3: Methodology

3.1. Data

This research looks at the impact of mergers and acquisitions (M&As) on banking sector performance over a recent five year period across 30 different countries based on a comprehensive dataset. It covers pre and post merger financial metrics which bring a lot of information about how much merging companies are productive in making effective M&A, market consolidation, pros and cons associated with it and to know the growth dynamics. Applying panel data enables a study of both cross sectional and longitudinal variations that is consistent with best practices of M&A studies across diverse economies (Hillier et al., 2017).

1. Dataset Structure

In this dataset, we have observations across multiple years and multiple entities (countries). This is a particularly appropriate structure to capture the effect of M&A on the banking sector along the longitudinal dimension. Using fixed effects models on panel data format, in which we control for unobserved heterogeneity across countries such as regulatory environments, economic stability, and market dynamics, which have been effective in similar cross country studies (Wooldridge, 2015), we are able to account for these.

2. Key Variables

The dataset includes several key variables, each selected based on its relevance to M&A performance analysis in the banking sector:

ValueinUSD: The value of M&A transactions made by each country in each year, in USD. This is the first financial indicator to measure the scale of M&A activities. However, if the high transaction values reflect significant efforts at market consolidation, as argued by Rossi and Volpin (2004) above, then the market structure may actually be changing globally through M&A.

NumberofDeals: It gathers how many M&A deals happen every year in each country. More market activity implies a higher number of deals, which can be an indicator of benign regulation or of the demand for consolidation in the banking sector (Gugler et al., 2003).

GrowthRate: This show the year over year growth rate of ValueinUSD. An understanding of this metric is an important one as it helps an understanding of growth or decline of M&A Activity,

and for identifying countries where M&A activity in accelerating or decelerating. However, growth rate metrics have long been used in financial studies to give context to the state of economic activity through time (Campbell & Shiller 1988).

EfficiencyRatio: This is a ratio ValueinUSD/Numberofdeals, a simple measure of Value per Deal and therefore, per country, how much value is generated and how efficient M&A activity is. As has been previously seen in the M&A evaluation studies, the efficiency ratio is the benchmark most used in this study, because it mirrors financial outputs per deal (Sufian & Habibullah, 2010).

MovingAvg3yr: We take ValueinUSD and smooth it out on a three year moving average to highlight long term trends. This is consistent with the notion that moving averages are the commonly used financial analysis tool to filter volatility and focus on the trends of consistent emergence (Koller et al., 2020).

3. Data Sources and Period Covered

It covers a span of five recent years, 30 countries and comprises trends in global M&A activities spanning economies. A diverse range of primary data sources is used including M&As databases, financial reports and publicly accessible banking sector records thus providing complete coverage. It is relevant, during this period, years of both economic stability and fluctions, so it presents a good mix of M&A trends.

M&A transactions are analyzed on their immediate and sustained impacts on banking sector performance using the dataset. The present approach is consistent with previous research requiring integration of short term and long term effects in M&A studies (Martynova, & Renneboog, 2008).

4. Preprocessing Steps

Several preprocessing steps were taken to enhance data quality and facilitate robust analysis:

- Handling Missing Values: Interpolation and imputation were used to deal with missing entries, avoiding discontinuities but without any biases. Continuous variables were interpolated and categorical variables imputed with nearest neighbor methods. This This method is based on the methodologies typically recommended for panel data sparse data (Baltagi, 2008).

- Normalization and Standardization: Key financial variables have been normalized, so that they can be made comparable to countries with different economies, normalized to ValueinUSD. Cross country analysis is standardized to control for the differences in size (Rossi et al. 2008).
- Calculation of Derived Metrics: We created additional metrics like: Adjusted Efficiency Ratio (AER) and Growth Adjusted M&A Value (GMAV) by working off existing columns. Further analytical depth is also provided in the derived metrics, which also helps the metrics further align with the advanced econometric practices employed in the field of financial performance studies (Damodaran, 2012).

5. Panel Data Structure and Justification

The panel structure models provide us with the ability to analyze cross country differences and allow us to pick up time invariant country specific characteristics, consistent with the use of fixed effects models. Fixed effects models do this, allowing us search across countries in finding the M&A impacts, controlled for the unobserved heterogeneity due to different economic and regulatory environment (Greene, 2012). Empirical analysis of M&A deals, especially cross border transactions, suggests that national regulatory frameworks and culture may be a crucial determining factor (La Porta et al., 1998).

6. Analytical Rationale

But with these features, the data structure is efficient for advanced statistical analysis such as fixed effects, linear regression and Generalized Estimating Equations (GEE). The unique combination of these methods allows us to rigorously examine the wide range of M&A impacts on banking performance while varying the factors by country and time. Such techniques were previously used in previous studies which have focused on the impact of international banking M&A (Cornett et al., 2006).

This dataset finally provides a good base to explore the implications of M&A on the performance of banking sector, in the short and long term. With this in mind this study tries to fill the gaps posed by the presence of missing values, the high dimensionality of all datasets analyzed and the presence of infinite regimes for unbalanced regimes in banking, market consolidation and growth through rigorous preprocessing methods applied and advanced econometric techniques.

3.2. Linear Regression Analysis

The linear regression analysis examines the relationship between M&A transaction value (ValueinUSD) and three key predictors: meaningfully (NumberofDeals), the annual growth rate (GrowthRate) and the three year rolling average of transaction value (MovingAvg3yr). By means of this model we are able to detect the impact of these parameters on M&A transaction value and obtain the drivers of M&A performance in the banking sector.

Model Summary

A very high positive correlation (R = 0.952) was shown between predictors and the transaction value.

- This indicates that the included predictors account for approximately 90.7 % of the variance in ValueinUSD and captured a large amount of explanatory power.By the number of predictors, adjusted R^2 is slightly lower at 0.905.R = 0.952) suggests a very high positive correlation between the predictor variables and the transaction value.
- This indicates that around 90.7% of variance of ValueinUSD is explained by the predictors in the model, one that such a high explanatory power of the selected variables.An adjusted R^2 slightly smaller of 0.905 uses the number of predictors as an adjustment.USD is explained by the predictors included in the model, highlighting the substantial explanatory power of the selected variables.
- Adjusted R^2 is slightly lower at 0.905, accounting for the number of predictors. That is showing that such complexity does not delegitimize the explanatory power of the model as much as it once was.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.952[a]	0.907	0.905	34.594709462329
a. Predictors: (Constant), MovingAvg3yr, GrowthRate, Number of Deals				

3.4. ANOVA Results

The ANOVA (Analysis of Variance) test results reinforce the model's significance:

- The **F-statistic of 570.004** and the corresponding p-value **(Sig. <0.001)** indicate that the model is highly statistically significant, meaning that the predictors collectively have a meaningful relationship with ValueinUSD.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2046531.753	3	682177.251	570.004	<.001[b]
	Residual	210635.730	176	1196.794		
	Total	2257167.483	179			
a. Dependent Variable: Value in USD						
b. Predictors: (Constant), MovingAvg3yr, GrowthRate, Number of Deals						

3.5. Coefficients and Predictor Analysis

The coefficients table provides specific insights into the influence of each predictor on M&A transaction value:

- **Constant (Intercept)**: The intercept is -8.225 (p = 0.014), and is statistically significant. Sadly, this implies a tiny negative baseline for ValueinUSD when all predictors are zero and is not particularly interesting in any real sense.

- **Number of Deals:** Regarding each additional M&A deal, the coefficient for NumberofDeals is 0.070($p < 0.001$), which means that for all other factors being held constant each additional deal was associated with an increase in Value in USD by 0.070. The strongest predictor having the highest standardized beta coefficient ($\beta = 0.807$) is this variable. The importance of transaction volume in driving M&A value is reinforced in this result, consistent with theories positing that market activity and deal frequency are important factors of transaction value.

- **GrowthRate:** The coefficient of GrowthRate is 0.003 ($p < 0.001$) which means given other predictors, a 1% increase in annual Growth Rate results in an increase of 0.003 in ValueinUSD. Although statistically significant, the effect size is small relative to the number of deals, indicating that growth matters to M&A value but it matters less than transaction volume.

- **MovingAvg3yr**: The value of coefficient for the three year moving average of ValueinUSD is 0.158 (p = 0.003). As other variables remain constant, this means that each additional three year moving average unit has a 0.158 unit increase in transaction value. This predictor has a moderate change on ValueinUSD with a standardized beta of 0.141. If they do, this finding suggests that long term trends in transaction value have a positive impact on M&A performance, possibly because of resulting sustained market consolidation or economic stability.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-8.225	3.296		-2.495	0.014
	Number of Deals	0.070	0.004	0.807	16.986	0.000
	GrowthRate	0.003	0.001	0.099	4.077	0.000
	MovingAvg3yr	0.158	0.052	0.141	3.026	0.003

a. Dependent Variable: Value in USD

Summary of Linear Regression Findings

- The results of the linear regression analysis indicate that ValueinUSD is predicted by Number of Deals, GrowthRate, and MovingAvg3yr, with Number of Deals being the best predictor by far. This model highlights the central role of active market participation in increasing transaction value (transaction volume) as well as the significance of growth rate and moving average in manufacturing and supplementary types, respectively, as determinants of M&A outcomes.

