MARIANNA ENDRESZ, PETER GABRIEL

IMPACT OF ACQUISITIONS ON FIRMS' PERFORMANCE

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ON FIRMS' PERFORMANCE

*MNB (The Central Bank of Hungary)

Contents

Abstract

This paper estimates the impact of acquisitions on various firm-level performance measures of Hungarian firms. Using difference-in-differences estimation with matching, we show that the performance of the acquirer improves significantly following an acquisition. By controlling for the – typically weaker – efficiency of the target, we also estimate the overall efficiency gain. Our results indicate that acquisitions are powerful tools to improve efficiency in the Hungarian economy. The estimated impacts are heterogeneous. Efficiency gains are higher if the acquirer is smaller and less efficient prior to the acquisition, highlighting that improving scale efficiency is an important motive for acquisitions. Furthermore, if the acquirer and target companies had business links beforehand, the productivity gain is twice as large. Acquisitions made during recessions are also different in some ways. Firms make fewer acquisitions, although the number of potential target companies increases. Because acquirers become more selective, the efficiency gains remain sizeable even in the unfavourable business environment.

JEL Codes: C22, D22, D24

Keywords: mergers, acquisitions, efficiency, productivity, matching

Összefoglaló

A tanulmány a felvásárlások vállalati teljesítménymutatókra gyakorolt hatását vizsgálja magyar adatokon. A különbségek különbsége módszert matchinggel kombinálva megmutatjuk, hogy a felvásárlást követően számottevően javul a felvásárló vállalatok teljesítménye. A felvásárolt cégek – jellemzően alacsony – hatékonysági mutatóit is figyelembe véve a felvásárlás teljes hatékonyságnövelő hatását is számszerűsítjük. Eredményeink szerint a magyar gazdaságban a felvásárlás hatásos eszköze a termelékenység javításának. A hatékonyságjavulás mértéke függ a felvásárlás típusától. Nagyobb javulás figyelhető meg, ha a felvásárló kisebb és kevésbé hatékony volt a felvásárlás előtt. Ez jelzi, hogy az akvizíciók jelentős mértékben járulhatnak hozzá a mérethatékonyság javításához. Az átlagos termelékenységi hatás kétszeresére nő, ha a felvásárló és a felvásárolt vállalat korábban beszállítói kapcsolatban állt. A recesszió alatti felvásárlások több szempontból is eltérnek az átlagostól. A felvásárlások gyakorisága csökken, annak ellenére, hogy nő a potenciális célvállalatok száma. Ugyanakkor a hatékonyságjavulás a kedvezőtlen üzleti környezet ellenére is jelentős marad, mert a felvásárló vállalatok több lehetséges ügylet közül választhatják ki a legkedvezőbbet.

Kulcs szavak: felvásárlások, hatékonyság, termelékenység, matching

1 Introduction

To preserve competitiveness firms should be reorganised and inputs should be reallocated from time to time. Mergers[1] are a means of large-scale shake-up of organisations and can significantly enhance productivity. Mergers are often in the policy spotlight. A permissive merger regulation may strengthen competition due to the restructuring of inefficient companies, and even the threat of being acquired may enhance the performance of corporate leaders (Bertrand and Mullainathan (2003)). However, regulators may also worry that mergers might further strengthen oversized, overly powerful multinationals. In developing countries, where the average size of domestic firms is much smaller than in developed economies, policymakers may be more supportive of mergers, as they may consider them necessary to reach sufficient economies of scale and also to support the rise of national champions.

The literature on the impact of mergers on firms' efficiency has grown extensively. The results are mixed, ranging from a significantly negative impact (Malmendier et al. (2018), Moeller et al. (2005)) to a significantly positive impact ((Healy et al. (1992), Rahman and Limmack (2004)), and efficiency gains tend to be higher if mergers are between companies belonging to the same sector (e.g. Gugler et al. (2003)). Many papers argue that even if the impact is positive at the firm level, it does not necessarily benefit society as a whole, as higher profitability may come from increased market power and not from higher productivity. This mechanism seems to be quite strong in the US (Blonigen and Pierce (2016)) and less so in Europe (Bellucci and Rungi, (2022)). The heterogeneity in results on efficiency gains at the firm level can be at least partly explained by the differences in the samples of firms, how mergers are defined and the applied methodology.

The samples of firms used to analyse firm-level performance after acquisitions are heterogeneous in at least two dimensions. First, they differ in terms of whose efficiency is examined: the efficiency of the acquirer (Ooghe et al. (2006)), the target (Ali-Yrkkö et al. (2022)) or the combined firm (Kruse et al. (2007)). Each of these entities is of interest, but post-acquisition data are needed to analyse the impact on the target firm. Even if the data are available, it is also worthwhile to analyse the overall efficiency gains at the level of the combined firm, as reallocation between the acquirer and the target may be part of the restructuring. Second, samples are quite heterogeneous in respect of the average firm size. The first wave of papers studying mergers focused mostly on mergers of listed companies (e.g. Andrade et al. (2001)) and hence used a sample of very large firms only. As large databases on firms' balance sheets and income statements (such as Orbis, Amadeus) became more widely available, the sample of mergers was also extended to private firms. However, large firms remained overrepresented. Size and ownership structures matter, because they may relate to the differences in motives behind mergers, and hence to differences in efficiency gains after acquisitions. In the case of listed firms with dispersed ownership structure, the main concern is that the motives of managers may not be in line with shareholders' interest and can lead to mergers with poor outcomes in terms of efficiency (Rolls (1986)). In the case of firms with concentrated ownership structures, which is common for smaller firms, the control problem is of less importance. However, as the owner is more connected to the firm, sales of companies may have motives not directly related to the efficiency of the firm, but more to the owner of the target company (such as aging of the owner). This may also contribute to the heterogeneity of outcomes among mergers.

The ambiguous impact of mergers can be partly explained by how mergers are defined. Although the aim of the papers is to measure the impact of restructuring on firms' efficiency following mergers, mergers are generally defined simply as fundamental changes in ownership. This definition has some drawbacks. First, a fundamental ownership change is not trivial to define, and papers use different rules. Moreover, results should be interpreted while keeping in mind that the motives of acquisitions are quite varied, and some acquirers may have no intention of restructuring at all. More

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[1] Mergers and acquisitions are used alternatively. Although the legal definitions differ and the term 'merger' is sometimes used to describe a merging of equals, the literature often use the two concepts as identical.

homogeneous sub-samples of mergers based on differences in motives would help to interpret the result more easily, but generally no information is available on what initially motivated the merger.

The methodology applied to measure the impact of mergers on efficiency is also rather varied. In the case of mergers of listed companies, efficiency gains are usually measured by short-term stock price changes (e.g. Maksimovic et al. (2011), Alexandridis et al. (2017)), which is an ex-ante measure of the expected efficiency gains. In the case of private companies, the estimation is usually based on balance sheet data and income statements, which can capture the ex-post impact. Balance sheet data also allow for the detection of the longer-term impact of acquisitions, which is rather useful, given that restructuring may take time and efficiency gains are realised gradually. Also, the estimated ex-post impact of acquisitions may depend significantly on how firms in the control group were selected. Some papers use sectoral average dynamics for counterfactual (e.g. Gugler et al. (2003)). However, if the acquirers are very different from the average firm, more sophisticated methods, typically matching, are used to select the control group (e.g. Martynova et al. (2007)). Acquirers may have considerably different dynamics before acquisitions than the sectoral average, which should be considered in the matching mechanism.

This paper estimates the impact of mergers on firms' efficiency using a sample of Hungarian firms. The dataset covers Hungarian companies subject to corporate income taxation between 1998 and 2021. Due to the almost complete coverage of Hungarian firms, we use a larger sample for measuring efficiency gains than is typical in the literature. In particular, we are able to cover SMEs and extend the analysis beyond large corporations – 95 percent of acquirers in the final estimation sample are classified as SMEs. To identify mergers, we exploit information submitted to the firm registry on changes in the legal entity of firms. We consider acquisitions, when two firms merge, and the target company ceases to exist following the acquisition. The benefit of using this definition instead of significant ownership change is that a more homogeneous sample of mergers is created. Moreover, given this definition of merger it is plausible to assume that the motive for mergers is mostly value creation through restructuring, exploitation of scale or scope efficiencies, and not something unconnected to firms' efficiency. At the same time, our paper and our results can still be linked and compared to the acquisition literature focusing on ownership changes, as the majority of cases in our sample also entail an ownership change.

Acquirers are quite different from the typical firm, both in the level and dynamics of key variables. Hence, we use a matching method to select control firms and create the estimation sample. Target firms are also considerably different from the acquirers – in our sample they tend to be much smaller and less efficient. Combining the two firms would, *ceteris paribus*, worsen the efficiency of the acquirer. An additional contribution of this paper is that it separates the impact of restructuring from composition by introducing additional variables related to the target firm's relative performance.

Our findings show that acquisitions are important means of accelerating growth. On average, companies produce 24 per cent more value added four years after the deal relative to the control group. Acquisitions also lead to sizable benefits in efficiency, as measured by labour productivity, TFP or operating profit. This productivity gain allows firms to produce close to 15 per cent more value added (results for TFP). As the targets of acquisitions tend to underperform their acquirers, restructuring of the target accounts for a material part of the productivity gain. Thus, acquisitions act as a powerful tool of resource reallocation.

There are many different kinds of mergers. Our paper's next contribution is the consideration of several sources of heterogeneity. Horizontal mergers have different motives and sources of productivity gain than the rest of acquisitions. The initial size and level of efficiency of the acquirer may also affect the potential of exploiting scale efficiencies via acquisitions. Also, acquisition deals made during recessions, or mergers of companies with previous business links may have distinct features, including their impact on post-merger performance. We are not aware of any paper studying acquisitions during recessions or between companies with supplier links.

We show that the impacts of acquisitions on performance measures are indeed heterogeneous. First, horizontal mergers are characterised by above-average growth. This suggests the existence of exploitable scale economies in the Hungarian corporate sector, which is dominated by small companies. Second, the smaller and less efficient the acquirer is prior to the acquisition, the larger the benefit is both in terms of size and productivity, reinforcing scale efficiency as an important motive for acquisitions. Third, merger deals become less frequent during recessions and the partners involved tend

to be larger and more productive than usual. Despite the elevated uncertainty, these mergers lead to similar gains in performance as ones occurring outside of recession periods. As targets tend to have better performance, reallocation and restructuring of the target as source of productivity growth is less important during recessions. On the other hand, acquirers can be more selective, which explains the sizeable improvement in performance. Fourth, supplier links prior to acquisition ease informational asymmetries and greatly contribute to the success of the acquisition. The productivity gain is twice as large in deals where the partners had business links beforehand. Finally, in almost half of the cases the target made a loss prior to the acquisition. Restructuring or reorganisation of these targets takes time, leading to gradual improvement in efficiency.

The estimation results are robust to changes in the specification of the empirical model – switching to categorical dependent variables or controlling for subsequent acquisitions in the post-acquisition period. Revaluation of certain assets and acknowledgement of intangibles during the merger may impact the performance measures used in the analysis. However, the paper did not find evidence of substantial revaluations, which reinforces our confidence in the estimation results.

The paper introduces the data and methodology first and then characterises the acquisition deals and the sample of acquirers and targets. Section 4 summarises the estimation results regarding the impact of acquisitions on the performance of the merged companies. Different sources of heterogeneity are considered in Section 5, followed by some robustness tests and the conclusion.

2 Data and methodology

Two data sources are utilised in the analysis. Information on acquisitions comes from the firm register, where the creation and termination of companies are recorded. In addition, firms are also obliged to report changes in the type of legal entity, or restructurings which entail the creation or termination of legal entities. Four categories of restructurings are differentiated: (1) mergers, when two previously separate companies merge and a new company is created (A + B → C); (2) acquisitions, when company A acquires company B (A + B → A) and the target ceases to exist; (3) divestitures, when company A downsizes its operation and creates a new company (A → A + B); and (4) split-ups, when two new legal entities are formed, while the old company is dissolved (A → B + C). The companies concerned are required to report the type and time of restructuring, and the names and identifiers of the participating firms to the Hungarian Central Statistical Office (HCSO). This paper focuses on the impact of acquisitions,[2] but information on other restructurings is also exploited, e.g. when the sample is determined.

