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Abstract

The empirical analysis has shown that monetary policy has non-neutral effects on the lending behavior of smaller rural banks. While big rural banks are able to protect their lending portfolio from contractionary monetary policy by the size of their balance sheet, small rural banks with less diversified funding portfolio cannot. Moreover, highly capitalized rural banks are more inclined to protect their capital than expand their lending portfolio, following monetary tightening and higher capital requirement. The insignificance of GDP growth may reflect weakness in effective loan demand and lack of diversification that could have also impinged on the earning capacity of rural banks, as supported by initial estimates on the drivers of rural bank profitability. The finding on non-neutral effects lends credence to the principle of proportionality embodied in the BSP's regulatory framework.

JEL classification: B23, C55, E52, E58

Keywords: rural bank, bank lending channel, monetary policy

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Table of Contents

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1. Introduction

The creation of the Philippine rural banking system through Republic Act 720 or the Rural Bank Act 1952 was a step towards fulfilling the vision of social and financial inclusion of small farm households in the post-war era. It has been recognized as an important mechanism for enabling economic and social integration of small farm households.

The network of rural banks in the Philippines has similarities with the community banking industry in the US and the *Sparkassen* in Germany. Corner (2010) observes that the emergence of thousands of community banks in the US is a legacy effect from an era when competition is curtailed. He notes that much of the community banks' cost and revenue advantages have been significantly diminished in an environment of heightened competition and financial technological advancement. Perhaps, the same can be said for the Philippine rural banks that have to carve out a niche market for their products and services as they face stronger competition with significantly bigger and more technologically agile universal and commercial banks.

Rural finance research in the Philippines typically ranges from farm-level assessment of credit efficiency to the broader question on rural financial market efficiency (Geron, et al, 2016, Llanto, 2005). In all of these, the rural banking system, by virtue of its mandate, plays an important function in credit intermediation. Over time, the general views on the role of rural banks have significantly changed from a credit conduit to farmers to a more dynamic, profit-maximizing producers of financial services (Von Pischke, 1978, as cited by Tolentino, 1987). At the same time, the policy and regulatory environment within which small, rural banks operate has non-neutral effects on the profit maximization objective of banks, i.e., to the *"extent that policy affects the bankers' costs and revenues, then ultimately policy determines the flow and level of funds in the rural economy (Tolentino, 1987)."*

The significance of the bank-lending channel is premised on the extent of bank-dependent borrowers and the quantitative impact of monetary policy on the supply of bank loans. In jurisdictions with limited alternative sources of financing other than bank credit, this channel is likely to be more important. Whether as wholesaler or retailer of credit, rural banks play an important role in credit facilitation. Familiarity with local cultural norms works to their advantage because monitoring and compliance with know-your-customer (KYC) protocols for small depositors/borrowers may be relatively easier. This, however, does not discount the possibility that KYC requirements are shunned because of difficulties of small depositors and borrowers in complying with documentary requirements. However, the effect of market imperfections on rural banks' ability to generate marginal sources of financing may be more evident in the loan supply portfolio of smaller banks.

[1] The study has been conducted under the auspices of the Office of Monetary Board Member V. Bruce, J. Tolentino, PhD. The team is grateful to Financial Supervision Sector's Deputy Governor Chuchi Fonacier, Managing Director Lyn Javier and the Department of Supervisory Analytics headed by Director Mark Perez for the data support provided to the project. The team is also thankful to Mr. Ferdinand Co for assistance in data processing. The usual disclaimer applies.

2. The bank lending channel of monetary policy revisited

The credit market creates value through the activities generated from the use of loans (Swinnen & Gow, 1997). At the same time, the credit market is characterized by asymmetric information and incentive compatibility problems. Lenders earn from financial intermediation by mobilizing short-term and demandable deposit liabilities to fund longer-term financing requirements of borrowers. To attenuate information asymmetry, lenders screen borrowers, stipulate terms of the loan contract, and monitor payment streams to ensure repayment and full recovery of capital throughout the life of the contract. An external finance premium is charged on the loan to cover the monitoring costs and uncertainty arising from the risk profile of the borrowers.