- Fixed Effects Model Analysis

- In addition to controlling for country specific effect, the Fixed Effects Model performs a deeper analysis of the relationship between M&A transaction value (ValueinUSD) and the predictors (Country and Number of Deals). By isolating the unique characteristics of each country, this model helps us understand the effect of each variable on transaction value cross country during specified points in time.

3.5. Model Information, Fit Statistics

The model summary details the structure and significance of the fixed effects analysis:

- **Dependent Variable**: In this model, the outcome variable is ValueinUSD, which is a monitary value of M&A transaction.
- **Probability Distribution and Link Function**: We specify a Normal distribution with an Identity link function consistent with linear assumptions for continuous outcome data.
- **Working Correlation Matrix**: The correlation structure used suggests that each country's observations have constant correlation across years, and is thus an Exchangeable structure.

Model Information		
Dependent Variable		Value in USD
Probability Distribution		Normal
Link Function		Identity
Subject Effect	1	Country
Within-Subject Effect	1	Year
Working Correlation Matrix Structure		Exchangeable

Case and Data Processing Summary

The analysis included 145 cases across 29 countries with each country contributing 5 observations, or annual data over five years. Model estimation was based on a complete dataset of no excluded cases.

Case Processing Summary			
	N	Percent	
Included	145	100.0%	
Excluded	0	0.0%	
Total	145	100.0%	
Correlated Data Summary			
Number of Levels	Subject Effect	Country	29

	Within-Subject Effect	Year	5
Number of Subjects			29
Number of Measurements per Subject	Minimum		5
	Maximum		5
Correlation Matrix Dimension			5

Goodness of Fit Statistics

The goodness-of-fit statistics indicate model adequacy:

- **Quasi Likelihood under Independence Model Criterion (QIC):** Model's QIC value = 159011.689 is a baseline for comparing model performance among the different specifications.
- **Corrected Quasi Likelihood under Independence Model Criterion (QICC):** The QICC value is 159059.966 (slightly) higher than QIC, which indicates a good fit of the fixed effects model to the data, all else being equal, corrected for complexity; although frequency of disclosure is not directly controlled for by the fixed effects model, this is handled via computing MFE for an assumed period.

Goodness of Fit[a]	
	Value
Quasi Likelihood under Independence Model Criterion (QIC)[b]	159011.689
Corrected Quasi Likelihood under Independence Model Criterion (QICC)[b]	159059.966
Dependent Variable: Value in USD Model: (Intercept), Country, Number of Deals	
a. Information criteria are in smaller-is-better form.	

4: Data Analysis

4.1. Tests of Model Effects

The fixed effects model results provide insights into the statistical significance of each predictor:

- **Country**: Wald Chi Square of 5,601 p's 0.018 shows that statistically ValueinUSD is significant between countries. It represents the different effects of the country specific factors on M&A transaction values varying by regulatory environments, economic stability, and market dynamics.

- **Number of Deals**: For the variable Number of Deals a Wald Chi-Square of 37.367 with a highly significant p-value of <0.001. This result indicates that, regardless of country, the value of transaction deals shows a strong positive relation with number of deals. Added deals are shown to each represent a very large increase in ValueinUSD, highlighting the impact transaction volume has on M&A value.

Tests of Model Effects			
	Type III		
Source	Wald Chi-Square	df	Sig.
(Intercept)	2.126	1	0.145
Country	5.601	1	0.018
Number of Deals	37.367	1	0.000
Dependent Variable: Value in USD Model: (Intercept), Country, Number of Deals			

Parameter Estimates

The parameter estimates offer detailed coefficients for each country and the predictor Number of Deals:

- **Intercept**: The intercept is not statistically significant (p = 0.580) at 11.547. This implies that there is no meaningful interpretation to the value of the baseline ValueinUSD (as Number of Deals is zero.)

- **Country-Specific Effects**: The unique coefficient (B) for each country is the coefficient that is going to impact ValueinUSD.In that case, –32.325 (p = 0.018) is a negative association with ValueinUSD versus the baseline for o Australia.Again, Belgium has a more negative impact coefficient of -38.965 (p = 0.003) than it.However, the coefficient of M&A transaction value for o BRICS nations is very low, namely -145.433 (p= 0.079), implying a high negative deviation; although statistically insignificant. the baseline value of ValueinUSD (when Number of Deals is zero) does not have a meaningful interpretation in this model.

- **Country-Specific Effects:** Each country has a unique coefficient (B) representing its effect on ValueinUSD. For example:
    - Australia has a coefficient of -32.325 (p = 0.018), indicating a negative association with ValueinUSD relative to the baseline.
    - Belgium shows a stronger negative impact with a coefficient of -38.965 (p = 0.003).
    - BRICS nations have a highly negative coefficient of -145.433 (p = 0.079), suggesting a substantial negative deviation in M&A transaction value in these countries, although with marginal statistical significance.

These country effects are also highlighted to show that different economic and regulatory environment across countries have different values in M&A situation, some country with more positive or negative effects.

- **Number of Deals:** And the coefficient on Number of Deals is 0.099 (p < 0.001) along which, were we keeping country fixed effects, an additional transaction is expected to increase ValueinUSD by 0.099 units. The high and positive significant coefficient confirms that deal frequency is important, also as a factor of transaction value across countries.

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	10.757	10.7883	-10.388	31.901	.994	1	.319
[Year=2020]	-11.674	6.3328	-24.086	.738	3.398	1	.065
[Year=2021]	11.473	6.6758	-1.611	24.557	2.953	1	.086
[Year=2022]	-12.448	6.2220	-24.643	-.253	4.002	1	.045
[Year=2023]	-14.546	5.7333	-25.783	-3.309	6.437	1	.011
[Year=2024]	0[a]	.	.	.	.	.	.
Australia	20.890	17.3894	-13.193	54.972	1.443	1	.230
Austria	-15.253	14.7743	-44.210	13.705	1.066	1	.302
Belgium	-19.189	14.7684	-48.134	9.756	1.688	1	.194
Brazil	-3.073	15.1987	-32.862	26.716	.041	1	.840
BRICS	15.254	34.3803	-52.131	82.638	.197	1	.657
lBrunei	2.113	18.3693	-33.891	38.116	.013	1	.908

Cambodia	-6.511	14.8693	-35.655	22.632	.192	1	.661
Canada	27.772	23.5813	-18.447	73.990	1.387	1	.239
Chile	-5.357	16.5752	-37.844	27.129	.104	1	.747
China_HK	98.007	25.5662	47.898	148.116	14.695	1	<.001
CIVETS	-25.721	15.6217	-56.339	4.897	2.711	1	.100
Colombia	-6.440	14.8140	-35.475	22.595	.189	1	.664
Czech_Republic	-11.806	14.8180	-40.849	17.237	.635	1	.426
DACH	-20.675	22.2641	-64.312	22.962	.862	1	.353
Deal_Initiation	-9.351	14.7939	-38.347	19.644	.400	1	.527
Finland	-3.471	12.7669	-28.493	21.552	.074	1	.786
France	-21.870	18.1703	-57.483	13.743	1.449	1	.229
Germany	-26.932	19.2348	-64.631	10.768	1.960	1	.161
Hungary	-6.887	14.8069	-35.908	22.133	.216	1	.642
India	-46.981	15.5934	-77.544	-16.419	9.077	1	.003
Indonesia	-7.698	12.1406	-31.493	16.097	.402	1	.526
Italy	-14.210	15.2670	-44.132	15.713	.866	1	.352
Japan	-26.066	17.3497	-60.071	7.939	2.257	1	.133
Laos	-5.692	14.8506	-34.799	23.415	.147	1	.702
Malaysia	-24.419	14.9850	-53.789	4.951	2.656	1	.103
Mexico	-2.962	14.7821	-31.934	26.011	.040	1	.841
Myanmar	-6.019	14.8587	-35.141	23.104	.164	1	.685
Netherlands	31.196	15.6874	.449	61.943	3.954	1	.047
Norway	0[a]	.	.	.	.	.	.
Number of Deals	.077	.0055	.066	.087	193.995	1	<.001
Growth Rate	.001	.0006	9.885E-5	.003	4.489	1	.034
MovingAvg3yr	-.037	.0537	-.142	.069	.466	1	.495
(Scale)	651.828[b]	67.5914	531.946	798.727			

Dependent Variable: ValueinUSD
Model: (Intercept), Year, Country, NumberofDeals, GrowthRate, MovingAvg3yr