The information on acquisitions is linked to an administrative dataset of the Hungarian tax authority (NAV), which includes the income statements and balance sheets submitted by all firms subject to corporate income tax. These reports allow for the calculation of several performance measures and firm characteristics, which are used in matching and evaluating the effects of acquisitions.

To **compile the sample** for matching (hereinafter the 'matching sample'), the following restrictions are imposed:
– Only privately held non-financial companies are included.
– We exclude acquisitions where the number of participants exceeds five, or the acquirer undergoes other restructuring in the same year.
– Acquisition cases are excluded if restructuring of any type occurred in the three years preceding the acquisition. As for controls, only firms which did not participate in any restructuring in the year of acquisition and during the pre-acquisition period are considered.
– At the same time, we do not filter by behaviour and events in the post-acquisition period: treated and potential control firms may exit, go bankrupt or undertake other restructurings.
– Acquirers and potential control firms are required to be active and submit report during the pre-acquisition period.
– As financial reports can be less informative and reliable about the performance of small firms,[3] a size limit is applied: the acquirer and potential control firms must have at least five employees and annual revenues of HUF 5 million on average during the pre-acquisition period. No similar restriction is imposed on the size of acquired firm(s) though.[4]

Once the matching sample is set, it is used to **calculate firms' performance measures** (profitability, labour productivity, TFP) and other characteristics (average wage, leverage, collateral, age, ownership indicator, etc.), which are used later in matching and for the estimation of treatment impact. The list of variables and their calculation is summarised in Table 9 in the Appendix. Productivity is measured by labour productivity and total factor productivity (TFP). The former has the advantage of being easy to calculate, but its comparability is limited given variable capital intensity. To obtain TFP, production functions are estimated using the Levinshon and Petrin (2003) method with the Ackerberg et al. (2015) correction. Real value added[5] is used to measure the output of firms. Real capital is calculated using the Perpetual Inventory Methodology. Expenditures on materials proxy intermediate inputs. Production functions are estimated for 2-digit NACE industries with year fixed effects. The estimation results are shown in Table 10 in the Appendix.

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[2] Mergers of type 1 and split-ups are very rare in Hungary. Mergers are similar to acquisitions. However, in the case of mergers it is not known which company is the target and which company is the acquirer.
[3] Because of the small size and indivisibility of production inputs, data can be very volatile.
[4] Size restrictions on target companies would severely downsize our sample. Using the same restrictions for target companies as for acquirers would eliminate roughly 70 per cent of the targets from the sample.
[5] One advantage of using value added to measure output is that in the case of vertical acquisitions sales would severely underestimate the impact on size and growth.

The decision on acquisitions is likely to take place at times when the firms follow a high growth strategy and make enough profit and cash flow. Hence, before acquisitions they are likely to be quite different from the average firms. To ensure that the control group includes firms with similar characteristics and performance, we employ **matching**. Propensity score matching[6] is conducted using a caliper of 0.001 together with exact matching for the following indicators: 2-digit NACE code, year, quartiles of pre-acquisition sales growth and quartiles of average labour productivity in the pre-MA period. For the sake of efficiency, the five nearest neighbours are searched for.

Once a matched sample with sufficient balance is achieved, a **standard difference-in-differences event study approach is used to estimate the impact of the acquisition**. **In the first specification (Equation 1), we estimate the impact on the performance of the acquirer.** We are primarily interested in the change in the size and efficiency of the acquirer. Size is expressed in terms of value added and number of employees. Efficiency is measured by three alternative indicators: profitability, labour productivity and TFP. Given T, the time of acquisition, the empirical model considers three pre-acquisition years and five post-acquisition years. As individual firms may engage in acquisition more than once,[7] the panel structure is defined over firm – acquisition deals and year. The empirical model is specified as

$$Y_{ic} = \sum_{t \neq T-1} \beta_t * Trend_t + \sum_{t \neq T-1} \gamma_t * Treat_t + \varepsilon_i + \mu_c + \omega_{ic} \qquad \text{(Equation 1)}$$

Y_{ic} measures the performance (growth or efficiency) of firm i at time c. T is the year of acquisition, $t \in [T-3, T+5]$ is relative time to event and c is calendar time. The Trend and Treat variables are indicator variables. Time T-1 is considered the base year. The β parameters capture the common trend over T-3, T+5, relative to T-1. The main parameters of interest are the γ_t's, which capture the impact of treatment. The γ_t parameters for $t \in (T-3, T-2)$ should be small and insignificant for the parallel pre-trend assumption to hold; and for the years following the acquisition, significant estimates prove the effect of acquisition. The estimated impact in the year of acquisition (t=T) should be handled with caution. As acquisitions spread within the year, at time T the flow variables (e.g. profit or RVA) and the related performance measures refer to a fraction of the year and by construction only partially capture the impact of acquisitions. Variables ε_i and μ_c are firm and year fixed effects. Given the peculiar panel structure, the firm fixed effects are firm-acquisition fixed effects.

Note that the estimated impact on the acquirer has two elements. The first is the mechanical impact of combining the two companies' production capacities, the second is the impact of restructuring. In our context, restructuring should be understood broadly – it may involve layoffs in order to eliminate overlap between the two firms, or adopting more efficient production processes and management practices for the combined company, but also realising synergies, size and scope efficiencies. Using Equation 1, we may find that the acquisition did not have any impact on the productivity of the acquirer: productivity neither improves nor deteriorates relative to the controls. This does not necessarily imply that the acquisition was ineffective. If the targets, on average, had weaker productivity than the acquirers, which is true in our sample, the no-change result of the first model indicates that the acquirer successfully restructured the combined firm and significant efficiency gains were realised.

To estimate the impact of restructuring separately, in the second specification a new variable controlling for the mechanical impact of the acquisition is defined and added to the empirical model. For the calculation of this term, we first combine the two firms (acquirer and target) by adding their value added, total assets, number of employees, profit, etc., using data from the pre-acquisition year (T-1), and calculate the performance measures (size, labour productivity, TFP,[8] etc.) of the combined firm. We then take the difference between the outcome of the combined firm and that of the acquirer (at T-1). We assume that *ceteris paribus*, this would be the change in the acquirer's performance after the acquisition without restructuring.

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[6] The propensity score model contains the following control variables: year and sector FE, firm age, export status, foreign ownership, size category and firm performance measures 1 and 2 years before the acquisition (profit, leverage, collateral, labour productivity, sales growth), some with squared terms too. Estimation results are reported in Table 10 in the Appendix.

[7] Also, control firms can be matched to several treated observations over the years.

[8] In the case of TFP, the production function of the acquirer is used to predict the TFP of the mechanically combined firm.

The new term controlling for the mechanical impact of the acquisition is defined as:

$$\text{Mechanical impact}_B = Y_{A+B, T-1} - Y_{B, T-1} \qquad \text{(Equation 2)}$$

where Y is the performance measure, A is the target and B is the acquirer. If Y is a size measure, the term equals the relative difference in the size of the new and old (acquiring) company. If the outcome measure is a ratio: Y = Nom/Denom, the term can be written as:

$$= (Nom_{A, T-1} + Nom_{B,T-1})/(Denom_{A, T-1} + Denom_{B,T-1}) - Nom_{B, T-1}/Denom_{B, T-1}$$

After rearrangements:

$$= (Y_{A, T-1} - Y_{B, T-1}) * Denom_{A, T-1}/(Denom_{A, T-1} + Denom_{B,T-1}) \qquad \text{(Equation 3)}$$

The second specification is given in Equation 4. The difference between the first (Equation 1) and second specification (Equation 4) is the inclusion of the mechanical impact as an additional control variable (MI). The variable MI_i is defined above and I_{it} is an indicator variable, which takes value 1 if t > T-1. The coefficients of the $I_{it} * MI_i$ terms are restricted to 1. While the estimated impact from the first specification shows how the acquirer's size and efficiency change, the second specification[9] shows the impact of restructuring the combined company. If the overall efficiency gain caused by the acquisition is in the focus, the latter is the more informative.

$$Y_{ic} = \sum_{t \neq T-1} \beta_t * Trend_t + \sum_{t \neq T-1} \gamma_t * Treat_t + I_{it} * MI_i + \varepsilon_i + \mu_c + \omega_{ic} \qquad \text{(Equation 4)}$$

The mechanical impact is proportional to the difference between the pre-acquisition performance of the target and the acquirer (left term of the formula in Equation 3) and to the relative size[10] of the target firm (right term). If the targets on average are less productive than the acquirers, the mechanical impact of the acquisition is negative, and the impact of restructuring (treatment effects from the second specification) is higher than the impact on the acquirer (treatment effects from the first specification). If firms tend to acquire much smaller firms relative to their own size, the mechanical impact is small and so is the difference between the estimated impacts from the two specifications.

The identification strategy is valid if treated and control firms are not systematically different before period T. Although matching is applied, some unobserved firm characteristics correlated with firms' performance but uncorrelated to observables potentially bias the estimates. To mitigate the concerns over selectivity, variables related to the growth of the firm before acquisition are also considered when control firms are chosen. Both treated and control firms are fast-growing, profitable companies on average. Hence, it is more plausible to assume that selection to treated and control companies is based more on investment opportunities, which can be regarded as random, and less on differences in firms' characteristics.

Firms may engage in other types of restructuring following the acquisition, which also affects their post-acquisition performance. Also, some **firms – both treated and control – may go bankrupt and exit** the sample. The exit of treated and control firms should be treated consistently to avoid distorting the estimates of the treatment effects. The main reason for the potential bias caused by exits is that firms do not exit randomly: firms with worse performance exit the sample with higher probability. To handle the exit of treated and control companies in a consistent manner there are two options. The first is to keep all treated and control companies in the sample until they exit and keep the matching weights of surviving control companies unchanged, even if some controls fall out of the sample. The other way to treat exits consistently is to keep control companies in the sample as long as the corresponding treated companies are in the sample and reweight controls if any of the controls linked to the same treated company exits. For the results shown in the paper, we applied the latter solution to handle exits, but the two approaches lead to quantitatively very similar estimates.

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[9] For this exercise only acquisitions with two participants are considered and where data are available for both the acquirer and the target. This results in slightly lower sample sizes compared to the first model capturing the impact on the acquirer.

[10] The denominator is always a size measure, total assets or value added.

Several sources of **heterogeneity** are examined in the paper. First, we examine differences in the impact of **horizontal and non-horizontal** acquisitions. An acquisition is regarded horizontal, if the 2-digit NACE code of the acquirer and the target companies is identical.[11] The rest are considered non-horizontal, which are mainly vertical or other types of related acquisitions. The motives of acquisition, the size of its impact and the potential sources of gains may differ depending on whether the target is a competitor, operating in the same industry, or a company from another industry, potentially operating in the value chain of the acquirer. In horizontal acquisitions, economies of scale can be exploited and the acquisitions can be a tool of a longer-term growth strategy. Horizontal acquisitions may also be motivated by the desire to lower competition, and the apparent rise in productivity may be the result of increasing markups. In non-horizontal or vertical acquisitions, diversification benefits and also economies of scope can be the source of the productivity gain, as the acquirer may use its existing infrastructure or client base to sell the products and services of the target firm. In addition, in vertical integration the acquirer can eliminate the markup it pays to the supplier (reducing double marginalisation). Some acquisitions are motivated by pure investment purposes and the target is unrelated to the operation of the acquirer. As the cases considered here all entail the combination of two organisations into one, not just change in ownership, pure investment motives are less likely.

