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M&A waves, capital investment and Tobin's *q*

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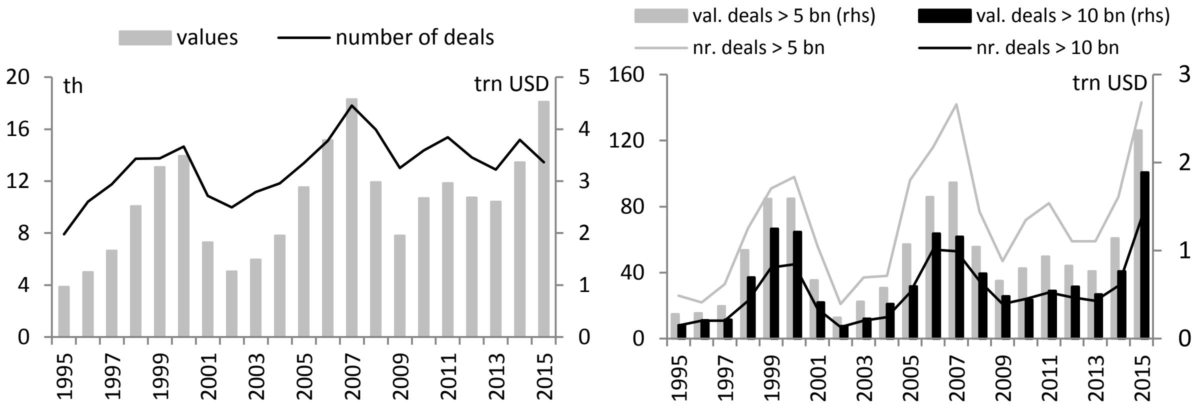
- Corporate mergers and acquisitions (M&A) are reaching an all-time high this year, with US-based transactions as always on the top.
- According to the neoclassical view, M&A waves occur as a result of shocks hitting specific sectors or the economy at large. Behavioral explanations see well-informed managers taking advantage of overvalued asset prices as a justification for M&A cycles. This paper argues that both approaches do not fully explain recent developments.
- Evidence for the US, based on a vector autoregressive model and Granger causality tests, shows that Tobin's *q* ratio drives M&A waves but fails to explain investment spending. At times of relatively high *q* ratios, a growing number of firms favors purchasing other firms over investing, and this creates a merger wave.

The appetite for dealmaking has been in the air. Although the number of deals this year is below the 2007 high, the nominal value of mergers and acquisitions (M&A) is reaching an all-time high, driven by numerous megadeals. Between January and November this year, the global M&A transactions amounted to USD 4.5 trn, only slightly below the 2007 peak of USD 4.6 trn. Also, megadeals of values above USD 5 bn and USD 10 bn, respectively, have surpassed last years' numbers (Fig. 1).

Among the largest transactions this year, Royal Dutch Shell PLC acquired BG Group PLC for USD 81 bn on April 10, Charter Communications Inc bought Time Warner Cable Inc for USD 78.3 bn on May 26, SABMiller accepted an offer worth more than USD 100 bn from Anheuser-Busch InBev on October 15, and Allergan announced on November 23 an all-stock merger with Pfizer valued at USD 160 bn, becoming the third biggest merger in corporate history.

Figure 1. Total value and number of global mergers and acquisitions, January to November.



Source: Thomson Reuters, Flossbach von Storch Research Institute.

In the economic literature, two main explanations (neoclassical and behavioral in nature) of the M&A waves have mainly been discussed. As shown below, there is clear evidence against them. This paper argues that Tobin's *q* is the driving force of M&A waves. Tobin's *q* was originally introduced to explain when it pays for a firm to invest in capital equipment to expand its existing business. However, in an empirical analysis with a vector autoregressive model and Granger causality test for the US economy between the first quarter of 1995 and the third quarter of 2015, we show that Tobin's *q* fails to explain private capital investment, but drives the last three waves of M&A.

