M&A and Macroeconomic growth

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Abstract

During 1985-2018, mergers and acquisitions were 9% of annual GDP; the peak of 30% occurred in the second quarter of 1998. This paper examines the role of mergers and acquisitions in long-run productivity growth. Using long-run recursive identification, my results suggest that M&A plays an important role in long-run growth. In particular, I estimate that about 30% of variation in M&A trade values is associated with the long-run productivity shocks. This finding suggests that restricting M&A without further analysis of its role in long-run growth might have unintended consequences on productivity growth. However, I find little evidence that M&A independently is the source of long-run growth.

Keywords: ??

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1 Introduction

Recently, the attention of policymakers and scholars has shifted once again towards mergers and acquisitions (M&A). In light of the recent evidence documenting the aggregate trends of increasing markups, corporate profits, the declining share of labor payments, and declining business dynamism, the U.S. Congress encouraged the Federal Trade Commission (FTC) and the antitrust division of the Department of Justice (DOJ) to increase scrutiny of M&A. In response, FTC and DOJ called for a revision of horizontal and vertical M&A guidelines.[1] In this paper, I investigate the role of M&A in aggregate productivity growth. In particular, I ask the following research question. How important is M&A in understanding the aggregate productivity growth?

I analyze a time series of aggregate M&A deal values with various productivity measures using VAR analysis to answer the above research question. I use long-run recursive identification method along the lines of Blanchard and Quah (1989) to identify long-run productivity shocks and understand the role of M&A in productivity growth process.

My findings suggest that M&A is an important part of the long-run productivity growth process. When productivity is measured using only labor, around 30% of variation in M&A is associated with the long-run productivity shocks. Under the multifactor productivity measure, this figure becomes about 16% but remains economically significant.

In general, there are two types of M&A. A merger is vertical when involved firms are in the same supply chain. Such a merger is often regarded as beneficial, for example, due to the elimination of double marginalization or saving associated with the

[1] See Rose and Shapiro (Rose and Shapiro).

elimination of transaction costs. However, a substantial concern with such a merger is that it might encourage acquirer firms to exert market power on their direct (or indirect) competitors through acquired upstream firms (usually using exclusionary contracts). A horizontal merger occurs when involved firms are operating within the same market. Often, horizontal mergers are considered to be less beneficial than vertical one.[2] The central issue in merger analysis is balancing efficiency-enhancing effects due to synergies between merged firms and anticompetitive price effects stemming from an increase in the market power of the acquirer firm.

In my analysis, I abstract from such micro-founded issues and investigate the role of M&A in aggregate productivity on a macroeconomic level. The benefit of using aggregate-level data is that it allows me to abstract from firm-specific granular details and concentrate on quantifying the relationship between M&A and macroeconomic growth. However, the limitation that comes with this approach is that it does not allow me to disentangle potentially important factors, such as, inbound and outbound M&A.[3]

In terms of microeconomic theoretical work, Perry and Porter, 1985; Farrell and Shapiro, 1990; Levin, 1990; McAfee and Williams, 1992 are classical references that study the effects of horizontal merger in Cournot models. Deneckere and Davidson (1985) analyze the merger effects in the case of Bertrand competition. An interesting implication that Farrell and Shapiro (1990) show is that if a merger does not involve synergies (hence only involves the reallocation of resources), it will necessarily increase markups of the merged firm.

The evidence from applied microeconomic literature is mixed. Blonigen and Pierce

[2] Regardless of merger type, it is generally considered that over the past 40 years, the merger policy has become much more permissive than it used to be in periods 1950-1980. See Whinston, 2008; Shapiro, 2019.

[3] This is especially important in the context of taxation of multinationals. See, for example, Harris and O'Brien (2018).

(2016) finds no evidence on plant- and firm-level of such gains but finds a significant increase in the market power of the post-merger firm. Furthermore, Ashenfelter et al. (2013) find a large post-merger price increase for clothes dryers. Similarly, Ashenfelter and Hosken (2010) find that four out of five mergers resulted in increased prices. In a case study of ready-mixed concrete plants, Hortaçsu and Syverson (2007) find that vertically integrated plants tend to be more productive and enhance efficiency through leveraging economies of scope. Furthermore, using plant-level data from the U.S. Census of Manufacturers, Maksimovic and Phillips (2002) find that a transfer of assets through M&A leads to an increase in plant-level productivity and hence results in more efficient allocations. However, more recently, Blonigen and Pierce (2016) finds no evidence on plant- and firm-level of such gains but finds a significant increase in the market power of the post-merger firm.

Studies that explore the issue on a macroeconomic level emphasize the role of reallocation of resources between firms through M&A. For example, Mulherin and Boone (2000) study acquisition and divestiture activities during the 1990–1999 period. They find the evidence supporting acquisitions responding to macroeconomic shocks that entail restructuring and reallocation of resources. Similarly, Jovanovic and Rousseau (2002) analyze mergers and acquisitions along the lines of q–theory of investment. The theory says that firms increase investment when q (market value of the firm divided by the cost of replacing its capital) increases. They argue that high-q firms buy low-q firms. Therefore, they view merger waves as reallocation waves. In contrast, Rhodes-Kropf and Robinson (2008) formulate a model where mergers are driven by complementarities between assets where firms with similar levels of productivity enjoy the largest synergies. Finally, David (2020) using the search and matching model investigates the aggregate implications of M&A. His finding suggests a sizable contribution to long-run output and consumption; however, his model does not feature imperfect competition and market power.

