Organizing Production Across Borders in a Time of Uncertainty

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Global value chains face unprecedented challenges following the COVID-19 pandemic, rising US-China trade tensions, and other geopolitical shocks (Alfaro and Chor, 2023; Aiyar, Presbitero and Ruta, 2023). In this uncertain environment, multinational firms are attempting to reorganize their production across borders. Integration of production stages located in different countries often takes place through cross-border mergers and acquisitions (M&A). For example, as a response to the US-China trade war, multinational firms are acquiring firms in Mexico as a means to relocate their manufacturing operations out of China (Reuters, 2023).

The subject of organizing production across borders or global value chains remains a vital topic of study in the trade literature. However, the role played by cross-border M&As in the organization of global value chains has received relatively little attention, including the nature of expanded boundaries along sequential stages of production. This paper aims to address this gap by being the first to examine the role of cross-border M&As in the vertical integration of production stages across borders in a time of uncertainty. In particular, we document that when economic policy uncertainty intensifies, more distant production stages in the value chain become more likely to be acquired.

I. Cross-border M&As by Integration Type

Our primary data comprises cross-border M&A transactions completed between 2000 and 2022 from Zephyr. We focus on transactions completed by acquirers in the manufacturing sector restricting the sample to transactions where a greater than 10% stake, a standard threshold for an investment to be classified as FDI. For each transaction, we characterize the inter-industry relationship between the acquirer and target using the 2012 US Benchmark Input-Output Tables from the Bureau of Economic Analysis (BEA).[1] We denote the input industry by i and the output industry by j to compute the total requirements coefficient tr_{ij}, which measures the total value of input i needed to produce \$1 of output j.

Following Alfaro and Charlton (2009), we classify M&A transactions based on industry relationships between acquirers and targets as horizontal (the firms share at least one industry code), vertical (the target's industry supplies inputs to the acquirer's industry), or complex (the firm-pair has both horizontal and vertical linkages). To construct input–output linkages, we match acquirer–target industry pairs to the corresponding total requirements coefficient, tr_{ij}, where we treat the target industry as input i and the acquirer industry as output j. In the full sample of 39,501 M&A transactions, 20% are horizontal (7,947), 36% are vertical (14,220), 39% are complex (15,226), and 5% are in neither category (2,050). The composition suggests that approximately 80% of transactions involving industry diversification (i.e., vertical and complex) feature the integration of production stages across borders (Chari, 2021).

Given that a vast majority of M&A transactions exhibit vertical linkages, we measure the relative distance in the production value chain between acquirers and targets using the I–O table. Following Alfaro et al. (2019), we construct a distance measure (*upstreamness*), denoted by λ_{ij}. A higher value

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[1] We use the detailed supplementary use table after redefinitions. Using the BEA concordance, we map the 2012 Input-Output industry codes to 4-digit NAICS 2017 codes to merge the input-output relationship information with the M&A transactions data.

TABLE 1—PROBABILITY OF M&A AND INDUSTRY DISTANCE, λ_{ij}

	$\mathscr{I}[MA_{ij}=1]$			
	(1)	(2)	(3)	(4)
upstreamness$_{ij}$ ($\log(\lambda_{ij})$)	-0.114^{***}	-0.219^{***}	-0.274^{***}	-0.339^{***}
	(0.006)	(0.008)	(0.013)	(0.021)
contractibility$_j$ (θ_j)			-0.110^{***}	-0.289^{***}
			(0.009)	(0.046)
$\log(\lambda_{ij}) \times \theta_j$				0.159^{***}
				(0.039)
Input industry FEs	No	Yes	Yes	Yes
Output industry FEs	No	Yes	No	No
N	36,114	36,113	20,655	20,655

Note: Standard errors are clustered at the industry pair level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

of λ_{ij} indicates a greater contribution of input i to the production of output j occurring further downstream in the value chain. We determine whether an acquirer or a target belongs to output industry j using the I-O table and then match the industry-distance measure λ_{ij} to each M&A transaction.

II. The Level of Vertical Integration in Cross-border M&As

We begin our analysis by examining cross-border M&A deals where acquiring and target firms have vertical relationships (either vertical or complex) using upstreamness measured by industry distance λ_{ij} in greater detail.[2]

A. *Industry Linkages and the Probability of M&A*

To evaluate whether the probability of an M&A transaction occurring between an industry pair depends on upstreamness, we aggregate transactions by input-output industry pairs ij and run the following linear probability regression:

$$\mathscr{I}[MA_{ij}=1] = \beta_1 \log(\lambda_{ij}) + \beta_2 \theta_j + \beta_3 \log(\lambda_{ij}) \times \theta_j + \alpha_i + \alpha_j + \varepsilon_{ij},$$

where MA_{ij} is an indicator that determines whether M&A occurs in the particular industry pair. The main explanatory variable is the logarithm of the distance between acquirer and target industries, λ_{ij}. The specification also includes an input contractibility measure of an output industry, which we denote by θ_j. This allows us to analyze the impact of contracting frictions in sourcing on the relationship between the probability of an acquisition and industry distances.[3] We include fixed effects for input and output industries, α_i and α_j, respectively. Standard errors are clustered at the industry-pair level.