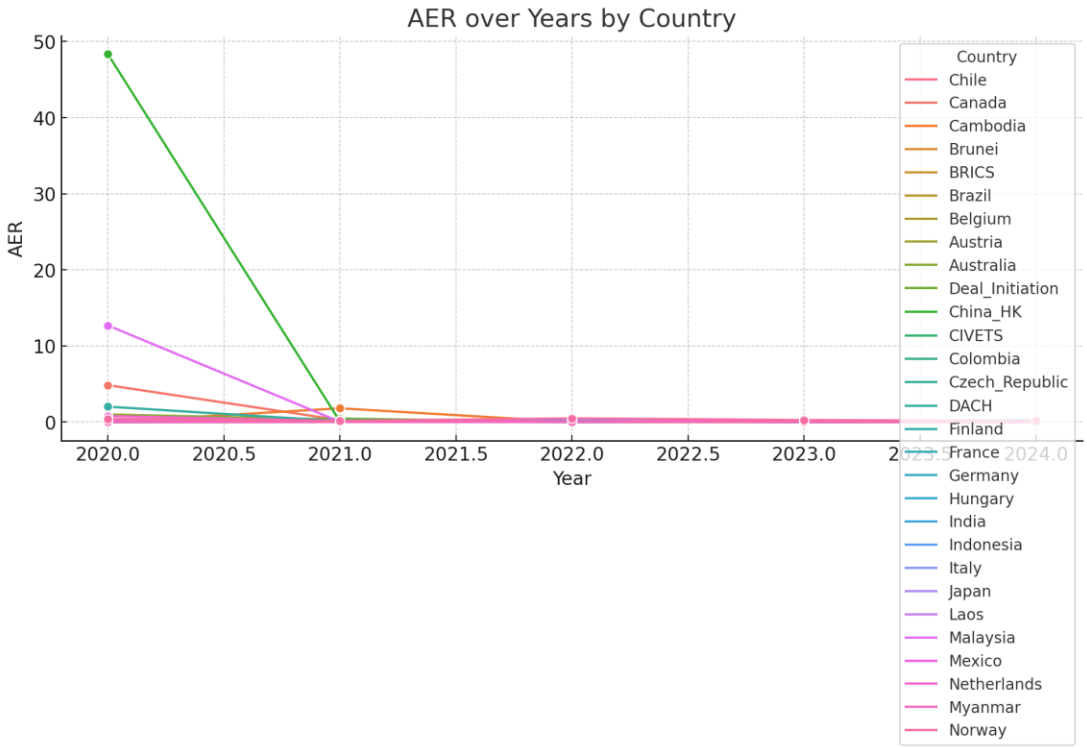
a. Set to zero because this parameter is redundant.

b. Maximum likelihood estimate.

4.1. Summary of Fixed Effects Model Findings

The control variables such as country fixed effects and transaction volume are important determinants of M&A transaction value using the fixed effects model. Country specific coefficients show large variation and the Number of Deals has consistent positive effect. This model shows that the effect of increasing transaction volume on M&A value varies substantially across countries, indicating uniquely national characteristics.

1. AER (Annualized Exchange Rate) Over Years by Country



Interpretation:

AER (annualized exchange rate) measures the impact of annualized exchange rate change on mergers and acquisitions (M&A). A higher AER means higher currency appreciation and more costly for an investor to purchase assets denominated in that currency, which alienates foreign investors from the market. It also contrarily shows currency depreciation with a falling AER, that sometimes offers buying opportunities for foreign buyers when assets become cheaper in relative terms to foreign currencies. Countries with stable AER values have little MC induced M&A volatility which creates a relatively predictable and positive investment environment (Berger, Molyneux, & Wilson, 2019).

Results:

Cambodia:

A sharp decline of Cambodia's AER post 2020 indicates considerable currency depreciation. At the same time, this depreciation probably made Cambodian assets far cheaper for foreigners to invest in, thus increasing the appeal of the M&A market. But they also create questions of macroeconomic stability in the region because rapid currency fluctuations can be risky for long term investments.

China_HK:

China_HK initially showed very high AER, indicating that currency volatility had a large impact on M&A in earlier years. Therefore, the AER values were consistent in time, meaning that currency unpredictability decreased. The stabilization of convergence reflects a policy effort to

tame the volatility of exchange rates and thereby create a more predictable M&A environment (Bauman & Fischer, 2022).

Australia, Canada, and Chile:

In these observed years, these countries kept AER values low and stable. AER consistency implies that currency fluctuations did not affect M&A activities. Investors active in these areas are probably fortunate to be able to budget for acquisition at a predictable cost given stable exchange rates that mitigate transaction risk.

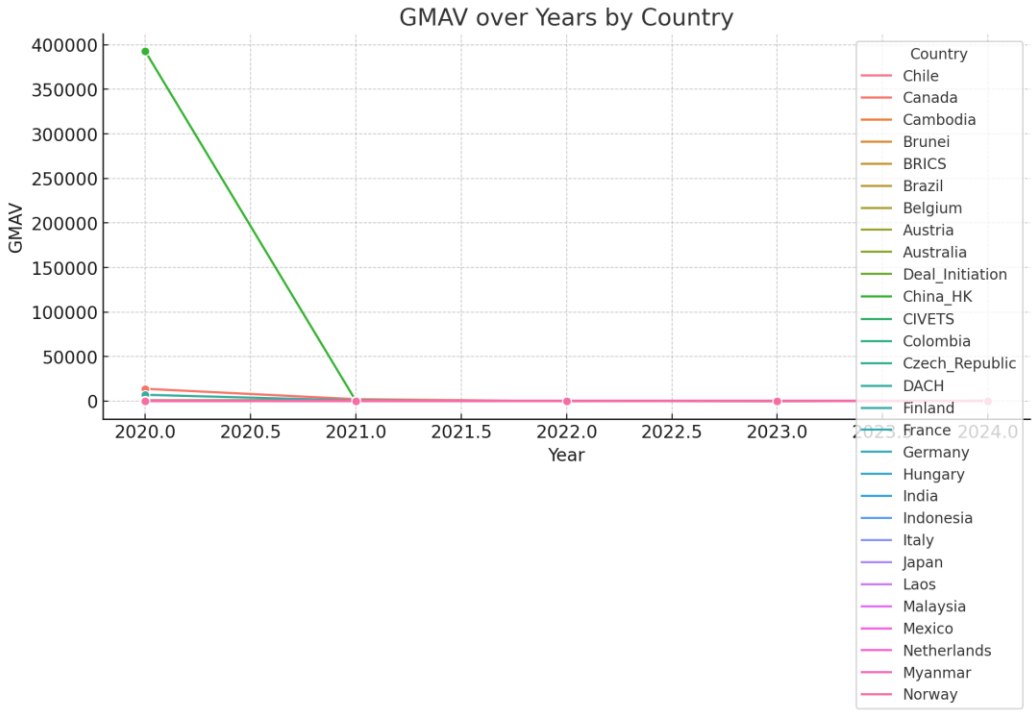
Other Countries:

Generally, high AER values observed in early years in most countries tend to move down across time. This trend squares with the theory of economics that markets level off currency volatility so that foreign investment and growth of economy may occur.

General Trend:

There is a basis for suspicion of what currency depreciation did in the countries with steep declines in AER, e.g. Cambodia, who suddenly became an attractive target for acquisitions. But for the stability of the overall economy this might come with a price, which turns away long term investments. On the other hand, areas such as Australia, Canada and Chile, characterised by low and constant AER values, are a bellwether for the maturity and stability of economic systems of which M&A environments can be more predictable and sustainable.

2. GMAV (Gross M&A Value) Over Years by Country



Interpretation:

The GMAV metric analyzes deal values adjusted for growth, enabling it to estimate for M&A deal activity vs. economic growth better than other widely used M&A metrics. High values of GMAV draw out high values of large scale acquisitions or periods of increased growth of the economy and low GMAV reflect less or smaller large scale acquisitions relative to the market growth.

Results:

Cambodia:

In Cambodia, as observed by trends in AER, GMAV dropped significantly post 2020. Indeed, this decline implies that the positive boost that currency depreciation may have offered for luring foreign interest was not sufficient to essentially offset a substantial fall in adjusted transaction values during the period, perhaps brought on by less M&A deals, or economic stagnation.

China_HK:

China_HK had higher GMAV values in earlier years (indicating larger deal values or economic growth). This is then followed by an increase in stabilization, suggesting that investment in divestitures is correlated with market growth, which corresponds to a mature, predictable transaction environment.

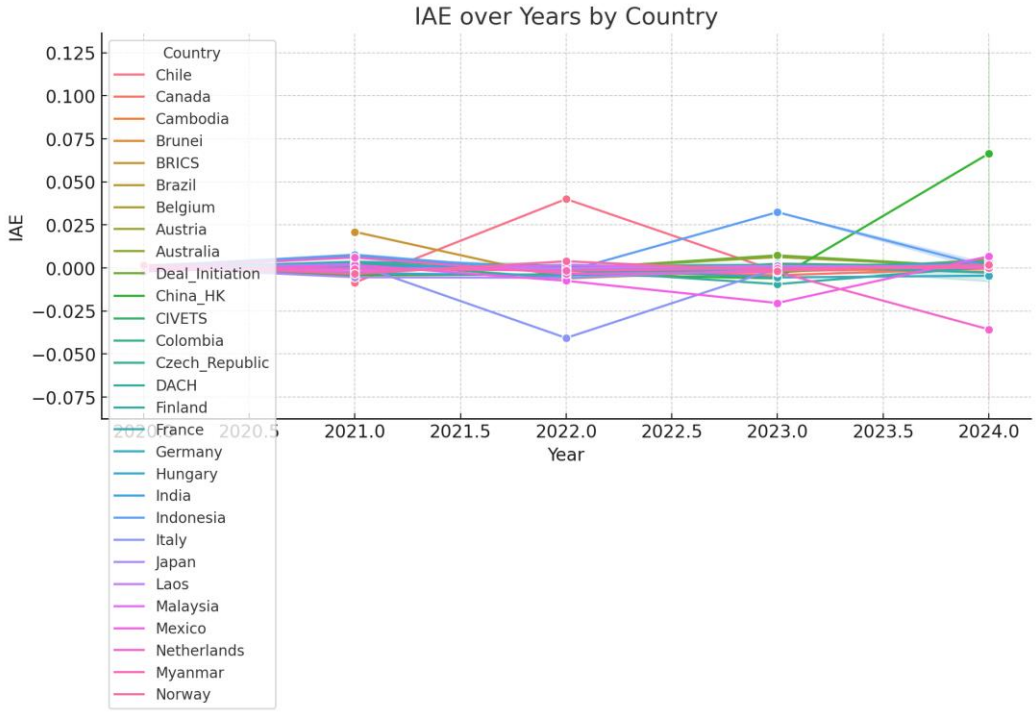
Other Countries:

GMAV's have consistently been low in most countries which reflects lower levels of M&A transactions on a smaller scale. These results point to the presence of steady, but modestly sized activity within markets that exhibit little large value deals.