My paper contributes to the literature discussed above that studies the role of M&A on a macroeconomic level. The paper's key contribution is to gain insights into the relationship between M&A and aggregate productivity growth by imposing as few structural and behavioral assumptions as possible.

The rest of the chapter is organized as follows. The next section discusses data and empirical methodology. Section 3 presents main findings. Section 4 concludes.

2 Data and empirical specification

The data on merger and acquisitions deal values comes from the Institute of Mergers, Acquisitions, and Alliances (IMAA) which provides aggregated M&A data in dollar values. IMAA is a non-profit organization that collects data both on public and private firms and uses other sources as well.[4] Unfortunately, the dataset reports aggregated inbound and outbound M&A values. Therefore, I cannot explore a potentially different effects of inbound and outbound M&A. I apply a variant of Census' X-13 for seasonal filtering of the raw M&A series.[5] Finally, I annualize seasonally adjusted M&A quarterly series to be compatible with U.S. Bureau of Labor Statistics (BLS) data.

Figure 1 plots M&A deal values as a percent of nominal GDP over the period 1985-2020. On average, mergers and acquisitions are approximately 9% of GDP over the sample period. The peak of 30% occurs around the second quarter of 1998. Finally, the data features well-documented waves of mergers and acquisitions.

The aggregate macroeconomic time series comes from FRED. I use the output for all employed persons in non-farm business sector, hours worked for all employed

[4] For example, from Deloitte, KPMG, US M&A Technology, and PWC.
[5] See Yvan (2022).

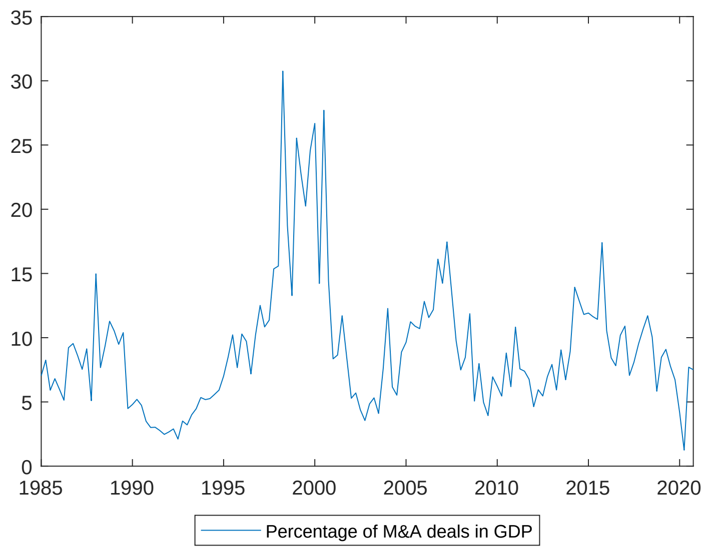

Figure 1: M&A deal values in percentages of GDP.

persons in non-farm business sector and multifactor productivity for private non-farm businesses.

Using output for all employed persons in non-farm business sector I calculate output growth percentages as $\Delta y_t^{NFB} = 100(\log(Y_t^{NFB}) - \log(Y_{t-1}^{NFB}))$, where Y_t^{NFB} is non-farm business output. I measure the average productivity of labor as $apl_t = \log(Y_t^{NFB}) - \log(HW_t)$, where HW_t is total hours worked per capita. Corresponding growth percent is calculated as $\Delta apl_t = 100(apl_t - apl_{t-1})$. I measure hours worked per capita as $hw_t = \log(HW_t) - \log(POP_t)$, where POP_t is population obtained from FRED as well. Finally, I also use the multifactor productivity series from FRED; however, the frequency of the series is only available at the annual level. Figure 2 plots the series described above. According to the figure, the time series appear to be stationary, except for hours worked per capita as in Gali (2005).[6]

[6] The use of nonstationary time series of hours worked can result in an estimated nonstationary VAR model. In what follows, all the results reported in this chapter that involve hours worked are from estimated stationary VAR model.

