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An evaluation of strategies for handling endogeneity in reporting and corporate governance studies

Paul, Karen
Department of Corporate social responsibility, Springer, Heidelberg

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Abstract:

Research Question/Issue: This paper does a thorough methodological assessment, investigating the approaches used to deal with endogeneity in the fields of financial reporting and corporate governance.

Method: This study examines how different approaches to the endogeneity problem have been used in the ten corporate governance-related journals that are part of the Web of Science's (WOS) Social Sciences Citation Index.

Research Findings/Insights: We examine the frequency of endogeneity and the strategies used to lessen its impact, concentrating on empirical research published in prestigious publications. The Two-Stage Least Squares (2SLS) method, a popular instrumental variable approach, is heavily relied upon, according to our data. Nonetheless, a noteworthy finding about the uneven use of distinct exogenous instrumental factors in some research points to a possible drawback in the use of 2SLS. Acknowledging the difficulties in locating exogenous variables, we suggest the Generalized Method of Moments (GMM) as a workable substitute. Although it requires a bigger sample size and a longer sample period, GMM provides flexibility by not imposing the same exogeneity constraint on instrumental variables.

Theoretical/Academic Implications: The study makes scholars more aware of the serious issue of endogeneity bias in governance studies. It offers a framework for identifying and resolving possible bias, raising researchers' awareness and promoting a more critical approach to methodological decisions. It acknowledges the prevalence of endogeneity in empirical studies, with a special emphasis on the widely used 2SLS technique.

Keywords: corporate governance, ESG disclosure, CSR reporting, business performance, endogeneity, and GMM.

Introduction

Researchers, practitioners, and politicians have all paid close attention to the disciplines of corporate governance and financial reporting in recent decades. An investigation of different aspects of these domains' efficacy and ramifications has been spurred by the complex interactions between them and their influence on the operation of contemporary enterprises. The problem of endogeneity is a crucial topic that scholars have struggled with in this dynamic environment. As a result, endogeneity-related difficulties have been brought to light in a growing number of studies on governance and related topics including corporate performance, reporting, and ownership structure (Ahmed & Atif, 2021; Cheung et al., 2015; Garcia-Blandon et al., 2022; Le & Tran, 2022).

There has never been a greater need for thorough empirical research to support decision-making as regulatory frameworks change and business sector scrutiny increases. Strong insights into the ways that financial reporting procedures and corporate governance frameworks affect shareholder value, accountability, transparency, and business performance are sought for by academics, professionals, and legislators. A increasing interest in methodological developments intended to lessen endogeneity's impacts has been sparked by the realization that it might skew these connections. According to Zaefarian et al. (2017), endogeneity undermines crucial

requirements for proving causation, making it a major research difficulty. It is difficult to foresee the direction and strength of its bias.

Endogeneity is a significant problem in research because it compromises the fundamental requirements for proving causation. A few factors, like missing data, simultaneity, or measurement mistakes, might increase endogeneity, as shown in Figure 1. As noted by Aerts et al. (2007) and Aldamen et al. (2012), the challenge of anticipating its bias beforehand highlights the need of addressing and correcting endogeneity. Ignoring it might lead to biased and inaccurate results, which could lead to incorrect conclusions about the causal linkages between the topics being studied. This may thus have deceptive theoretical and managerial ramifications. If endogeneity is not properly managed, modeling the relationship between the variables will be challenging (Abu Afifa et al., 2022). The best approaches should be chosen based on the kind of data available (cross-sectional, time series, or panel), with instrumental variables being the most reliable.

Usually, endogeneity is studied in the context of ordinary least squares (OLS) estimation. It concerns a situation when the structural error term in a model is associated with an independent variable. Because of the reverse or dynamic causation in endogeneity types II and III, conventional least squares parameter estimations will be inconsistent. Because of this association, the estimation is inconsistent, which may contribute to endogeneity bias (Gerged, 2021; Liu et al., 2015; Shabir et al., 2023) and impact how coefficient estimates are interpreted. Additionally, endogeneity is frequently cited by editors and reviewers in management disciplines as a plausible alternative explanation for findings, and neglecting to address it may be a contributing factor in the rejection of an article.

Even though several endogeneity-addressing methods have been available for decades, their use in governance research is still somewhat limited. It is also notable that there is a dearth of research that particularly reviews and addresses this important issue and its ramifications. Although endogeneity is widely acknowledged as a potential problem in governance studies, a thorough analysis of this problem and its effects on empirical findings in the governance domain is lacking in the literature currently in publication (see, Aldamen et al., 2012; Andres & Vallelado, 2008; Bu et al., 2021). Thus, the purpose of this study is to raise awareness among academics, provide a framework for identifying and addressing possible endogeneity bias in governance research, and give a summary of existing methods. By elucidating the concept of endogeneity, highlighting its origins via governance instances, and stressing the significance of addressing endogeneity in governance research, the work advances knowledge. In order to help researchers investigate cause-and-effect linkages, an overview of possible therapies is provided. The paper's ultimate goal is to increase awareness of endogeneity bias, a problem that is often overlooked in the area of governance.

