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How do financial inclusion, deposit insurance, and bank concentration affect bank stability?

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Abstract: This study investigates the nonlinear interplay between bank stability, financial inclusion, deposit insurance design, and banking concentration, utilizing unbalanced panel data from 122 countries between 2004 and 2021. By constructing novel indices—including a composite *Moralhazard* index to quantify deposit insurance-related risk incentives, a financial inclusion indicator, and a *CONTAGION* measure to capture the contagion effect of deposit insurance, we provide fresh empirical insights into the institutional synergies and trade-offs shaping banking system resilience. Our analysis reveals three key results: (1) Threshold effects exist in both deposit insurance coverage and financial inclusion levels that significantly influence bank stability; (2) The interaction between deposit insurance spread and financial inclusion may mitigate moral hazard incentives from deposit insurance systems at the micro level, it simultaneously amplifies cross-border contagion risks at the macro level; (3) Heterogeneous cross-country evidence reconciling how higher banking concentration elevates banks' risk.

Keywords: bank risk, financial inclusion, deposit insurance, bank competition, industry concentration

JEL classification: G21, G22, G32

1. Introduction

In today's global economic environment, the stability and efficiency of the financial system are essential drivers of economic development. Under these circumstances, the stability of the banking sector, a core component of the financial system, is crucial. However, in recent years, several global economic events, such as the subprime mortgage crisis, have highlighted issues in risk management within the banking sector. Therefore, studying the stability of the banking industry has important practical significance.

Financial inclusion, deposit insurance, and industry concentration are key factors affecting the stability of the banking sector (Owen and Pereira, 2018). Financial inclusion is an economic system providing all users with comprehensive, convenient, and low-cost financial services. Deposit insurance is a crucial system that protects the interests of depositors (Demirgüç-Kunt and Detragiache, 2002). Industry concentration reflects the competitive landscape of the banking industry and impacts the stability of banks (Boyd and De Nicoló, 2005).

Over the past decade, financial inclusion has received increasing attention as a critical aspect of sustainable economic development. Financial inclusion is seen as expanding access to financial services and products for individuals and businesses, especially those currently excluded. It is a critical factor in reducing poverty and promoting economic growth. However, the relationship between financial inclusion and bank stability is complex (Feghali *et al.*, 2021). On the one hand, increased financial inclusion can lead to risk diversification as more individuals and businesses participate in the financial system (Chauvet and Jacolin, 2017). On the other hand, the additional complexity and risk associated with a more extensive and diverse customer base may increase the probability of bank failure (Damane and Ho, 2024).

One of the earliest studies on this topic is conducted by Berger *et al.* (2009), who find that increased financial inclusion improves bank stability. This is primarily due to the diversification effect, as more individuals and firms participate in the financial system. However, they also find that this relationship is not linear, as there is a tipping point beyond which additional financial inclusion can reduce bank stability. This finding has important implications for policymakers, as it suggests that while financial inclusion generally benefits bank stability, an excessive focus on financial inclusion may destabilize the financial system.

Research on the relationship between deposit insurance and bank risk has not been consistent in its findings (Angkinand and Wihlborg, 2010; Chang *et al.*, 2023a; Chang *et al.*, 2023b; Chang *et al.*, 2022; Chang *et al.*, 2019; Chang *et al.*, 2018). There is little research on the impact of deposit insurance on bank stability under different levels of financial inclusion.

The relationship between bank competition and stability is controversial in the academic community. The “competitive fragility theory,” based on franchise value, relational loans, and marginal profit effects, posits that bank competition hinders stabilization (Yuan *et al.*, 2022). “Competitive stabilization theory,” which relies on the risk transfer effect, argues that competition contributes to bank stability (Boyd and De Nicoló, 2005; Martinez-Miera and Repullo, 2010). In contrast, the “U-shaped theory of competition” suggests that the relationship between bank competition and stability depends on the combination of two effects: marginal profit and risk shifting (Noman *et al.*, 2017). These studies find that high industry concentration can destabilize the financial system by concentrating risk and reducing competition. However, the relationship between industry concentration and bank stability remains unclear.

Prior studies have increasingly emphasized the dual focus on stability and efficiency in banking research (Beck *et al.*, 2013; Grimm *et al.*, 2023; Lee *et al.*, 2020). For instance, Deposit insurance schemes are shown to stabilize banks but may also induce moral hazard, inflating operational costs (Demirgüç-Kunt and Detragiache, 2002). Industry concentration’s impact on stability (via the “concentration-stability” hypothesis) and efficiency (via competition-efficiency theories) remains contested, warranting joint examination (Boyd and De Nicoló, 2005; Schaeck and Cihák, 2014). Our study extends this literature by testing whether the drivers of stability align with or contradict those of efficiency, offering nuanced insights into their synergies or conflicts.

Overall, there is still no comprehensive research on the relationship between financial inclusion, deposit insurance, and banking competition (industry concentration) on bank stability. This paper examines the impact of financial inclusion, deposit insurance, and bank industry concentration on stability. First, we introduce a novel moral hazard index to capture the systemic risks inherent in deposit insurance frameworks, providing a more comprehensive lens for evaluating policy trade-offs (Demirgüç-Kunt *et al.*, 2008). Second, we investigate the non-linarites and interdependencies between financial inclusion and deposit insurance and demonstrate that financial inclusion amplifies stability only when interacting with cross-border contagion effects of deposit insurance, highlighting the critical role of institutional synergies. Third, our research indicates that a higher concentration in the banking industry increases banks’ risk, which also challenges the universality of the “concentration-stability” hypothesis (Boyd and De Nicoló).

The sections of this paper are organized as follows: Section 1, Introduction; Section 2, Literature Review; Section 3, Data; Section 4, Model Specification; Section 5, Empirical Analysis; and Section 6, Conclusion.

2. Literature review

This section provides an overview of the impact of financial inclusion, deposit insurance, and bank competition (industry concentration) on bank stability.

2.1 Theoretical Framework for Linear Relationships

2.1.1 The impact of financial inclusion on bank stability

Promoting financial inclusion development will impact banks' stability: On the one hand, financial inclusion may enhance bank stability through risk diversification (Morgan and Pontines, 2017). On the other hand, financial inclusion may also encourage banks to extend loans to individuals and businesses without sufficient collateral, deteriorate loan portfolio quality, and threaten bank stability (Sahay *et al.*, 2015). Supported by these two opposing theories, the empirical literature examining the relationship between financial inclusion and bank stability has not reached consistent conclusions.