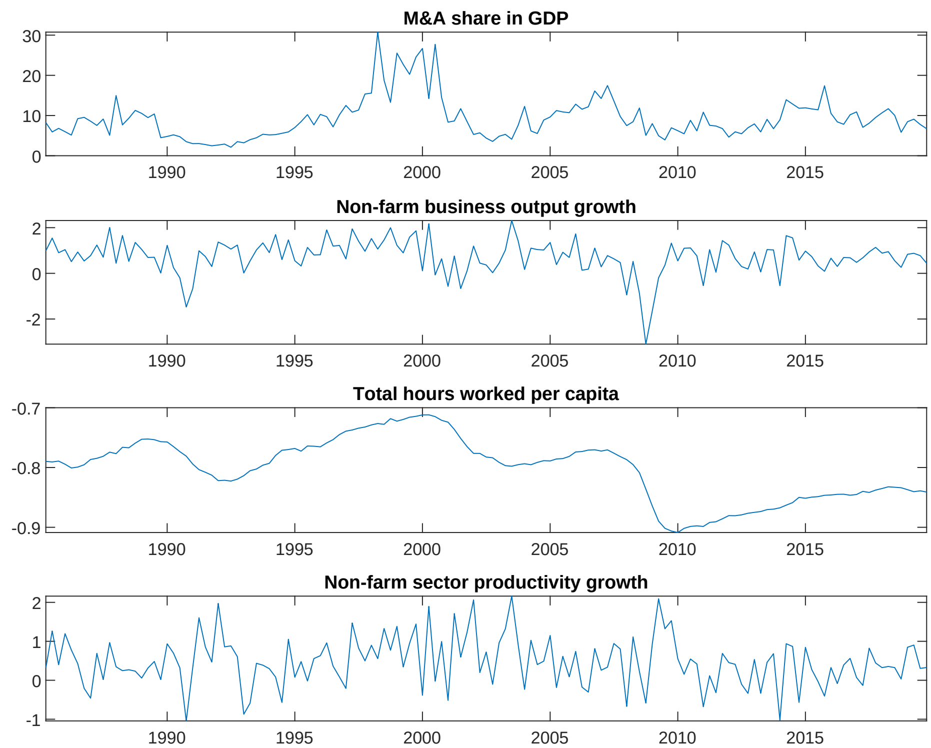

Figure 2: Time series of key variables used in the analysis.

Next, I turn to empirical model specification and discuss the identification method. I use the long-run identifying scheme along the lines of Blanchard and Quah (1989) to explore how M&A reacts to long-run permanent macroeconomic growth. Additionally, I use a short-run recursive identification as an alternative way to explore the relationship between M&A on productivity growth. I will lay out a general framework before turning to the details of the above identification schemes.

Let z_t be K–dimensional vector generated by a reduced-form, stationary VAR(p) process

$$A(L)z_t = u_t, \tag{1}$$

where $A(L) = I + A_1 L + \cdots + A_p L^p$ is matrix polynomial in the lag operator and u_t is a vector of reduced-form errors. Corresponding structural representation is given by

$$B(L)z_t = w_t, \tag{2}$$

where w_t is a vector of uncorrelated, unit-variance structural shocks and $B(L) = B_0 + B_1 L + \cdots + B_p L^p$ is matrix polynomial in the lag operator. The relationship between structural and reduced-form representation of z_t is given by $B(L) = B_0 A(L)$. Since we only observe (1) but are interested in the effect of structural shocks in (2) the problem of identification boils down to pinning down B_0 matrix.

Turning to identification schemes, first, I use long-run identification scheme in spirit of Blanchard and Quah (1989). In particular, let $z_t = (\Delta gdp_t, hw_t, m_t)'$ be a stationary process, where hours worked per capita, hw_t, and M&A as a percent of GDP, m_t, are $I(0)$ but the GDP process is assumed to be $I(1)$. The effects of structural shocks, w_t, on z_t is summarized by the structural MA representation of (2):

$$z_t = \Theta(L)w_t, \tag{3}$$

where $\Theta(L) = B(L)^{-1}$. The key identifying assumption is that only TFP shocks affect the level of GDP in the long run and that M&A shocks do not affect hours worked per capita in the long run. The idea behind the above assumption is to view long-run growth as driven only by permanent productivity shocks, while shocks to hours worked or M&A are only transitory. These exclusion restrictions are implemented by imposing a lower-triangular structure on the matrix of long-run cumulative effects, $\Theta(1)$. Intuitively, restricting the structure of $\Theta(1)$ achieves identification by imposing an implicit restrictions on B_0 since $\Theta(1) = A(1)^{-1}B_0^{-1}$.

Second, as an alternative way to investigate the effects of M&A on the aggregate economy, I use a short-run recursive identification scheme. In particular, I impose a lower-triangular structure directly on B_0 in a bivariate VAR(p) model where the last component of z_t is M&A share in GDP.[7] The key identifying assumption can be stated as follows. The synergies promised by M&A need more than a quarter to materialize.

3 Main results

This section is organized into two parts. First, using the long-run recursive identification, I report the main results that explore and quantify the role of productivity growth in explaining the dynamics of M&A. Next, I use a short-run recursive identification as an alternative way to investigate the effects of M&A on the aggregate economy.

The role of productivity growth in M&A. To explore the importance of M&A in productivity growth, I use the long-run recursive identification scheme in a 3–

[7]In what follows, I will employ different variables placed in the first component of vector z_t. I will specify what the variable of interest in each application is.