These results suggest that the effects of monetary policy are different from those generally expected by central bankers. They reckon that monetary policy has an impact on stock market prices and market valuations, which are the basis for calculation of the *q* ratio. Ben Bernanke stated this as follows: "monetary policy actions have their most direct and immediate effects on the broader financial markets, including the stock market, government and corporate bond markets, mortgage markets, markets for consumer credit, foreign exchange markets, and many others."[1] Bernanke and Kuttner (2003) focused on changes in monetary policy unanticipated by market participants and found a significant although limited effect of these changes on the stock market: a loosening of monetary policy leads investors to view stocks as safer investment and thus to accept lower returns. As a consequence, stock prices rise.[2] "[H]igher stock prices effectively reduce the cost of capital for firms, stimulating increased capital investment."[3] The results of this paper show that easing monetary policy stimulates more M&A transactions rather than capital investment.

What explains M&A waves?

The main competing explanations of the M&A waves advanced in the literature refer to either neoclassical or behavioral theory. According to the neoclassical view, M&A transactions are

[1] Bernanke Ben (2003). Monetary policy and the stock market: some empirical results. Remarks by Governor Ben S. Bernanke at the Fall 2003 Banking and Finance Lecture, Widener University, Chester, Pennsylvania.

[2] Bernanke Ben, Kuttner, Kenneth (2003). What explains the stock market's reaction to Federal Reserve policy? Federal Reserve Bank of New York Working Paper, October.

[3] See the reference in footnote 1.

rational reactions of market participants to shocks (economic, regulatory, or technological), which trigger the need of structural adjustment at the industry level. If these impulses coincide with or contribute to low transaction costs – driven by high "capital liquidity" – corporations find it convenient to reallocate assets, with the consequence that M&A deals tend to concentrate in size and in short periods of time.[4]

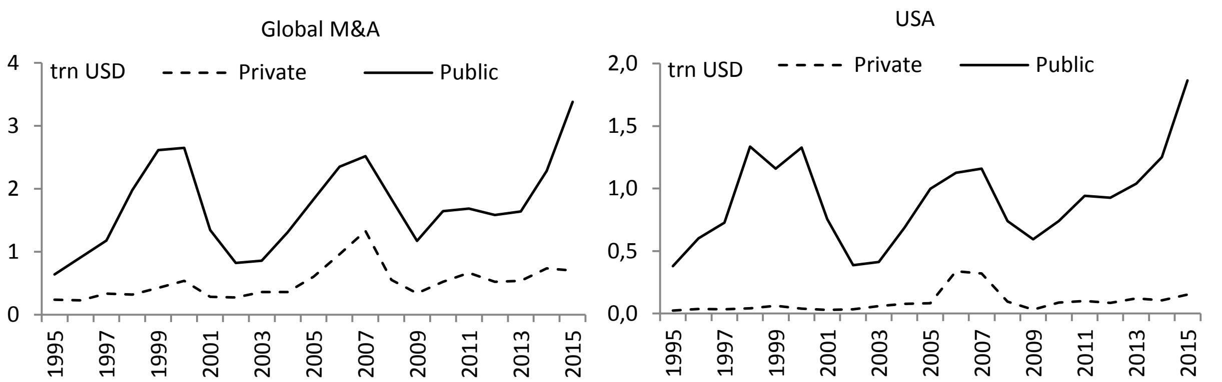
The second explanation originates from behavioral finance and postulates that during bull markets driven by irrational investors, rational managers take advantage from their overvalued stocks to acquire less overvalued or undervalued companies.[5]

Both explanations suffer from important deficiencies, which can be easily exposed. Regarding the neoclassical explanation, if industry-specific or common economic, regulatory or technological shocks were underlying the merger waves, we would observe intensified M&A activity not only for publically listed but also private companies.

This is contradicted by the evidence shown in Figure 2. Measured in terms of the total value of transactions, M&A deals by companies listed on stock exchanges exhibit clear waves around the year 2000, 2007 and 2015. For the private deals, only a small peak is evident around the year 2007, the year in which many smaller firms from the financial sector participated in numerous M&A deals of rather small value. All this is true for global deals and even more for M&A involving US-based acquiring companies.

Although there are studies finding support for the behavioral theory, mostly by using some measure of firm overvaluation,[6] Harford (2005) provides evidence of a strong positive correlation between cash-financed and stock-financed M&A activity. This contradicts the behavioral hypothesis, which sustains that there should be no other reason for an M&A wave than the opportunity taken by managers to use

Figure 2. Total amount of mergers and acquisitions of private and listed companies (acquirers), January to November.