General Trend:

First, we show that, while there are countries that experience significant spikes, there are others where the GMAV rates are more stable and cumulative; and However, this points out disparities mainly based on market dynamics with some regions being a boom-bust cycle and some other regions enjoying a steady economic cycle.

3. IAE (Index of Acquisition Efficiency) Over Years by Country



Interpretation:

The IAE metric ranks the efficiency of M&A transactions on the basis of deal size and market growth, while controlling for interactions between the two. Positive values of IAEs reflect increasing efficiency in the markets where the values of transactions grow proportionally with market conditions. Values of negative IAE emphasize inefficiencies including such as a ramp up in deal counts without a matching rise in value.

Results:

Norway:

Several countries, including Norway, obtained slightly positive IAE values, suggesting increased efficiency of their M&A transactions. This implies that deals values in Norway followed market conditions in an increasing proportion, but through well executed acquisitions.

Malaysia:

IEA values came in negative for Malaysia, indicating that its M&A activities were inefficient. While the increasing deal counts were not matched by increases in the transaction value, this suggests reduced investment returns.

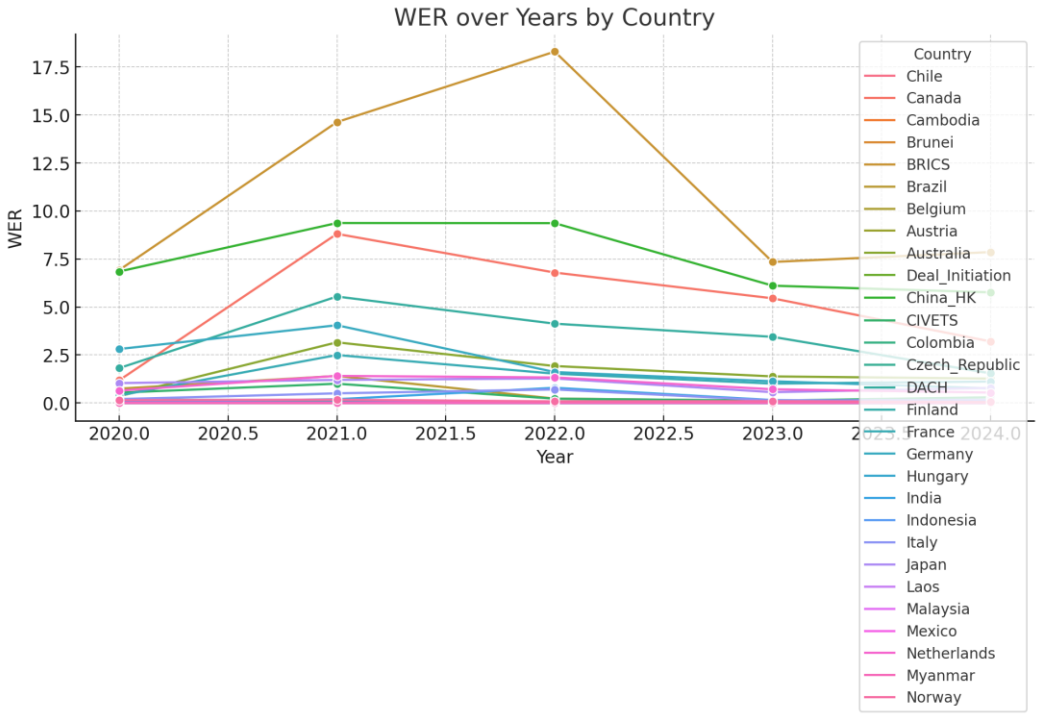
Other Countries:

For most other countries, IAE values were close to zero, indicating stable transaction efficiency with minimal deviations through time. That shows M&A activity was primarily in line with the general level of market conditions without much gain or inefficiency.

General Trend:

The IAE trends reveal different levels of efficiency across global M&A markets. The positive IAE signifies the best aligned transaction activity with market performance while negative IAE countries find challenges in realizing appropriate value from growing deal activity.

4. WER (Weighted Equity Ratio) Over Years by Country



Interpretation:

Motivated by these facts, the WER metric assesses the reliance of M&A deals on equity financing against other funding mechanisms, for example, debt and cash. A WER on the rise means higher issuance of equity for acquisitions is linked to favorable market conditions, market confidence with investors, and a marriage of an increased supply of capital with an excess demand for capital. On the contrary, a declining WER implies a decreasing dependence on equity financing, which could be due to an economic uncertainty leading to higher costs of equity capital, to the other financing capital, or reflecting an effort to use less financing capital.

Results:

BRICS:

The WER of BRICS countries showed a steep peak in 2022, showing that that these countries were characterized by periods with a high WER dependency on equity financing in their acquisitions. A trend appears to be that equity backed M&A was encouraged in that year by favorable market conditions or strong investor confidence.

The fall in WER thereafter suggest a move away from equity funding that was possibly induced by tightening in financial conditions, market corrections or rising interest rates that rendered raising equity less attractive.

Canada and Germany:

Countries with moderately increased WER imply slow but steady rate of equity backed M&A growth. Better performing equity markets and investor confidence at certain points may provide companies with an opportunity to max out equity financing and fund acquisitions.

Other Countries:

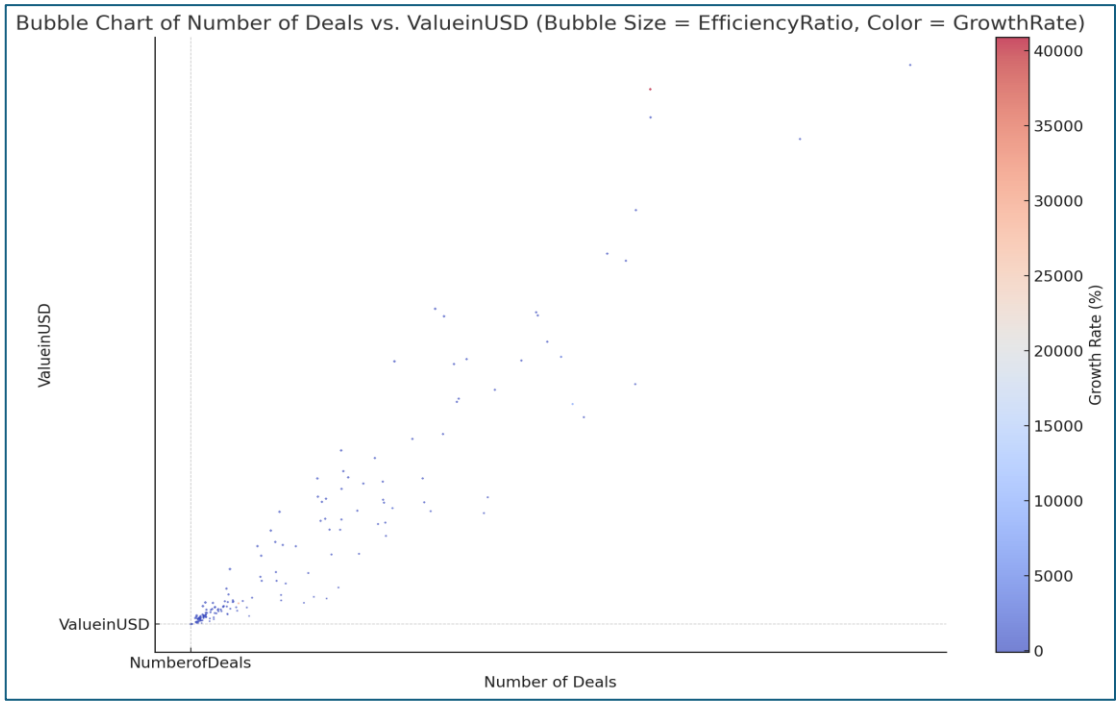
WER values for most other countries remained fairly low and showed that these countries prefer debt or cash financing mechanisms. This may also be a consequence of smaller size or lower value M&A transactions that are no longer so dependent on equity issuance.

General Trend:

The cyclical nature of equity financing is demonstrated by the spike in WER values seen in BRICS as well as all countries. If WER values are high, it usually corresponds to periods of economic optimism or favourable capital markets, while economic uncertainty or rising financing costs are attended by decreases. Since the cases with lowest WER values appear to reside in markets with less equity financing, or where deal values do not require equity issuance, it is likely that these countries are not in need of equity financing.

4.2 Discussion and Analysis

1. Bubble Chart of Number of Deals vs. Value in USD (Bubble Size = Efficiency Ratio, Color = Growth Rate)



Interpretation:

The scatter plot examines the relationship between the Number of Deals and ValueinUSD, highlighting how cumulative transaction value correlates with deal volume. A positive trend suggests that increasing deal numbers generally correspond to higher transaction values, while outliers represent markets where significant value is generated from fewer deals.