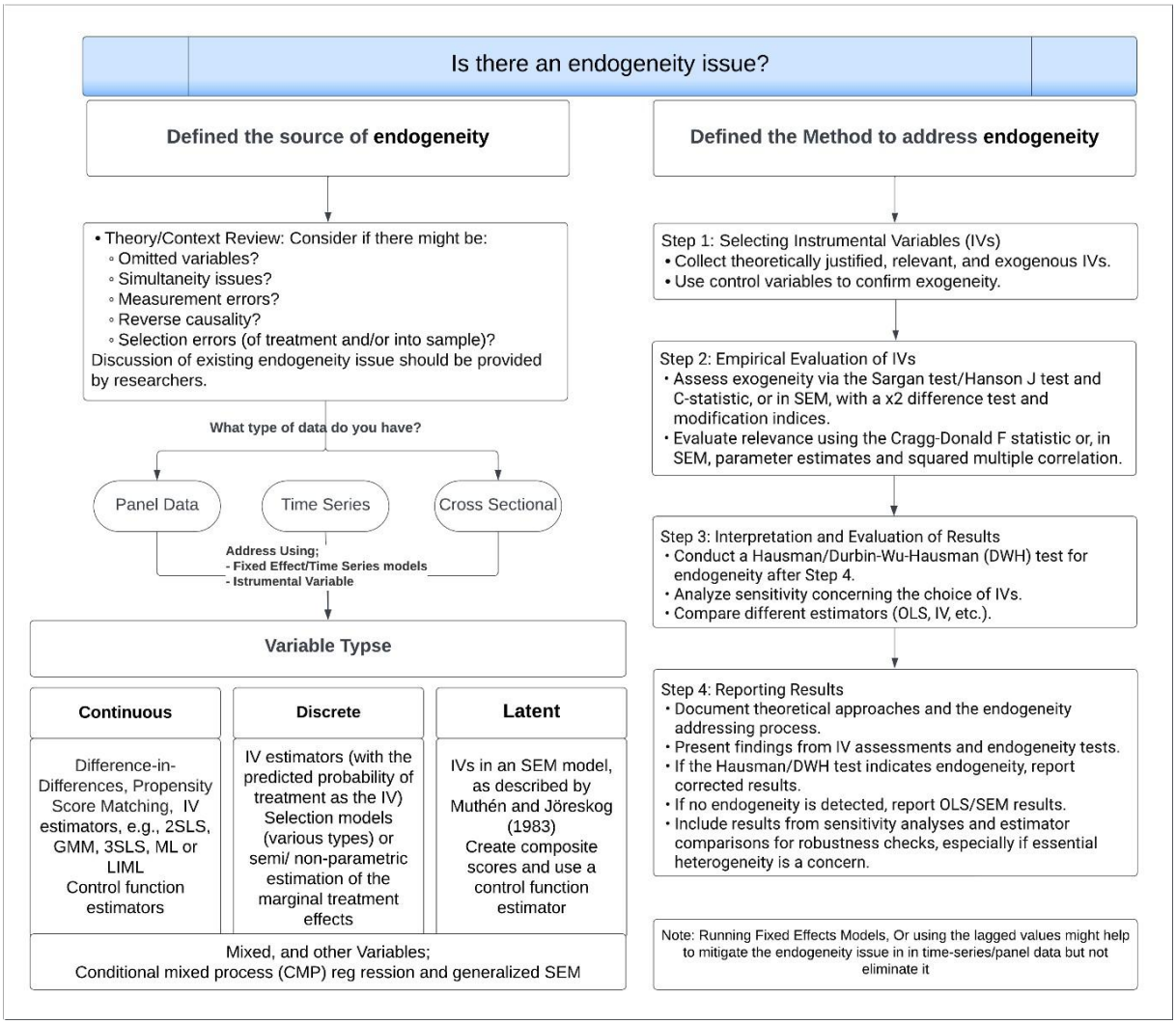


Figure 1: Addressing endogeneity framework
Source: Developed by the author

By examining and contrasting the efficacy of important techniques used in the literature, this study undertakes a thorough evaluation of the approaches used to address the endogeneity problem in the fields of corporate governance and financial reporting research. The research offers a sophisticated grasp of the methods that may be used to deal with endogeneity issues. The results of this study have important ramifications for practitioners and policymakers who want to use evidence-based tactics to improve corporate governance and reporting procedures, as well as for academics who want to demonstrate causal relationships in their investigations. By tackling the ubiquitous problem of endogeneity, this paper makes a substantial addition to the literature on corporate governance and financial reporting. By combining and synthesizing various approaches to endogeneity, the study gives researchers a thorough understanding of the advantages, disadvantages, and underlying presumptions of each strategy, enabling them to negotiate the complexity of endogeneity and choose the best approach for their particular situation. For researchers to choose the best approach for their investigation, a comparative knowledge is essential. The corporate governance and financial reporting literature may continue to develop as a result of these discoveries, which may have an impact on future study areas and approaches.

The methodologies under inquiry, the research design and data sources, the empirical findings, and implications and future research directions are all covered in detail in the parts that follow.

Endogeneity issue and sources

When variables in econometric models correlate with the error term, endogeneity—a ubiquitous problem in empirical research—occurs. Dealing with endogeneity is essential in the complicated field of corporate governance literature, where scholars examine the intricate relationship between governance procedures and business results (Hermalin & Weisbach, 1988; Blundell & Bond, 1998). Because the bias cannot be predicted by procedures alone and the coefficients are equally likely to be overstated or underestimated, endogeneity is particularly detrimental. As a result, one of the biggest obstacles to management researchers' ability to precisely describe models and establish causal links is often recognized as endogeneity (Hill et al., 2021).

In corporate governance research, endogeneity has far-reaching consequences. A paradigm shift occurs in the traditional method of determining causal linkages. Researchers proceed carefully, recognizing discovered links as correlations rather than boldly claiming causality. This change adds layers of complication to the interpretation of study results by making it more difficult to determine the real direction and intensity of causality within the researched phenomenon (Hermalin & Weisbach, 1988; Blundell & Bond, 1998; Guevara, 2015). It may seem that the endogeneity problem is under control when reading the empirical publications resulting from this increased understanding. It is widely acknowledged as a problem, institutional protections have been implemented or are being implemented, and academics are working to address the issue via meticulous design, theory, and analysis (Hill et al., 2021). As a consequence, researchers often claim that endogeneity has no effect on their findings and/or that any such problems have been resolved.

Endogeneity Type I: Unobserved Heterogeneity/Omitted Variable The impact of unobservable factors on the connection between variables is introduced via unobserved heterogeneity. This might result from company-specific traits influencing both governance frameworks and business performance, according to corporate governance literature. Decisions in the governance and performance domains, for example, may be influenced by CEOs' special abilities or risk aversion, underscoring the complex and hidden dynamics at work (Haubrich, 1998). The conclusions may be erroneous because of reverse causality or unobserved heterogeneity, even when corporate governance researchers use several control factors in their models to lessen omitted variable bias (Al Farooque et al., 2007; Andres & Vallelado, 2008; Lodh et al., 2022). According to Aldamen et al. (2012), an irrelevant variable may lead to a poor model fit while missing variables may distort coefficients. To address this problem, researchers use a variety of techniques, including the use of fixed effect and random effects models with an adequate number of control variables. This is the most often used analytical method in

corporate governance literature, enabling a more in-depth analysis of the connection between corporate governance and results. Nevertheless, endogeneity is not entirely addressed by Fixed and Random Effects models, and bias resulting from unobserved factors may still exist even with the addition of control variables. Furthermore, even if these models enhance the control for certain kinds of bias, proving causation is still difficult. The problem of missing variables is important in econometric analysis because it might result in estimates of the effects of the included variables that are skewed and inconsistent. This issue is especially important when researching the connection between corporate governance and business performance since excluding out important factors might skew the results. Examine a simple model that aims to investigate how a certain governance structure (X) affects business performance (Y):

$Y = \beta_0 + \beta_1 X + \varepsilon$ (1)

Where: Y represents firm performance, X is a proxy for corporate governance (e.g., board size, diversity, etc.), and ε is the error term. Suppose there is a relevant factor, such as managerial expertise (W), which influences both corporate governance (X) and firm performance (Y), but is omitted from the model. The true model should be:

$Y = \beta_0 + \beta_1 X + \beta_2 W + \varepsilon$ (2)

When W is omitted, it gets absorbed into the error term of the simplified model, making the new error term $\varepsilon = \beta_2 W + \varepsilon_0$. This introduces an endogeneity problem if W is correlated with X, as is likely in this case. The ordinary least squares estimation of β_1 would then be biased, as it also captures the effect of W on Y:

$E(\beta_1) = \beta_1 + \beta_2 \quad Cov(x, w)$ (3)

$\overline{Var(x)}$

If Cov (X, W) = 0, meaning X and W are uncorrelated, the OLS estimate of β_1 is unbiased. However, this is rarely the case in practice, especially in corporate settings where variables like managerial expertise and corporate governance structures are often interrelated. The bias in β will reflect both the direct effect of X on Y and the indirect effect through W. For instance, if we consider corporate innovation strategies (X) and their impact on firm performance (Y), factors such as the CEO's background in innovation or previous positions (W) might also influence bothX and Y. Omitting the CEO's background would likely lead to an overestimated influence of corporate innovation strategies on firm performance due to the spurious correlation between X and Y that is actually mediated by W.

In practical terms, this means that empirical studies need to carefully consider what variables are included as controls. Simply including additional variables like managerial background or firm productivity without considering their relationships with both corporate governance and firm performance can also lead to specification errors. Thus, a comprehensive understanding of the theory underpinning the relationships among variables is crucial, along with methods like instrumental variables or fixed effects models to address such endogeneity concerns effectively.