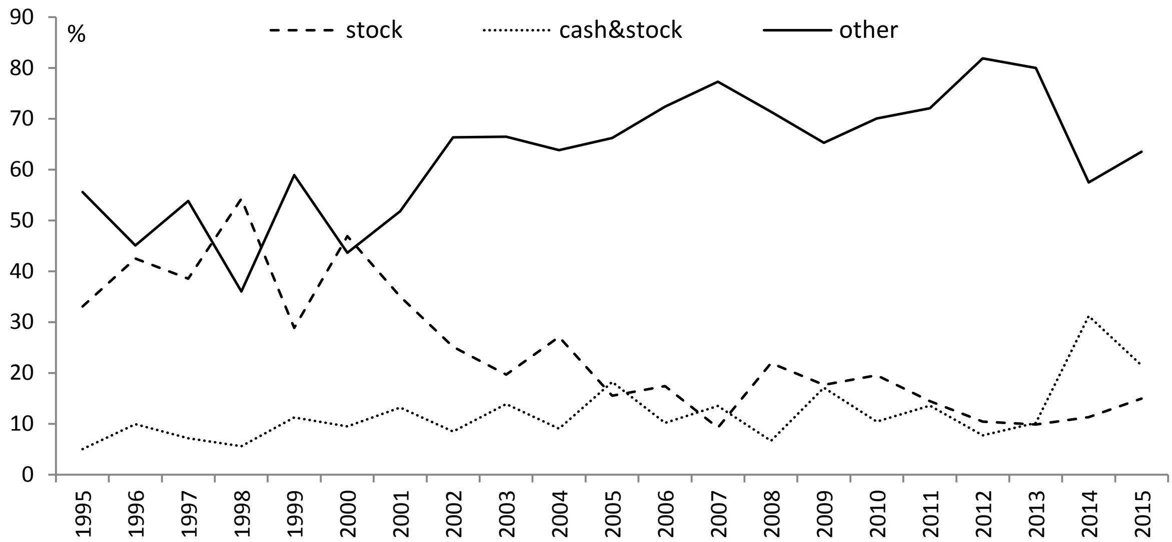
Source: Thomson Reuters, Flossbach von Storch Research Institute.

[4] The hypothesis originates from Gort, Michael (1969). An economic disturbance theory of mergers. *Quarterly Journal of Economics* 83, 623–642. For a more recent analysis, see Harford, Jarrad (2005). What drives merger waves? *Journal of Financial Economics* 77(3): 529-560.

[5] See Shleifer, Andrei and Vishny, Robert (2003). Stock market driven acquisitions. *Journal of Financial Economics* 70(3): 295-311.

[6] See, for instance, Rhodes-Kropf, Matthew, Robinson, David T., Viswanathan S. (2005). Valuation waves and merger activity: the empirical evidence. *Journal of Financial Economics* 77(3), 561-603; and Dong, M., Hirshleifer, D., Richardson, Scott, Hong Teoh Siew (2006). Does investor misevaluation drive the takeover market? *Journal of Finance* 61(2), 725-762.

Figure 3. Percentage shares of M&A deals financed with stock, cash & stock and cash.



Source: Bloomberg, Flossbach von Storch Research Institute.

overvalued stocks to acquire less overvalued firms.

This thesis is rejected by more recent evidence illustrated in Figure 3, which shows a declining share of stock-financed deals. More specifically, after 2001 a higher share of all M&A deals were cash- and/or debt-financed than stock-financed. Between January and November this year, only 15% were financed with shares, almost 22% were financed with cash-and-stock solutions, and 64% were financed in ways not involving shares.

While neither of the two hypotheses is able to unequivocally explain why M&A waves occur, Tobin's q offers a more convincing explanation. According to this hypothesis a firm's investment is determined by a ratio dubbed *q*, which is defined as:

$$q = \frac{\text{market value of installed capital}}{\text{replacement cost of installed capital}}.$$