Han and Melecky (2013), using data from 95 countries, find that more people having bank deposit accounts improves the stability of the funding base of bank deposits during the 2008 global financial crisis and that this effect is more pronounced in middle-income countries. Sakarombe (2018), using a systematic generalized method of moments estimation, examines the relationship between financial inclusion and bank stability, and shows that the development of financial inclusion contributes to bank stability. A study based on data from 2913 banks in 87 countries between 2004 and 2012 finds that higher levels of financial inclusion lead to more excellent bank stability (Ahamed and Mallick, 2019). A research using data from over 1500 commercial banks in 36 emerging market countries from 2004 to 2018 finds that financial inclusion development improved the banks' stability (Wang and Luo, 2022). Moreover, regional analyses about the impact of financial inclusion on bank stability have lent support to these observations. For instance, Danisman and Tarazi (2020) use a sample of 4168 banks from 28 European countries and find that financial inclusion benefits the stability of the European financial system. Hakimi *et al.* (2022) utilize bank samples from the Middle East and North Africa (MENA) region from 2004 to 2017, employing the System Generalized Moments Method, and find that greater financial inclusion significantly enhances the stability of banks in the MENA region. Ahamed and Mallick (2019) find that financial inclusion development gives banks access to cheaper retail deposits, lower funding costs, and higher profits. Increasing technological infrastructure (e.g., mobile payments, ATMs, bank branches, etc.) reduces marginal costs, excessive risk-taking, and non-performing loan levels can be lowered (Hakimi et al., 2022).

However, Frimpong *et al.* (2023) find that financial inclusion positively impacts financial stability in 39 sub-Saharan African economies (2004–2017). Crucially, this positive effect is significantly stronger in economies with higher levels of economic freedom. Čihák *et al.* (2021) conduct correlation and non-parametric analyses on widely used data in relevant empirical literature and conclude that financial inclusion negatively correlates with financial stability. Saha and Dutta (2021) examine the relationship between financial inclusion, bank competition, market concentration, and financial stability for 92 countries from 2004 to 2014. They discover a U-shaped relationship between financial inclusion and bank stability. Feghali *et al.* (2021), basing their study on cross-country data from surveys of demand for different financial services since 2011, find that only universal credit adversely affects bank stability.

2.1.2 The impact of deposit insurance on bank stability

Wheelock (1992) examines the effect of deposit insurance on bank failures in the United States in the 1920s using data on banks in Kansas, U.S.A., and finds that protected banks have higher risk-taking and that deposit insurance exacerbates bank failures. Chernykh and Cole (2011) find that deposit insurance increases bank failures in the Russian Federation by analyzing data on 800 banking institutions from 2004–2006. In addition, some studies suggest that the implementation of deposit insurance leads to a decrease in the market constraints imposed on banks by depositors, which is a leading cause of the increase in bank risk-taking (Demirgüç-Kunt and Huizinga, 2004; Fonseca and González, 2010; Martin, 2003). It has also been found that deposit insurance increases banks' moral hazard, especially in countries with lax banking regulations (Duran and Lozano-Vivas, 2015).

Eichengreen and Arteta (2002) analyze data for 75 countries from 1975–1997 and find that the deposit insurance system reduces the moral hazard of banks to some extent, and its implementation reduces the likelihood of banking crises in developing countries. Hovakimian *et al.* (2003), by analyzing banking data for 56 countries from 1991–1999, find that implementing deposit insurance exacerbates banks' risk transfer. In addition, it has also been found that while deposit insurance increases banks' risk-taking, it reduces banks' risk-taking problem as long as strict regulations are imposed on them (Lambert *et al.*, 2017).

Chang *et al.* (2023) find a non-linear relationship between bank risk-taking and deposit insurance coverage. The household savings rate, bank deposit loan spread, their intersection with deposit coverage, and the ratio between bank credit and bank deposits exhibit cyclical characteristics across different periods. Chang *et al.* (2023b) find that, before the 2008 financial crisis, the impact of financial market development and the deposit insurance system on bank risk is more pronounced, and a nonlinear relationship exists between financial market development, deposit insurance, economic crises, and bank risk.

2.1.3 Impact of bank competition on bank stability

Using data from 1,872 publicly traded banks from 63 countries over the period 1997–2009, Anginer *et al.* (2014) conclude that competition induces banks to take on more diversified risks, which in turn reduces the vulnerability of the banking system to shocks, implying support for the competitive stabilization thesis. Schaeck and Cihák (2014) study the dynamic relationship between competition and stability in the European cooperative banking system based on a profit redistribution competition metric, and the analysis of Clark *et al.* (2018) is based on the transition markets of the CIS countries' bank-level data between 2005 and 2013, all of which provides evidence that competition contributes to bank stability.

However, Beck *et al.* (2013), using bank-level data for 79 countries over the period 1994 to 2009, find that after accounting for cross-country differences in market, regulatory, and institutional characteristics, increased bank competition leads to higher bank fragility in countries with tighter activity restrictions, lower systemic fragility, more developed stock exchanges, more generous deposit insurance, and more effective information sharing. In addition, there are also some studies that support the theory of competitive fragility (Albaity *et al.*, 2019; Bashir *et al.*, 2021; Feghali *et al.*, 2021; Fu *et al.*, 2014; Khattak *et al.*, 2021; Risfandy *et al.*, 2022; Saif-Alyousfi *et al.*, 2020).

Moreover, Saha and Dutta (2021) examine the relationship between financial inclusion, bank competition, market concentration, and financial stability in 92 countries from 2004 to 2014. They find that bank competition helps to enhance bank stability. However, high market concentration in bank competition increases bank vulnerability. Dutta and Saha (2021) analyze the data of Bangladesh's 30 listed banks from 2009 to 2017. Data shows a U-shaped relationship between bank competition and banking system stability, indicating that bank competition is beneficial for bank stability only at low levels.

2.2 Theoretical Framework for Non-Linear Relationships

The relationship between financial inclusion, deposit insurance, industry concentration, and bank stability has been extensively studied in the literature. However, recent empirical evidence and theoretical advancements suggest that these relationships are not linear but exhibit threshold effects, diminishing returns, and conditional interdependencies. Below, we synthesize the theoretical foundations underpinning these non-linear dynamics.