Next, we test **if the pre-acquisition performance of the acquirer matters**. The treated observations are allocated to two groups, based on their relative performance prior to the acquisition. The question we seek to answer is whether the benefit from the acquisition in terms of productivity or profit differs for firms with above/below average pre-acquisition productivity or profitability. Firms which are already at or close to the efficiency frontier are expected to have less room to improve their efficiency just by increasing their size. The thresholds used to define the two groups are the medians in the respective 2-digit NACE – year groups. To preserve the balance of the matched sample, both treated and control observations are classified, and controls are kept only if they belong to the same category as their paired treated firm.

Acquisitions between firms which had previous business links are considered next. The acquisition of a familiar firm lowers informational asymmetries and may contribute to the success of the acquisition. To identify these acquisitions, we exploit an administrative dataset on bilateral firm-firm transactions with value added tax content. The data collection starts in 2016, which does not allow for the identification of all acquisitions with supplier links for the whole sample. Nevertheless, the available sample (2016–2021) is utilised to identify acquisitions of firms with existing business links and analyse the impact on performance following the acquisition.

MAs during recession are also examined. The motivation of acquisitions, the composition of acquirers and the characteristics of targets may change during recessions. During booms, acquisitions are fuelled by buoyant growth prospects. By contrast, in a recession, growth prospects are poor and uncertainty is high, which makes acquisitions riskier. At the same time, companies hit by the recession may become a target of firms with sufficient cash flow, which can buy up rivals or unrelated companies at a reduced price. For this exercise, we identify recession years (2009, 2012, 2020) and seek to find differences in the composition and the impact of the acquisitions in this sub-sample.

Acquisitions of loss-making firms are worth investigating for several reasons. The acquisition of firms with weak performance is a clear case of resource reallocation, where the acquisition by a better performer and the ensuing reorganisation of the target is the major contribution to productivity growth. One way to identify those cases is to pick acquisitions of targets which recorded a loss prior to the deal. This case is also of interest to examine the relevance of tax avoidance as a potential motive for acquisitions. This motive can be especially relevant when the firms belong to the same group. If the primary motive for acquiring loss-making firms is tax avoidance, the acquisition will likely affect after-tax profit, but not productivity or operating profit.

Robustness of the results is investigated by replacing the performance indicators with **categorical variables (deciles)**. In some cases, filtering outliers was not clear-cut, and many potential thresholds could have been applied. Employing deciles handles outliers without arbitrarily selecting thresholds.

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[11] In the base regressions, we also keep acquisitions with more than one target in the sample. In those cases, at least one of the target companies should operate in the same 2-digit NACE industry as the acquirer to qualify as horizontal.

In the post-acquisition period (from T+1 to T+5), treated firms acquire companies with higher probability than control firms do. This may be explained by the new competencies gained from the acquisition in period T and by improvements in the performance measures (e.g. higher profitability) of the treated firms. However, potentially this could also be the consequence of the difference in the acquisition probabilities of treated and control firms before period T. Although this difference cannot be observed directly, if it was high, then the matching was imperfect, and the estimated impact of acquisitions could be distorted. As a robustness test, we also define acquisitions after period T as treatments. This way we can disentangle the impact of the higher acquisition probabilities of treated firms after period T (indirect impact) from the total impact. This can be informative about the indirect impact of acquisitions through the increase in acquisition probabilities or alternatively, about the potential distortions caused by the differences between the unobserved acquisition probabilities of treated and control firms before period T.

Finally, the paper elaborates on the potential of **revaluations** to distort our results. Before the acquisition takes place, the target firm should prepare a closing financial report. This may involve the revaluation of certain assets, which were previously recorded in the books below market value. Also, revaluation may take place during acquisition. The acquirer may record the value of the customer base or internal IT systems of the acquired firm (previously not acknowledged in the books of the target) as intangible assets. Any difference between the book value of the target and the actual price the acquirer pays should be recorded as intangible assets. All these cases suggest upward revaluation, but in some cases distressed targets may be under pressure to sell the company and its assets under market or book value, leading to a downward revaluation. Revaluations may affect our estimation results. For example, if revaluation leads to a longer-term – not just a temporary, 1-year – shift in the value of capital or total assets, this may impact the results on TFP and profitability. As a robustness check, a simple diff-in-diff type measure is introduced to capture revaluation and to elaborate on the importance of revaluation during the acquisition. As for revaluation by the target prior to the acquisition, the financial report at T-1 and at T (at the year of MA) are compared on a limited sample starting in 2017.[12] The focus is on total assets (which is the denominator of the profitability ratios), and capital (which is an input in TFP calculation).

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[12] Companies which suspend their license because of acquisition are to submit a separate report, which is available to the authors only from 2017.

3 Characteristics of the sample

The final sample includes 3,187 treated firms with acquisitions between 1998 and 2021.[13] Table 1 shows how the number of observations changes with the key restrictions applied to the sample, due to size restriction or matching.[14] We lose most of the observations by applying the size restriction and requiring firms to be active during the pre-acquisition period. Matching is successful for 3,187 out of the 3,791 treated observations and on average it yields 4.34 controls for each treated.

Table 1 Size of sample	
A: Initial number of acquisitions between 1998–2021:	9,253
B: Number of acquirers which are either regarded as too small or which do not have at least three pre-acquisition observations:	5,204
C: Number of cases dropped for other reasons:	258
D: Pre-match sample size (A-B-C):	3,791
E: Successful match:	3,187
Number of matched controls:	13,833
Average number of matched controls:	4.34

The size of the sample also changes depending on the question considered. Any time we control for the characteristics of the target firm (and the mechanical impact of acquisition), roughly 20 per cent of the observations are lost, due to missing reports by the target or multiple targets. This means that all the calculations for the second specification (Equation 4) are completed on a smaller sample. To cover as large a share of the population as possible, the first model (Equation 1) is always estimated on the fully matched sample. It should be noted, however, that restricting the sample to acquisitions for which the target observation is available has a minor effect on the first model's estimation results.

Some of the treated and control firms **exit or participate in other restructurings** during the post-acquisition period (see Table 2). The share of exits[15] due to suspension of operation or default is 13.9 per cent of control and 11.2 per cent of treated firms. Control firms are more likely to exit, but the difference is not too large. In addition, a few firms disappear from the sample by becoming the target of an acquisition. Altogether, after controlling for right censoring, by T+5 the sample size falls to 84.4 per cent and 83.3 per cent of the initial sample of treated and control firms, respectively. Both control and treated firms engage in additional acquisitions – either as an acquirer or target – in the post-acquisition period, the latter do more so. Firms also divest. Additional acquisitions and divestitures[16] do not change the size of the sample but may alter the estimated impact of acquisitions.

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[13] Our definition of acquisition is based on the change of the legal entity of the firms and not on the change in ownership. We have information on ownership changes only for a shorter time period (2015–2019) and not for the whole sample. However, during this sub-period we calculated the proportion of target firms not owned by the acquirer firm or by any of the owners of the acquirer firm. In most cases, there was no overlap between the owners of the acquirer and target firms (84 per cent in the estimation sample). Hence, in most cases the change in the legal entity of the target firms is also accompanied by a change in ownership.

[14] The initial sample already excludes those cases with more than five participants, companies with multiple restructurings within the year or with other restructurings in the pre-acquisition period.

[15] If a firm does not submit a financial report for at least two years, it is considered as an exit. Becoming a target of acquisition is not regarded as an exit. Some of the exits are temporary, but the suspension of operation for a sufficiently long time is not differentiated from default or closure. Exits cannot be defined for 2020–2021. This is one reason why the numbers in Table 2 do not add up.

[16] Other restructurings, namely mergers and split-ups are not considered, as we have very few such cases in our sample.

Table 2
Events affecting the number of treated and control observations in the post-acquisition period

	Treated	Control
Number of obs. at T-1	3,187	13,833
Number of obs. at T+5	2,128	9,042
Right censored at 2021	564	2,480
Exit	357	1,927
Acquired after T	20	35
Acquire after T	268	351
Divest after T	134	247

The number of acquisitions is distributed rather evenly over the years (see Table 3). We do not observe large acquisition waves, which can be explained by the dominance of small firms in the sample. However, as we will see later, the number of acquisitions is cyclical; during recessions fewer acquisitions take place.

Table 3
Number of acquisitions over the years (estimation sample)

Year	Freq.	Per cent	Year	Freq.	Per cent
1998	44	1.38	2010	135	4.24
1999	80	2.51	2011	114	3.58
2000	143	4.49	2012	131	4.11
2001	124	3.89	2013	117	3.67
2002	136	4.27	2014	131	4.11
2003	124	3.89	2015	133	4.17
2004	151	4.74	2016	171	5.37
2005	153	4.8	2017	160	5.02
2006	164	5.15	2018	148	4.64
2007	163	5.11	2019	136	4.27
2008	146	4.58	2020	101	3.17
2009	163	5.11	2021	119	3.73

Our sample is dominated by less knowledge-intensive services (43.8 per cent), mainly firms in trade, and manufacturing (23 per cent). Table 4 differentiates manufacturing firms by the level of technology and service sectors by their knowledge intensity. The reported shares roughly correspond to the share of each industry in our matching sample.

Table 4
Industrial composition of the acquirers (estimation sample)

	Number	%		Number	%
Manufacturing	733	23.0%	**Services**	1,734	54.4%
high-technology	39	1.2%	knowledge-intensive	339	10.6%
medium-high tech	124	3.9%	less knowledge-intensive	1,395	43.8%
medium-low tech	261	8.2%	**Agriculture**	195	6.1%
low tech	309	9.7%	**Real estate**	190	6.0%
Construction	292	9.2%	**Other**	43	1.3%

As for the composition of acquisitions by type, 43.8 per cent of the acquisitions in the estimation sample are horizontal, 12.4 per cent occurred during the three recession years, one third of the merging firms had business links prior to the deal (data from 2016–2021 only) and in almost half of the cases the target was loss-making (in the sample of acquisitions for which target data is available).

Acquirers are very distinct from the average firm. The comparison is made on the matching sample, where we applied the same size restriction for treated firms and potential controls ('rest of firms' in Table 5). Firms which make an acquisition are, on average, much larger, more productive, make more profit, less leveraged, have more physical capital and pay higher wages prior to the acquisition. Measuring size by value added, acquirers are 81 per cent larger, while the number of their employees is 50 per cent higher. They produce 33 per cent more value added per employee. Their TFP is slightly smaller, but that is related to compositional effects – a conditional estimate with controls on industry and years reverses the picture (not shown). Firms initiating acquisitions also tend to be older, more likely foreign owned and exhibit above-average growth prior to the acquisitions.

When targets are compared to the acquirers, they appear less profitable and productive, more leveraged, and younger. Also, their activity shrinks before the acquisition. As for target firms, we did not use any size limits, and we use the original full sample to compare the targets' performance to the rest of firms ('rest of firms2'). In this comparison, targets are larger and more productive, pay higher wages, are somewhat older and are more likely to be foreign owned than the average firm. Strikingly, they underperform their peers in terms of profit and growth. This is a strong indication of firms becoming targets due to their deteriorating performance prior to the acquisition.

Table 5 Characteristics of acquirers and the targets (means)	Profit	TFP	Labour productivity	RVA	Employees	Leverage	Collateral	Average wage	Age	Foreign	Sales growth
Acquirers	8.53	5.68	8.80	11.91	3.11	59.44	35.11	7.76	13.18	0.19	5.06
Targets	-5.53	5.50	8.42	9.99	1.36	88.26	31.28	7.22	10.38	0.14	-20.84
Rest of firms	7.22	5.71	8.47	11.10	2.61	65.34	33.41	7.58	12.50	0.13	3.12
Rest of firms2	-3.70[17]	5.43	7.79	8.77	0.89	94.08	26.57	6.84	9.39	0.10	8.84

Note: The group 'rest of firms' is defined on the matching sample (small firms excluded) and should be used to benchmark the characteristics of acquirers. By contrast, 'rest of firms2' is defined on the original sample to provide a benchmark for targets. Age is in years; TFP, labour productivity, RVA, employees and average wage is in log; the rest of the variables are expressed in per cent.