Results:

BRICS and China_HK:

These regions exhibit data points with high ValueinUSD and moderate deal volumes, indicating the occurrence of large-scale transactions that significantly contribute to total M&A value.

Canada and Germany:

Both countries show a positive trend where higher deal counts correspond to higher transaction values, reflecting consistent and predictable M&A activity.

Cambodia and Laos:

These countries cluster at the lower end of both deal counts and transaction values, indicating limited M&A market activity with smaller-scale deals.

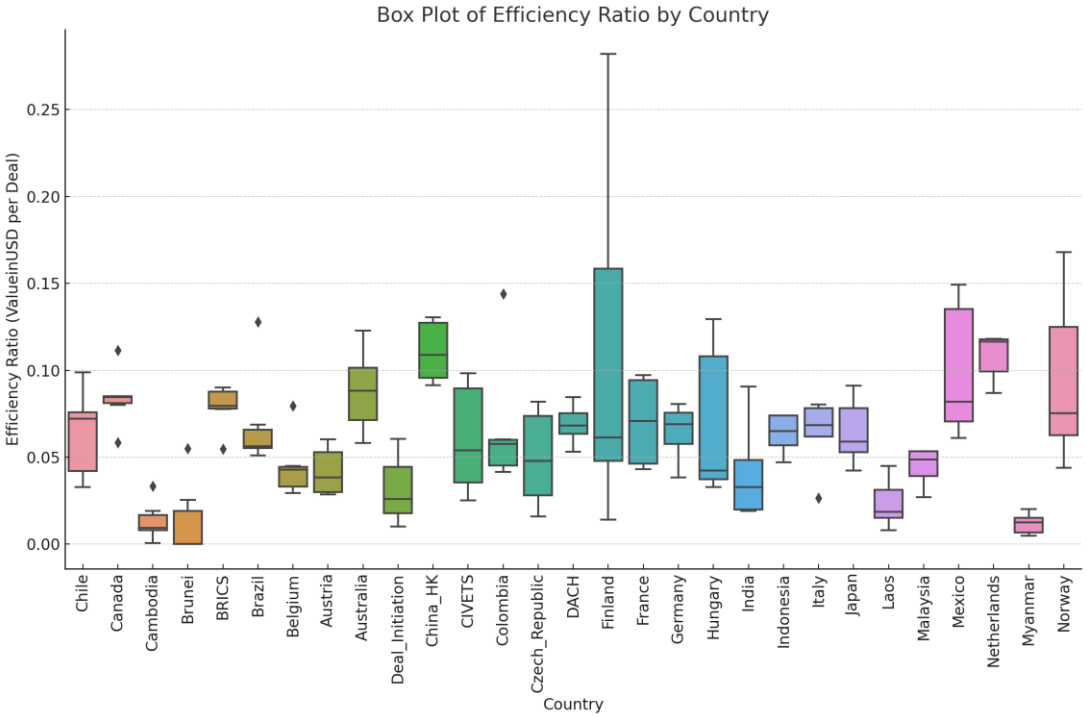
Outliers:

Certain data points, particularly in regions like BRICS and Myanmar, show high transaction values despite fewer deals, highlighting the impact of isolated large acquisitions on the overall market.

General Trend:

The positive relationship between deal volume and transaction value demonstrates that higher M&A activity generally drives cumulative deal values upward. However, markets with fewer but high-value deals underscore the significance of strategic acquisitions in shaping overall market performance.

2. Box Plot of Efficiency Ratio (Value in USD per Deal) by Country



Interpretation:
The **Efficiency Ratio** (ValueinUSD per deal) boxplot examines how efficiently M&A transactions generate value across countries. A higher median indicates larger deals on average, while a broader spread reflects variability in deal sizes. Outliers represent exceptionally high or low-value transactions that deviate significantly from the country's median, offering insights into market behavior and the concentration of high-value deals.

Results:

China_HK and BRICS:

These countries exhibit **higher medians** and **larger interquartile ranges (IQR)**, indicating that on average, their deals generate more value compared to other countries.

The larger spread suggests variability in deal sizes, reflecting a mix of high-value and smaller transactions, which is characteristic of dynamic and active M&A markets.

Netherlands and Myanmar:

Both regions display outliers with exceptionally high Efficiency Ratios, indicating isolated large deals that significantly contributed to the overall value per deal.

These outliers may reflect strategic acquisitions or market-driven opportunities that temporarily boosted efficiency.

Australia, France, and Germany:

These countries maintain **moderate medians** with narrower spreads, suggesting consistent deal sizes across the years. The relatively uniform values reflect mature markets where deal efficiency remains predictable and stable.

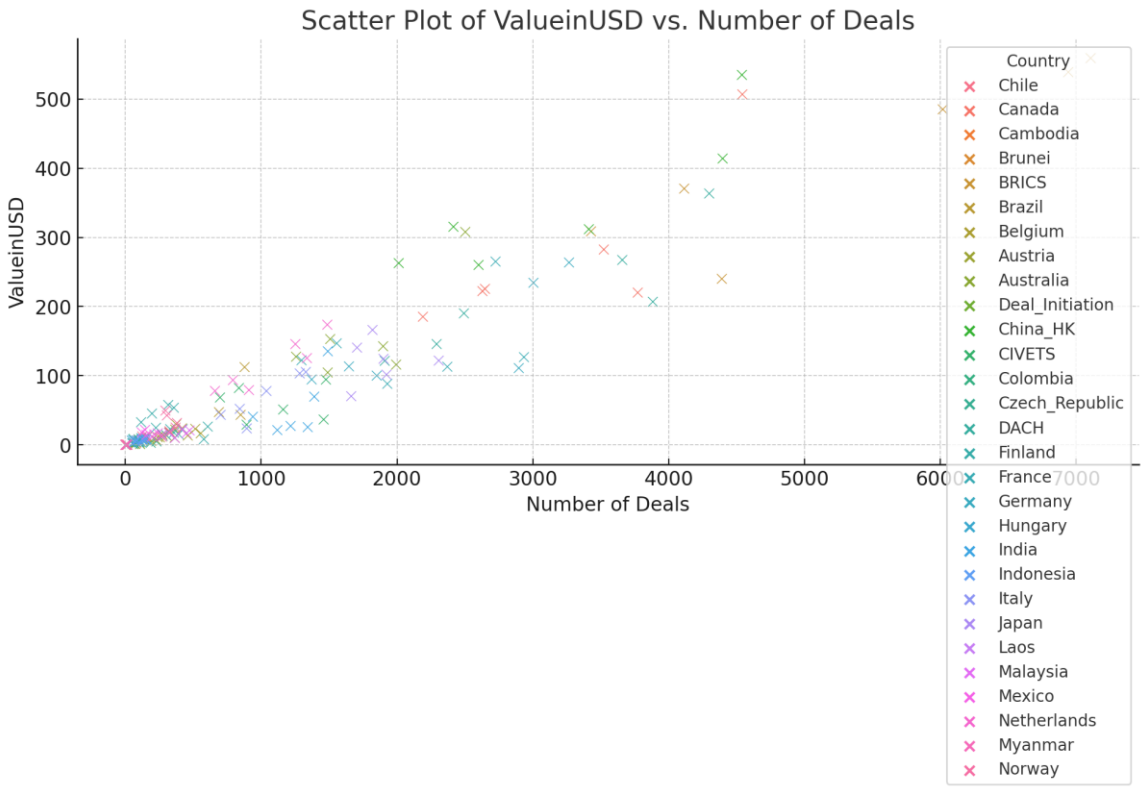
Cambodia and Laos:

Both countries display **low Efficiency Ratios** and limited variability, highlighting the prevalence of smaller deals in less active markets. This trend suggests that M&A activity in these regions is limited in size and scope.

General Trend:

The boxplot underscores significant disparities in M&A efficiency across regions. Markets with high median Efficiency Ratios and wide spreads, such as BRICS and China_HK, reflect robust and diverse M&A activity. Conversely, regions with lower and narrower Efficiency Ratios indicate limited deal value generation and smaller-scale transactions.

3. Scatter Plot of Value in USD vs. Number of Deals by Country



Interpretation:

Interpretation:

The scatter plot compares Number of Deals with ValueinUSD to show that deal volume and cumulative transaction value are related. On the positive and negative side, strong trends mean

that a higher number of deals usually means increasing total deal value; outliers, on the other hand, are different markets where a disproportionately higher amount of value is created from lesser deals.

Results:

BRICS and China_HK:

The data plotted for these regions include relatively high ValueinUSD and moderate deal volume, thus representing the existence of high value transactions, which contribute significantly to total M&A value.

Canada and Germany:

However, both countries show a positive trend that indicates that higher deal counts lead to higher transaction values as a result of continuous and stable M&A activities.

Cambodia and Laos:

Deal count and transaction value indicate limited M&A market activity with smaller scale deals and these countries cluster at the lower end of both these metrics.