Table 1 presents the results. Column 1 shows that the coefficient on $\log(\lambda_{ij})$ is negative and statistically significant, suggesting that firms that are closer to each other in a sequential production value chain are more likely to merge. The result remains robust to the inclusion of input and output industry fixed effects (Column 2). The coefficient on contractibility θ_j is negative and significant, suggesting that holding value-chain distance constant, higher contractibility reduces the probability of an M&A between industries (Column 3). The result implies that if a firm in the output industry can source its inputs relatively more easily (i.e., higher input-contractibility), the firm is less likely to integrate through M&A because contracting at arms-length coordinates transactions efficiently. There

[2] We exclude transactions involving tax haven countries as these firms often function as shell companies or special-purpose vehicles without real production activity.

[3] We follow Nunn (2007) and Alfaro et al. (2019) to construct a measure of input contractibility.

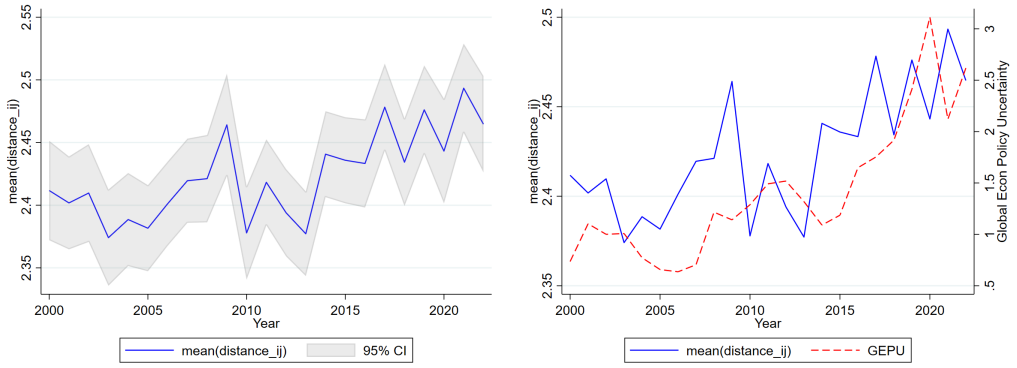

FIGURE 1. THE TIME TREND IN VERTICAL INTEGRATION THROUGH M&AS

Note: Panel (a) shows the yearly weighted average industry distance, with weights given by the number of deals in each industry pair. Panel (b) plots the average industry distance together with the GEPU index.

is a positive and significant coefficient on the interaction term between industry distance and input contractibility (Column 4), indicating that the negative effect of distance on the probability of M&A is ameliorated in industries with high contractibility. Contractibility mitigates coordination problems that integration would otherwise solve.

B. The Time Variation in Value-Chain Distance and Economic Policy Uncertainty

We then use M&A announcement dates to examine the time variation in industry distance between acquiring and target firms. Panel (a) of Figure 1 illustrates the annual trend in the weighted average distance between acquirer and target industries. The average distance increases during the global financial crisis, and further after 2014, with rising economic policy uncertainty. Panel (b) of Figure 1 plots the industry distance and the Global Economic Policy Uncertainty (GEPU) index (Baker, Bloom and Davis (2016)). The figure shows a strong correlation between the average distance and GEPU, suggesting that firm pairs located farther apart along the production value chain tend to integrate when economic policy uncertainty is heightened.

Using monthly data, we evaluate the statistical relationship between industry distance and economic policy uncertainty by estimating the following specification:

$$\log(\lambda_{ijt}) = \beta_1 \log(GEPU_{y(t)-1}) + country\text{-}pair\text{-}FEs + \alpha_i + \alpha_j + \varepsilon_{ijt},$$

where $\log(\lambda_{ijt})$ is the logarithm of the distance on a value chain between an acquirer and a target for each M&A transaction, and $\log(GEPU_{y(t)-1})$ is the log value of the GEPU index. Here, t indexes month–year and $y(t)$ denotes the calendar year associated with month t, so $\text{GEPU}_{y(t)-1}$ is the GEPU index in the previous calendar year. We use the one-year lag of GEPU to account for any time delays between changing economic conditions and M&A announcements. We include three sets of fixed effects: by country-pair, input-industry (α_i), and output-industry (α_j). Standard errors are clustered at the month–year and industry-pair levels.