Endogeneity Type II: Simultaneity/ reverse causality

Simultaneity occurs when two or more variables are co-determined, mutually affecting each other concurrently. Within corporate governance studies, simultaneity implies a reciprocal relationship where decisions about governance structures and firm performance are intertwined. A firm's choice of governance mechanisms may reflect its current performance and be influenced by expectations of future performance, illustrating the dynamic and intertwined nature of these variables (Guevara, 2015). Consider the relationship between corporate governance (X) and firm performance (Y). It is plausible to argue that effective governance leads to better firm performance due to better management and oversight. However, it is equally plausible that firms with better performance may have more resources and motivations to invest in and develop more robust governance structures. To demonstrate this simultaneity, consider the following simple two-equation models; firm performance equation:

$Y = \beta_0 + \beta_1 X + \varepsilon_1$ (4)

Corporate Governance equation :

$X = \alpha_0 + \alpha_1 Y + \varepsilon_2$ (5)

Here, ε_1 *and* ε_2 are the error terms for each equation, indicating factors affecting Y and X that are not accounted for in the model. This system suggests that Y and X are jointly determined — X affects Y, and Y also affects X. The simultaneity issue arises because X, which is an explanatory variable in the first equation, is itself determined by an equation that includes Y as an explanatory factor.

To address the bias caused by simultaneity, we can rewrite the equation for X by substituting the equation for Y into it, leading to an expression for X in terms of the parameters and error terms:

$X = \alpha_0 + \alpha_1(Y = \beta_0 + \beta_1 X + \varepsilon_1) + \varepsilon_2$ (6)

That is equal to:

$$X = \frac{\alpha 0 + \alpha 1 \ \beta 0 + \ \alpha 1 s 1 +}{s2} \quad (7)$$
$$1 - \alpha_1 \beta_1$$

This formulation reveals that X is correlated with ε_1, the error term from the equation for Y. As a result, using OLS to estimate β_1 in the first equation will yield biased results because X is endogenous — it is affected by ε_1. Two common approaches to tackle this problem are the use of Instrumental Variables (IV) and the application of the Simultaneous Equations Model (SEM), particularly through the Two-Stage

Least Squares (2SLS) method. Instrumental variables offer a powerful solution for isolating the clean, exogenous variation in an endogenous explanatory variable (X), which might otherwise be correlated with the error term (ε_1) in a regression model. An ideal instrument influences the endogenous variable but has no direct effect on the dependent variable (Y) outside of its connection to X. This characteristic ensures that the variation in X captured by the instrument is free from the confounding influences that plague ordinary least squares estimates, providing a clearer view of the causal relationship between X and Y. Meanwhile, the Simultaneous Equations Model, particularly when implemented via the 2SLS technique, handles situations where variables are mutually influencing each other—commonly referred to as simultaneity. The 2SLS approach tackles this by first predicting the values of the endogenous variables using all available exogenous variables as instruments in the first stage. This step creates values of X that are purged of their correlation with the error terms. The second stage then uses these "cleaned" values to estimate the coefficients in the main equation of interest. This approach essentially breaks the feedback loop between X and Y, allowing for a more accurate estimation of the structural parameters. The validity of 2SLS results heavily depends on the relevance and validity of the chosen instruments. The estimates may lack precision if the instruments are not strongly correlated with the endogenous variable. Hence, the instruments used in the first stage of 2SLS should be exogenous to the model. If instruments are correlated with the error term, the estimates may be biased. Furthermore, 2SLS may require a relatively large sample size to produce reliable estimates, especially when dealing with a high-dimensional instrument set.

Endogeneity Type III: Dynamic Endogeneity

Dynamic endogeneity manifests when the current values of variables are influenced by their past values. In the corporate governance context, this dynamic interplay is evident when a firm's present governance structure is shaped by its historical value. For example, companies may adjust governance mechanisms in response to past financial performance trends, reflecting an evolving relationship over time (Hermalin & Weisbach, 1998).

To address dynamic endogeneity that presence in panel/time-series data, econometricians often use dynamic panel data models. These models can explicitly incorporate past values of the dependent variable as explanatory variables, acknowledging and measuring the influence of historical data on present outcomes. The model can be represented as follows:

$$Y_{it} = \propto Y_{it-1} + \beta X_{it} + y_i + \varepsilon_{it} \quad (8)$$

Y_{it} is the dependent variable (e.g., firm performance) for firm i at time t, $Y_{it-1}$is the lagged dependent variable, representing past performance, X_{it} are other explanatory variables influencing the current outcome (e.g., current governance mechanisms), y_i captures firm-specific effects that do not vary over time, and ε_{it} is the error term.

The Generalized Method of Moments (GMM here after) extends the GMM method to dynamic panel data models, allowing for the inclusion of lagged levels of variables as instruments (internal instruments). GMM allows for a more efficient use of instruments compared to 2SLS. It effectively addresses the endogeneity of the lagged dependent variable by using its past values as instruments, assuming that these past values are correlated with the current value but uncorrelated with the error terms of the current and future equations.

$$Y_{it} = \propto Y_{it-2} + \beta X_{it-1} + y_i + \varepsilon_{it} \quad (9)$$

Here, Y_{it-2} *and* X_{it-1}can be used as instruments for Y_{it-1} in the GMM estimation process. However, GMM requires large sample sizes (ideally over 150 observations) and extended time periods (more than five years) to provide reliable results. Smaller or shorter panels may not provide enough variation and instrumental validity, leading to weak instrument problems akin to those faced in 2SLS but on a potentially larger scale.

Endogeneity studies in corporate governance research: journals and themes

This study examines how different approaches to endogeneity problems have been used in the 15 corporate governance-related publications that are part of Web of Science (WOS), such as Corp. Gov. and J. Corp. Financ. The first sample of literature, as seen in Figure 2, consists of 1435 searches using the keywords found in the titles and abstracts of the indexed articles. Due to the author's linguistic restrictions, the results were then improved by restricting the findings to journal papers published in English. The top 15 prolific journals came next. Similar studies have often used this strategy (e.g., Ali et al., 2018; Jean et al., 2016). A final sample of 361 studies that specifically addressed the endogeneity problem was produced as a consequence of this procedure. The use of endogeneity has lately gained traction in corporate governance research, as seen by the split of papers by journal and year (Table 1).

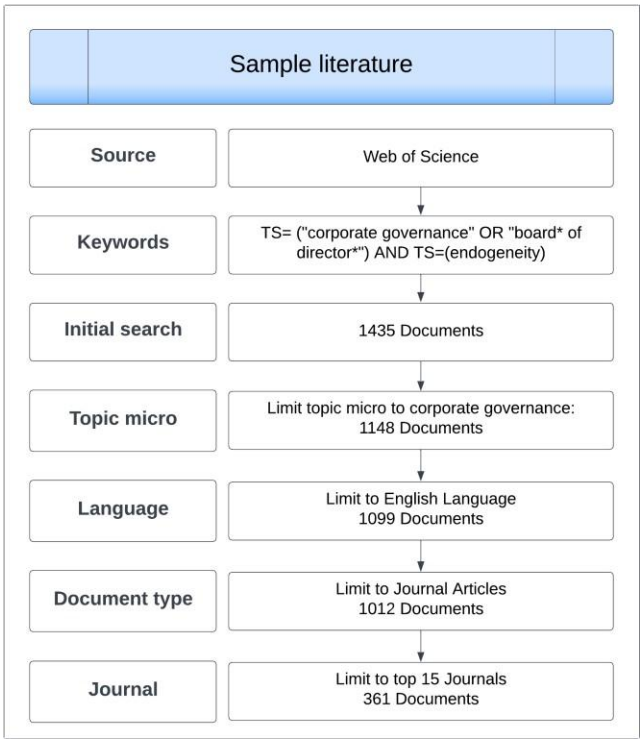


Figure 2: Searching the literature process
Source: Developed by the author

Table 1: Number of studies per journal

Journal name	ISSN	pre-2005	2006-2010	2011-2015	2016-2020	2021-present	Total
J. Corp. Financ.	1057-5219	1	4	10	22	19	56
Int. J. Financ. Econ.	1099-1158	1		5	6	28	40
Corp. Gov.-Int. J. Bus. Soc.	1758-6054			3	10	25	38
Int. Rev. Financ. Anal.	0378-4266			4	6	24	34
Corp. Gov.	1467-8683	1	7	4	6	12	30
J. Bank Financ.	0929-1199	1	1	8	8	5	23
J. Bus. Ethics	1573-0697		1	6	11	2	20
Int. J. Emerg. Mark.	1746-8809				1	18	19
Account. Financ.	1467-629X		1	4	7	7	19
Pac.-Basin Financ. J.	1879-0585			3	3	11	17
J. Bus. Res.	0148-2963		1	3	7	5	16
Int. Rev. Econ. Financ.	1873-8036			2	5	9	16
J. Bus. Finan. Account.	1468-5957			1	2	9	12
J. Financ. Econ.	0304-405X		1	7	2	1	11
Contemp. Account. Res.	1911-3846		2	4	3	1	10