2.2.1 Financial Inclusion and Stability: A U-Shaped Relationship

Early studies on financial inclusion primarily emphasized its stabilizing effects through diversification benefits. Beck *et al.* (2007) argue that broadening access to financial services diversifies banks'customer bases and revenue streams, thereby reducing systemic risk: a proposition aligned with the diversification-stability hypothesis. However, emerging research highlights that excessive financial inclusion may inadvertently undermine stability. Mare and Melecky (2016) introduce the overextension hypothesis, positing that beyond a critical threshold, financial inclusion strains bank' risk management capacities, particularly when serving informationally opaque or high-risk borrowers. This duality suggests a U-shaped relationship: moderate inclusion enhances stability, but overextension amplifies default risks and operational fragility.

2.2.2 Deposit Insurance and Stability: An Inverted U-Shaped Relationship

The role of deposit insurance in stabilizing banking systems is rooted in the seminal work of Diamond and Dybvig (1983), who demonstrate that deposit guarantees mitigate panic-driven bank runs. However, subsequent studies reveal that the stabilizing effect is contingent on the scope of coverage. Demirgüç-Kunt and Detragiache (2002) identify an inverted U-shaped relationship: moderate insurance fosters stability by curbing withdrawals, but excessive coverage induces moral hazard, encouraging banks to engage in riskier activities. This non-linearity underscores the trade-off between depositor confidence and risk-taking incentives.

2.2.3 Interaction Between Financial Inclusion and Deposit Insurance

The interplay between financial inclusion and deposit insurance introduces further complexity. While deposit insurance can mitigate risks associated with inclusion, such as preventing bank runs amid higher defaults, its efficacy depends on regulatory oversight. Barth *et al.* (2004) propose the regulatory offset hypothesis, arguing that in weakly regulated environments, deposit insurance may amplify moral hazard when paired with aggressive inclusion. Banks may perceive insured deposits as a"safety net," leading to reckless lending to underserved segments. Conversely, robust regulation can temper these risks, highlighting the conditional nature of this interaction.

2.3 Synthesis and Gaps in Existing Literature

Existing studies reveal divergent findings on the relationships between financial inclusion, deposit insurance, industry concentration, and bank stability. While some literature highlights stabilizing effects of financial inclusion (e.g., risk diversification) and moderate deposit insurance (e.g., curbing bank runs), others emphasize destabilizing outcomes due to moral hazard, overextension, or excessive competition. Non-linear dynamics, such as U-shaped (Dutta and Saha, 2021) or threshold effects (Chang *et al.*, 2023a), further complicate these relationships. However, critical gaps persist: (1) systematic theorization of non-linearities and interaction effects remains limited; (2) thresholds (e.g., optimal inclusion levels, insurance coverage) are rarely quantified; and (3) contextual moderators (e.g., regulatory quality, market structure) are underexplored. These gaps hinder policymakers' ability to balance stability-efficiency trade-offs, underscoring the need for a unified framework integrating non-linear dynamics and institutional contingencies.

3. Data

Due to data availability constraints, this article chooses unbalanced panel data for 122 countries from 2004 to 2021 as the sample (refer to Table A1). This article considers three variables to represent bank risk, which are the Non-Performing Loan Ratio (Hereafter *NPL*), Non-Performing Loan Ratio to Bank Capital Asset Ratio (Hereafter *NPLCAP*), and Z-score (Hereafter *Zscore*). These data are obtained from the World Bank's GFDD database.

Regarding financial inclusion (Hereafter *FI*), this paper refers to the definition provided by Wang and Luo (2022). It introduces principal component analysis to construct the financial inclusion indicator *FI* with the following six variables as components: the number of banks per 1000 km^2 (Hereafter *Numkm*), the number of banks per 100,000 adults (Hereafter *Numad*), the number of ATMs per 1000 km^2 (Hereafter *NumATMkm*), the number of ATMs per 100,000 adults (Hereafter *NumATMad*), outstanding deposits with commercial banks (% of GDP) (Hereafter *Outdep*), outstanding loans from commercial banks (% of GDP) (Hereafter *Outloa*). The data for the above six variables is from the IMF Financial Access Survey (Hereafter *FAS*).

Considering the impact of the design features of explicit deposit insurance systems on moral hazard, we refer to Asli Demirgüç-Kunt et al. (2008). We construct a moral hazard index (Hereafter *Moralhazard*) based on the following 11 indicators: *Coverage ratio*, the ratio of deposit insurance coverage to GDP per capita, which is treated as an implicit guarantee of full deposit insurance for countries that do not have explicit deposit insurance, takes the value of 53.598. (Angkinand and Wihlborg, 2010); *Administration*, if the department responsible for managing and implementing the deposit insurance mechanism is the public sector, takes 1; if it is the private sector, takes 2; if it is a public-private partnership, takes 3; *Multipleschemes*, if there are multiple deposit insurance design schemes, takes 1, otherwise, takes 0; *Unlimitedguarantee*, the presence of an unrestricted government guarantee is taken as 1, otherwise it is taken as 0; *Foreign currency*, deposit insurance covers foreign currencies is taken as 1, otherwise it is taken as 0; *Interbankdeposits*, if deposit insurance covers interbank deposits, 1 is taken; otherwise, 0 is taken; *Statecurrency*, if the deposit insurance covers government funds, 1 will be taken; otherwise, 0 will be taken; *Nocoinsurance*, if coinsurance is not implemented, takes 1; otherwise, takes 0; *Payouts*, coverage is taken as 0 for each depositor, 1 for each depositor at each institution, and 2 for each bank account; *Noriskadjust*, deposit insurance premiums are taken as 1 if they are a single rate, and 0 if the rate is adjusted with risk; *Exantefund*, deposit-insured funds are taken to be 1 if they are financed before the crisis and 0 if they are financed after the crisis; These data come from the Deposit Insurance Database (Demirgüç-Kunt *et al.*, 2014; IADI, 2019). We also introduce *CONTAGION* to define the contagion effect of deposit insurance, which is the number of countries that introduced explicit deposit insurance in the year as a percentage of the global number of countries. This is calculated by the authors based on IADI's statistical data (IADI, 2019).

Bank concentration (%) (Hereafter *Bankconcentration*), this variable represents the proportion of assets of the three largest commercial banks to the total assets of commercial banks in the country. The six variables are obtained from the World Bank's GFDD database.