Instead of comparing average features of the acquirer and their targets, one can also examine the relative performance measure (MI term). This has the advantage of being computed for pairs of acquirers and targets. The average of the mechanical impact calculated for different performance measures confirms (see Table 12 in the Appendix) that acquirers indeed target weaker-performing companies on average. Mechanical merger of the acquirer and target would lower labour productivity by 9 per cent, TFP by 13 per cent, average wages by 2.7 per cent, and would result in growth of 17.2 per cent in real value added.

As treated firms differ from the typical firms in the sample, we apply matching to balance our sample. Following matching, **the balance of the treated and control** groups improves (see Table 6), and remaining differences are within an acceptable range. Standardised mean difference (the measure of imbalance used) is below 10 per cent for all variables, except for age. QQ plots for propensity score – reported in the Appendix – indicate very similar distribution for the two groups.

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[17] This figure is affected by large outliers at the left tail of the distribution of the profitability ratio, which is partly related to the large number of loss-making micro firms with small asset size. The median is positive (1.74).

Table 6
Balance of the matched sample

	Treated	Control	Imbalance	Improvement
Operating profit (%)	8.48	7.38	5.9%	-0.5%
After-tax profit (%)	12.75	11.79	5.1%	-1.4%
TFP (ln)	5.68	5.67	0.7%	-4.3%
Labour productivity (ln)	8.80	8.79	0.9%	34.7%
RVA (ln)	11.91	11.87	2.0%	54.4%
Sales (ln)	13.05	12.96	5.0%	51.8%
Employees (ln)	3.11	3.04	5.3%	42.4%
Leverage (%)	59.42	58.58	2.0%	-13.3%
Collateral (%)	35.10	37.04	-7.6%	14.2%
Average wage (ln)	7.76	7.80	-5.2%	29.3%
Age	13.18	14.69	-22.2%	32.1%
Foreign owned	0.19	0.19	0.0%	18.9%
Sales growth (%)	5.07	3.78	2.6%	1.2%
Market share (%)	0.153	0.156	-0.4%	3.8%

4 The impact of acquisitions

To analyse the impact of acquisitions on size and efficiency, we estimate the two models outlined in the previous section. One assesses the impact on the acquirer, and in the other one we control for the mechanical impact of the acquisition and estimate the impact of restructuring. Both measures are of policy relevance. The latter shows whether the acquisition enhanced efficiency at the combined firm level. If the efficiency gain is positive, this indicates an improvement in resource allocation. However, as targets tend to be low efficiency firms, the performance measures of the acquirer may decrease following the acquisition even if the gain is positive. The estimated impact from the first model shows, how the efficiency and financial strength of the acquirer change. The estimation results for the two models are presented by plotting the treatment effect over time.

Firms use the takeover of production capacities, including employees, to grow more rapidly. At its peak (four years after the acquisition), the real value added of acquirers is 24 per cent higher than that of their controls on average. Firms grow in terms of the number of employees as well, where the gap to control firms increases by up to 20 per cent. The second specification measures the impact beyond the mechanical increase in size due to taking over the assets and employees of the target company. RVA still exhibits some increase, signalling some synergies between the two firms, which can be used to increase output. The employment level decreases, indicating some adjustment in labour management. That could involve layoffs due to redundant positions at the two merged organisations, reorganisation of the target or cuts allowed by better allocation of tasks and other improvements in human resource management. Note that we are not able to disentangle layoffs or voluntary exits at the target during the year of acquisition, but prior to the takeover, from adjustments made by the acquirer following acquisition. Value added and average number of employees jumps after acquisition even in the second specification, showing that restructuring starts rapidly after acquisition in general.[18]

Figure 1
Impact of acquisition on growth

Note: The left and right panel shows the estimated parameters of treatment impact with a 90 per cent confidence interval on log real value added and log employees, respectively, for the two models. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

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[18] The gradual increase in value added and employment between T-1 and T+1 has technical reasons, as in the year of acquisition measures based on flow variables capture the characteristics of the acquirer partly before and partly after acquisition.

Acquisitions boost the productivity of firms. The labour productivity of the acquirers improves by 4 to 5 per cent on average. The productivity improvement caused by restructuring is even greater, at 12 per cent (see the model on the impact of restructuring in Figure 2). This is consistent with the fact that the target firms are less productive on average than their acquiring peers, and the mechanical merger of the two firms would, *ceteris paribus*, lead to a fall in productivity with respect to the pre-acquisition performance of the acquirer.[19]

Total factor productivity also improves. Although the total factor productivity of the acquirers does not increase markedly following acquisition (Figure 2, right panel), this is because the total factor productivity of the targets lags behind that of the acquirers. The second specification shows that the estimated gain from restructuring is sizeable. The largest total impact is measured four to five years following the acquisition and translates into a 15-per cent gain in value added.
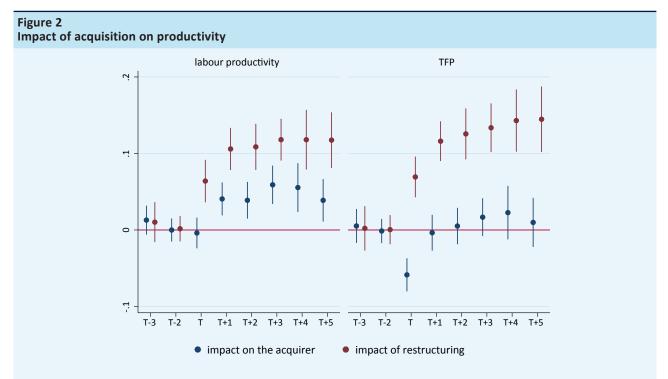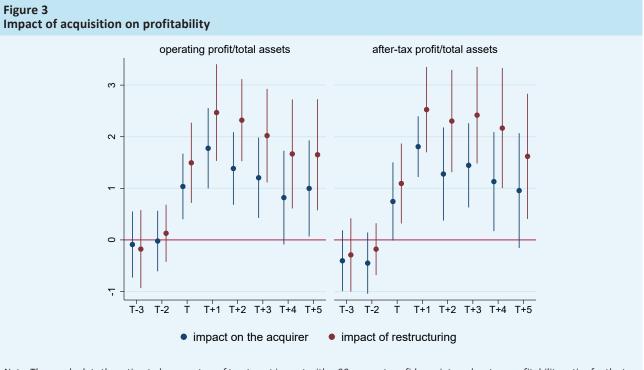
Figure 2
Impact of acquisition on productivity

Note: *The left and right panel shows the estimated parameters of treatment impact with a 90 per cent confidence interval on log labour productivity and TFP, respectively, for the two models. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.*

In line with the improvement in productivity, firms are able to increase their profit after acquisition. Acquirers outperform control firms by 1 to 2 percentage points. Two profitability ratios are calculated: one using operating profit, the other using after-tax profit as the nominator. The former captures the ability of a firm to generate profit from its daily operation, while the latter is affected by financing decisions and other sources of revenues and expenditures as well. The impacts of acquisition on the two profitability measures are similar, in terms of both their size and evolution over time, suggesting that the improvement is mainly due to improved operational efficiency.[20] As before, the estimated impact of restructuring exceeds the impact on the acquirer, because of the inferior pre-acquisition performance of the targets.

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[19] It should be noted that the term capturing the efficiency differences between the acquirer and the target is based on balance sheet data from period T-1 and hence it is an imperfect proxy of the impact of mechanical merger.

[20] As the results for operating profit and after-tax profit are similar, from now on only results for operating profit will be reported, unless the question considered requires the analysis of both profit measures.

Figure 3
Impact of acquisition on profitability

Note: The graph plots the estimated parameters of treatment impact with a 90 per cent confidence interval on two profitability ratios for the two models. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

In contrast to the mixed evidence from the related literature, all three efficiency measures (labour productivity, TFP, operating profit) point to a significant increase in efficiency. The potential reasons for finding a robust, large impact are manifold. The sample allows extensive coverage of smaller firms, and most of them may not operate at the efficiency frontier and have more room to benefit from scale economies via acquisition. Also, Hungary underwent a structural change during the transition to a market economy. The birth rate of firms was very high in the first half of the sample, prior to the global financial crisis. Many industries went through the phase of natural selection and consolidation. Acquisitions may have played an important role in this process.
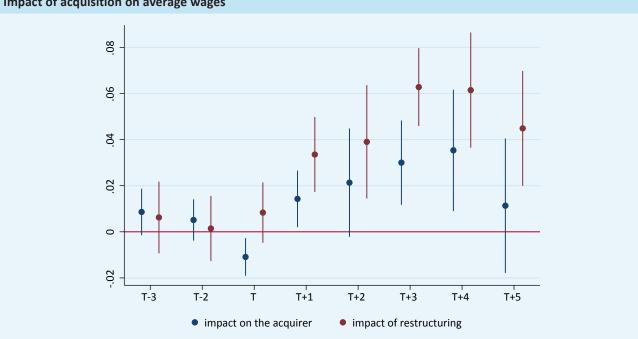
The increase in productivity may also reflect the increase in markups, instead of a productivity gain, if the acquisition weakens competition. This is unlikely to be the case, given the relatively small market share of the firms in the sample. The value added-based market shares[21] of the treated firms are small, with an average 0.16 per cent in the estimation sample. The total number of treated firms with market share above 5 per cent is 9 in the year preceding acquisition, which increases to 11 at the time of acquisition, and the maximum number of such observations is 14 during the post-acquisition period. The corresponding numbers with a 10-per cent threshold are 3, 4 and 4. Most of the large firms (with at least 5-per cent market share) operate in manufacturing and IT. Compared to the size of the sample, these are very small numbers, and thus it is unlikely that an acquisition-induced increase in market power explains the results on productivity gains.

In the long term, acquisitions are accompanied by higher average wages relative to the control group. Figure 4 summarises the estimation results on the impact of acquisition on average wages. The peak is between 3 per cent and 6 per cent, which is a material effect. The increase in average wages relative to the control firms may suggest that lower skilled or lower waged workers are more likely to be laid off. Alternatively, an increase in average wages may also signal sharing productivity gains with workers. For a more definitive answer, one would need to examine detailed labour flow data, which falls outside of the scope of this paper.

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[21] Market shares are calculated for 2-digit NACE industries.

Figure 4
Impact of acquisition on average wages

Note: The graph plots the estimated parameters of treatment impact with a 90 per cent confidence interval on log average wages for the two models. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

5 Heterogeneity of the impact of acquisitions

The impact of the acquisition may depend on various features of the acquisition. The following sources of heterogeneity are considered in this section: horizontal and non-horizontal acquisitions, performance of the acquirer prior to the acquisition, acquisitions made during recessions, acquisitions of firms with previous supplier links and acquisitions of weak (loss-making) targets. First, we look at how the characteristics of the acquirers and the relative performance and size of the targets differ across various sub-groups. Differences in the impact of acquisition are then examined.

5.1 FEATURES OF ACQUISITIONS FOR VARIOUS SUB-GROUPS

Unconditional means of the key outcome variables for various subgroups are collected in Table 12 in the Appendix. Here, to control compositional effects, differences in conditional means are calculated. Firm characteristics (performance and size) are regressed on the heterogeneity indicator, year and industry fixed effects.