Source: Developed by the author

Test for Presence of Endogeneity

The first step in addressing endogeneity's detrimental impacts is to recognize its existence, as needless endogeneity correction might result in estimates that are less accurate. To ascertain if an independent variable in a model is really endogenous, the Durbin-Wu-Hausman (DWH) test is used; this depends heavily on the caliber of the instruments utilized. Larcker and Rusticus (2007) state that the validity of these tests depends on the suitability of the instruments used.

After determining the instruments' validity and strength, researchers use the Hausman test to identify endogeneity. Determining if there is a substantial difference between the uncorrected set of parameter estimates and those adjusted for endogeneity is the main goal of this test, also called the Durbin-Wu-Hausman test. Rejecting the null hypothesis, which holds that there is no difference, indicates a considerable discrepancy and, assuming the instruments are trustworthy, a preference for the endogeneity-corrected values. As shown in previous parts of the approach, this test is comparable to evaluating the importance of the control function term in certain equations.

It is crucial to remember that traditional model fit metrics, such as holdout sample fit or R-squared, are inappropriate for evaluating the effectiveness of endogeneity correction. There is a trade-off when using 2SLS or any other endogeneity correction technique: we give up fit in order to get more reliable parameter estimations. In contrast to OLS, which seeks to optimize the fit by minimizing the sum of squared residuals, 2SLS modifies the regression line to ensure a consistent estimation of the actual connection, even if doing so prevents the sum of squared residuals from being minimized. Because of this change, the OLS fit line should outperform the 2SLS line in both in-sample and out-of-sample situations.

Unlike previous developments in marketing modeling, such nonlinear functional forms or unobserved parameter heterogeneity, the success or failure of 2SLS is not determined by in-sample and out-of-sample fit. When comparing two theoretically sound endogeneity-correcting strategies, temporal fit can only be used as a criteria to help researchers decide which strategy is better based on empirical results. This emphasizes how difficult it is to handle endogeneity and how important it is to make cautious methodological decisions in order to guarantee reliable empirical analysis.

Techniques to address the endogeneity

Over the past two decades, the evolution of techniques to address endogeneity in governance literature reflects an increasing sophistication in econometric methods and a growing awareness of the complexities inherent in empirical research. In the early 2000s, 2SLS began to gain traction, indicating researchers' recognition of endogeneity as a significant concern. Its use has consistently grown, underscoring its perceived robustness and versatility across various research contexts (see table 2). As we moved into the late 2000s and beyond, the GMM started to emerge, later experiencing a substantial increase in usage. This trend likely stems from GMM's ability to handle dynamic panel data adeptly and effectively address unobserved heterogeneity and serial correlation. Its adoption marks a shift towards more dynamic and complex econometric models, which are especially beneficial in longitudinal studies.

Table 2: Method applied in the literature

	pre-2005	2006-2010	2011-2015	2016-2020	2021-2023	Total
2SLS	2	9	17	43	44	115
GMM	0	2	17	28	50	96
PROPENSITY	0	0	4	20	35	59
DiD	0	0	4	15	24	43
HECKMAN	0	2	6	13	11	31
3SLS	2	5	2	2	2	17

Source: Developed by the author

Propensity Score Matching (PSM here after) and Difference-in-Differences (DiD here after) methodologies began to be employed more frequently after 2010, reflecting a burgeoning interest in causal inference and policy impact evaluation in observational studies. PSM's growth indicates an emphasis on matching treated and control groups to infer causal relationships, while the increasing use of DiD suggests a focus on assessing longitudinal policy impacts, leveraging its ability to control for unobserved, time-invariant factors. The 3SLS, though less frequently used and slightly declining in recent years, remains relevant in complex settings involving simultaneous equation models with endogenous variables. Its specialized application indicates its suitability for intricate models where simpler methods might not suffice.

Generalized Method of Moments

The GMM significantly influences governance-related research, as evidenced by numerous studies (Farag et al., 2014; Orazalin & Mahmood, 2021; Tanthanongsakkun et al., 2023). This method excels in econometric analysis, especially when models surpass the complexity manageable by OLS estimation. GMM's power lies in its ability to clarify intricate relationships in governance studies, where endogeneity and unobservable variables are common challenges. It stands out as a comprehensive solution for all three types of endogeneity bias, offering a dynamic model that yields more consistent and reliable results compared to static estimations like

OLS.
To implement Generalized Method of Moments (GMM) in STATA for dynamic panel data models, you typically use commands like xtabond, xtdpd, xtdpdsys, and especially xtabond2 that is developed by Arellano–Bover/Blundell–Bond estimator. The latter is particularly popular due to its flexibility and extensive options for handling various dynamic panel data estimator issues, including endogeneity and autocorrelation among the explanatory variables.

Step-by-Step Guide to Using xtabond2 in STATA;
Installing xtabond2: Before you can use xtabond2, ensure it's installed in your STATA. If not, you can install it using the following command:
ssc install xtabond2 (8)

Specifying the GMM Model: The xtabond2 command allows for a detailed specification of the dynamic panel data model.
xtabond2 y L.y x1 x2 x3 x4, gmm(L.y, lag(2 .)) gmm(x1 x2 x3 x4, lag(2 .)) noconstant twostep robust (9)
Where;
y: Dependent variable.
L.y: Lagged dependent variable, L. denotes one lag. which can adjust this according to your model specification.
x1 x2 x3 x4: Independent variables.
gmm(L.y, lag(2 .)): Specifies y lagged twice as an instrument for the differenced equation. *gmm*(x1 x2 x3 x4, lag(2 .)): Specifies lags of x1, x2, x3, and x4 as instruments. Replace (2 .) with specific lags based on your study's requirements.
noconstant: Excludes the constant from the model.
twostep: Specifies the estimator to use the more efficient two-step GMM.
robust: Computes robust standard errors to control for any heteroscedasticity.