Regarding other bank-level indicators, this paper considers the impact of savings bank assets on bank stability. We multiply Deposit money banks' assets to GDP (%) by GDP (constant 2015 US$), take the natural logarithm, and use *Lnbankasset* to represent savings bank assets. Deposit money banks' assets to GDP (%) and GDP (constant 2015 US$) are from the World Bank's GFDD and WDI databases, respectively. In addition, this paper considers Bank capital to total assets (%) (Hereafter *Capta*); Liquid assets to deposits and short-term funding (%) (Hereafter *LIQADEP*); Bank noninterest income to total income (%) (Hereafter *Noninterest*); Bank overhead costs to total assets (%); Bank return on equity (%, before tax) (Hereafter *ROEat*).

At the macro level, we introduce three variables, the first being the GDP growth rate (Hereafter *GDPgrowth*), which is the natural logarithm of the real GDP derived from the WDI database. The second *POP65*, which denotes the proportion of people over 65 years old in a country as a percentage of the country's total population, has been found to influence the setting of a country's deposit insurance coverage, affecting banks' risk-taking behavior (Demirgüç-Kunt *et al.*, 2008). Another is the Banking crisis dummy (Hereafter *Crisis*). This dummy variable takes the value of 1 if the country experienced a banking crisis during the year. Otherwise, it takes a value of 0. The data is from the GFDD database.

Considering the impact of a country's institutional factors on bank risk, we introduce six variables: Control of Corruption Estimate (Hereafter *CorrEstimate*), Government Effectiveness Estimate (Hereafter *GovEstimate*), Political Stability and Absence of Violence/Terrorism Estimate (Hereafter *PoliEstimate*), Regulatory Quality Estimate (Hereafter *ReguEstimate*), Rule of Law Estimate (Hereafter *LawEstimate*), Voice and Accountability: Estimate (Hereafter *VoiEstimate*). These variables are from the World Bank's Governance Indicator database. To avoid multicollinearity, we utilize principal component analysis to reduce the dimensions of these institutional variables, forming a single variable, *Institution*.

4. Model specification

We give the specific model through equations (1) – (3), where the dependent variables of equations (1) – (3) are bank non-performing loan ratio (*NPL*), bank non-performing loan ratio over bank capital asset ratio (*NPLCAP*), and Z-score (*Zscore*), respectively. The independent variables are the same in all three equations, where *FI* stands for Financial Inclusion. *Moralhazard* denotes the Moral Hazard Index, *BCON* denotes the Bank-Level Indicator, *MAC* denotes the Macro-Level Indicator, *INS* denotes the Institutional Variable, and TE_t stands for time effect:

$$NPL_{i,t} = \beta FI_{i,t-1} + \delta Moralhazard_{i,t-1} + \gamma BCON_{i,t-1} + \eta MAC_{i,t-1} + \lambda INS_{i,t-1} + \theta_i + \varepsilon_{i,t} + TE_t \quad (1)$$

$$NPLCAP_{i,t} = \beta FI_{i,t-1} + \delta Moralhazard_{i,t-1} + \gamma BCON_{i,t-1} + \eta MAC_{i,t-1} + \lambda INS_{i,t-1} + \theta_i + \varepsilon_{i,t} + TE_t \quad (2)$$

$$Zscore_{i,t} = \beta FI_{i,t-1} + \delta Moralhazard_{i,t-1} + \gamma BCON_{i,t-1} + \eta MAC_{i,t-1} + \lambda INS_{i,t-1} + \theta_i + \varepsilon_{i,t} + TE_t \quad (3)$$

To investigate whether there is a non-linear relationship between bank risk, financial inclusion, and deposit insurance, we introduce some cross terms based on equations (4) – (8), with specific variables including *LnCOV*, which is the natural logarithm of the sum of the ratio of deposit coverage to per capita GDP and 1. For countries that have not implemented explicit deposit insurance systems, it is considered that the government has implemented complete deposit insurance with implicit guarantees; at this point, the coverage ratio value is 53.5982 (Angkinand and Wihlborg, 2010); $LnCOV^2$ represents the quadratic term of *LNCOV*; The cross term between *LnCOV* and *FI* is mainly introduced to explore the impact of deposit coverage and financial inclusion on bank risk; FI^2 represents the quadratic term of *FI*; The introduction of the intersection term between *CONTAGIN* and *FI* mainly aims at exploring the joint impact of the spread effect of the deposit insurance system and financial inclusion on bank risk, this is theoretically anchored in institutional complementarity and network externalities (Demirgüç-Kunt *et al.*, 2008). The cross-term between *Crisis* and *FI* is introduced mainly to explore the relationship between financial inclusion and bank risk when a banking crisis occurs. In summary, the model is set up as follows:

$$NPL_{i,t} = \beta_1 LnCOV_{i,t-1} + \beta_2 LnCOV_{i,t-1}^2 + \gamma BCON_{i,t-1} + \eta MAC_{i,t-1} + \lambda INS_{i,t-1} + \\ + \theta_i + \varepsilon_{i,t} + TE_t \tag{4}$$

$$NPL_{i,t} = \beta_1 LnCOV_{i,t-1} + \beta_2 LnCOV_{i,t-1}^2 + \beta_3 FI_{i,t-1}^2 + \beta_4 FI_{i,t-1} + \gamma BCON_{i,t-1} + \\ + \eta MAC_{i,t-1} + \lambda INS_{i,t-1} + \theta_i + \varepsilon_{i,t} + TE_t \tag{5}$$

$$NPL_{i,t} = \beta_1 LnCOV_{i,t-1} + \beta_2 LnCOV_{i,t-1}^2 + \beta_3 FI_{i,t-1}^2 + \beta_4 FI_{i,t-1} + \beta_5 Crisis \times FI_{i,t-1} + \\ + \gamma BCON_{i,t-1} + \eta MAC_{i,t-1} + \lambda INS_{i,t-1} + \theta_i + \varepsilon_{i,t} + TE_t \tag{6}$$

$$NPL_{i,t} = \beta_1 LnCOV_{i,t-1} + \beta_2 LnCOV_{i,t-1}^2 + \beta_3 FI_{i,t-1}^2 + \beta_4 FI_{i,t-1} + \beta_5 Crisis \times FI_{i,t-1} + \\ + \beta_6 CONTAGION \times FI_{i,t-1} + \gamma BCON_{i,t-1} + \eta MAC_{i,t-1} + \lambda INS_{i,t-1} + \theta_i + \varepsilon_{i,t} + TE_t \tag{7}$$

$$NPL_{i,t} = \beta_1 LnCOV_{i,t-1} + \beta_2 LnCOV_{i,t-1}^2 + \beta_3 FI_{i,t-1}^2 + \beta_4 FI_{i,t-1} + \beta_5 Crisis \times FI_{i,t-1} + \\ + \beta_6 CONTAGION \times FI_{i,t-1} + \beta_7 FI_{i,t-1} \times LnCOV_{i,t-1} + \gamma BCON_{i,t-1} + \eta MAC_{i,t-1} + \\ + \lambda INS_{i,t-1} + \theta_i + \varepsilon_{i,t} + TE_t \tag{8}$$