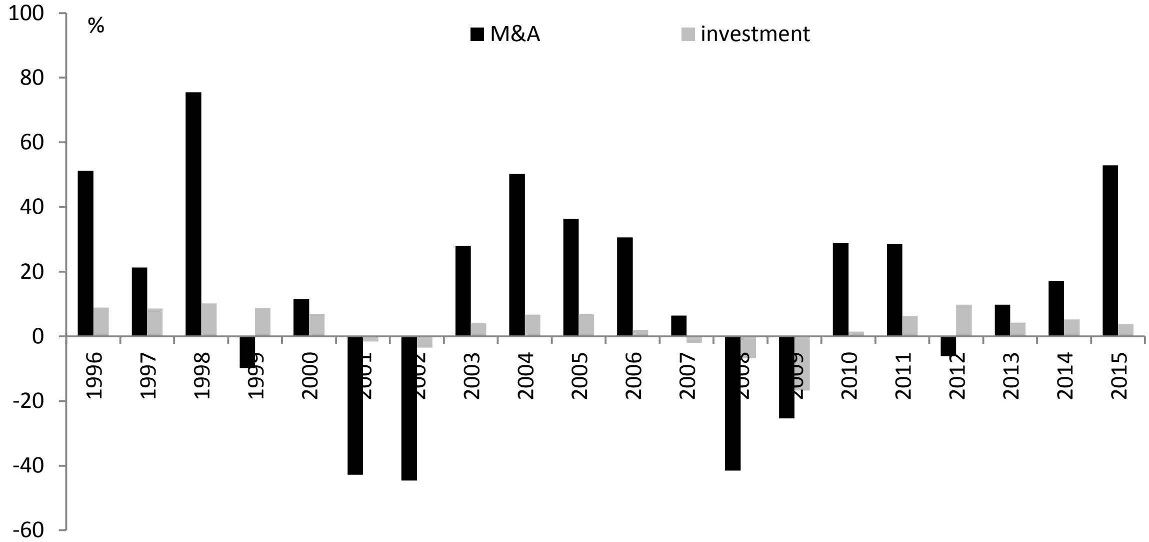
If the market value of installed capital, which is set by the stock market valuation of the company, exceeds the replacement cost, a firm has two choices: (1) it can build new capital, or (2) it can buy existing capital through an M&A deal.

Why should firms opt for M&A instead of building new capital equipment? The reason is the relatively higher uncertainty associated with new capital construction. Moreover, M&A activity implies a high fixed cost but low marginal costs (Jovanovic and Roussea, 2002).[7] As long as acquirers find target firms with convenient market valuation, it is more economical to invest in at least ex-ante surer projects rather than to begin new ventures with unknown outcome.

All this doesn't imply that there must be a trade-off between M&A activity and capital investment. Indeed, the evidence of the past decades shows that investment activity was moving pro-cyclically as well. However, the shape of investment waves was always much less pronounced than the shape of the M&A waves, implying a relatively higher

[7] Jovanovic, Boyan, Rousseau Peter L. (2002). The q-theory of mergers. *American Economic Review Papers and Proceedings* 92(2), 198-204.

Figure 4. Growth rates of M&A transaction volumes and of private fixed capital investment in the USA.



Source: Haver Analytics, Thomson Reuters and Flossbach von Storch Research Institute.

attractiveness of M&A deals at times with high q (Fig. 4). M&A is attractive in periods of a relatively high aggregate and more dispersed q when a growing number of firms with a high q seek quick and lucrative market opportunities among firms with a relatively lower q (Jovanovic and Sousseau, 2002). As a consequence, Tobin's q should be powerful in explaining the M&A waves, but not necessarily the investment waves.

Tobin's *q*, M&A and capital investment waves – empirical evidence

To empirically test the hypothesis that Tobin's q is able to explain M&A but not investment waves, we use vector autoregressive (VAR) models and Granger causality tests for a sample of US quarterly data, ranging from 1995q1 to 2015q3. The choice of the US is driven by the dominance of US corporations in M&A waves as well as by data availability for Tobin's q, or precisely the equity q.[8] This variable is calculated by the Federal Reserve for the US economy and published quarterly in the "Flow of Funds Accounts of the United States Z1", and is not available for other countries.