In the landscape of governance research, the importance of GMM is underscored by its ability to handle endogeneity. This issue, where independent (e.g., board size) and dependent variables (e.g., firm performance) may influence each other, is a frequent stumbling block in governance studies (e.g., Does larger board size increase the financial performance of companies or more profitable companies would hire directors on the board?). Additionally, GMM's aptitude for dynamic data analysis enables researchers to account for unobserved individual differences and the evolving nature of dependent variables, a critical feature in analyzing governance data that often spans across time (Karim et al., 2022). This aspect is crucial for governance data analysis, which typically extends over time. As such, GMM's application is preferred for its ability to incorporate lagged variables and individual-specific effects, leading to more influential and unbiased model estimations. Prior studies employ this estimator to evaluate the impact of corporate governance on corporate performance (Duru et al., 2016; Tan et al., 2017), capital structure (Ezeani et al., 2022; Gyimah et al., 2021), earnings management (Abu Afifa et al., 2022; Fan, Jiang, et al., 2019), corporate reporting (Gerged, 2021; Khandelwal et al., 2020), and environmental performance (Lu & Herremans, 2019; Nuber & Velte, 2021).
One of the key advantages of the GMM in dynamic models is its capacity to utilize internal instruments, specifically lagged variables. This characteristic of GMM is highly valued in academic circles as it addresses the challenge of identifying robust and valid external instruments (Ahmed et al., 2021; Cicero et al., 2013; Duru et al., 2016; Karim et al., 2022; Lucas-Pérez et al., 2015; Uyar et al., 2023). Out of 96, 78 studies relied only on the internal instrument and dynamic models featured lagged dependent variables and control for unobserved individual-specific effects such as dynamic endogeneity, reverse causality, simultaneity and unobserved heterogeneity. This preference likely stems from the ready availability of these internal instruments in panel datasets. The GMM estimator is acclaimed for its robustness across various estimation techniques, as it operates

without unnecessary assumptions. For instance, it is not necessary to possess comprehensive knowledge about the precise distribution of the data generation process and the error terms. In the development of GMM estimation, a common assumption is that the error terms in the model are uncorrelated with a set of explanatory variables, as asserted by Arellano and Bond (1991) and Blundell and Bond (1998). This econometric method effectively estimates parameters in a manner that minimizes correlations between error terms and explanatory variables, aiming for near-zero correlations. Additionally, dynamic models predominantly focus on single-equation and autoregressive distributed lag models, particularly in scenarios with numerous cross-section units and a limited number of time periods, yielding consistent outcomes (Bond, 2002).

As shown in Table 3, the studies under review present varied sample sizes. With an average sample of over 711 firms across ten years, the data sets seem robust, ideally suited for GMM analysis. However, the studies with smaller samples, those with fewer than 100 firms, might confront specific challenges (e.g., Abu Afifa et al., 2022 [49 frims]; Areneke & Tunyi, 2022 [80 firms]; Nguyen et al., 2015 [4 years]). Smaller samples can lead to issues like weak instruments, particularly noticeable in different GMM applications. Moreover, the reliability of results from smaller samples could be compromised due to larger variances and a greater risk of overfitting the models.

A notable trend is the preference for system GMM, as proposed by Blundell and Bond (1998), over difference GMM. This preference likely arises from system GMM's efficiency in panels with a larger time dimension, as seen with the average of 10 years across these studies. Orazalin and Mahmood (2021) suggested that System GMM is commonly applied in governance literature as it enables the control for dynamic panel bias, especially in a dynamic panel context related to the corporate governance-performance relationship. System GMM's proficiency in handling persistent data, which is common in governance research where variables often exhibit stability over short periods, adds to its appeal. When there is a consistent connection between the regressors and the firm fixed-effects over the course of the sample period, the dynamic system GMM estimates will yield more accurate estimates than those of the dynamic difference GMM. Moreover, it addresses the issue of weak instruments more effectively by integrating information from both levels and differences in the data.

Table 3: Summary of studies used GMM estimation

Sample size		Sample period		GMM types		Instrument types	
	# Studies		# Studies		# Studies		# Studies
Over 1000 firms	13	Over 15 years	20	Difference GMM	7	External	18
500-1000 firms	15	10-14 years	34	System GMM	89	Internal	78
200-500 firms	34	7-9 years	28				
100-199 firms	22	Less 7 years	12				
Less Than 100 firms	12						
Average	711	10					

Source: Developed by the author

Two studies (e.g., Kassi et al., 2023; Schultz et al., 2017) take account of such possible simultaneity using the dynamic difference GMM estimator developed by Arellano and Bond (1991). This estimator, however, has few limitations (Farag et al., 2014), including weak instrumental variable (IV) problem (Lee et al., 2022), particularly when using variables lagged by T periods (T = 1, 2, …) as IVs. As T increases, the correlation between the endogenous variable and the IVs weakens. This weakness in IVs can result in suboptimal performance, especially with finite (typically small) samples. To address this issue, it is necessary to limit the lag periods of the IVs instead of incorporating all past lags when assessing regressions.

To overcome this limitation, a strategy involves directly estimating the original-level equations, a task facilitated by employing the system GMM. The system GMM estimator proves more efficient than exclusively estimating either the difference equation or the level equation. However, it imposes stringent orthogonality conditions, as both the assumptions for "the level equation" and "the difference equation" must be satisfied. When using the system GMM estimator, it is crucial to report the statistics of three tests. Addressing such limitation by directly estimating the original-level equations which can be easily covered by applying system GMM. The system GMM estimator is more efficient than estimating only the difference equation or the level equation. However, it imposes serious orthogonality conditions, because the assumptions for both “the level equation” and “the difference equation” must be satisfied. The statistics of the following three tests should be reported when using the system GMM estimator.

These tests check for serial correlation in the residuals of the differenced equation. Specifically, it tests for first-order (AR (1)) and second-order (AR (2)) serial correlation. For this one, the p-value of AR (1) should be significant. In the context of GMM, finding evidence of first-order serial correlation (AR (1)) in the differenced residuals is common and not necessarily problematic. However, the presence of second-order serial correlation (AR (2)) in the differenced residuals is a cause for concern, as it suggests that the moment conditions used might not be valid. For this one, the p-value of AR (2) should not be significant.

Sargan Test or Hansen Test of overidentifying restrictions to assess the overall validity of the instruments used in the GMM estimation. The Sargan test is appropriate when the error terms are homoskedastic, while the Hansen test is a more general test that is robust to heteroskedasticity and autocorrelation. The null hypothesis is that the instruments as a group are exogenous, i.e., they are not correlated with the error term. A rejection of the null hypothesis suggests that some of the instruments are invalid, potentially leading to biased and inconsistent estimates. Table 4 presents a comparison difference between GMM and system GMM.

Table 4: Difference GMM versus system GMM

	Difference GMM (Arellano-Bond)	System GMM (Blundell-Bond)
Basic Approach	Differencing the data to remove fixed effects.	Combines differenced and level equations.
Instruments Used	Lagged levels are used as instruments for the differenced equation.	Lagged differences for level equations, and lagged levels for differenced equations.
Applicability	More suitable for panels with small *T* (time dimension) and large *N* (cross-sectional dimension).	More efficient for panels where *T* is not very small, and for data with persistent variables.
Efficiency	Less efficient, especially if variables are close to a random walk.	Generally more efficient, especially with persistent data.
Handling Persistent Data	Less effective with highly persistent data.	More effective in handling persistent data.
Weak Instruments Issue	Potential problem with weak instruments in short panels.	Addresses the weak instrument problem by adding more information from levels.
Instrument Proliferation	Less prone to instrument proliferation.	More prone to instrument proliferation, requiring careful handling.

Robustness to Model Specification	More robust in smaller samples, but sensitive to model specification.	Requires more stringent assumptions, less robust to mis-specification in small samples.
Complexity	Simpler to implement and interpret.	More complex due to additional equations and instruments.

Source: Developed by the author

Two-Stage Least Squares Estimation

The 2SLS estimation is the most applied techniques in the governance literature to address the endogenies issue with 115 studies (Campbell & Mínguez-Vera, 2008; Farooq et al., 2023; Mak & Li, 2001; Ntim et al., 2013; Safiullah & Shamsuddin, 2019). The 2SLS method is particularly useful when dealing with an endogenous independent variable that may be influencing the dependent variable.