We take several steps to deal with the potential problems of panel data with long time dimensions. Considering unbalanced panel data, differences in autoregressive coefficients between panels, and asymptotic theories of the time and cross-section dimensions, we introduce a panel unit root test to verify the stationarity of each variable and find that the commonly used variables and instrumental variables selected in this paper are stationary. As shown in Table A2 in the Appendix, we use the modified Wald test to identify group-wise heteroskedasticity in the regression model. The statistics in Table A2 reject the null hypothesis of homoscedasticity and lead us to believe there is heteroscedasticity between groups.

We use the Wooldridge test to identify the intra-group autocorrelation problem in the regression model. The specific results are shown in Table A3 in the Appendix. The statistics in Table A3 reject the null hypothesis that there is no first-order within-group autocorrelation.

Countries may be subject to contagion effects in establishing explicit deposit insurance systems and may have endogenous problems that lead to biased estimates. This paper uses the Davidson-MacKinnon test to determine whether *Moralhazard* is endogenous. It shows that the introduction of an explicit deposit insurance system in a country is highly correlated with the *POP65* (Demirgüç-Kunt *et al.*, 2008), and *POP65* is not directly related to the bank's risk-taking behavior. Therefore, if *Moralhazard* is an endogenous variable, this paper considers *POP65* as an instrumental variable for *Moralhazard*. The endogeneity test in Table A4 shows that the panel regression equations in columns (1) – (2) of Table 2, columns (1) – (3) of Table 3 have endogeneity problems.

Choosing a fixed or random effects model is the key to setting the panel model. In the fixed-effect model, the explanatory variables can be correlated with the individual effects θ_i but not with the error terms. The individual effects θ_i are purely random and uncorrelated with the regressor variables in the random effects model. This paper uses the Hausman test to select a more appropriate model to estimate the impact of financial inclusion and the introduction of an explicit deposit insurance system on bank risk. The results are shown in Table A5.

5. Empirical analysis

Table 1 presents descriptive statistics for variables related to bank risk, financial inclusion, and macroeconomic controls across the full sample. The bank risk/stability measures exhibit notable dispersion: *NPL* displays a mean of 7.064% with significant right-skewness (Median = 4.268%, Max = 74.10%), indicating outlier banks with severe asset quality deterioration in some countries. The *Zscore* shows a mean of 16.42 but extreme values (−0.326 to 142.6), reflecting substantial cross-bank variation in insolvency risk. *FI* demonstrates a near-zero mean (9.20e-10) with wide dispersion (Std. Dev. = 0.596, Min = −0.601, Max = 11.19), suggesting heterogeneous financial inclusion across countries.

Table 1: Descriptive Statistics of Variables Related to Bank Risk and Financial Inclusion

Variable	Mean	Median	Std. Dev.	Min	Max
NPL	7.064	4.268	7.556	0	74.10
NPLCAP	0.765	0.427	1.009	0	13.52
Zscore	16.42	14.96	9.720	−0.326	142.6
FI	9.20e-10	−0.0792	0.596	−0.601	11.19
Lnbankasset	27.35	27.10	2.823	16.60	35.76
Capta	10.02	9.500	3.959	1.490	30.60
LIQADEP	36.30	32.39	18.75	0.380	156.7
Noninterest	38.45	36.14	13.84	6.116	95.42
ROEat	12.60	12.13	12.66	–117.7	259.0
Bankconcentration	70.14	70.38	19.72	16.14	100
Bnim	4.503	3.839	2.840	0.0688	23.32
ProvisionsTNL	71.28	60.97	42.81	0.800	604.1
GDPgrowth	3.667	3.795	6.320	−64.05	150.0
Crisis	0.0447	0	0.207	0	1
Moralhazard	−4.97e-09	−0.386	0.744	−0.386	3.221
CONTAGION	0.227	0.126	0.209	0.00917	0.610
Pop65	6.633	4.553	4.761	0.172	35.97
Institution	–2.81e-10	–0.142	0.881	–2.260	1.906

Source: Authors' calculations using Stata SE 15.1 based on Section 3. Data

In Table 2, the estimated coefficients of *MoralHazard*, *FI* and *Bankconcentration* are not significant. Linear specifications may miss threshold effects (Beck *et al.*, 2006), we will test quadratic terms in Table 3. The coefficient of *Capta* in columns (2) and (3) of Table 2 is statistically significant at the 1% level but exhibits divergent signs, indicating that a higher capital-to-asset ratio mitigates bank risk (as measured by *NPLCAP*), while simultaneously enhancing bank stability (as captured by the *Zscore*). *Noninterest* displays significantly positive coefficients in columns (1) and (2), suggesting that greater reliance on non-interest income is positively associated with elevated bank risk. Furthermore, the coefficient of *Institution* is statistically significant in columns (1) and (3) with opposing signs, underscoring that robust institutional environments contribute to reducing bank risk (as reflected in *NPL*) and improving systemic stability (as measured by the *Zscore*). These results align with theoretical expectations, emphasizing the dual role of capital adequacy and institutional quality in balancing risk mitigation and stability enhancement.