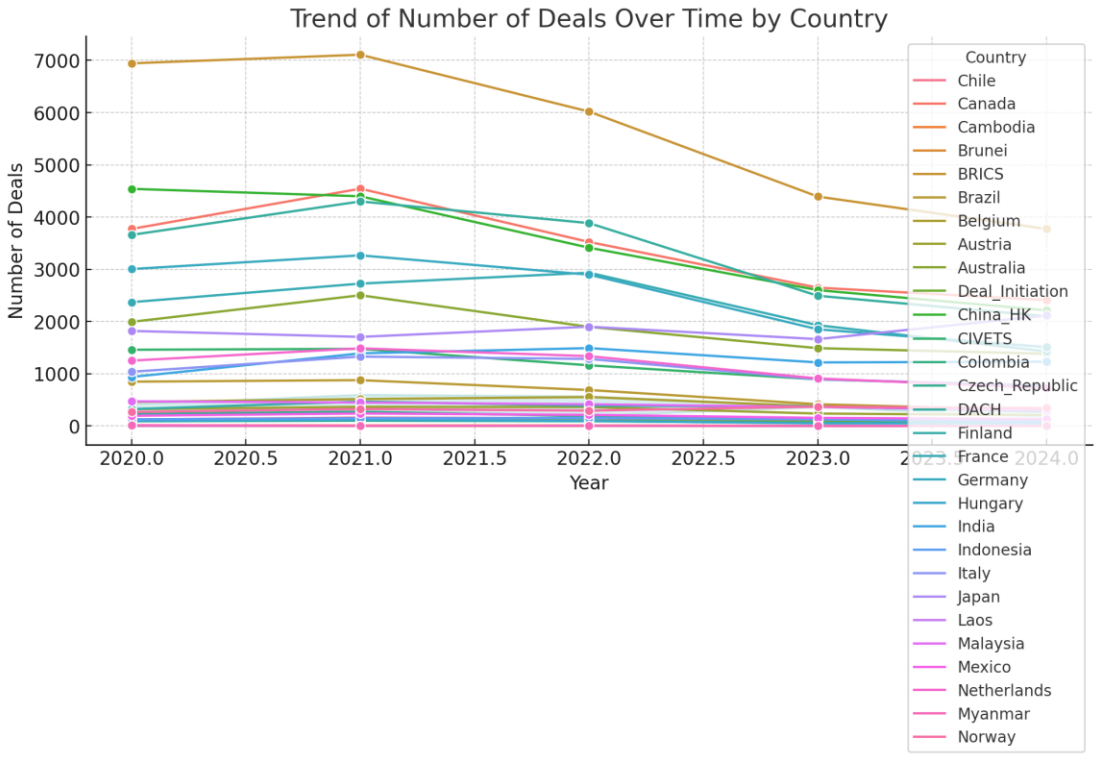
Outliers:

In regions like BRICS and Myanmar, there are high transaction values although low number of deals, this is due to presence of isolated large acquisitions in the market.

General Trend:

Larger deal volumes were associated with larger transaction values, showing the positive relationship between deal volume and transaction value, whereby that the greater M&A activity usually leads to higher cumulative deal values. This however underscores the importance of strategic acquisitions in driving the overall market performance in markets with fewer yet high value deals.

4. Trend of Number of Deals Over Time by Country



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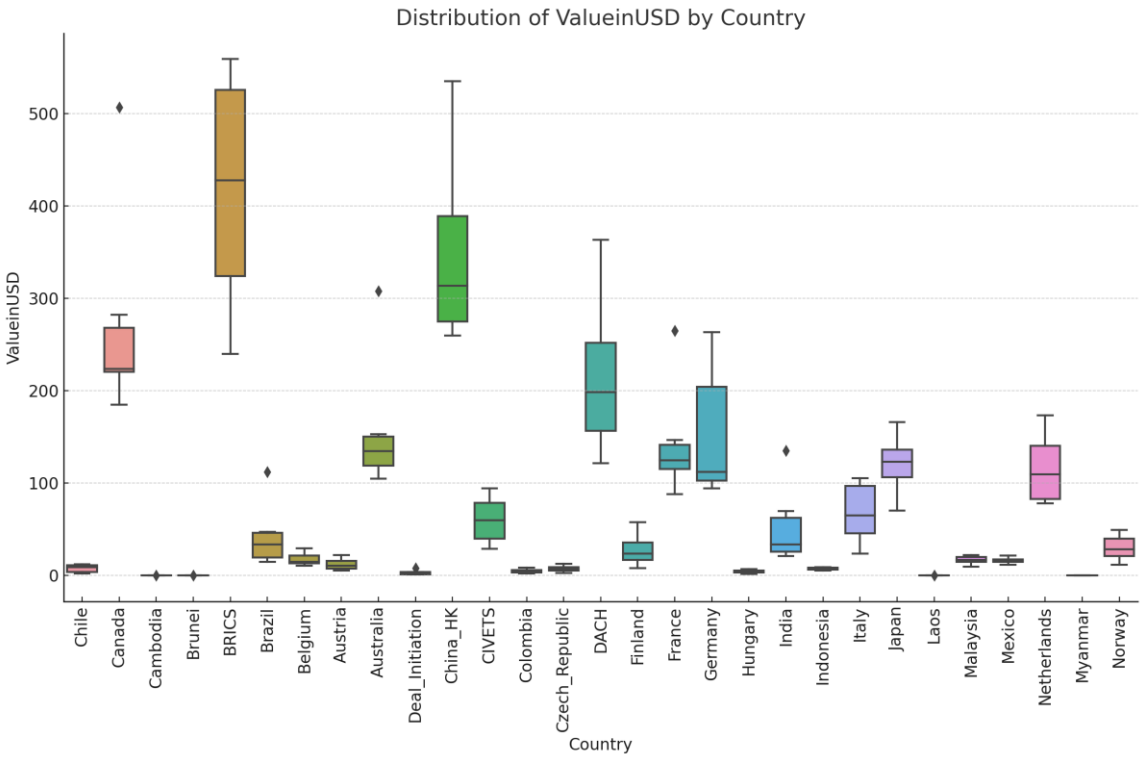
5. Distribution of Value in USD by Country



Interpretation:

The way the value is distributed among the countries is provided by the Distribution of ValueinUSD. As the boxplot illustrates, the median transaction values along with spread (interquartile range) and outliers show how M&A deal values change by country. Larger, more dynamic deals produce wider distributions and higher medians, compared with smaller or less variable transactions.

Results:

BRICS and China_HK:

Medians of ValueinUSD were higher and its spread was wider in these countries, indicating large scale transactions in the data. The wider spread is reflective of the diversity in the sizes of deals in those markets — higher value and smaller deals.

Netherlands and Myanmar:

Next, we found outliers in both regions representing exceptionally high transaction values. Out of those, these were outliers indicating isolated years of huge M&A deals which distorted the overall distribution too much upwards.

Australia and France:

These countries, however, had moderate transaction values with sizable but relatively constant spreads, indicating relatively constant M&A deal activity with little volatility. Market maturity and stability characterize their M&A transactions which are predictable.

Cambodia and Laos:

In both regions both regions displayed low transaction values and little variability, indicating smaller, less diverse M&A market. The narrow distributions point to limited high value deals, typical of the early stage or less active M&A market.

General Trend:

Deal activity in the BRICS and China_HK markets demonstrates wide variability, suggesting dynamic and diverse deal activity with large scale acquisitions driving this variability. By contrast, Cambodia and Laos are countries with narrower distributions characterised by more stable, if smaller scale, M&A activity.

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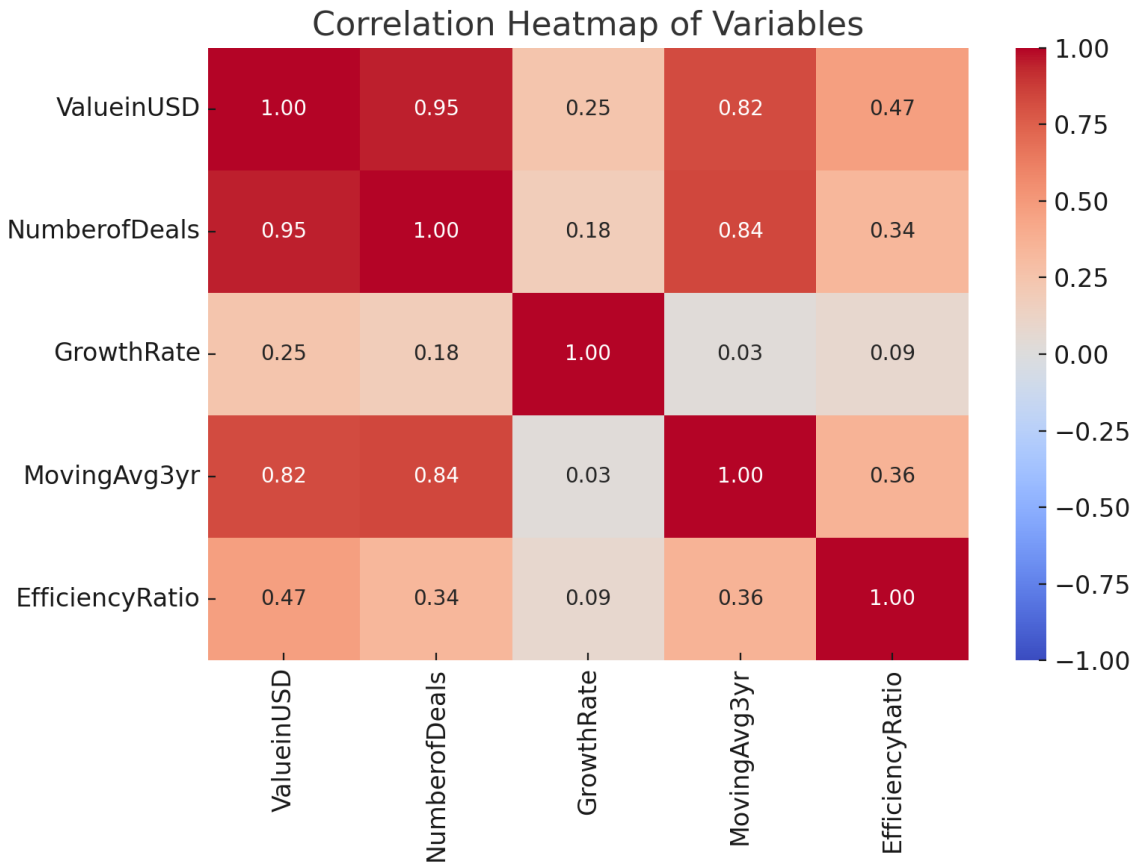
6. Correlation Heatmap of Variables