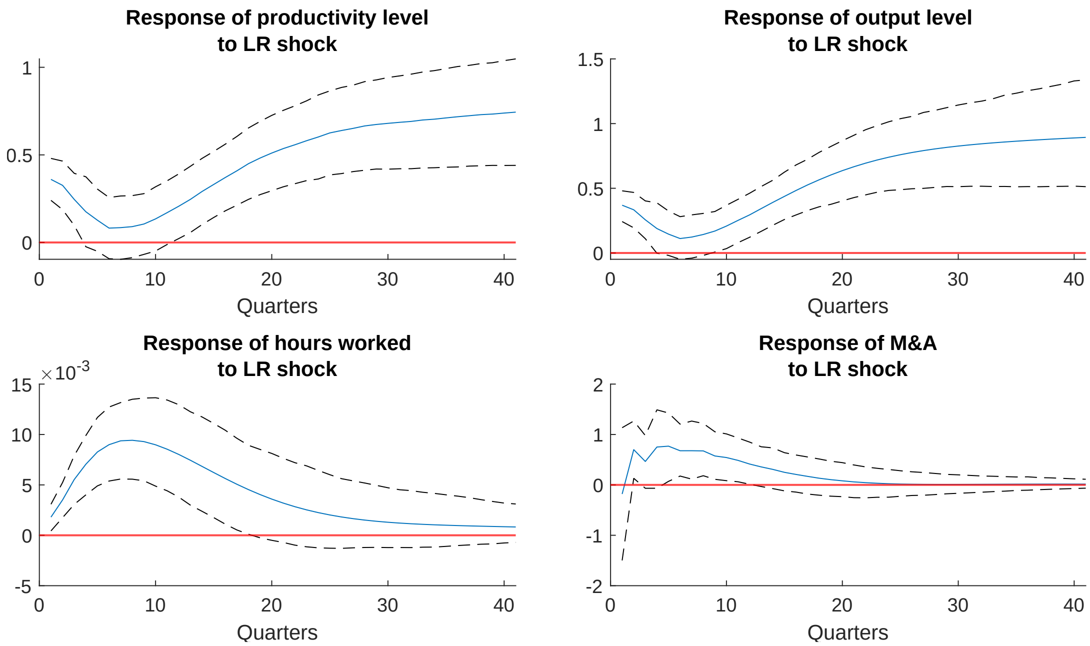

Figure 3: Structural impulse response functions, $z_t = (\Delta apl_t, hw_t, m_t)'$.

dimensional VAR(4) model with $z_t = (\Delta apl_t, hw_t, m_t)'$, where Δgdp_t is the percentage growth of non-farm output, hw_t is total hours worked per capita and m_t is M&A as a percent of GDP. Figure 3 plots the structural impulse response functions on a productivity shock that raises the long-run productivity level permanently. The productivity shock generates an initial increase in the productivity and output levels followed by decrease for about 7 quarters. Similarly, hours worked and M&A activity increase, followed by a gradual decline over longer horizons. Notice that the response of M&A lags the response of productivity on the long-run shock. This suggests that M&A plays an important role in the long-run growth process, presumably through the reallocation of resources among firms.[8]

To quantify the role of M&A in long-run growth, Figure 4 plots the variance

[8]The above results are robust to VAR order selection (VAR(2) and VAR(6) specifications yield similar results) and are not driven by the great recession.

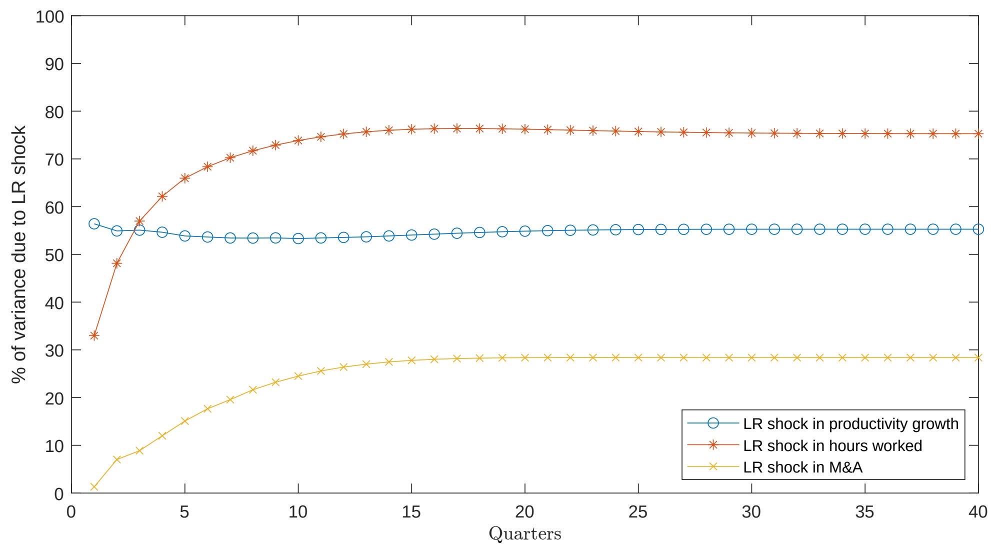

Figure 4: Variance decomposition, $z_t = (\Delta apl_t, hw_t, m_t)'$.

decomposition of M&A along with total hours worked per capita and productivity. About 30% of variation in response of M&A is due to long-run productivity shock, highlighting that M&A is a significant part of the long-run growth process. Not surprisingly, the long-run shock plays a major part in explaining movements in productivity and hours worked. Notice that the long-run shock explains little in the initial movements of M&A; however, in 6 quarters, almost one-fifth of the variation in M&A forecast error is due to the long-run shock.[9] This further suggests the lagged response of M&A to the productivity shock, meaning that M&A follows the productivity process rather than leads it.