Table 2: Response of bank risk to financial inclusion and deposit insurance

	(1)		(2)		(3)	
	NPL		NPLCAP		Zscore	
	Instrumental variable: *Pop65*		Instrumental variable: *Pop65*			
	Fixed effect		Fixed effect		Fixed effect	
	Coefficient	P-value	Coefficient	P -value	Coefficient	P -value
Moralhazard	25.602	(0.356)	4.442	(0.314)	−0.182	(0.485)
FI	0.307	(0.966)	0.388	(0.733)	−0.570	(0.524)
Lnbankasset	−5.586	(0.136)	−0.885	(0.138)	−0.542	(0.192)
Capta	−0.125	(0.525)	−0.085***	(0.006)	0.697***	(0.000)
LIQADEP	−0.070*	(0.066)	−0.010	(0.103)	−0.004	(0.616)
Noninterest	0.085*	(0.065)	0.014*	(0.061)	0.007	(0.445)
ROEat	−0.013	(0.629)	−0.003	(0.426)	0.042***	(0.000)
Bankconcentra-tion	0.027	(0.380)	0.003	(0.572)	−0.008	(0.322)
GDPgrowth	−0.121	(0.208)	−0.014	(0.362)	−0.004	(0.884)
Crisis	2.521#	(0.208)	0.403#	(0.206)	−1.106***	(0.001)
CONTAGION	−1.765	(0.936)	−1.633	(0.640)	7.866***	(0.000)
Institution	−6.082**	(0.048)	−0.463	(0.344)	1.939**	(0.013)
Pop65					−0.194	(0.122)
Constant	150.152	(0.126)	24.420	(0.118)	22.581*	(0.059)
R^2	0.188		0.211		0.273	
N	1133		1133		1153	

Notes: For the complete name and definition of variables, please refer to Section 3. *, ** and *** indicate significance levels of 10%, 5% and 1%, respectively. # indicates that the coefficient value of zero that falls outside one standard deviation of the estimate.

Source: Authors' calculations using Stata SE 15.1 based on Section 4. Model specification

The regression equation in column (5) of Table 3 adds *FI* and its quadratic term on the basis of column (4). However, the estimated coefficients of both are insignificant. The regression equation in column (6) of Table 3 adds the interaction term of *Crisis* and *FI* on the basis of column (5), and the estimated coefficient of this term is also insignificant. The regression equation in column (7) of Table 3 adds *CONTAGION* × *FI* on the basis of column (6), and the estimated coefficient of this term is significantly positive. Notably, in the regression results of column (7) of Table 3, the coefficients of *FI* and its quadratic term become significant, which indicates that there is a non- linear relationship between bank risk and financial inclusion. As the degree of financial inclusion increases, it leads to a decrease in bank risk. This highlights that financial inclusion significantly enhances stability in countries exposed to cross-border deposit insurance contagion. However, the interaction between the contagion effect of deposit insurance and financial inclusion will increase bank risk. The regression equation in column (8) of Table 3 adds *FI*×*LnCOV* on the basis of column (7). However, the signs and significance of the estimated coefficients in the regression equation of column (8) of Table 3 do not change. From columns (7) and (8) of Table 3, which consider more interaction terms, in the context of financial inclusion, the moral hazard caused by the design features of the deposit insurance system has an inhibitory effect on bank risk.

Introducing interactions (*FI* × *CONTAGION*, *FI* × *LnCOV*) reverses the sign of *Moralhazard*. In Columns (4) – (6) of Table 3, which focus on testing non-linearities in deposit insurance coverage ($LnCOV^2$) without incorporating interaction terms with financial inclusion (*FI*), the positive and significant coefficients for *Moralhazard* in Column (4) reflect their role as a standalone measure of systemic institutional risks. These risks, such as public-sector administration of deposit insurance or the absence of risk-adjusted premiums, independently exacerbate non-performing loans by amplifying moral hazard. In contrast, Columns (7) – (8) introduce interaction terms *FI* × *CONTAGION* and *FI* × *LnCOV*, which fundamentally alter the interpretation of *Moralhazard*. It can be interpreted through the lens of moderating effects and endogenous channel adjustments. In the baseline specification without the interaction term, the positive coefficient of moral hazard implies that unmitigated risk-taking incentives amplify systemic vulnerabilities, consistent with conventional theories where weaker market discipline exacerbates financial instability. However, the sign reversal observed in Columns 7–8 of Table 3 suggests that the *CONTAGION* × *FI* interaction term acts as a countervailing force, systematically altering the direct effect of moral hazard. A plausible explanation is that the interplay between financial inclusion (*FI*) and cross-border contagion (*CONTAGION*) introduces institutional or behavioral constraints that neutralize moral hazard's standalone impact. This shift also hints at potential omitted variable bias in the baseline model, where the interaction term captures previously unobserved institutional safeguards that attenuate direct moral hazard effects. Consequently, the negative moral hazard coefficient in the augmented model in Columns 7–8 of Table 3 reflects its conditional dependency on the *CONTAGION×FI* nexus, underscoring the necessity of modeling synergistic institutional factors when assessing risk dynamics. It indicates that synergies between inclusive financial systems and institutional frameworks can counteract moral hazard risks, underscoring the importance of contextual interdependencies in shaping deposit insurance outcomes (Haans *et al.*, 2016). This also aligns with Owen and Pereira (2018), who argue that institutional synergies can counteract risk-taking incentives. This duality implies that financial inclusion's stabilizing role is conditional: it tempers moral hazard but may simultaneously introduce vulnerabilities in interconnected systems. Thus, policymakers must balance inclusive policies with safeguards against cross-border spillovers. The insignificant coefficient of *FI* × *LnCOV* in Column 8 of Table 3 implies that deposit coverage limit does not synergize strongly with financial inclusion in the sample.

The U-shaped relationship between deposit insurance coverage and bank risk, posited via the positive coefficient of $LnCOV^2$ (0.662**) in Column 4 of Table 3, is not uniformly robust. In Columns 5 – 8 of Table 3, the coefficient of $LnCOV^2$ remains insignificant, and its sign fluctuates (e.g., −0.080 in Column 5). While the Column 4 result aligns with prior theoretical work (Angkinand and Wihlborg, 2010; Chang *et al.*, 2023a; Diamond and Dybvig, 1983), the inconsistency across specifications suggests sample-specific dynamics or differences in the selected variables may influence the nonlinearity.

In Table 2, *Bankconcentration*'s coefficient is insignificant across all columns, suggesting limited standalone influence on bank risk. However, the coefficient of *Bankconcentration* in columns (4), (7), and (8) of Table 3 exhibits statistically significant positive values when nonlinearities (e.g., quadratic terms) or interaction effects (e.g., *FI×CONTAGION*) are incorporated, suggesting that elevated bank concentration may exacerbate banking sector instability. Empirical studies indicate that heightened bank concentration threatens financial stability through three primary pathways: structural fragility, incentive distortions, and regulatory inefficiencies (Ben Ali *et al.*, 2018; Chang *et al.*, 2023a). This aligns with the "concentration-fragility" hypothesis, where oligopolistic structures may incentivize risk-taking under weaker governance (Boyd and De Nicoló, 2005).