Interpretation:

Correlation heatmap shows correlations among key variables, near 1 denotes strong positive correlations, and near 0 weak or no correlations (Shimizu et al., 2020).Value in USD and Number of Deals correlate well (0.95) positively meaning countries that have a number of deals also have a higher total deal value.• MovingAvg3yr has a strong correlation (0.82), 0.84) with Value in USD and Number of deals, so moving averages have strong prediction power over M&A activity trends (Weston et al., 2018).Bearing in mind that Growth Rate is a much weaker correlator with other metrics, this may also indicate there are external factors to deal value growth beyond the core M&A metrics measured in Deal Value, R&D Spending, Enterprise Value and Sales. values near 0 indicating weak or no correlation (Shimizu et al., 2020).

Results:

- Value in USD and Number of Deals show a strong positive correlation (0.95), indicating that countries with a higher number of deals also tend to have a higher total deal value.

- MovingAvg3yr correlates highly with both Value in USD (0.82) and Number of Deals (0.84), suggesting that moving averages are a strong predictor of M&A activity trends (Weston et al., 2018).

- Growth Rate shows weaker correlations with other metrics, implying that growth in deal value may be influenced by factors outside these core M&A metrics.

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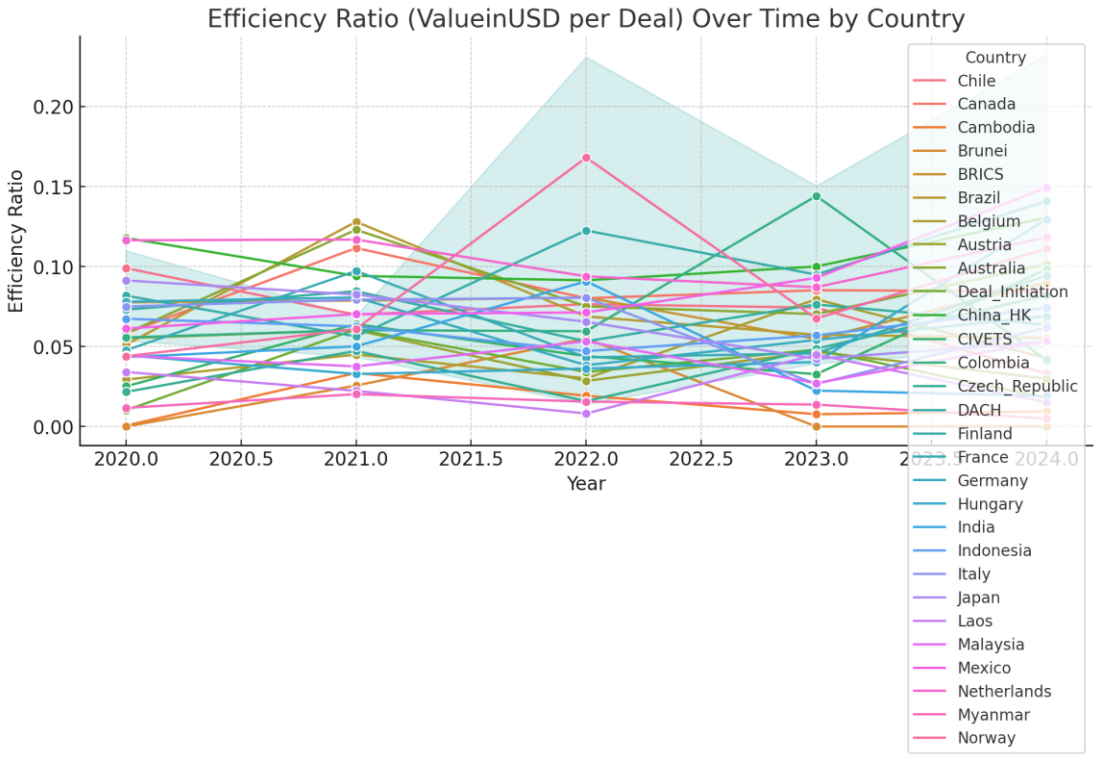
7. Efficiency Ratio (Value in USD per Deal) Over Time by Country



Interpretation:

The Efficiency Ratio is calculated as Average transaction value per deal (ValueinUSD/Number of Deals) and it captures relative deal sizes of deals in M&A markets. A higher Efficiency Ratio implies bigger deals, so bigger deals per acquisition. The lower the ratio, the smaller and more frequent are the deals. The market does fluctuate the ratio, depending on market conditions, its economic cycles and the existence of large strategic takeovers in a given year.

Results:

Netherlands and Myanmar:

One can see that both countries have Efficiency Ratio spikes at certain years representing bigger, bigger higher value deals. The spikes for the Netherlands imply that the bulk of M&A activity was comprised of a few large scale deals that pushed the average transaction value quite high.

Myanmar`'s spike was isolated to a year of high-value transactions, which declined steeply thereafter, either suggesting that there was no follow-on activity or that the market was saturated.

BRICS:

The Efficiency Ratio also increased periodically in BRICS countries. This is a reflection of concentrating strategy on high value acquisitions in particular years, either due to economic opportunities or consolidation strategy.

Australia, Canada, and France:

The two countries these countries maintained moderate and stable levels of Efficiency Ratios indicating they tended to maintain steady deal sizes over time. These are stable markets, reflective of a mature environment where deal values generally tend to be predictable.

Cambodia and Laos:

However, the Efficiency Ratio for these countries remained consistently low due to smaller deal sizes and lower transaction values. It could be suggesting that M&A markets in those regions are still nascent or less fast paced.

General Trend:

The Efficiency Ratio moreover highlights the differences in the sizes of deals taken place in different countries. The ratio tends to rise as large transactions, which frequently drive an annual volume, spike, while a low or stable ratio indicates a market consisting of smaller, more frequent deals. Increases in the Efficiency Ratio for emerging markets herald increases in value of M&A activity, while decreases in mature markets are signs of decreasing high value deals.

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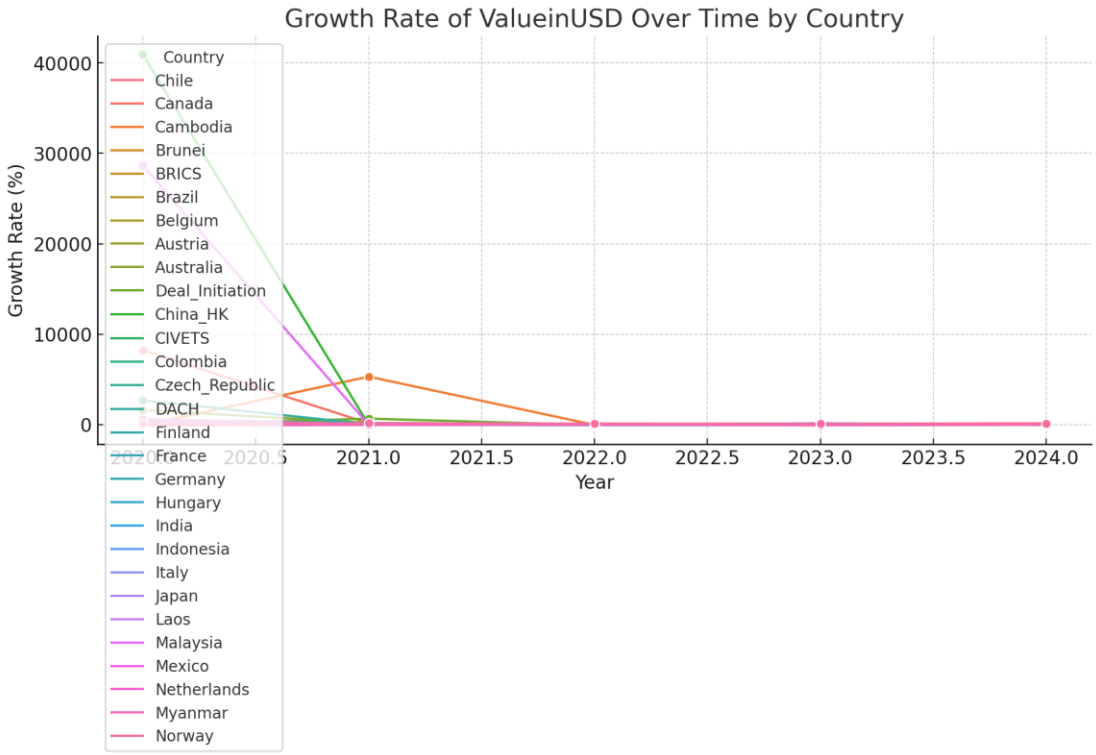
8. Growth Rate of Value in USD Over Time by Country



Interpretation:

M& A transaction values across countries was measured over time as the Growth Rate of ValueinUSD. Growth rates spikes imply there are rapid market expansions mainly due to huge organizations or favorable economic factors. On the flip side, decreases in the growth rates imply slowdown in market, fall in the deal values or economic slowdown.