The empirical VAR(p) model assumes the following general form:

$$\mathbf{y}_t = \mathbf{v} + \mathbf{A}_1\mathbf{y}_{t-1} + \cdots + \mathbf{A}_p\mathbf{y}_{t-p} + \mathbf{u}_t \qquad (1)$$

where $\mathbf{y}_t$ is a vector of K variables, modeled as a function of p lags of those variables. In the present paper, two separate VAR models are estimated, with $\mathbf{y}_t$ referring to M&A transaction volumes and the q ratio in the first model (called *M&A-q*), and to capital investment and the q ratio in the second model (called *invest-q*). The vector $\mathbf{v}$ collects the constant term and $\mathbf{u}_t$ the idiosyncratic error terms.

The quarterly observations on total M&A transactions for the US economy were calculated based on data obtained from Thomson Reuters. We concentrate on the values of transactions, where the acquirer is a

[8] Tobin's q originally introduced by the Nobel Laureate James Tobin was defined to include corporate debt. Equity q is calculated excluding corporate debt and is commonly used as a valid method to value the stock market. It is in this form that it is calculated by the Federal Reserve.

publically listed company. Data for fixed capital investment are taken from Haver Analytics.

In order to test for the causal relationship between M&A/investment and the *q* ratio, the Granger causality test was performed. For each equation in the VAR model, under the null hypothesis, the estimated coefficients on covariates are jointly zero, meaning that the variables on the right hand side of the equation do not Granger-cause the variable on the left hand side.[9]

Since the VAR models are over-parameterised systems, the meaning of individual parameters is blurred. Their estimation, however, is a basis for the application of other methods, namely, Granger causality tests and impulse response analyses. In the following, we concentrate on the interpretation of the results from these two methods. The detailed results from the VAR estimations are reported in Table A.3 in the Appendix.

The outcomes from the Granger causality tests are reported in Table 1. They clearly confirm that there exists a strongly significant one-way causal relationship going from the *q* ratio to M&A activity. Specifically, as shown in the first row of the table (VAR specification for *M&A* as a dependent variable), we must reject the null hypothesis of the test that the estimated coefficients on the *q* ratio are jointly zero. This implies that *q* Granger-causes *M&A*. In the second row (VAR specification with q as a dependent variable), we cannot reject the null hypothesis that the estimated coefficients on *M&A* are jointly zero. The results in the last two rows (model *invest-q*) confirm that there is no causal relationship between investment activity and the *q* ratio. Indeed, in both VAR specifications, the joint significance of the estimated coefficients is zero.

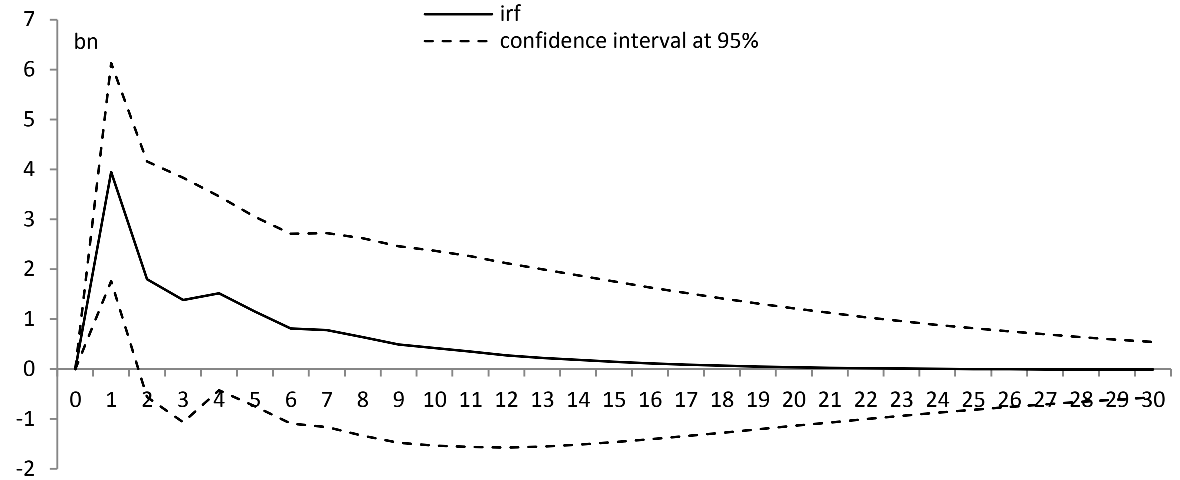
These results are corroborated by the analysis of the impulse response functions of the VAR models, which show the reaction of the M&A volumes and of investment activity to shocks in the *q* ratio. The outcome of this analysis is shown in Figures 5 and 6. M&A but not investment significantly responds to shocks in the *q* ratio. Specifically, a one percentage point increase in the *q* ratio triggers around USD 4 bn increase in M&A activity in the US economy in the same period. This effect fades out in the subsequent periods.