Table 7
Characteristics of different kinds of acquisitions

	Operating profit	Labour productivity	TFP	RVA	Employees
Characteristics of acquirer					
All acquirers: unconditional mean	**8.53**	**8.798**	**5.68**	**11.90**	**3.106**
Horizontal acquisition	0.2806	0.0696	0.0583*	0.1188*	0.0492
Acquirer: high pre-MA labprod	9.8862***	1.2555***	0.8936***	1.4610***	0.2055***
MA during recession	-0.2795	0.1196***	0.0625	0.1196*	0.0000
Acquiring previous supplier	-2.2476	0.1346*	-0.2116***	0.7331***	0.5985***
Target making loss	-0.3447	-0.1274***	-0.0953***	-0.2198***	-0.0924**
Characteristics of target					
All targets: unconditional mean	**-5.53**	**8.42**	**5.5**	**9.99**	**1.36**
Horizontal acquisition	2.5178	0.0713	0.1610	0.6560***	0.5198***
Acquirer: high pre-MA labprod	1.2310	0.6234***	0.3911***	0.9889***	0.3737***
MA during recession	-0.6199	0.2716**	0.2785***	0.1055	-0.1585**
Acquiring previous supplier	6.2888**	0.6226***	0.3369**	1.5739***	0.9179***
Target making loss	-41.3783***	-1.0086***	-0.8857***	-0.9143***	-0.3256***
Mechanical impact of acquisition/relative size					
All deals: unconditional mean	**-0.85**	**-0.09**	**-0.13**	**0.172**	**0.287**
Horizontal acquisition	-0.2837	-0.0274	-0.0284	0.0694***	0.0970***
Acquirer: high pre-MA labprod	-2.0647***	-0.0804***	-0.0355**	-0.0528***	0.0289**
MA during recession	0.0922	0.0264	0.0316	-0.0203	-0.0439***
Acquiring previous supplier	-0.3706	0.0318	0.0300	0.1297***	0.0980***
Target making loss	-4.0219***	-0.1357***	-0.1335***	-0.2028***	-0.0664***

Note: The table shows estimated parameters and indicates their significance level; the column variable is regressed on the row variable and year and industry fixed effects. All explained variables are in log, except profitability, which is in per cent. Each cell comes from a separate estimation. In the upper/middle panel the explained variable is the characteristics of the acquirer (profit, labour productivity, etc.) and the target respectively; while the lower panel refers to the mechanical impact of acquisition – the difference between the performance of the mechanically merged new firm (acquirer and target) and the acquirer. The lower panel: in the row 'All deals', the mechanical impact of acquisition for RVA and employees informs about the size of target relative to the acquirer. As for the mechanical impact of acquisition for the efficiency measures, if it is negative (ALL firms), this implies that the target was less productive and profitable than the acquirer in the year prior to the acquisition. The reported parameters for the sub-groups are more challenging to interpret. For example, a more negative parameter implies either more weaker performance of target relative to its acquirer OR larger relative size in the sub-group of interest. Comparison with the parameter for relative size (last two columns) and the conditional average for 'All firms' (first row) may help interpretation. Recession years are 2009, 2012, 2020. Information on supply links is accessible from 2016.

Table 7 presents the estimated parameters for the heterogeneity indicators: the upper/middle/lower panel refers to the characteristics of the acquirers, the target companies and the term capturing the mechanical impact of acquisition, respectively. The first two allow for a comparison of the acquirers (targets) between the sub-group and the total sample. By contrast, the mechanical impact term informs about the differences in the performance of the target relative to its acquirer. The interpretation of the results for this term needs some clarification. In the case of RVA and employees, the term informs about the size of the target relative to the acquirer. In the case of efficiency measures (productivity, profit), the term capturing the mechanical impact of acquisition depends on the differences in both relative performance AND relative size. Its interpretation is not always clear (see also notes below Table 7), but a large negative parameter suggests a higher potential for productivity gain from upgrading the target.
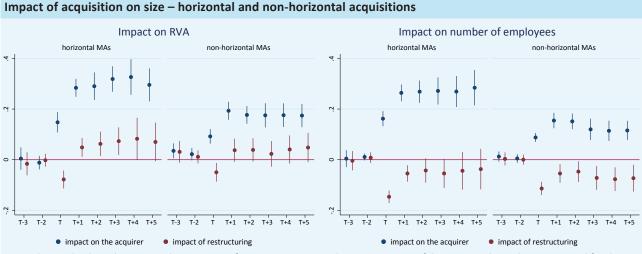
• Acquirers in **horizontal** acquisitions tend to be larger and more productive. The targets are even larger and more productive relative to non-horizontal targets. Hence, the target's relative size to its acquirer tends to be larger in the case of horizontal acquisitions. We can call this a case of 'Large, strong firm acquires large, strong target'.

• Firms with **above-average labour productivity** (measured prior to the acquisition) are much larger, productive, and profitable than their peers or their own target. The targets are also larger and show superior performance relative to other targets. Overall, the potential for upgrading the target is above average. 'Very large, very strong firm acquires large, strong target.'

• **During recessions** firms become cautious. More productive, larger firms engage in acquisitions, and they target firms which are smaller, but more productive. 'Large, strong firm acquires small, strong target.'

• Acquisitions with **previous supplier links** involve large firms (both acquirer and target) with similar productivity. The superior performance of the target is more evidenced than that of the acquirer.[22] 'Large firm acquires large, strong target.'

• In **acquisitions of loss-making firms**, both participants tend to be smaller, below-average performers, but the acquirer is much larger, and its performance is superior relative to its target. 'Small, weak firm acquires smaller, weaker target.'

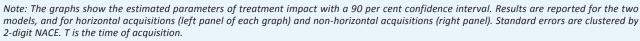## 5.2 HORIZONTAL AND NON-HORIZONTAL ACQUISITIONS

The findings of the empirical papers on acquisitions show that horizontal acquisitions tend to differ both in terms of their size and their impact on productivity. Returns-to-scale considerations are more relevant in the case of horizontal acquisitions. If production efficiency increases after the acquisition, this may lead to further expansion. Furthermore, if the deal is between competitors, profitability may also improve due to an increase in market power.

Overall, in our sample, **horizontal acquisitions tend to be bigger deals**, with large, productive companies acquiring relatively large, productive targets. According to the estimation results, the average impact on RVA exceeds 30 per cent for horizontal cases, while the same figure for non-horizontal acquisitions is below 20 per cent. Controlling for the impact of target companies shows that the differences are mainly driven by the size of the target companies. However, horizontal acquirers tend to grow further following the acquisition. The impact on employment shows a similar pattern. The differences are mainly driven by target characteristics, but controlling for that highlights that the adjustment in labour seems to be bigger in the case of non-horizontal acquisitions.
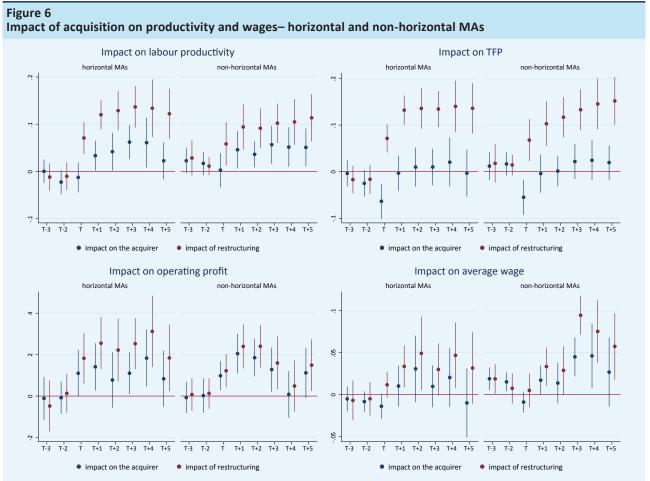
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[22] Note that these features are observed on a limited sub-sample covering acquisition between 2017 and 2021.

Figure 5
Impact of acquisition on size – horizontal and non-horizontal acquisitions

Note: The graphs show the estimated parameters of treatment impact with a 90 per cent confidence interval. Results are reported for the two models, and for horizontal acquisitions (left panel of each graph) and non-horizontal acquisitions (right panel). Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

These findings indicate that growth motives and returns-to-scale considerations can be quite important behind horizontal acquisitions in our sample. At the same time, in the non-horizontal cases, restructuring after acquisition may concentrate more on eliminating inefficient operations and downsizing the target company. The labour adjustment may also change the composition of employees and partly explain the higher increase of the average wage after non-horizontal acquisitions (see Figure 6).

Figure 6
Impact of acquisition on productivity and wages– horizontal and non-horizontal MAs
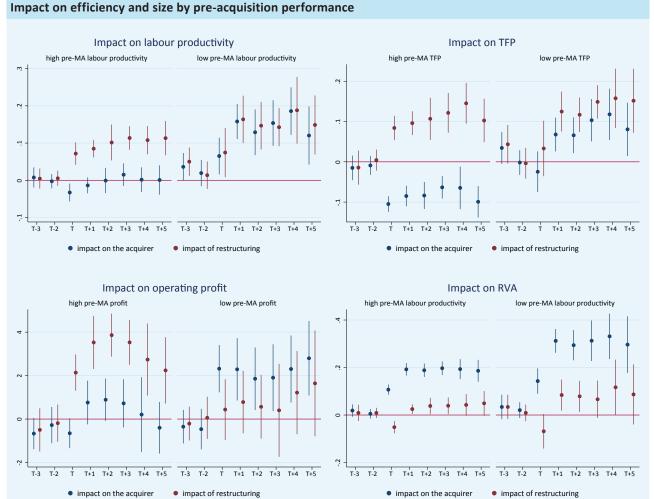

Note: The graphs show the estimated parameters of treatment impact with a 90 per cent confidence interval on various measures of efficiency and average wages for horizontal and non-horizontal acquisitions. Two sets of parameters are reported corresponding to the two model specifications. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

The mechanism and source of efficiency gain might differ, but **firms become more productive following acquisitions, irrespective of whether they are horizontal or non-horizontal**. Labour productivity and TFP improves after acquisitions in both sub-samples. Horizontal and non-horizontal acquisitions lead to gains in profitability as well, although in case of horizontal acquisitions the impact seems to be more permanent.

5.3 PRE-ACQUISITION PERFORMANCE OF THE ACQUIRER

The impact of the acquisition may depend on the pre-acquisition performance of the acquirer. Highly productive firms may enhance the efficiency of the target firm's operation more, although the acquisition is expected to have less impact on its own operation. On the other hand, firms which are further away from the efficiency frontier – for example, because they have not reached the ideal size for optimising economies of scale – may benefit more from acquisition. Hence, it is ambiguous whether acquisitions should have a smaller or larger impact on both efficiency and size in the case of acquirers with better pre-acquisition performance. To test the importance of the pre-acquisition performance of the acquirer, firms are classified into two categories. High/low performers have above/below-median outcomes (productivity, profitability) in the year before the acquisition.[23]

Figure 7
Impact on efficiency and size by pre-acquisition performance

Note: The graphs show the estimated impact of MA on labour productivity, TFP, profitability and RVA separately for firms with above/below median productivity or profitability prior to the MA. We plot 90 per cent confidence intervals. Results are reported for both model specifications. All variables except profit are in log. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

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[23] High/low performers are defined for each efficiency measure separately.

The findings show that the labour productivity of high performers does not change significantly following the acquisition. However, once we control for the fact that target firms have much lower productivity, the productivity gain increases beyond 10 per cent. This indicates that sizeable benefits may come from improving the productivity of the target firm. By contrast, low performing acquirers experience quite substantial improvement in labour productivity, even without controlling for the target firm's weaker efficiency. As acquirers in this group tend to be smaller and less efficient, increasing scale efficiency could be an important source of improvement. This is confirmed by the results for growth performance as well: acquirers with lower pre-acquisition labour productivity experience higher growth in real value added in both specifications.

A similar pattern is observed for TFP (second graph in Figure 7). Although the impact on high performing acquirers is negative on average, this is due to the targets' characteristics. Estimates from the second specification shows that restructuring has enormous efficiency gains for acquirers both with higher and lower productivity. Regarding the impact on profit, restructuring has a bigger and more immediate impact if the acquirers had high profit prior to the deal. Despite the positive impact of restructuring, the impact on the profit of the acquirers with higher initial profitability is smaller due to the relatively weak performance of the target.

5.4 ACQUISITIONS DURING RECESSIONS

During recessions acquirers become cautious. The profitability of most companies is under pressure, and the outcome of acquisitions becomes less predictable. This may decrease the number of acquisition deals. In our sample in years with falling output, the number of acquisitions is indeed lower than in the preceding and following years. At the same time, some struggling companies may become easy targets for the few cash-rich companies. The number of potential target companies is increasing, as otherwise sound companies could face temporary difficulties. Hence, the acquirers are in a better position to select target companies with more value added to their own operations in the long run.