A possible explanation of the above-discussed results is as follows. When there is a shock that permanently increases productivity, new possibilities become available. In response, workers start diverting their efforts from production into technological augmentation; hence the hours worked increase and output decreases (at least does

[9]Often, I will refer to impulse response functions as forecasts since they correspond to the estimated response of endogenous variables to a one-time structural shock.

not immediately increase to the new long-run level). When innovation arrives, there are new ideas that firms can build upon and consolidation through M&A facilitates the process of materialization of such new ideas. However, it takes time before the new ideas result in higher productivity and output. Therefore, we see the sluggish response of M&A to a technological shock.

Next, I report the results when productivity is measured using multifactor productivity (MFP) that relates output to inputs such as capital, labor, energy, materials, and services (KLEMS). This provides a more accurate measure of productivity than the one measured by only labor inputs. Unfortunately, the time series for MFP is only available at the annual frequency; hence the benefit of using a better measure of productivity comes at the cost of losing about a quarter of the sample size. Figure 5 plots impulse response functions in such case. We see a similar pattern as before, an initial decrease in the productivity and the output level followed by an increase over the longer horizon. Finally, M&A also follows a similar pattern as before – the initial increase in M&A activity followed by a gradual decrease over time. Naturally, the impulse response functions are less precisely estimated due to the smaller sample size. For example, in the case of the response of M&A to the long-run shock, the 90% confidence bounds include zeros. However, the joint hypothesis test that estimated impulse responses at each forecast horizon equals zero is rejected under 10% significance level.[10]

Figure 6 plots results from variance decomposition of key variables when MFP is used as a productivity measure. About 16% of variation in response of M&A is associated with the long-run productivity shock; this figure is about half of the previous estimate but remains economically large.

[10]The test statistic is 0.3314 while the lower critical value is $\chi^2_6 = 1.2373$ under 5% significance level. The test statistic is obtained using bootstrap method.

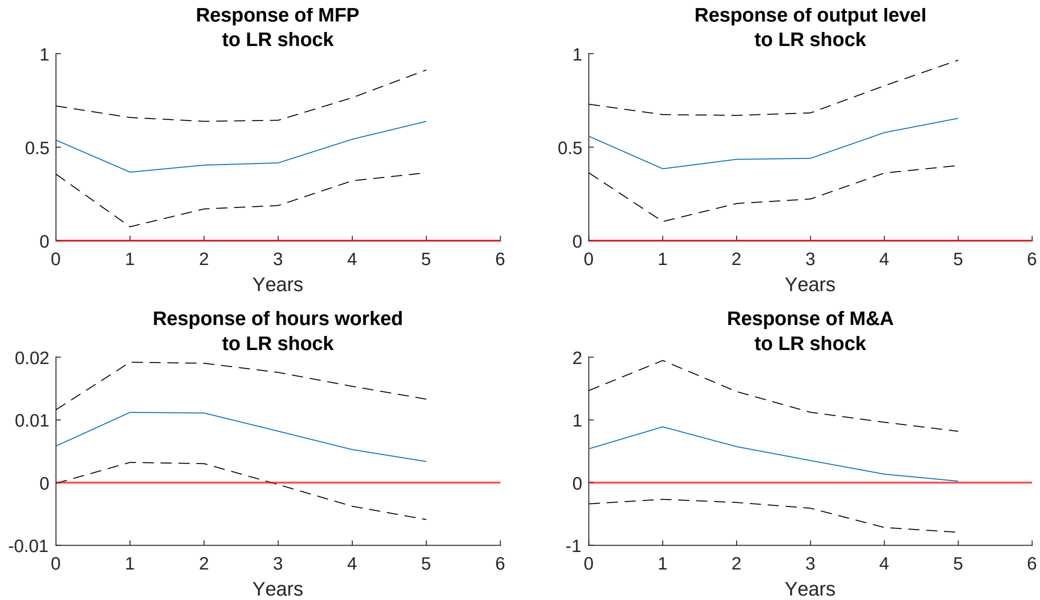

Figure 5: Structural impulse response functions, $z_t = (MFP_t, hw_t, m_t)'$.

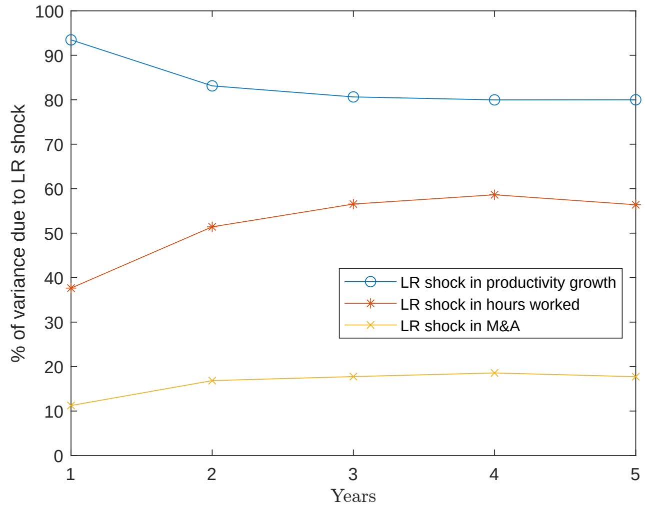

Figure 6: Variance decomposition, $z_t = (MFP_t, hw_t, m_t)'$.