In the context of corporate governance, consider an example where one is interested in examining the relationship between "Board Size" (the independent variable) and "Firm Performance" (the dependent variable). In this scenario, "Board Size" might be endogenous. This endogeneity could arise, for instance, if larger boards are more likely in firms with specific performance characteristics, or if unobserved factors influence board size and firm performance simultaneously. In the first stage of the 2SLS approach, "Board Size" is regressed on chosen instrumental variables. These instruments should be correlated with "Board Size" but not directly affect "Firm Performance." For example, such instruments could be factors related to the regulatory environment or industry-specific governance norms that influence board size but are not directly linked to firm performance. The residual from this regression is then computed, capturing the "Board Size" part not explained by the instruments. The second stage involves regressing "Firm Performance" on this residual. This step aims to isolate the variation in "Board Size" that is not correlated with the potential errors in the "Firm Performance" regression, providing a more accurate estimate of the impact of board size on firm performance.

Identifying valid instrumental variables is a critical challenge in this method. The instruments must strongly correlate with the endogenous variable ("Board Size") and should not be associated with the error term in the main regression ("Firm Performance"). Finding such instruments often requires careful theoretical and empirical considerations.

The strength and validity of the instrumental variables used significantly influence the effectiveness of the 2SLS approach. Weak or invalid instruments can lead to biased and inconsistent estimates. Furthermore, even with valid instruments, the estimates obtained through 2SLS might sometimes lack statistical significance due to weaker identification compared to standard regression methods. Among other instrumentals, the prior studies have used state-level gender equality index, retirements and deaths of directors, enterprise risk management, CEO tenure-to-age, currently active CEOs on board, information disclosure measured, ownership concentration, and growth opportunities (Bhagat & Bolton, 2008; Fan, Boateng, et al., 2019; Frijns et al., 2016; Uribe-Bohorquez et al., 2018). Also, using the mean value of endogenous variables for firms within a specific category (like industry or geographical location) as instrumental variables is a common practice in empirical research. This approach has both advantages and drawbacks, and researchers should be cautious when employing it (e.g., Al-Shaer et al., 2023; Ye et al., 2019). The advantages of this approach include the easy availability and accessibility of mean values, the potential to reduce endogeneity bias by capturing exogenous variations within the industry or region, and providing insights into how industry or regional norms influence individual firm behavior. Summary of studies that applied this technique are presented in Table 5.

Three-Stage Least Squares Estimation

The 3SLS provides a robust approach for analyzing complex relationships in econometric models, particularly useful in the context of corporate governance and firm performance. This method can be vital when exploring how various aspects of corporate governance interact with firm performance, especially when other variables

influence these interactions or when the relationship is suspected to be endogenous, and it was applied in nine studies (e.g., Aerts et al., 2007; Areneke et al., 2023; Elyasiani & Zhang, 2015; Jackling & Johl, 2009; Lefort & Urzúa, 2008). 3SLS is particularly useful in models involving variable interactions across different equations. For example, in a model examining the impact of corporate governance on firm performance, 3SLS can effectively capture how changes in governance might interact with other factors like market conditions or regulatory environments and how these interactions, in turn, affect firm performance. The 2SLS only allows for potential endogeneity, while the 3SLS allows for both potential endogeneity and cross-correlation between the equations (Jackling & Johl, 2009). In a typical application of 3SLS in this context, the analysis might look into how a specific aspect of corporate governance, say board composition, affects firm performance. However, this relationship could be influenced by or interact with other factors like market conditions or regulatory environments.

Table 5: Summary of studies used 2SLS estimation

Sample size			Sample period		
# Studies		Example	# Studies		Example
Over 1000 firms	56	(Renders et al., 2010; Ye et al., 2019)	Over 15 years	26	(Gyimah et al., 2021)
500-1000 firms	20	(Lahlou & Navatte, 2017; Patro et al., 2018)	10-14 years	43	(Li et al., 2022)
200-500 firms	12	(Boshnak, 2021; Frijns et al., 2016)	7-9 years	16	(Bolton, 2014)
100-199 firms	8	(Mak & Li, 2001; Safiullah & Shamsuddin, 2019)	Less 7 years	30	(Ngo et al., 2018)
Less Than 100 firms	19	(Campbell & Mínguez-Vera, 2008; Ntim et al., 2013)			
Average	1733				

Source: Developed by the author

First stage - corporate governance as endogenous: initially, the corporate governance variable, such as board composition, is regressed on an instrumental variable that influences it but is not directly related to firm performance. This could be a regulatory change or a market trend. This stage aims to predict the corporate governance variable in a way that is free from the direct influence of firm performance. Second stage - firm performance analysis: Next, firm performance is analyzed as a function of the residual corporate governance variable obtained from the first stage. This residual represents the part of corporate governance not explained by the instrumental variable, isolating the pure effect of governance on performance. Third stage - introducing interactions: In the final stage, interaction terms are introduced into the model. This might include the interaction between the residual corporate governance variable and another relevant factor like market volatility or economic conditions. This step is crucial for understanding how the impact of corporate governance on firm performance changes under different conditions.

The 3SLS method stands out for its ability to dissect these layered relationships and provide insights that are obscured in simpler models. It helps in understanding whether corporate governance affects firm performance and how and under what conditions this effect is amplified

or diminished. However, employing 3SLS demands a high level of precision and consideration. The choice of instrumental variables is critical, as they must be relevant to corporate governance but exogenous to firm performance. The model's specification must accurately reflect the theoretical underpinnings of the relationship between governance and performance. Moreover, in the presence of interaction terms, mean-centering the variables is crucial to prevent collinearity issues, ensuring that the model remains stable and interpretable.

Difference-in-Differences method

The DiD method is an econometric approach widely used in governance research to assess the effects of policy changes, regulatory interventions, or other treatments over time (e.g., Baghdadi et al., 2023; Chen et al., 2020; Funchal & Monte-Mor, 2016; Jacob et al., 2016; Liao et al., 2021; Masulis & Mobbs, 2023; Oware et al., 2022; Tosun, 2021). This method contrasts the changes in outcomes between a group that receives the intervention and one that does not across different time periods. It's a valuable tool for causal inference in observational studies where randomized control trials are infeasible. Jacob et al. (2016) applied DiD setting to exploit regional differences because the phase-out applied only to investors in one province against another.

DiD is particularly useful in governance studies for evaluating the impact of regulatory changes or corporate governance reforms (at firms over time or between different regions) on firm performance, board composition, and corporate decision-making. One of its key strengths is its ability to control for unobserved fixed characteristics that might otherwise bias results, by focusing on changes over time rather than absolute levels. Compared to methods like the GMM and 2SLS, DiD has several advantages. It is simpler to implement and its results are more straightforward to interpret, making it more accessible to a non-technical audience. DiD also does not require the use of instrumental variables, a necessity in 2SLS and GMM that can often be challenging to validate or find in practice. Additionally, it tends to be more robust to model specification errors compared to GMM or 2SLS, which are sensitive to the choice of instruments and functional form assumptions.

However, DiD is not without limitations. Its effectiveness hinges on the assumption that the treatment and control groups would have followed parallel paths over time in the absence of the treatment. If this parallel trends assumption is violated, the results can be misleading. DiD can also be compromised by spillover effects, where the treatment impacts the control group, and by changes over time that are unrelated to the treatment. Furthermore, DiD estimates are specific to the time period and context studied, which can limit their generalizability.

Propensity score matched

The PSM is an approach used in governance research and other fields to estimate the effect of a treatment or intervention when a randomized control trial is not feasible (Ahmad et al., 2023; Ahmed et al., 2021; Baghdadi et al., 2023; Bu et al., 2021; J. Chen et al., 2017; Le & Tran, 2022; Lu & Herremans, 2019; Lu & Wang, 2018; Zalata & Abdelfattah, 2021). This method involves matching subjects in a treatment group with similar subjects in a control group based on their propensity scores, which represent the probability of being assigned to the treatment given a set of observed characteristics. In the context of governance studies, PSM is particularly useful for examining the effects of corporate governance policies, board composition changes, or other organizational interventions. The key idea is to create a control group that is as similar as possible to the treatment group in all relevant pre-treatment characteristics, reducing selection bias in the comparison.