Table 3: The Nonlinear Relationship of Bank Risk to Financial Inclusion and Deposit Insurance

	(4)	(5)	(6)	(7)	(8)
	NPL	NPL	NPL	NPL	NPL
	Instrumental variable: *Pop65*	Instrumental variable: *Pop65*	Instrumental variable: *Pop65*		
	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Fixed effects
	Coefficient P-value	Coefficient P-value	Coefficient P-value	Coefficient P-value	Coefficient P-value
Moralhazard	23.779** (0.017)	10.165** (0.045)	9.746** (0.046)	−1.595*** (0.001)	−1.600*** (0.001)
LnCOV	−4.578# (0.142)	2.380# (0.109)	2.373# (0.105)	0.285 (0.803)	0.286 (0.802)
LnCOV2	0.662** (0.046)	−0.080 (0.452)	−0.083 (0.427)	−0.055 (0.514)	−0.055 (0.514)
Lnbankasset	−1.587 (0.308)	−3.467*** (0.000)	−3.386*** (0.000)	−2.124*** (0.005)	−2.127*** (0.005)
Capta	−0.221 (0.197)	−0.109 (0.329)	−0.106 (0.335)	−0.033 (0.705)	−0.034 (0.702)
LIQADEP	−0.058** (0.041)	−0.055*** (0.002)	−0.055*** (0.002)	−0.046*** (0.001)	−0.046*** (0.001)
Noninterest	0.089** (0.011)	0.059*** (0.004)	0.057*** (0.005)	0.042** (0.011)	0.042** (0.011)
ROEat	−0.075*** (0.006)	−0.018 (0.218)	−0.018 (0.211)	−0.018 (0.101)	−0.018 (0.101)
Bankconcentration	0.051* (0.097)	0.025 (0.193)	0.025 (0.177)	0.024* (0.099)	0.024* (0.099)
GDPgrowth	−0.181* (0.064)	−0.113** (0.042)	−0.114** (0.038)	−0.153*** (0.000)	−0.153*** (0.000)
Crisis	2.461* (0.076)	1.641** (0.033)	2.217** (0.034)	1.412* (0.073)	1.412* (0.073)
CONTAGION	−37.313** (0.032)	8.779* (0.094)	9.130* (0.073)	11.703*** (0.001)	11.667*** (0.001)
Institution	−4.803* (0.072)	−5.660*** (0.003)	−5.685*** (0.002)	−7.225*** (0.000)	−7.226*** (0.000)
FI		−1.601 (0.542)	−1.819 (0.482)	−13.737*** (0.000)	−13.881*** (0.001)
FI2		−1.459 (0.444)	−1.109 (0.575)	−3.491** (0.014)	−3.481** (0.015)
Crisis × FI			−1.284 (0.377)	−0.635 (0.578)	−0.640 (0.576)
CONTAGION × FI				25.281*** (0.000)	25.247*** (0.000)
Pop65				0.187 (0.454)	0.189 (0.454)
FI × LnCOV					0.026 (0.953)
Constant	52.080 (0.244)	84.216*** (0.002)	82.164*** (0.003)	64.355*** (0.003)	64.442*** (0.004)
R^2	0.219	0.201	0.194	0.223	0.212
N	1131	1131	1131	1131	1131

Notes: For the complete name and definition of variables, please refer to Section 3. *, ** and *** indicate significance levels of 10%, 5% and 1%, respectively. # indicates that the coefficient value of zero that falls outside one standard deviation of the estimate.

Source: Authors' calculations using Stata SE 15.1 based on Section 4. Model specification

6. Conclusion

This study investigates how financial inclusion, deposit insurance, and bank concentration affect bank stability, drawing on cross-country empirical evidence.

First, the design of deposit insurance systems significantly influences bank stability. The moral hazard risks embedded in deposit insurance frameworks—captured by the composite index *Moralhazard*—exhibit a destabilizing effect on banks refer to columns (4) – (6) in Table 3. However, this effect is mitigated when financial inclusion interacts with cross-border contagion ($FI \times CONTAGION$), underscoring the importance of institutional synergies in counteracting moral hazard (Haans *et al.*, 2016).

Second, the non-linear relationship between deposit insurance coverage and bank stability reveals a U-shaped pattern, which suggests moderate coverage limits enhance stability by reducing panic withdrawals, while excessively generous guarantees amplify risk-taking, consistent with theoretical framework of previous research (Angkinand and Wihlborg, 2010; Diamond and Dybvig, 1983). Although the estimated coefficients of $LnCOV^2$ in columns (5) – (8) of Table 3 are not significant, this may be due to sample limitations.

Third, financial inclusion exerts a nuanced influence. While its standalone effect is statistically muted in columns (4) – (6) in Table3, after the introduction of the cross term, the estimation coefficients of FI, FI^2, $FI \times CONTAGION$ become significant, suggesting that inclusive financial systems act as buffers against external shocks in interconnected economies.

Finally, the positive coefficients for *Bankconcentration* in three specifications Columns (7) – (8) of Table 3 suggest that higher bank concentration is associated with elevated bank risk. This finding aligns with the "concentration-fragility" view under certain conditions. In advanced economies, high bank concentration often correlates with mature regulatory frameworks and risk-sharing mechanisms, which may suppress risk-taking. However, in emerging markets, concentrated banking systems might reflect oligopolistic structures where dominant banks engage in rent-seeking or excessive risk-taking due to weaker governance (Boyd and De Nicoló, 2005). The pooled sample in this research likely combines these divergent dynamics, leading to an overall positive coefficient.

These results have important policy implications. Regulators should prioritize targeted reforms to deposit insurance systems, such as risk-adjusted premiums and coverage limits calibrated to GDP per capita, to balance stability and moral hazard. Financial inclusion policies should be integrated with cross-border regulatory coordination to harness their stabilizing potential. Meanwhile, the ambiguous role of bank concentration warrants context-specific assessments, particularly in emerging markets where institutional quality varies widely.

There are three aspects worth further exploring regarding the research topic of this paper. Firstly, for a country, if the introduction of explicit deposit insurance systems can be seen as a "direct effect", then the global spread of explicit deposit insurance systems can be seen as a "contagion effect". We believe that the relationship between the direct effect and contagion effect of the deposit insurance system and its impact on banking system risk deserves further discussion. Secondly, the multiple non-linear relationship between bank risk and financial inclusion, deposit coverage, and whether an optimal level of financial inclusion exists that minimizes bank risk and maximizes bank stability is worth further exploration. Thirdly, is there a phased characteristic difference in the relationship between financial inclusion and bank risk?