As the characteristics of the acquirer and target companies are changing in recessions, the efficiency gain of acquisitions may also be different. On the one hand, even without controlling for the economic cycle, both the acquirer and the target companies are relatively more productive than in other periods; in addition, acquirers pick relatively smaller targets.[24] Hence, there is less room for enhancing productivity. On the other hand, acquirers can be pickier, so the match of the acquirer and target companies may be better than in normal times. That may lead to a higher impact on efficiency.
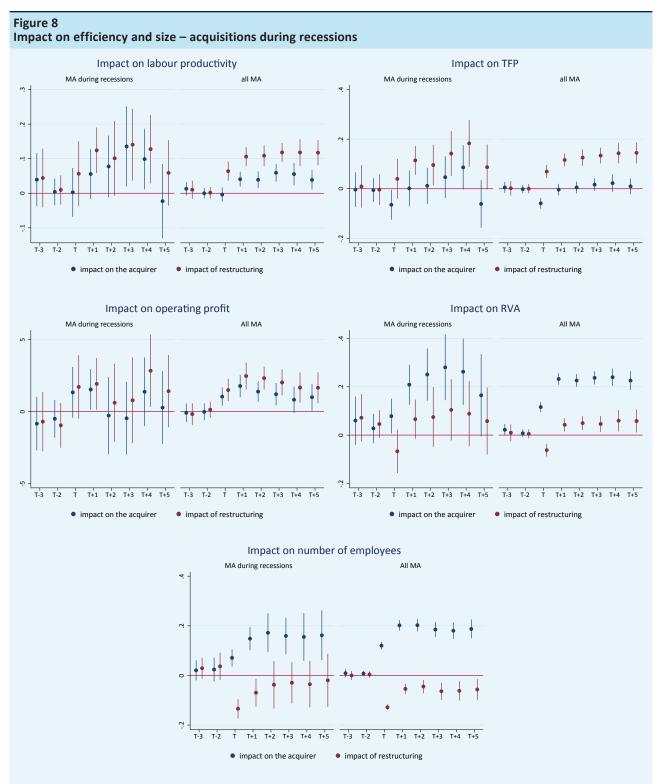
When interpreting the results, the small number of deals during recessions (only 3 years) should be noted. The estimation results are associated with high standard errors, so the average change in the output variables after acquisitions should be in focus, not the dynamics of the annual estimates.

Our results on the productivity benefits of acquisition deals made during recessions are mixed. The point estimates suggest a sizeable improvement in labour productivity and TFP, albeit with a very wide confidence interval. The estimated impact on profit is more volatile. Overall, there is a significant efficiency gain by all the measures. Also, given the small size and better relative performance of the target, acquisition benefits are probably rooted less in the reorganisation of the target and more in the better synergies between the acquirer and target companies, due to the more careful selection of the target.

Acquisitions during recessions also lead to considerable growth in output. Estimates are large and significant for RVA, and point estimates show a similar impact on acquirers as in the full sample (see Figure 8). As the relative size of target companies is smaller during recessions, the sizeable impact is of interest. One potential explanation may be that as the target companies are more productive, there is less need for restructuring and eliminating non-viable operations. Also, due to the more careful selection of the target the merged companies may be better positioned to benefit from the recovery. The estimates for the impact on employment during recessions are more similar to the results for the whole sample.

Overall, acquisitions made during recessions result in similar growth and efficiency gains as deals made during non-recessionary periods. However, this is the net of two offsetting effects. Targets tend to be smaller and relatively more productive, so there is less potential gain from restructuring the target. At the same time, as the number of potential target companies increases, cash-rich acquirers are able to pick the best matches to benefit the most during the following recovery.

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[24] The share of horizontal mergers does not change, at least not in our estimation sample. Serial acquirers are more active during recessions.

Figure 8
Impact on efficiency and size – acquisitions during recessions

Note: The graph shows the estimated impact of MA on labour productivity, TFP, profit and size separately for all MAs and MAs made during recession years. We plot 90 per cent confidence intervals. Results are reported for both models. Labour productivity, TFP, RVA and number of employees are in log. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

5.5 ACQUISITIONS OF FIRMS WITH PREVIOUS SUPPLIER LINKS

For a limited period (2016–2021), we have information on bilateral firm-firm transactions with value added tax content. That allows us to identify business links between acquirers and targets prior to the acquisition. If the target company is known by the acquirer, this decreases the risks of the acquisition considerably. Consequently, the relative size of the target companies can be larger. Furthermore, business links between the firms may indicate potential operational synergies and

elimination of double margining. Although target companies with previous business links tend to be more productive than the typical target company, acquisition may still lead to a significant improvement in productivity. Note that this group of acquisition deals is not identical to non-horizontal (or vertical) acquisitions – many pairs of acquirer and target operate in the same industry and would be classified as horizontal acquisitions.

According to the estimation results, **acquisitions of firms with previous supplier links result in very large increases in productivity**, both in labour productivity and TFP, much higher than observed in the full sample, as the impact of restructuring on labour productivity and TFP almost doubles.

Figure 9
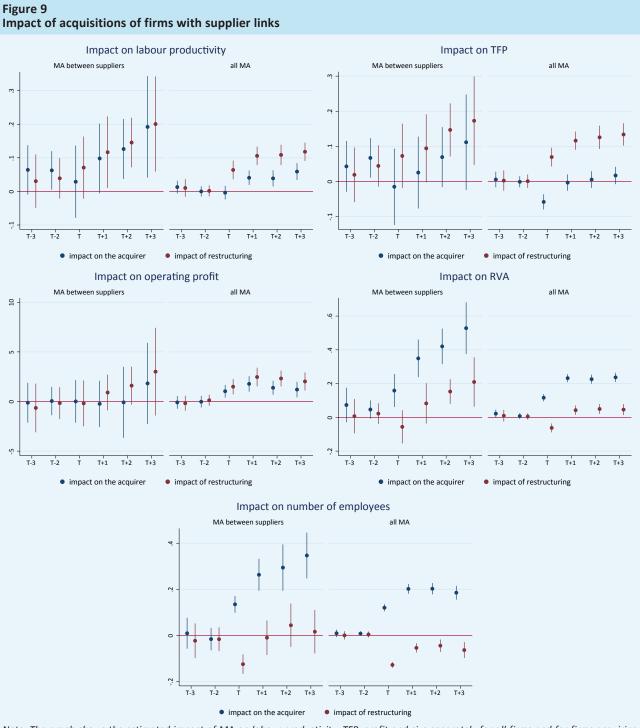**Impact of acquisitions of firms with supplier links**

Note: The graph shows the estimated impact of MA on labour productivity, TFP, profit and size separately for all firms and for firms acquiring suppliers. We plot 90 per cent confidence intervals. Results for efficiency measures are reported for both models. All variables, except profitability are in log. Standard errors are clustered by 2-digit NACE. T is the time of acquisition. Results are shown only up to T+3, given the short sample (there is no observation at T+5 and very few at T+4).

Due to the small sample size and volatility of profit data, the impact on profitability is not significant, but point estimates indicate a gradual improvement. In addition, these deals are accompanied by much larger growth in value added than in the whole sample. This is explained partly by relatively bigger targets, but restructuring increases value added further even years after the acquisition. The outcome for employment (impact of restructuring) is also different, as there is no sign for labour adjustment.
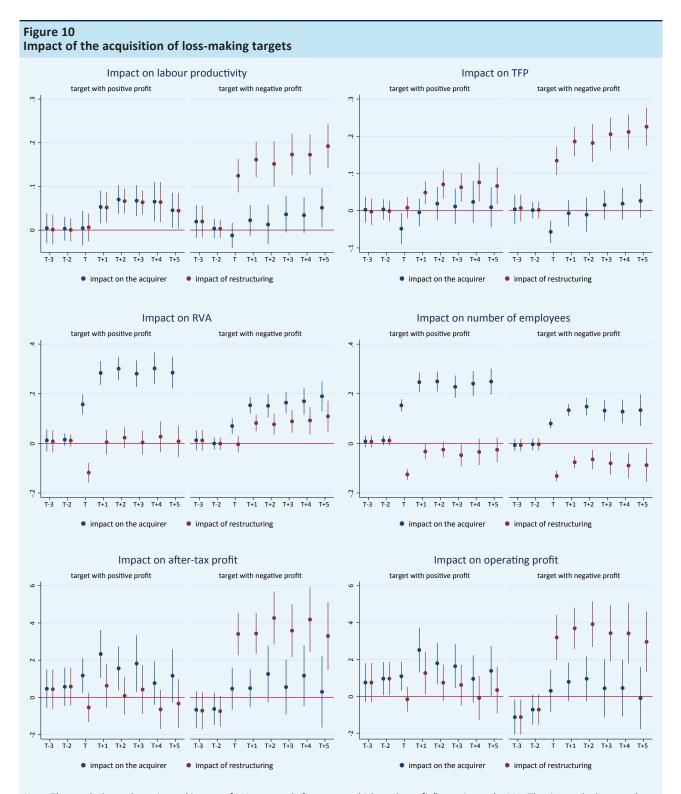
5.6 ACQUISITIONS OF LOSS-MAKING TARGETS

One specific case of MAs is the acquisition of firms which made a loss prior to the deal. If the target made a loss, this is a strong indication of bad management, oversized operation, or other strategic problems.[25] Acquisition of weak companies is a clear case for resource reallocation, where the acquisition by a better performer and the ensuing reallocation of production inputs may contribute substantially to productivity growth. Loss-making companies can be ideal targets of companies which intend to grow and/or have expertise in restructuring. To scrutinise those cases, we differentiate acquisitions in which the target is making a loss from those where the target is profitable. We then estimate our models on the two sub-samples. The two sub-samples are of almost identical size. The acquisition of loss-making companies is a rather frequent phenomenon.

According to the results, the acquisition of loss-making targets leads to an above-average productivity gain. All the efficiency measures – labour productivity, TFP and profit – follow a similar pattern. **The improvement is gradual and takes more time to be fully realised** compared to the almost immediate change observed in acquisitions of profitable targets. On the other hand, the impact on the acquirers' value added is below the average if the target made losses. However, this is related to the relatively small size of the targets. The impact of restructuring on size is significantly positive, which indicates that the target operated below its potential before the acquisition. Also, labour adjustment is much stronger if the target made losses before the acquisition, which is in line with the sizeable improvement in efficiency.

The estimation results for the impact of the acquisition of loss-making companies can be used to learn about the significance of another phenomenon, which may bias downward the estimates of the impact of MA. Acquisition can be a tool for tax optimisation for companies, especially – but not exclusively – when firms are linked via ownership. If there is a company which makes a loss, while another makes large profit, a merger of the two would lower taxable income and increase overall retained profit without an improvement in productivity. Our results contradict this hypothesis. First, acquisitions improve productivity if the target made a loss prior to the acquisition. More importantly, the impact on after-tax profit is very similar to the one on operating profit. These findings suggest that acquisitions motivated by pure tax evasion may occur, but their dominance can be ruled out.

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[25] We expect those companies to have lower productivity as well – which is also true in our sample – but it is more challenging to define thresholds for productivity. Loss-making is a crude, but powerful condition to identify less successful companies.