The role of M&A in productivity growth. In the second set of results, as an alternative view of the data, I use short-run recursive identification to explore the role of M&A in macroeconomic growth.

The first specification that I investigate is the fourth-order VAR model with $z_t = (g_t^{NFB}, m_t)$ where g_t^{NFB} is the growth rate of output of the non-farm business sector and m_t is M&A as a percent of GDP. Figure 7 plots impulse response functions in this specification. The first column in the figure plots structural impulse response functions to M&A shock that increases the percentage of M&A in GDP by about 3%. Notice that, at the impact, output growth does not respond to M&A shock; this is due to the identification assumption. The output growth increases for a couple of periods but dies out after four quarters. This suggests some transitory synergies associated with the merger activity, at least in output growth.[11] However, the channel through which output grows is unclear. Later, I will explore how employment responds to mergers to address this issue.

The second column corresponds to impulse response functions to a productivity shock that raises the growth rate by about 0.6% on the impact. Even though this is not the focus of my analysis, the impulse response functions show that following a positive output growth shock, M&A activity increases significantly. Even though output growth shock dies out in about two years, the response of M&A is considerably sluggish.

Figure 8 plots the cumulative impulse response function of the output growth rate of the non-farm business sector to M&A shock to get a sense of how negative and positive movements balance out over time. The figure shows that a 3% increase in M&A activity is associated with a 0.3% increase in output level in a year; however,

[11] These results are robust when M&A share is calculated by deals value divided by the previous period's GDP. This means that movements in GDP do not drive the results.

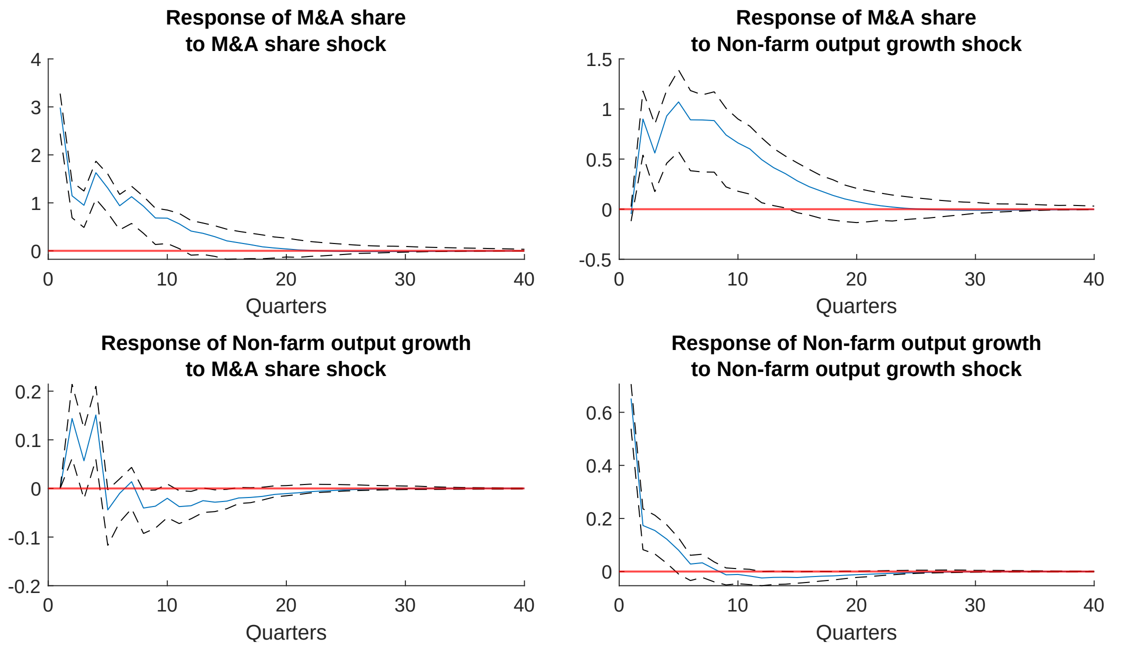

Figure 7: Structural impulse response functions of M&A and output.

the effect declines after that, suggesting a short-lived effect.

To explore the potential source of output growth, I examine the hours worked per capita. A simple hypothesis is that if hours decline when M&A activity increases, this further supports the hypothesis that M&A indeed involves some synergies. Figure 9 plots the impulse response functions in this specification. The lower panel of the first column shows that hours worked per capita increase following a sizable increase in M&A. This suggests that output growth in the short run following M&A stems from increased hours worked, while the decline in output growth over a longer horizon might be due to a decline in hours worked.