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Appendix

Table A1: 122 sample countries

Country	Country	Country	Country
Afghanistan	Cuba	Italy	Pakistan
Albania	Cyprus	Jamaica	Panama
Algeria	Czech Republic	Japan	Paraguay
Andorra	Denmark	Kazakhstan	Peru
Angola	Djibouti	Kenya	Philippines
Argentina	Dominica	Kuwait	Poland
Armenia	Ecuador	Latvia	Portugal
Australia	Estonia	Lebanon	Qatar
Austria	Eswatini	Libya	Romania
Bangladesh	Ethiopia	Lithuania	Russian Federation
Belarus	Faroe Islands	Luxembourg	Rwanda
Belgium	Fiji	Madagascar	Saudi Arabia
Belize	Finland	Malawi	Serbia
Bhutan	France	Malaysia	Singapore
Bolivia	Germany	Maldives	Slovak Republic
Botswana	Ghana	Mauritius	Spain
Brazil	Gibraltar	Mexico	Sudan
Bulgaria	Greece	Monaco	Swaziland
Burkina Faso	Greenland	Mongolia	Sweden
Burundi	Grenada	Montenegro	Switzerland
Cambodia	Guinea	Morocco	Tajikistan
Cameroon	Guyana	Myanmar	Tanzania
Canada	Haiti	Namibia	Thailand
Central African Republic	Honduras	Nauru	Turkmenistan
Chad	Hungary	Nepal	Uganda
Chile	Iceland	Netherlands	Ukraine
China	India	New Zealand	United Kingdom
Colombia	Indonesia	Nicaragua	United States
Comoros	Iraq	Nigeria	Zambia
Costa Rica	Ireland	Norway	Zimbabwe
Croatia	Israel		

Source: Authors' statistics based on Section 3. Data

Table A2: Modified Wald test for group-wise heteroscedasticity in regression model

Equation	H_0: $\sigma^2(i) = \sigma^2$ for all i	
Column (1), Table 2	Chi^2 (120) = 5.8e+31	Prob > chi^2= 0.0000
Column (2), Table 2	Chi^2 (120) = 5.5e+05	Prob > chi^2= 0.0000
Column (3), Table 2	Chi^2 (120) = 5.1e+31	Prob > chi^2= 0.0000
Column (1), Table 3	Chi^2 (123) = 2.1e+32	Prob > chi^2 = 0.0000
Column (2), Table 3	Chi^2 (120) = 5.3e+31	Prob > chi^2 = 0.0000
Column (3), Table 3	Chi^2 (120) = 5.7e+31	Prob > chi^2 = 0.0000
Column (4), Table 3	Chi^2 (120) = 4.6e+31	Prob > chi^2 = 0.0000
Column (5), Table 3	Chi^2 (120) = 4.5e+31	Prob > chi^2 = 0.0000

Source: Authors' calculations using Stata SE 15.1 based on Section 4. Model specification

Table A3: Wooldridge test for intra-group autocorrelation in the regression model

Equation	H_0: no first-order autocorrelation	
Column (1), Table 2	F (1,109) = 214.821	Prob > F = 0.0000
Column (2), Table 2	F (1,108) = 109.069	Prob > F = 0.0000
Column (3), Table 2	F (1,110) = 7.516	Prob > F = 0.0071
Column (1), Table 3	F (1,115) = 226.802	Prob > F = 0.0000
Column (2), Table 3	F (1,109) = 224.982	Prob > F = 0.0000
Column (3), Table 3	F (1,109) = 229.468	Prob > F = 0.0088
Column (4), Table 3	F (1,109) = 244.013	Prob > F = 0.0000
Column (5), Table 3	F (1,109) =238.251	Prob > F = 0.0088

Source: Authors' calculations using Stata SE 15.1 based on Section 4. Model specification

Table A4: Davidson-MacKinnon test of exogeneity in regression model

Equation	Instrumented	Instrument	IV Regression	Davidson-MacKinnon test of exogeneity
Column (1), Table 2	Moralhazard	POP65	F (119,1001) = 2.58 Prob > F = 0.0000	F(1,1000) = 4.077552 P-value = 0.0437
Column (2), Table 2	Moralhazard	POP65	F (119,1001) = 1.38 Prob > F = 0.0061	F(1,1000) = 9.38829 P-value = 0.0022
Column (3), Table 2	Moralhazard	POP65	F (119,1021) = 37.99 Prob > F = 0.0000	F(1,1011) = 2.396787 P-value = 0.1219
Column (1), Table 3	Moralhazard	POP65	F (122,1309) =2.07 Prob > F = 0.0000	F(1,1308) = 34.35328 P-value = 5.8e-09
Column (2), Table 3	Moralhazard	POP65	F (119,996) = 7.29 Prob > F = 0.0000	F(1,995) = 7.617924 P-value = 0.0059
Column (3), Table 3	Moralhazard	POP65	F (119,995) = 7.45 Prob > F = 0.0000	F(1,994) = 7.437068 P-value = 0.0065
Column (4), Table 3	Moralhazard	POP65	F (119,994) = 5.33 Prob > F = 0.0000	F(1,993) = 0.5604259 P-value = 0.4543
Column (5), Table 3	Moralhazard	POP65	F (119,993) = 8.64 Prob > F = 0.0000	F(1,992) = 0.5607766 P-value = 0.4541

Source: Authors' calculations using Stata SE 15.1 based on Section 4. Model specification

Table A5: Hausman test in regression model

Equation	H_0: difference in coefficients not systematic		Model selection
Column (1), Table 2	$chi^2(13) = 41.38$	Prob > chi^2 = 0.0001	Fixed effects
Column (2), Table 2	$chi^2(13) = 41.48$	Prob > chi^2 = 0.0001	Fixed effects
Column (3), Table 2	$chi^2(11) = 33.24$	Prob > chi^2 = 0.0005	Fixed effects
Column (1), Table 3	$chi^2(14) = 52.26$	Prob > chi^2 = 0.0000	Fixed effects
Column (2), Table 3	$chi^2(16) = 46.94$	Prob > chi^2 = 0.0001	Fixed effects
Column (3), Table 3	$chi^2(17) = 46.68$	Prob > chi^2 = 0.0001	Fixed effects
Column (4), Table 3	$chi^2(18) = 39.63$	Prob > chi^2 = 0.0023	Fixed effects
Column (5), Table 3	$chi^2(19) = 39.62$	Prob > chi^2 = 0.0037	Fixed effects

Source: Authors' calculations using Stata SE 15.1 based on Section 4. Model specification