One of the main advantages of PSM over methods like 2SLS or GMM is its ability to create balanced groups based on observable characteristics, thereby addressing selection bias more directly. It's a non-parametric method that does not rely on strong model assumptions, which can make it more robust in certain contexts. PSM is also relatively straightforward to implement and interpret, making it accessible for researchers and practitioners.

However, PSM has its limitations. It only accounts for observable characteristics, so any unobserved factors that affect both the likelihood of receiving the treatment and the outcome can still bias the results. This limitation is particularly relevant in governance research, where many unobservable factors can influence both governance decisions and firm outcomes. Additionally, finding appropriate matches can be challenging, especially in cases where the treatment group is very different from the potential control group in key aspects. The quality of the matching process critically depends on the choice of variables used to calculate the propensity score and the availability of rich data.

Another challenge is the issue of "common support" or "overlap" – PSM requires that for each subject in the treatment group, there is a similar subject in the control group. When this condition is not met, it limits the applicability of the method.

Instrumental variable

Instrumental variables in governance research refer to external factors or variables used to address endogeneity and establish causal relationships between independent and dependent variables. Instrumental variables are prevalent in empirical studies, particularly in situations where the endogeneity of certain variables poses a challenge to unbiased estimation (e.g., Ahmed & Atif, 2021; Lodh et al., 2022; Shoham et al., 2020). Instrumental variables help mitigate this issue by systematically isolating exogenous variation in the endogenous variable of interest. By doing so, researchers aim to uncover the causal impact of governance structures on various outcomes, such as firm performance or corporate reporting (Naheed et al., 2021; Tan et al., 2017). Hence, having valid instrumental variables is crucial for the effectiveness of IV methods. Validity is assessed based on two key criteria: sufficiency and validity conditions. Sufficiency ensures that instruments are strongly correlated with the endogenous variable, while validity ensures that instruments are uncorrelated with the error term in the second-stage regression. The importance of valid IV lies in their ability to address endogeneity without introducing bias, leading to more reliable and interpretable results. A valid instrument must meet two criteria: a strong correlation with the instrumented regressors and orthogonality with the error term.

Figure 3 categorizes different types of instrumental variables used in governance science based on their externalities and how well they meet econometric conditions such as exogeneity and relevance. This is crucial for selecting appropriate IVs in empirical research, particularly for addressing endogeneity concerns. First, there are clearly determined outside the unit of analysis. These include factors like weather data and genetic markers that are external to the subject under study and unaffected by it. These variables are typically excellent candidates for satisfying the exogeneity condition because their external nature means they are unlikely to be influenced by the unit of analysis. However, their relevance can vary depending on their impact on the dependent variable being studied. Next, there are variables that describe phenomena external to the unit of analysis but may still be affected by the unit. This category includes industry average or median, which might evolve or react in response to the unit's actions. These variables are less ideal for meeting the exogeneity condition because of potential feedback effects but are often highly relevant if they significantly influence the dependent variable. Lastly, variables that describe the unit of analysis itself are considered. While these are directly related to the unit and therefore generally relevant, they are less suitable as IVs because they frequently fail to meet the exogeneity criterion. This inherent connection with the unit of analysis makes it challenging to distinguish the influence of these variables from other internal dynamics.

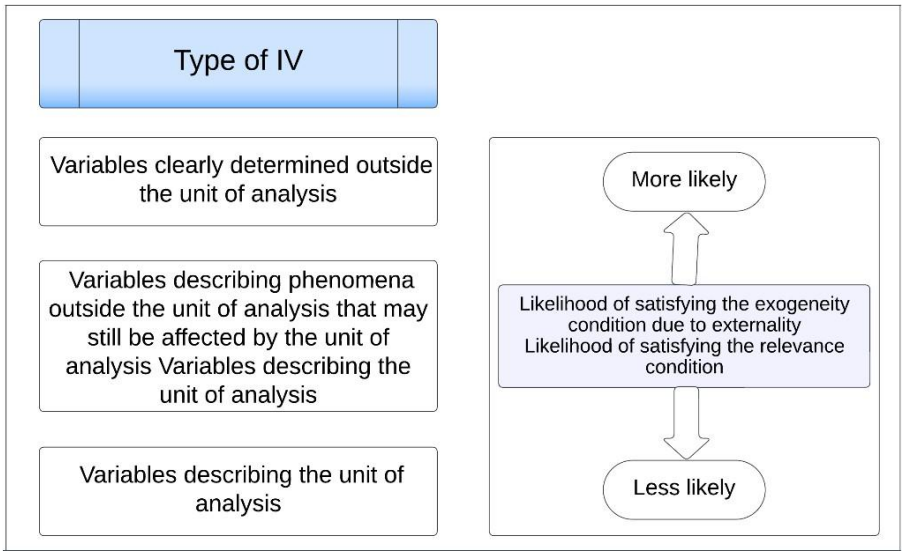


Figure 3: Potential IVs with the satisfactory likelihood
Source: Developed by the author

It is difficult to find a valid instrument in social sciences, including the governance domain, but we follow existing literature and attempt to develop a semi-true instrument. Cumming and Leung (2021) and Renders et al. (2010) suggested that it is greatest challenge to attain valid instruments that enable dealing with endogeneity. Most empirical studies use "imperfect" instruments. They either are exogenous but have a low correlation with the endogenous variable ("weak instruments"), or are partially endogenous but have a high correlation with the endogenous variable ("semi-endogenous" or "quasi-instrumental" variables). Larcker Kanashiro (2020) argued that in the context of this research, a theoretically valid instrumental variable does not appear to exist in the current literature. As summarized in Table 6, the sample literature has used variety instrumental variables. For example, gender diversity has been linked to gender intensity index, the percentage of women in each industry, the proportion of male directors on a board who sit on other boards (Ahmed & Atif, 2021; Shoham et al., 2020; Tao et al., 2022). While literature that applied GMM has mainly relied on the Lagged value of the endogenous variables as instrument, such as past governance structures or performance measures, which are commonly used as internal generated IV (Ezeani et al., 2022; Jackling & Johl, 2009; Kassi et al., 2023; Lefort & Urzúa, 2008). These instruments capture the historical influence on current decisions, providing a source of exogenous variation.

Table 6: The common instruments used in the sample literature

Variable	Instrument
Governance index	- Percentage of directors who are currently active CEOs
Director busyness	- The number of public firms headquartered in the same city
Cultural diversity	-Dummy variable for whether a firm is headquartered outside of a large metropolitan area - Genetic diversity
	-Headquater related attrebutes
Governance veriables	- The year-average of each of the corporate governance variables
	- Industry-average

	- Industry median
Board independence	The mean value of the percent of independent directors of other firms headquartered in the same province/municipality in the same year The total number of directors residing in the firm's home country Growth opportunities
-Foreign chairman -Foreign chief executive officer	- The country of origin corporate ethics and accountability
Director compensation	The industry median equity-based compensation
Talented inside directors	- Industry talented inside directors average in the same year
Gender diversity	Average female director interlock Total pensions scaled to the number of employees State-level gender equality index Firm's male directors who sit on other boards with at least one female director Board connectedness of white male directors
Firm performance and firm value	- Treasury Stock
CEO ownership	- CEO Tenure-to-Age
Audit committee attributes	Directors' tenure

Note: reference for the summarized instruments (see, Ain et al., 2020; Areneke et al., 2023; Areneke & Tunyi, 2022; Bhagat & Bolton, 2008; Bu et al., 2021; Dodd et al., 2022; Elyasiani & Zhang, 2015; Frijns et al., 2016; Liu et al., 2015; Miletkov et al., 2014; Nadeem et al., 2020; Nuber & Velte, 2021; Tampakoudis et al., 2022; Upadhyay & Zeng, 2014; Ye et al., 2019).
Source: Developed by the author

Lagged variable

The use of lagged variables as instrumental variables (IVs) is a common strategy to tackle this challenge because these variables help mitigate concerns related to simultaneity and reverse causality. By employing data from previous periods, researchers can argue that these variables are less influenced by contemporary shocks or changes within the firm or industry, which enhances their suitability as IVs (Wintoki et al., 2012). Lagged variables are particularly appealing because they are often strong predictors of current variables, making them fulfill the requirement of being a strong IV. For instance, a firm's financial performance or governance structures from previous years can be powerful predictors of current outcomes, underpinning their frequent use in corporate governance studies. However, the validity of lagged variables as instruments depends significantly on the absence of feedback loops where past events influence future outcomes beyond the scope of the variable measured.