Next, I explore the effects of M&A on productivity growth. A simple (although imperfect) measure is the growth rate of labor productivity. Figure 10 plots corresponding impulse response functions. The response of labor productivity growth to M&A share shock exhibits an unreasonable pattern. In three quarters, labor pro-

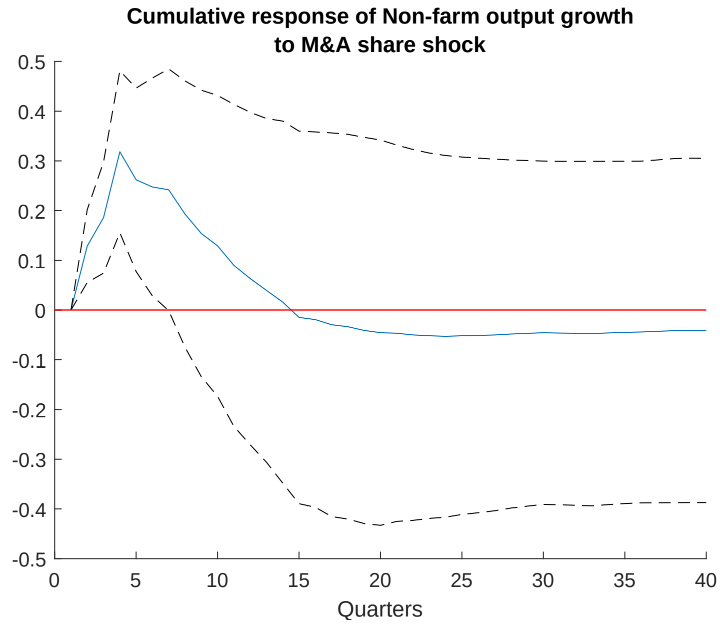

Figure 8: Impulse response function of output level to M&A shock.

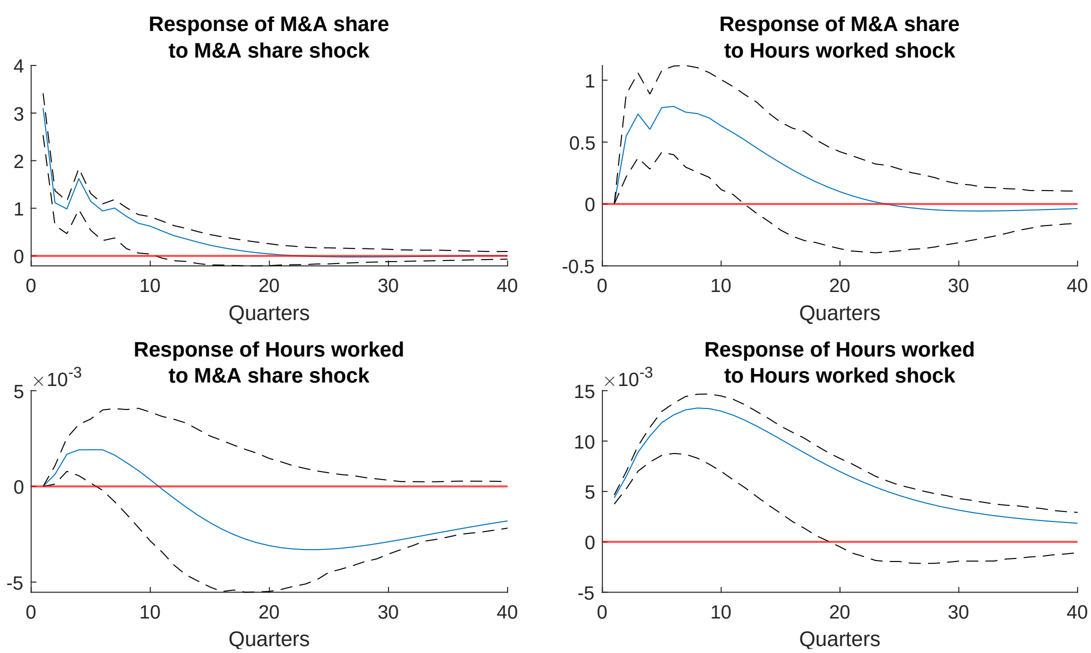

Figure 9: Impulse response functions of M&A share and hours worked per capita.