Figure 10
Impact of the acquisition of loss-making targets

Note: The graph shows the estimated impact of MA separately for targets which made profit/loss prior to the MA. The six panels show results on labour productivity, TFP, growth in terms of real value added and employment, after tax and operating profit. We plot 90 per cent confidence intervals. Results are reported for both models. Labour productivity, TFP, RVA and employees are in log. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

6 Robustness

The robustness of the results is investigated by handling acquisitions taking place during the post-acquisition period; switching to categorical outcome variables; and discussing the size of revaluations and its potential to distort the estimates.[26]
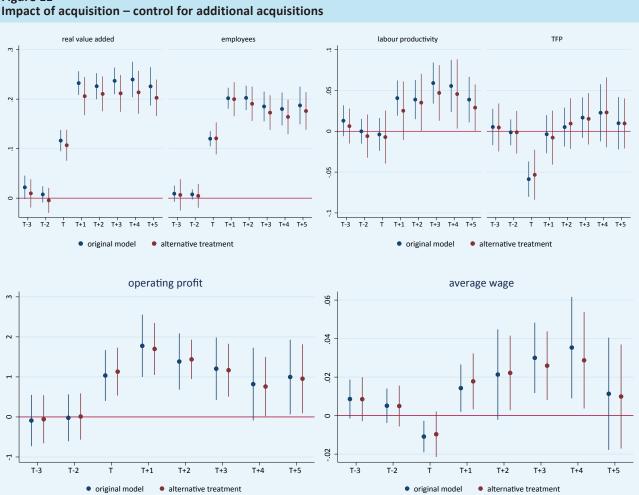
6.1 ALTERNATIVE TREATMENT DEFINITION

Acquisition probabilities prior to the acquisition are assumed to be the same for the matched treated and control firms. From T+1, acquisition probabilities may diverge. The acquirer gains special competencies through the acquisition, and that may increase the probability of further acquisitions. Furthermore, on average, acquisitions significantly improve productivity and profitability. As previously shown, improved effectiveness also increases the probability of acquisition. In our data, from T+1 treated firms do indeed engage more often in acquisitions than control firms. Hence, the impact of the acquisitions on the outcome variables can be decomposed into two terms. First, the direct impact of the acquisition, and second an indirect impact caused by the increasing probability of further acquisitions. In our baseline specifications, we do not distinguish between the direct and indirect effect, as we are interested in the overall impact. However, with a slight modification of the baseline specifications it is possible to check the importance of the indirect impact. In an alternative specification, we also use the treatment dummies for acquisitions of the treated and control firms taking place after time T.[27] The comparison of the estimated treatment effect coming from the baseline and this new, alternative specification is informative in relation to the relative importance of the indirect impact.

Comparison of the treatment effect from the two specifications shows that the direct impact dominates (see Figure 11). The higher acquisition probability contributes somewhat to the increase in real value added, employment and labour productivity. However, in the case of TFP and profitability the difference is negligible.

The alternative specification may be also regarded as a robustness test. The manner in which we constructed the estimation sample does not let us directly check whether acquisition probabilities were equal for treated and control firms before T. Although treated and control firms were matched, it cannot be ruled out that treated firms acquire more often than controls after period T, because acquisitions probabilities were higher even before period T. In that case, treatment effects could be somewhat overestimated. However, as the estimated treatment effects from the base and alternative specifications are close to each other, the potential bias is small.

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[26] We also examined if the results change after excluding acquisitions of very small targets (with less than 5 employees). Our findings remain fairly robust, although the falling number of observations widens the confidence intervals.

[27] The first acquisition may have different impact on performance than subsequent ones. However, the number of acquisitions after T is low, and thus the impact of subsequent acquisitions cannot be estimated precisely. Hence, in the alternative specification, we assume that first and subsequent acquisitions have the same impact on performance.

Figure 11
Impact of acquisition – control for additional acquisitions
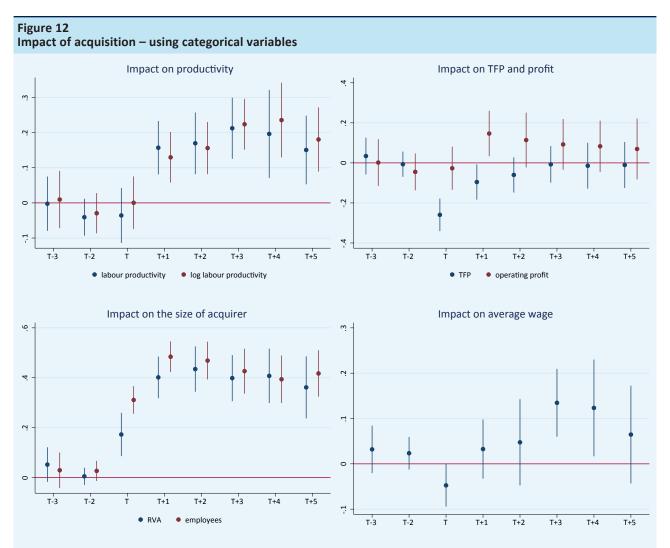

Note: The graph shows the estimated impact of acquisitions with 90 per cent confidence intervals on all the outcome variables. Two versions are reported: the original estimations capturing the impact on the acquirer and one with the alternative treatment definitions, which aims to handle additional acquisitions taking place during the post-acquisition period. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

6.2 CATEGORICAL DEPENDENT VARIABLES

To further investigate the robustness of the results, we define deciles of the dependent variables. Estimation on categorical variables is better at handling outliers. Note that with deciles we are not able to control for the relative efficiency of the target and calculate the impact of restructuring. At the same time, we can cover a larger set of firms, including those with negative RVA and labour productivity. Those observations drop out from the sample when log transformation is applied, but deciles can be defined using the original data instead of its log and keep negative values as well. For the robustness check, only the results for the full sample are reported; heterogeneity is not discussed here.[28] The value of the new parameter estimates cannot be compared directly with the earlier results, but the signs and dynamics of impact are expected to be the same.

Overall, the results based on the deciles of the dependent variable are very similar to the previous ones (see Figure 12). Strong evidence is found on the impact of acquisitions on growth, increasing average wages, improvement in labour productivity, while TFP is catching up to pre-acquisitions levels but cannot exceed that. Profit also jumps following the acquisition, and then the gain slowly declines. The two alternative definitions of labour productivity yield very similar estimates, implying that the results are robust to the removal of observations with negative RVA due to log transformation.

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[28] Most of our earlier findings on heterogeneity survive the move to categorical dependent variables. For the sake of brevity, they are not reported.

Figure 12
Impact of acquisition – using categorical variables

Note: The graph shows the estimated impact of MA on the acquirer using deciles-based categorical variables. For labour productivity, two different versions are reported: the first uses RVA/employees, the second uses its log. We plot 90 per cent confidence intervals. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

6.3 THE IMPACT OF REVALUATION

During the acquisition, some revaluation of the acquired firm's assets and acknowledgement of intangibles may take place. This may have an impact on the performance measures. First, profitability ratios may be affected via the denominator (total assets). Revaluation may also impact TFP, because of the change in the value of capital. We introduce a simple framework to analyse and estimate revaluation and elaborate on its potential to affect the results reported so far.

The change in total assets (capital) of a **treated firm** at time T can be decomposed into the following terms: the impact of acquisition, potential revaluation of acquired assets or goodwill, growth occurring independently of the acquisition and the impact of depreciation. Formally:

$$\text{Closing Assets} = \text{Opening stock of assets} + \text{Increase in assets via acquisition} +$$
$$\text{Revaluation during MA} + \text{Other net investments} - \text{Depreciation} \quad \text{(Equation 4)}$$

With abbreviations: $\quad ClosingA_T = OpA_T + Acqu_T + Reval_T + OInv_T - Depr_T \quad$ (Equation 5)

After rearrangement: $\quad OInv_T + Reval_T = ClosingA_T - OpA_T - Acqu_T + Depr_T \quad$ (Equation 6)

ClosingA, OpA and Depr are reported by the acquirer. For Acqu, we assume that the assets reported by the target at T-1 is a good proxy.

In the case of the **control firms**,[29] Reval and Acqu fall out and what remains is

$$\text{Oinv}_C = \text{ClosingA}_C - \text{OpA}_C + \text{Depr}_C \qquad \text{(Equation 7)}$$

Let us take the difference of Equation 6 and Equation 7:

$$\text{OInv}_T - \text{Oinv}_C + \text{Reval}_T = (\text{ClosingA}_T - \text{OpA}_T - \text{Acqu}_T + \text{Depr}_T) - (\text{ClosingA}_C - \text{OpA}_C + \text{Depr}_C) \qquad \text{(Equation 8)}$$

Because of the matching, we can assume that Treated and Control firms would follow the same trend in the absence of acquisition. This implies that other net investments would be similar too, and what remains on the left-hand side is just revaluation. As we know or can proxy all the terms on the right-hand side, revaluation will be calculated as:

$$\text{Reval}_T = (\text{ClosingA}_T - \text{OpA}_T - \text{Acqu}_T + \text{Depr}_T) - (\text{ClosingA}_C - \text{OpA}_C + \text{Depr}_C) \qquad \text{(Equation 9)}$$

Note that the only variable we are not able to observe is Acqu_T, which is proxied by the value of assets (or capital) reported by the target at time T-1. As the activity of targets is declining prior to the acquisition, its asset and capital value is likely to decrease between T-1 and T. If the proxy overestimates the book value of the target's assets, that will in turn lower our revaluation estimate. This measurement error induces downward bias in the calculation of revaluation.

We apply Equation 9 to total assets and capital (calculated as the sum of tangible and intangible assets), as those asset categories have an impact on the outcome measures we use.

Table 8 shows the results of our calculation for revaluation. The median values are negative, part of which may come from measurement issues. The estimated median revaluation of total assets makes up -8.3 per cent of total asset, while the same figure for capital is -2 per cent. These are small numbers and their impact on the estimation results must be small.

Table 8 Distributional properties of the estimated revaluation		
	p50	#Nu
Revaluation of total assets	-19,665	2,498
Revaluation of capital	-1,418	2,498
Revaluation of TA, as % of TA	-8.3%	2,498
Revaluation of capital, as % of TA	-0.7%	2,498
Revaluation of capital, as % of capital	-2%	2,494

Notes: Revaluation is calculated in HUF 1,000 or per cent. Sample is restricted to those with available target reports. Weighted average of characteristics of control firms are used to calculate the revaluation proxy. For the ratios, the denominator is the average total asset of the acquirer in T and T-1. In the trimmed version outliers (below/above p1 and p99) are excluded.

Since 2017 the closing reports of target firms submitted in the year of acquisition are also available for the authors, and the calculation is repeated using a more updated proxy for the value of acquired assets (Acqu) – from T instead of T-1. The findings are very similar to the ones reported above (see Table 13 in the Appendix). The closing report is also used to test if the target companies themselves revalue their assets when they submit the report. There is no proof of this either – see Table 14 in the Appendix. The average target firm's assets and capital shrink slightly during the year of acquisition. Based on this, no evidence is found on systemic revaluation by the targets prior to the acquisition either.

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[29] For controls we use the weighted average capital, depreciation, etc. of the control firms linked to the respective treated firm.

7 Conclusion

This paper exploits information from the firm register to identify acquisitions and investigate their impact on firms' performance. The key question we seek to answer is whether acquisitions enhance efficiency, where efficiency is measured by labour productivity, TFP and operating profit. The estimation sample covers acquisitions of non-financial private companies between 1998 and 2021. The paper uses a difference-in-differences approach on a matched sample to detect the impact of acquisition up to 5 years following the deal.

The paper makes several contributions to the existing literature. First, we consider cases of acquisitions which entail legal and organisational changes, not just a change in ownership. This definition ensures a rather homogenous sample of acquisitions, and thus the interpretation of the average impact of acquisitions is more straightforward. Second, we explicitly control for the characteristics of the target companies and the mechanical impact of the acquisition, which allows the full efficiency gain coming from the restructuring of the combined firms to be estimated. Third, given the length of the sample and access to various administrative datasets (i.e. supplier links between firms), several sources of heterogeneity can be analysed. Most importantly, we examine the distinctive features of horizontal acquisitions, acquisitions during recessions and acquisitions of suppliers.

Both acquirer and target companies are different from the typical Hungarian company. Prior to the acquisition acquirers are larger, more productive and profitable, less levered, and more dynamic than the average firm. They target companies, which are smaller, less efficient and productive than the acquirers themselves. Thus, the acquisition and restructuring of less efficient companies makes acquisitions a potentially effective tool of resource reallocation. When targets are compared to the entire population of firms, they are larger and more productive, but their profit and sales are declining prior to the acquisition.

