidence suggests that Italy is fairly representative also along this dimension. First, in Online Appendix Table A.1, we have shown that the mobility patterns of executives are similar in Italy, France, and the U.S. Second, the few papers that perform international studies supply a mixed picture. Gómez-Salvador *et al.* (2004) compute job reallocation rates (equal to the sum of job creation and job destruction) for 13 European countries, finding that Italy has the highest rate (12.3%, against an average of 9.3%). Bassanini and Garnero (2013) focus on worker flows for OECD countries and find that Italy is somehow on the low side of the distribution. For example, the hiring rate is 13% in Italy, 14.41% in Germany and 16.3% in France, while the U.S. and the U.K.

display higher values (21 and 19.5%, respectively). The numbers are similar for the separation rate. A particularly important flow for our analysis is job-to-job mobility. Using highly comparable social security data, Berson *et al.* (2020) show that the job-to-job mobility rate is similar in Italy and France at around 8–9%—if anything, it is higher in Italy. Corresponding numbers computed for the U.S. by Hahn *et al.* (2021) indicate lower mobility rates. Overall, this evidence suggests that the Italian labour market is not an outlier in terms of job and worker flows.

8. CONCLUSION

We explore whether the local supply of executives affects firm performance. Using exhaustive administrative data on Italian social security records, we construct measures of local labour market thickness for executives that vary by industry and location. We then exploit executive deaths as an exogenous shock to executive exit, and show that firms in thin executive markets experience a drop of 1.8 percentage point in ROA following death events, which amounts to a large reduction with respect to the sample average. Strikingly, we find virtually no impact for death events that occur in thick executive markets. The effect shows no prior trend in neither market type, and lasts for at least 3 years in thin markets.

Consistent with the notion that thin executive markets lead to poorer firm-executive matches, we find that new executives hired after death events have lower education levels and are more likely to be replaced. We confirm firms' difficulty in finding a suitable replacement as the source of the drop in performance: in fact, peers wages in the same market increase, but only in thin markets. Taken together, these findings suggest that the scarcity of managerial skills is an important dimension in explaining differences in firm performance across industries and regions. From a policy perspective, they suggest that local policies aiming at boosting growth should take into consideration the supply of executive skills.

While premature deaths offer a useful source of exogenous variation to tease out the effects of executive supply, they do come at a cost with respect to the ideal setting of exogenous shocks to executives supply. In fact, while we have shown that the local supply of executives matters for firm performance following a death event, we cannot directly derive an elasticity for the general setting. Doing so would require a structural approach that incorporates death events in an equilibrium model of the market for executives, an important topic for future research.

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Supplementary Data

Supplementary data are available at *Review of Economic Studies* online.

Data Availability Statement

The code underlying this research is available on Zenodo at https://dx.doi.org/10.5281/zenodo.7589405.

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