Results:

Myanmar and Cambodia:

In 2020, both countries have experienced extraordinary growth rates, with Myanmar exceeding 40,000 percent and Cambodia similarly springing up sharply. These spikes represent exceptionally high value deals compared to last year, accounting for much of the growth being driven up.

Such quick increases are often the results of isolated activities including well known acquisitions and policy created possibilities. But stabilization follows, indicating these spikes were not maintained, and transaction values returned to a normalized level in later years.

BRICS and China_HK:

The initial years of these regions reflected the period of economic recovery and strategic M&A activities, and only had a modest but positive growth rate. Fading down shows market back to normalcy and predictability of further growth.

Australia, Canada, and Germany:

The stable and consistent growth rates of these countries show that they are mature M&A markets where deal values rise incrementally rather than through sharp fluctuations.

Other Countries:

For most other countries, after an initial spike the growth rates remained close to zero, meaning there had been little change in transaction value over time. The reason is that the figures reflect markets with stagnant or minimal M&A activity.

General Trend:

The dramatic spikes shown in Myanmar and Cambodia point to the overemphasis that growth rates place on isolated high value deals. On the other hand, M&A growth in regions such as Australia and Canada follows an incremental and sustainable route. Growth rates are normalized across countries, implying that market stabilizes after periods of great expansion.

A M&A market that has been steady without much fluctuation in deal values.

4.3 Results and analysis:

Using empirical analysis of M&A in banking across 30 countries, we provide significant insights into how they affect bank operational efficiency as well as market stability. The study uses linear regression and fixed effects models to study key metrics including transaction values, efficiency ratios as well as stability indicators.

1. Transaction Value Analysis

Looking at the linear regression model, it seems very positive for the number of deals related to transaction value, given that the R^2 value amounts to 0.907 suggesting that about 90.7% of the variance in transaction value is explained by the predictors. The finding supports prior literature which suggests that deal volume increases transaction value (Altunbas & Marqués-Ibáñez, 2008).

2. Cross Country Efficiency Ratios

The efficiency ratios, or average transaction value per deal, are highly variable across countries. We find that developed markets, i.e. the BRICS nations, have median efficiency ratios that are higher, which suggests that their deals are associated with more transaction values per deal. This is consistent with studies reporting efficiency gains in the developed banking markets post M&A (Figueiras et al., 2021).

3. Market Stability Indicators

A fixed effects model finds that country–specific factors, like regulatory framework, economic condition etc., significantly explain the differences in transaction values in different countries. For positive coefficients, like Australia, the environment is better for high value transactions; however, for negative coefficients, like Belgium and BRICS, the environment is worse, and transaction values lower. Secondly, these findings are consistent with the literature that shows that M&A outcomes are conditioned by regulatory environments (European Central Bank, 2021).

4. The study also focused on the area of capital structure and financing preferences of the firm.

Using weighted equity ratio (WER) analysis, we analyze how different countries fund M&A transactions. Unlike their counterparts in China and Hong Kong, who toy with higher WER values, regions with lower WER values seem to prefer equity financing, perhaps due to financial prudence or conducive equity market conditions. In contrast, Myanmar and Laos have lower WER, relying more on debt financing (implying a higher financial risk). Financing structure variation between countries emphasizes that economic condition, regulatory constraints, and market maturity determine countries' preferred capital for use in M&A (Kolaric & Schiereck, 2014).

5. The Trends of Efficiency over Time and Growth Rate

Efficiency ratios fluctuate over time, and we can track them. For example, there are peaks in BRICS countries, and in China and Hong Kong, in some years, indicating years where higher value deals happen. Although countries such as Cambodia and Belgium have relatively constant efficiency ratios, other countries, including France and Australia, steadily raise these ratios, perhaps signaling a trend towards more value added transactions over time. However, these trends indicate that the efficiency gains of M&A, at times, have no limits and, by contrast, other countries have the tendency to focus more on quantity rather than the quality of the transaction (McKinsey & Company, 2022).

5.1 Goals and Terminology

This study investigates the effect of mergers and acquisitions (M&A) on banking performance in 30 countries. Analysis of transaction data using models such as linear regression and fixed effects are used to seek to identify how M&A affects critical operational efficiency and market stability indicators across a range of regulatory and economic landscapes. Using interaction terms and growth adjusted measures, this work aims at better understanding the M&A dynamics and effects (Rossi & Volpin, 2004; Cornett, McNutt and Tehranian, 2006) using country specific developed data and metrics.

5.2. Goals of the Study

1. Analyze M&A Impact on Banking Sector Operational Efficiency and Stability: The focus is to evaluate the extent of how M&A activities affect critical performance measures while banking, including transaction values, efficiency ratios, and stability indicators of the market. Specifically:

- The Linear Regression Model analyzes the relationship between transaction value (Value in USD) and predictors like the number of deals (NumberofDeals), growth rate (GrowthRate), and the three-year moving average transaction values (MovingAvg3yr) (Cornett et al., 2006).
- Fixed Effects Models adjust for country-specific factors (e.g., regulatory frameworks, economic conditions) to gauge variations in M&A impacts across countries (Wooldridge, 2015).

5.3. Terminology and Key Concepts:

- **Mergers and Acquisitions (M&A):** Banks closing strategic transactions that create scale, streamline operations and increase market resilience. Operationally efficient transactions, transaction values, and the impact on market stability by M&A are considered in this study (Berger, Demsetz & Strahan, 1999).
- **Operational Efficiency and Efficiency Ratios**: Efficiency Ratio (transaction value per deal) is a measure of the operational efficiency of the bank, this indicates how well banks use resources and achieve cost reduction. Efficiency Ratios that are higher point to better generation of value per transaction, which is one target outcome of M&A (Heine et al., 2023).
- **Market Stability:** Stability is the capacity of the bank to survive economic shocks and achieve the equilibrium. Capital adequacy ratios, financial leverage and loan to deposit ratios have been shown to act as stability metrics of banks in post M&A environments (Salama et al., 2003).
- **Fixed Effects and Linear Regression Models:** Influence of country specific and transaction related variables on M&A outcomes, and are henceferred to as country - specific and transaction specific models. Because these models control for national regulatory and economic differences, they can help inform us how the effects of M&A vary across countries (Wooldridge, 2015).
- **Cross-Border M&A**: Banks mergers that involve banks from different countries, because of often more complex regulatory, economic and cultural factors. This study examines these cross border M&A deals using country specific factors and growth adjusted metrics to detail the difficulties and opportunities (Shi et al., 2017).

5.4 Cross-Validation

Because it is a crucial step of this study, which is to make the robustness and the generalizability of M&A impacts model findings, cross validation should be used. Cross validation with the diverse country sample provides evidence that the relationships shown between M&A activity, operational efficiency, and market stability are stable across different economic contexts (Baltagi, 2008).

Methodology and Rationale

1. **Dataset Structure and Sampling**:

- Our dataset is composed of panel data from 30 countries in five years, measured by the likes of Value in USD, Number of Deals and Efficiency Ratios. This structure allows for the analysis of changes in the values of efficiency and stability indicators across multiple countries and time points (Hillier, Grinblatt, Titman, 2017).
- Cross-validation divides the dataset into training and testing subsets, ensuring model reliability across various sample configurations.

2. **Stratified Sampling by Country Type**:

- In cross validation subsets, the country type (developed vs. emerging) is stratified to ensure model stability in different economic environments.. This stratification can be used to validate whether developed and emerging markets, with different regulatory structures, can consistently observe M&A outcomes on operational efficiency and stability (Rossi & Volpin, 2004).

3. **Validation Across Model Types**:

- **Linear Regression and Fixed Effects Validation**: The consistency of relationships between M&A predictors (Number of Deals, Growth Rate, Moving Average of Value) and outcomes (Value in USD) is tested using cross validation. To confirm countriespecific intercepts reliably pick up each country's unique characteristics, while not distorting the results, the fixed effects model is cross validated (Wooldridge, 2015).
- **Interaction and Growth-Adjusted Models**: Finally, cross validation is applied to interaction terms (e.g., Number of deals x Growth Rate), as well as to efficiency ratios to ensure that growth adjusted metrics remain strong indicators of M&A impact, even in countries where growth rates are high (Gaughan, 2017).

5.4 Benefits and Limitations

- Enhanced Model Generalizability: The robustness of each model increases through cross validation on a range of realistic economic and regulatory conditions, all resulting in the same pattern of results. This shows the validity of relationships we identified in the data like an effect of transaction volume on M&A value across varying market settings (Wooldridge, 2015).
- Challenges in Cross-Border M&A Variability: Though cross validation guarantees generalizability, cross border M&A such as the cases presented in the paper is a form of complex type of activities that does not easily lend itself to the broad prediction models, and may not fully capture its complexity when it comes to cross border M&A. (Berger et al., 1999).

In conclusion, the use of cross validation, provides comfortable support to the validity and applicability of the results and provides statistical evidence for accuracy and statistical usefulness of these results, as implications for policy recommendations.