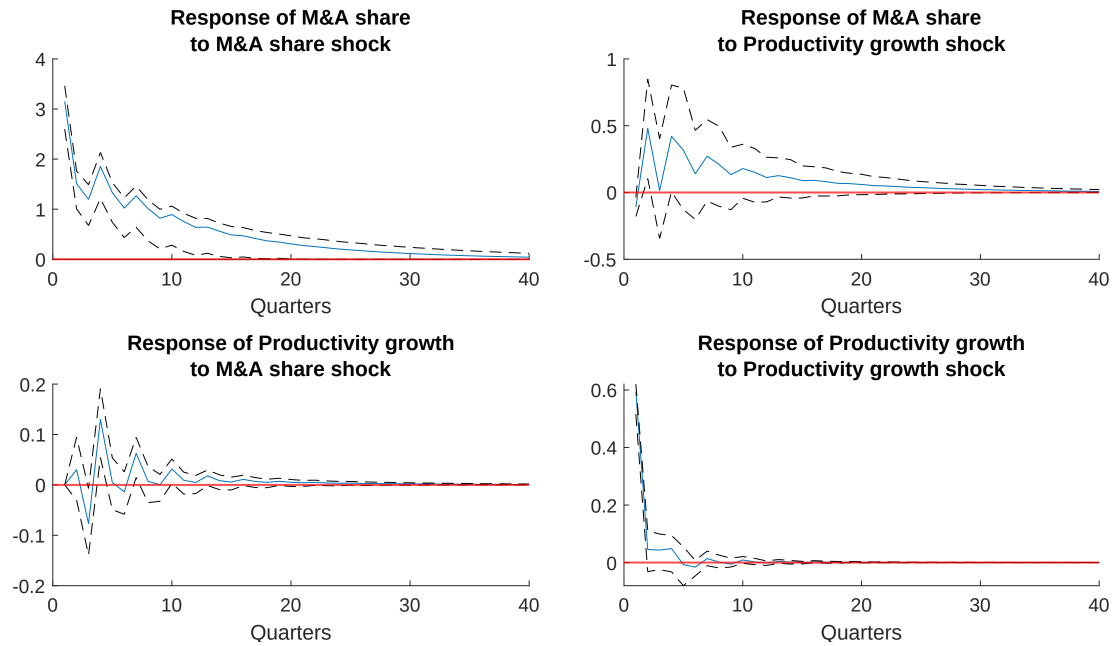

Figure 10: Impulse response functions of M&A share and growth rate of labor productivity.

ductivity substantially decreases while it increases by a large amount in the fourth quarter. This cyclical pattern continues for the rest of the quarters with diminishing magnitude. I interpret this result as follows. Since the labor productivity calculated above implicitly assumes that labor is the only input in the production, it does not account for other inputs (such as capital, equipment, and materials) in the production.

Finally, as in the case of long-run recursive identification, I use the multifactor productivity measure. Figure 11 plots structural impulse response functions of M&A share and MFP. In this case, there is no evidence that M&A shocks are associated with productivity enhancements.

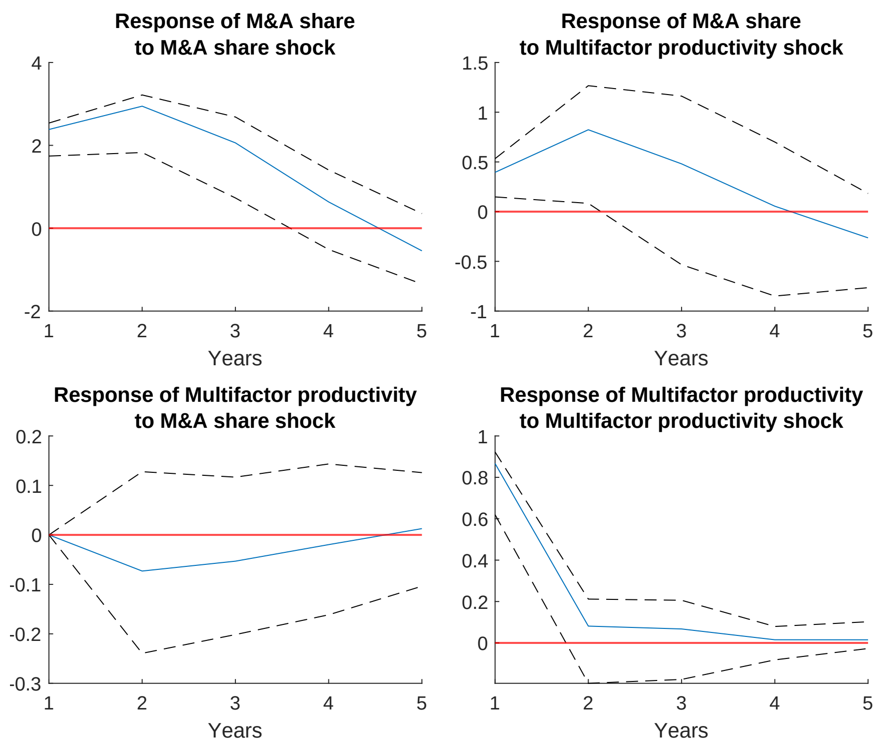

Figure 11: VAR(2) structural impulse response functions of M&A share and MFP.

4 Conclusion and further plans

This paper analyzes how M&A and productivity growth are related. Using the long-run identification scheme, the data suggests that M&A is an important component of the growth process. In particular, about 30% of variance in M&A forecast error is associated with long-run productivity shock. It appears that M&A lags the productivity growth rather than leads. A possible explanation is that M&A facilitates the process of building upon new ideas that become available after a permanent shock to productivity level.

Assuming that synergies associated with M&A take more than a quarter to realize, I use recursive identification to explore the effects of M&A. The results suggest that synergies following M&A shocks are most likely short-lived and increase output temporarily through an increase in hours worked.

Taken the above results together, the data suggest that M&A is an important channel through which long-run productivity growth is facilitated; however, it is less likely that M&A independently is the source of long-run growth.

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