Table 2 displays the results. The main specification (Column 3) includes all three fixed effects. The coefficient of GEPU is positive and statistically significant at the 5% level. Column 4 presents a more restrictive specification that only includes acquirer fixed effects. The coefficient on GEPU remains positive and statistically significant, indicating that even within the same acquirer over time, firms adjust their industry diversification strategies in response to economic uncertainty and are more likely to merge with targets located further along the production value chain during periods of heightened uncertainty. Based on the estimate, a 1% increase in GEPU increases industry distance by 0.01%. Evaluated at the sample mean, this result corresponds to an increase in industry distance of approxi-

TABLE 2—PROBABILITY OF M&A AND INDUSTRY DISTANCE, λ_{ij}

	Upstreamness$_{ijt}$ ($\log(\lambda_{ijt})$)			
	(1)	(2)	(3)	(4)
$\log(\text{GEPU}_{y(t)-1})$	0.023^{***}	0.018^{***}	0.006^{**}	0.010^{***}
	(0.006)	(0.005)	(0.003)	(0.004)
Country-pair FEs	No	Yes	Yes	Yes
Input industry FEs	No	No	Yes	Yes
Output industry FEs	No	No	Yes	Yes
Acquirer FEs	No	No	No	Yes
N	21,184	20,605	20,584	13,384

Note: Standard errors are clustered at the year-month period and industry pair level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

mately 0.01 unit, or about 0.015 standard deviations of λ_{ijt}.

Theoretically, we can conjecture a trade-off between M&A synergies and exposure to unexpected shocks in vertical integration decisions. On the one hand, M&A transactions tend to occur between proximate industries because firms can realize greater productivity gains from merging. This distance penalty is attenuated when the output industry exhibits higher contractibility. On the other hand, firms face industry-specific disruption shocks, and the likelihood of experiencing such shocks increases during periods of heightened economic uncertainty, as industry-level outcomes become more dispersed—a feature documented in Bloom (2014). We conjecture that merging with a more distant firm reduces the probability that both the acquirer and the target experience simultaneous shocks, enhancing the survival prospects of the merged entity during economically turbulent times. Consequently, heightened economic uncertainty shifts firm integration choices towards more distant partners along the value chain, consistent with our empirical findings shown in Table 2.

Our conjecture further implies that economic uncertainty has a stronger effect on the distance between acquirers and targets along the production value chain with higher input contractibility. When contracting frictions are lower, firms can more easily respond to uncertainty by integrating with more distant stages of production. We test these implications by adding input contractibility θ_j to the previous specification:

$$\log(\lambda_{ijt}) = \beta_1 \log(GEPU_{y(t)-1}) + \beta_2 \theta_j + \beta_3 \log(GEPU_{y(t)-1}) \times \theta_j + country\text{-}pair\text{-}FEs + \varepsilon_{ijt}.$$

Regression results in Table 3 confirm our conjecture. The coefficient on lagged GEPU remains positive and statistically significant in specifications without the interaction. The negative coefficient on input contractibility is consistent with the use of M&As to overcome a less reliably contractible environment by acquiring more distant partners. The coefficient on the interaction term between lagged GEPU and input contractibility is positive and significant, in line with our conjecture.

III. Conclusion

This paper examines the role of cross-border M&A in sequential vertical integration decisions by multinational firms. There is a growing literature on the fragmentation of global value chains and its impacts on trade reallocation. Our research highlights the significant reallocations taking place through the reorganization of production stages via cross-border M&A transactions. Using M&A transactions data matched to input–output linkages, we show that while unconditionally firms are more likely to integrate with closer production stages, periods of elevated uncertainty result in integrating more distant segments of the production value chain. In industries with lower input contractibility, integration may offer greater protection against disruption. By examining cross-border M&As that bring production within the firm boundaries, our paper focuses on an underexplored margin of firm organization to mitigate exposure to shocks along global value chains. Overall, our results

TABLE 3—INPUT CONTRACTIBILITY AND THE SENSITIVITY OF MERGER DISTANCE TO GEPU

	Upstreamness$_{ij}$ ($\log(\lambda_{ijt})$)			
	(1)	(2)	(3)	(4)
$\log(\text{GEPU}_{y(t)-1})$	0.014^{***}	-0.004	0.014^{***}	0.005
	(0.005)	(0.011)	(0.005)	(0.007)
contractibility$_j$ (θ_j)	-0.162^{*}	-0.169^{*}		
	(0.095)	(0.096)		
$\log(\text{GEPU}_{y(t)-1}) \times \theta_j$		0.056^{**}		
		(0.028)		
$\mathscr{I}[\text{high contractibility}_j = 1]$			-0.069	-0.073
			(0.052)	(0.052)
$\log(\text{GEPU}_{y(t)-1}) \times \mathscr{I}[\text{high contractibility}_j = 1]$				0.025^{**}
				(0.011)
Country-pair FEs	Yes	Yes	Yes	Yes
N	19,757	19,757	19,757	19,757

Note: Standard errors are clustered at the month-year period and industry-pair level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Columns 1 and 2 use a continuous measure of the output industry's input contractibility, while columns 3 and 4 use a dummy indicating above-median contractibility.

suggest that rising uncertainty is reshaping the boundaries of multinational firms, with implications for the structure and geographic organization of global production networks.

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