One way to enhance the validity of lagged variables is to use longer lags. Although not an ideal solution, lagging variables may to some extent alleviate endogeneity (Jean et al., 2016). This approach assumes that the further back the data, the less likely it is influenced by or to influence current conditions. This method was suggested by researchers like Ataman et al. (2010), who used longer lags until tests like the Sargan test validated the exclusion restriction. However, using longer lags might weaken the IV's relevance as the historical data may become too detached from current conditions to provide meaningful insights into current governance issues. Another approach to improve the validity of lagged variables is to incorporate into the model the mechanisms

through which these lagged variables influence current conditions. For example, in corporate governance, if previous years' governance structures influence current performance through mechanisms like policy-setting roles of the board of directors (see, policy setting hypothesis by Khatib et al. (2021)), explicitly modeling these

pathways can help justify the use of lagged governance structures as IVs. This method addresses potential omitted variable biases and ensures that the lagged variables do not correlate with the error terms in the current model, enhancing their validity as IVs.

Median and Average value of industry

Utilizing industry-level metrics such as median or average values of financial performance, governance characteristics, or other relevant metrics as IVs is another common practice. These variables are based on the assumption that industry norms or benchmarks influence individual firm behavior or characteristics, while individual firm performances or characteristics are unlikely to significantly alter industry-wide metrics. This approach can help control for unobserved heterogeneity at the industry level that might otherwise bias the estimates of the impact of corporate governance on firm outcomes. However, the validity of these instruments hinges on the assumption that there is no feedback loop from individual firms to the industry metrics, which might not hold in cases where the industry is dominated by a few large firms.

Geographical attributes

Geographical attributes include variables such as the location of the firm's headquarters, regional economic conditions, or legal and regulatory environments specific to a location. These factors are used as IVs under the assumption that they affect firm behavior and performance through regional market conditions, regulatory impacts, or cultural influences. For example, firms located in regions with strict regulatory frameworks for corporate governance might adopt more rigorous governance practices. These geographical attributes are generally exogenous to individual firm decisions, making them suitable as instruments. However, their relevance must be clearly established, as geographical effects might be too broad or not directly linked to the governance variables being studied.

Discussion and guidance for empirical researchers

In the realm of empirical research, the consideration of endogeneity is a critical aspect that warrants meticulous attention from scholars. Surprisingly, prior studies have notably not comprehensively discussed endogeneity, with few exceptions (e.g., Areneke et al., 2023). The scarcity of prior discourse accentuates the necessity for researchers to proactively engage with the intricacies of endogeneity, recognizing its presence and discerning its origins before delving into the application of pertinent techniques to address it. Hence, if the researcher suspects endogeneity, the first step would be to determine its source.

In scenarios where endogeneity is attributed to the omission of pertinent variables, scholars can consider the application of fixed or random effects models with alternative measures and controls. These models, designed to account for unobserved heterogeneity, are robust tools to rectify endogeneity arising from variables that have eluded inclusion in the analytical framework, especially if the sample size is small and the period is short.

On the other hand, if the specter of endogeneity is linked to simultaneity or dynamic factors, the researcher faces a strategic choice between two prominent methodologies: 2SLS and GMM estimations. The selection between these methodologies is contingent upon the nature of the available instrumental variables. Notably, 2SLS necessitates the availability of exogenous instrumental variables, emphasizing the importance of external factors that are not influenced by the endogenous variables under scrutiny. In the context of this research, findings a theoretically valid instrumental variable is challenging. Hence, scholars might rely on quasi-

instrumental. In contrast, GMM offers flexibility by not imposing the same exogeneity requirement on instrumental variables.

In essence, the researcher is confronted with a dynamic decision-making process, wherein the choice between 2SLS and GMM is intricately linked to the nuanced characteristics of the identified endogeneity and the nature of the instrumental variables at hand. This strategic interplay underscores the sophisticated nature of addressing endogeneity in empirical research and underscores the need for a judicious and context-specific selection of methodologies.

Conclusion

The disciplines of corporate governance and financial reporting have been under intense examination in recent decades, which has prompted an investigation of many aspects of their efficacy and ramifications. However, the endogeneity problem has become a crucial issue throughout this investigation. The potential for endogeneity to undermine causality in research is becoming more widely recognized, which has led to a greater emphasis on methodological developments meant to lessen its consequences.

This study has conducted a thorough evaluation of the approaches used to deal with the endogeneity problem in the fields of financial reporting and corporate governance research. The results highlight the 2SLS technique's widespread use as the most popular approach for resolving the endogeneity issue in financial reporting and corporate governance studies. Nevertheless, despite the fact that explicit external instrumental factors are a crucial prerequisite for the implementation of 2SLS, a significant finding is that they are not consistently used in certain research. The availability of external instrumental variables that are independent of the endogenous variables being examined is a prerequisite for this often used instrumental variable technique. The results show a gap in the use of this method, indicating that researchers may sometimes have trouble discovering theoretically sound external instrumental variables. This is a possible barrier to 2SLS's ability to effectively handle endogeneity in situations when obvious exogenous factors are not easily accessible.

The research highlights GMM's appropriateness as a workable substitute when exogenous variables are elusive in order to address this issue. Because GMM does not impose the same exogeneity restriction on instrumental variables as 2SLS, it provides flexibility. However, there are certain requirements for this flexibility, such as the need for a bigger sample size and a longer sample duration. The recognition of GMM as a workable substitute highlights the complex decision-making process that researchers must go through when dealing with endogeneity. The kind of discovered endogeneity and the availability of instrumental variables are closely related to the decision between 2SLS and GMM. Even though 2SLS is still a commonly used method, the study urges researchers to think about GMM when they encounter difficulties in identifying distinct exogenous factors and realizing the associated trade-offs, such as the need for a bigger sample and a longer sample period.

This research has ramifications that go beyond the realm of academia. There is a greater need for thorough empirical research to support decision-making as regulatory frameworks change and business sector scrutiny increases. Strong insights into the ways that financial reporting procedures and corporate governance frameworks affect stakeholder value, accountability, transparency, and business performance are sought for by academics, policymakers, and practitioners. The understanding that endogeneity may obscure these connections emphasizes how crucial methodological rigor is to empirical research. This study also acts as a wake-up call for researchers, encouraging them to aggressively address the complexities of endogeneity. The lack of thorough considerations of endogeneity in earlier research emphasizes the need for researchers to prove its existence and identify its origins before choosing suitable approaches. The study highlights how ignoring endogeneity may result in skewed and erroneous findings, raising the possibility of erroneous conclusions and deceptive theoretical and managerial ramifications.

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