Table 1. Results from Granger causality tests.

	Chi-squared	Prob > Chi-squared
Model *M&A-q*		
M&A	13.06	0.011
q	3.984	0.408
Model *invest-q*		
Invest	1.188	0.756
q	5.075	0.166

[9] See Appendix for additional technical details regarding the estimation procedure.

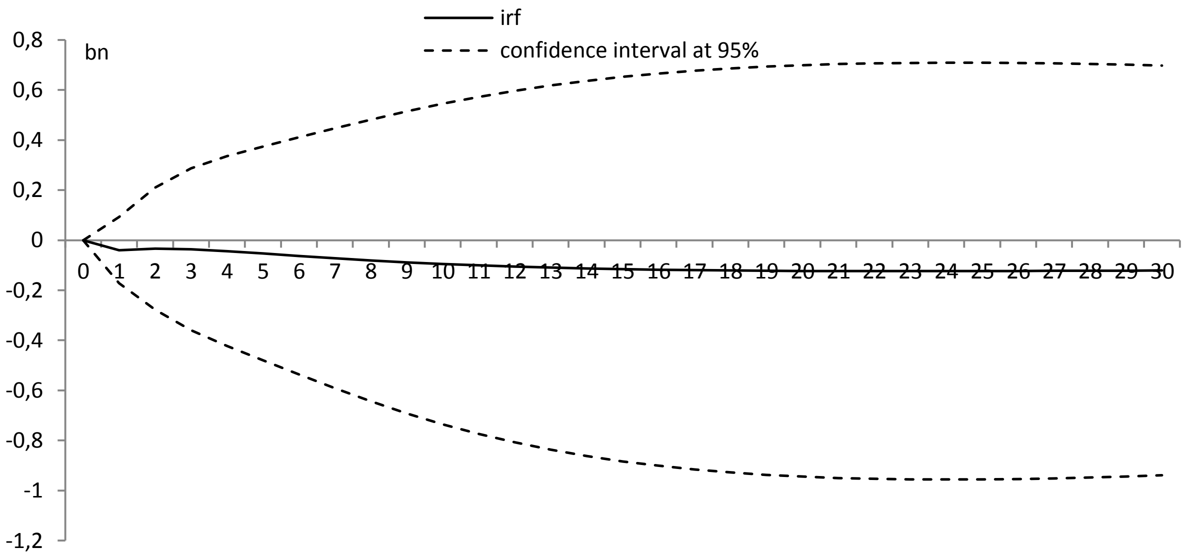
Figure 5. Impulse response function (irf) in the model *M&A-q*.



Note: Impulse = *q*; response = *M&A*.

Source: Own elaboration based on the results of the VAR estimations.

Figure 6. Impulse response function (irf) in the model *invest-q*.



Note: Impulse = *q*; response = *invest*.

Source: Own elaboration based on the results of the VAR estimations.

Is there a link between M&A activity and monetary policy?

It is not straightforward to find a direct link between monetary policy and M&A activity. This is even more the case during the post-2008 recovery, when monetary policy interventions were extended to non-conventional policy measures. However, central bankers themselves provide some useful indication to analyze the issue. The previously discussed result from a paper by Ben Bernanke and Kenneth Kuttner confirms that there is a direct and positive impact of lower policy rates on stock market prices.

We find support for this view. In additional VAR estimations of the US short-term interest rate and the S&P 500, a both-way causal relationship between the two variables was found. The effect of the short-term interest rate on the stock market index is non-negligible: a one percentage point cut in the short-term interest rate resulted in a 40 points increase in the S&P 500. Additionally, to complete the evidence shown in the previous section, our findings based on analogous VAR estimations show that there is also a positive and causal relationship going from stock market to M&A activity. A one-point increase in the S&P 500 triggers an increase of USD 0.5 bn in M&A activity.[10]

Conclusion

This paper provides evidence against both neoclassical and behavioral explanations of past M&A waves. Instead, Tobin's *q* explains the M&A activity. At the same time, Tobin's *q* does not explain new capital investment.