According to our results acquisitions act as a faster alternative to internal growth, and the mean difference in real value added between acquirers and their controls grew by 24 per cent after acquisitions. The efficiency gain of acquisitions is also sizeable. The impact of restructuring on labour productivity is 12 per cent. The impact on TFP and profit is also significant and large. Firms may benefit from larger size, potential scope efficiencies, elimination of double margining and restructuring the target firm's inefficient operation also makes a significant contribution. The strong, robust efficiency improvement stands in contrast to the rather mixed evidence from the literature. Our findings suggests that exploitation of economies of scale via acquisitions played an important role in enhancing productivity in the Hungarian economy. The sample used in the paper includes many smaller firms, which may not operate at the efficiency frontier. Also, the structural changes taking place in the Hungarian economy during the transition to a market economy were associated with a lot of churning, natural selection and consolidation.

The impact of acquisitions is heterogeneous. Less productive, smaller firms benefit more from the acquisition: both their size and productivity grow more. Horizontal acquisitions are bigger deals and result in a much larger increase in size than non-horizontal acquisitions (30-per cent increase in RVA versus 20-per cent).

Acquisitions during recessions are also different. Firms become cautious and acquisitions become less frequent during recessions. More productive, larger companies target smaller, but relatively more productive companies. That lowers the potential of productivity enhancement via the restructuring of the target or exploiting scale economies. Despite these features and the uncertainty of the macro-financial environment, these deals are as successful as acquisitions made during more peaceful times. Acquirers seem to find especially good matches to their needs and ride the recovery following the recession.

The paper found that informed acquirers make better deals. If the acquirer and the target had supplier links prior to the acquisition, the firm grows more and the efficiency gain is much larger. Another interesting group of acquisitions includes targets which made a loss prior to the acquisition. Not surprisingly, the restructuring of targets plays a major role in

enhancing productivity in those deals. The results for this group also indicate that tax optimisation motives are not too strong. Acquisitions of loss-making targets are also associated with improving efficiency and the impact on operating and after-tax profit is similar.

The results are robust to several amendments of the base model. Using categorical dependent variables or controlling for additional acquisitions in the post-acquisition period have minor impact on the estimation results. Also, the paper did not find compelling evidence of major revaluations during the acquisitions, which may otherwise induce measurement errors in the performance indicators.

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9 Appendix

Table 9
List of variables and their calculation

labour productivity = ln (real value added/nu of employees)

operating profitability = 100 * operating profit/total assets

after tax profitability = 100 * after tax profit/total assets

average wage = ln (labour compensation/nu of employees)

collateral = 100 * physical assets/total assets
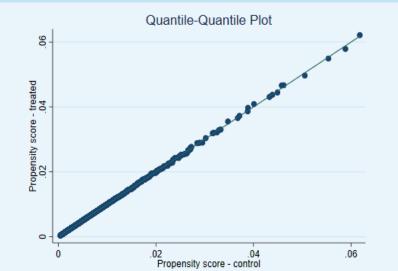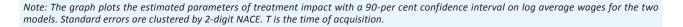
leverage = 100 * (1 − equity/total assets)

Table 10
Production function estimation results by 2-digit NACE

NACE	1	2	3	8	9	10	11	13	14	15	16
ln_empl	0.739***	0.236***	0.845***	0.825***	0.796***	0.866***	1.016***	0.759***	0.854***	0.891***	0.835***
	(0.0105)	(0.0168)	(0.0567)	(0.0241)	(0.0649)	(0.0032)	(0.0089)	(0.0062)	(0.0018)	(0.0219)	(0.0059)
ln_capital	0.306***	0.402***	0.282***	0.414***	0.361***	0.256***	0.299***	0.297***	0.205***	0.211***	0.265***
	(0.0034)	(0.0194)	(0.0377)	(0.0259)	(0.0598)	(0.0084)	(0.0153)	(0.0144)	(0.0066)	(0.0120)	(0.0118)
time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	55,876	3,159	1,033	2,575	307	37,785	6,367	7,584	12,886	4,368	15,789
NACE	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
ln_empl	0.663***	0.699***	0.706***	0.753***	0.907***	0.830***	0.808***	0.861***	0.883	0.719***	0.689***
	(0.0164)	(0.0046)	(0.0745)	(0.0086)	(0.0596)	(0.0011)	(0.0114)	(0.0061)	(0)	(0.0134)	(0.0185)
ln_capital	0.414***	0.372***	0.451***	0.362***	0.240***	0.308***	0.331***	0.246***	0.245	0.314***	0.338***
	(0.0071)	(0.0085)	(0.111)	(0.0254)	(0.0133)	(0.0030)	(0.0059)	(0.0205)	(0)	(0.0042)	(0.0080)
time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4,552	12,619	135	5,773	1,304	17,969	10,929	3,212	52,269	13,256	8,108
NACE	**28**	**29**	**30**	**31**	**32**	**33**	**35**	**36**	**37**	**38**	**39**
ln_empl	0.794***	0.817***	0.976***	0.874***	0.760***	0.804***	0.763***	0.829***	0.657***	0.747***	0.375***
	(0.00783)	(0.0053)	(0.0377)	(0.0072)	(0.0100)	(0.0107)	(0.0125)	(0.0173)	(0.0149)	(0.0089)	(0.0236)
ln_capital	0.257***	0.276***	0.226***	0.269***	0.300***	0.322***	0.338***	0.195***	0.374***	0.347***	0.527***
	(0.0038)	(0.0040)	(0.0273)	(0.0054)	(0.0095)	(0.0204)	(0.0304)	(0.0343)	(0.0173)	(0.0234)	(0.0325)
time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	24,007	5,087	1,555	11,278	6,959	6,470	2,559	675	1,750	5,092	588
NACE	**41**	**42**	**43**	**45**	**46**	**47**	**49**	**50**	**51**	**52**	**53**
ln_empl	0.890***	0.806***	0.919***	0.848***	0.721***	0.732	0.847***	0.814***	1.034***	0.870***	0.877***
	(0.0049)	(0.0045)	(4.80e-07)	(0.0029)	(4.16e-07)	(0)	(0.0002)	(0.0491)	(0.0925)	(0.0021)	(0.0257)
ln_capital	0.230***	0.328***	0.264***	0.335***	0.393***	0.296***	0.321***	0.349***	0.248***	0.258***	0.356***
	(0.0077)	(0.0069)	(3.63e-06)	(0.0010)	(8.02e-06)	(8.15e-06)	(0.0001)	(0.0336)	(0.0745)	(0.0100)	(0.0470)
time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	60,833	21,343	81,826	57,137	141,005	170,451	45,561	592	387	16,472	2,266
NACE	**55**	**56**	**58**	**59**	**60**	**61**	**62**	**63**	**68**	**69**	**70**
ln_empl	1.046***	1.004***	0.815***	0.655***	0.755***	0.714***	0.885***	0.751***	0.740***	0.906***	0.880***
	(0.0084)	(0.0103)	(0.0024)	(0.0374)	(0.0420)	(0.0123)	(0.0069)	(0.0347)	(0.0190)	(0.0082)	(0.0092)
ln_capital	0.206***	0.210***	0.399***	0.399***	0.501***	0.381***	0.291***	0.430***	0.323***	0.376***	0.345***
	(0.0061)	(0.0033)	(0.0337)	(0.0586)	(0.0172)	(0.0140)	(0.0075)	(0.0252)	(0.0134)	(0.0073)	(0.0323)
time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	15,952	61,874	10,289	2,692	1,245	3,944	21,796	3,990	41,672	27,692	17,220
NACE	**71**	**72**	**73**	**74**	**75**	**77**	**78**	**79**	**80**	**81**	**82**
ln_empl	0.734***	0.817***	0.948***	0.912***	1.011***	0.584***	0.819***	0.814***	0.824***	0.840***	0.847***
	(0.0061)	(0.0066)	(0.0377)	(0.0156)	(0.0384)	(0.0149)	(0.0065)	(0.0076)	(0.0104)	(0.0051)	(0.0030)
ln_capital	0.376***	0.307***	0.375***	0.301***	0.266***	0.567***	0.158***	0.256***	0.286***	0.257***	0.267***
	(0.0045)	(0.0364)	(0.0160)	(0.0310)	(0.0144)	(0.0426)	(0.0175)	(0.0333)	(0.0120)	(0.0036)	(0.0207)
time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	31,639	5,659	9,046	5,297	1,127	5,713	6,505	4,960	13,761	16,582	16,262

Note: Results are reported only for industries with MA cases.

Table 11
Propensity score – estimation results

labourprod	0.0599***	L.labourprod	0.0581***
	[0.0069]		[0.0070]
leverage	-0.0005*	L.leverage	0.0002
	[0.0003]		[0.0003]
collateral	0.0044***	L.collateral	-0.0000
	[0.0009]		[0.0009]
profit	-0.0006**	L.profit	-0.0010***
	[0.0002]		[0.0002]
salesgrowth	-0.0001	L.salesgrowth	-0.0003***
	[0.0001]		[0.0001]
profit_sq	0.0000	L.profit_sq	-0.0000*
	[0.0000]		[0.0000]
leverage_sq	0.0000	L.leverage_sq	-0.0000
	[0.0000]		[0.0000]
collateral_sq	-0.0000***	L.collateral_sq	-0.0000
	[0.0000]		[0.0000]
d_small	-0.5874***	d_exporter	0.0153
	[0.0154]		[0.0139]
d_medium	-0.2488***	d_foreign	-0.0203
	[0.0149]		[0.0139]
d_large	0.1938***	age FE	yes
	[0.0256]		
industry FE	yes	year FE	yes
Observations	2,963,888		

Figure 13
QQplot – propensity score of treated and control firms

Note: The graph plots the estimated parameters of treatment impact with a 90-per cent confidence interval on log average wages for the two models. Standard errors are clustered by 2-digit NACE. T is the time of acquisition.

Table 12

Characteristics of acquirers – by type of acquisitions

	Mean characteristics of Acquirers					
	all	horizontal	non-horizontal	MA in recession	high pre-MA productivity	supplier link
Operating profit	8.53	8.63	8.45	8.32	11.95	7.69
Log Labour productivity	8.798	8.856	8.753	8.904	9.241	9.106
Log TFP	5.68	5.70	5.66	5.73	5.99	5.64
Log average wage	7.756	7.833	7.696	8.043	7.944	8.457
Log real value added	11.90	11.96	11.86	12.02	12.41	12.69
Log Nu of employees	3.106	3.104	3.107	3.114	3.170	3.587
Leverage	59.34	60.93	58.09	58.95	57.84	60.49
	Mean of the term capturing the mechanical impact of acquisition					
	all	horizontal	non-horizontal	MA in recession	high pre-MA productivity	supplier link
Operating profit	-0.85	-1.01	-0.72	-0.81	-1.58	-0.83
Log Labour productivity	-0.090	-0.102	-0.079	-0.057	-0.122	-0.088
Log TFP	-0.13	0.15	-0.12	-0.11	-0.15	-0.11
Log average wage	-0.027	-0.030	-0.024	-0.036	-0.033	-0.024
Log real value added	0.172	0.212	0.138	0.152	0.154	0.199
Log Nu of employees	0.287	0.338	0.242	0.235	0.300	0.295
Leverage	-0.693	-1.040	-0.405	0.180	0.469	0.797

Table 13

Revaluation on the sample 2017–2021

Revaluation on:	p50	#Nu
Revaluation of total assets	-32 536	510
Revaluation of capital	-4 649	510
Revaluation of TA, as % of TA	-7.8	510
Revaluation of capital, as % of TA	-1.3	510
Revaluation of capital, as % of capital	-4	509

Table 14

Change of capital and total assets in targets' BS in the year of acquisition (2017–2021)

	p50	mean	#Nu
Total assets	-458	47,999	495
Capital	-67	-5,384	495
Total assets as % of TA	-2.2	-12	493
Capital as % of TA	-0.1	-3	493

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