These empirical findings have potentially important policy implications for the interpretation of monetary policy. Expansionary monetary policy increases stock market prices and with them market valuations. This induces more firms to respond to profitable market opportunities through more intensive M&A, whereas capital investment – which is a crucial element of the monetary transmission mechanism described by the central banks – remains broadly unaffected.

[10] The results of these estimations are not reported here, but are available from the author upon request.

Technical Appendix

The estimation of a VAR model defined in equation (1) normally requires that the variables in $\mathbf{y}_t$ are covariance stationary, with their first moments finite and time-invariant. The Dickey-Fuller unit root test applied on our three variables showed that they are integrated of order 1, I(1), meaning that they are stationary in first differences. In this case, the usual Wald test statistic for testing causality will not have asymptotic Chi-square distribution. To deal with this is to use the procedure proposed by Toda and Yamamoto (1995)[11], which requires testing for the order of integration of all the time series and adding m additional lags to the p lags of the VAR model, where m is the maximum order of integration for the included time series and p is the appropriate maximum lag length for the variables in the VAR.

Alternatively, given that all the variables are integrated of the same rank, in principle it would be appropriate to test for causality in the framework of the vector error correction model (VECM). However, to apply this method, it is required that there is a long-term relationship between the variables, or in other words that the series are cointegrated. The tests for cointegration showed that there is no cointegration either between M&A and q or between investment and q.

The tables below show the results of the Dickey-Fuller unit root test (Tab. A1), as well as of the cointegration test (Tab. A2).

Table A1. Results of the Dickey-Fuller unit root test.

		Test statistic	Order of integration
M&A volumes	In levels	-2.065 (0.259)	I(1)
	In first diff.	-5.133 (0.000)	
Investment	In levels	-0.797 (0.820)	I(1)
	In first diff.	-3.789 (0.003)	
q ratio	In levels	-2.468 (0.123)	I(1)
	In first diff.	-5.362 (0.000)	

Note: p-values are in parenthesis. In all tests, three lags were included.

Table A2. Results of the cointegration test.

	Trace statistic	Rank
M&A and *q* ratio	8.449	0
Investment and *q* ratio	8.128	0

Note: In both tests the optimal lags structure of two lags was applied.

[11] Toda, Hiro Y., Yamamoto Taku (1995). Statistical inferences in vector autoregressions with possibly integrated processes. *Journal of Econometrics* 66(1-2), 225-250.

Table A.3. Results from VAR estimations.

	VAR *M&A-q*	
	Equation: *M&A*	Equation: *q*
$M\&A_{t-1}$	0.176	-0.0003
	(0.120)	(0.013)
$M\&A_{t-2}$	0.219*	0.019
	(0.118)	(0.012)
$M\&A_{t-3}$	0.254**	-0.017
	(0.116)	(0.012)
$M\&A_{t-4}$	0.093	-0.007
	(0.120)	(0.012)
q_{t-1}	3.947***	0.976***
	(1.115)	(0.116)
q_{t-2}	-2.751*	-0.056
	(1.153)	(0.159)
q_{t-3}	-0.649	-0.090
	(1.555)	(0.162)
q_{t-4}	-0.195	0.082
	(1.115)	(0.120)
R-sq	0.431	0.828
N. obs.	78	78
	VAR *invest-q*	
	Equation: *invest*	Equation: *q*
$invest_{t-1}$	1.541***	-0.212
	(0.114)	(0.172)
$invest_{-2}$	-0.587**	0.037
	(0.198)	(0.299)
$invest_{-3}$	0.036	0.169
	(0.116)	(0.174)
q_{t-1}	-0.049	0.902***
	(0.073)	(0.111)
q_{t-2}	0.059	-0.011
	(0.099)	(0.149)
q_{t-3}	-0.042	-0.039
	(0.072)	(0.108)
R-sq	0.994	0.829
N. obs.	82	82

Note: ***, **, * are significance levels at 1%, 5% and 10%, respectively. Standard deviations are in parenthesis. The lag length is the one obtained from the appropriate statistical tests, augmented by the maximum order of integration for the included time series. See technical Appendix for more details.

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