Expected profits of banks depend not only on interest income but also on the probability of default. On one hand, higher rates lead to higher expected returns for banks. On the other hand, higher rates also affect the riskiness of the total loan portfolio and hence, the probability of default. Since banks cannot distinguish between good borrowers from bad borrowers, they may also resort to credit rationing, which could adversely affect credit-worthy but riskier entrepreneurial class of borrowers with relatively smaller business scale. Borrowers, in need of funds, enter into loan covenant defined by lenders' standards. They could default in payment, not necessarily because of bad intentions but due to inadequate income returns that impair their capacity to repay the loan (Stiglitz & Weiss, 1981).

The policy actions of the central bank have impact on the lending operations of financial institutions like banks. The traditional view of the bank lending channel of monetary policy works through the effect of monetary policy on reservable deposits that could expand or contract the supply of bank loans and consequently, affect the real spending of borrowers. Two conditions must be satisfied for the bank lending channel to hold: first, the banks cannot fully insulate their loan portfolio from monetary policy actions by central banks and second, borrowers cannot protect their spending from the changes in loan availability (Oliner and Rudebusch, 1995), or more commonly referred to as the broad credit channel.

Other than the impact of monetary policy on reservable deposits, Disyatat (2010) posits a bank lending channel that works primarily through the impact of monetary policy on banks' balance sheet strength and risk perception. Banks, in general, have access to other funding sources like commercial paper and borrowings. As such, bank characteristics like size, liquidity, and capitalization could help shield their lending portfolio from monetary policy action by the central bank.

Many of the studies that utilize bank-level data looked into the lending behavior of commercial banks in response to monetary policy (Kashyan & Stein, 1995; Worms, 2001; Kishan, R. & Opiela, T., 2000; Lui, L., 2012), risk-taking behavior of banks (Kohler, 2012), and distance effect in banking using gravity model in bank lending in the European Union (Gudmundsdottir, et al., 2017; Carling and Lundberg, 2005).

The preponderance of studies that examine the nexus between commercial bank lending behavior and monetary policy may have been partly motivated by relatively easier access to data. The same can be said for the Philippines where there are only a few studies on the bank lending channel, ranging from assessment of the quantitative importance of credit

channel at a macroeconomic level (Bayangos, 2010) to the use of universal and commercial bank-level data to account for asset size (Aban, 2012; 2013) and expanded set of characteristics such as asset size, capitalization, and liquidity (Glindro, Lemence, and Sabuga, 2016) in understanding the bank lending channel of monetary policy in the Philippines.

By far, there are very few studies that examine the rural banking system in the Philippines, moreso on strength or even the presence or absence of bank lending channel. This may be due to the relative smallness of the asset size and deposit base of rural banks. Even if they are larger in numbers, they pale in comparison to the characteristics of bigger universal and commercial banks. Nonetheless, it is equally important to understand the transmission of monetary policy on the lending behavior of rural banks since they cater to smaller borrowers in underserved areas. Rural banks are particularly niche players in countryside lending. In some areas, a rural bank, regardless of the asset size or loan portfolio, is the sole provider of financial services.

Objectives of the Study. The study is a purely empirical work that aims to determine if there is heterogenous effect of monetary policy on the least studied class of banks in the Philippines, i.e., rural banks. Using a comprehensive quarterly dataset of the Philippine rural banking system from 2010Q1 to 2018Q2, this study seeks to add to the literature by empirically analyzing whether bank lending channel operates in the Philippine rural banking system. Specifically, it looks at whether rural banks' balance sheet indicators absorb or amplify the effects of monetary policy adjustments. More importantly, the study also examines if monetary policy adjustments have differential impact on rural banks' loan supply based on their balance sheet-specific characteristics such as size, liquidity and capitalization.

Unlike universal and commercial banks that have large and more diverse corporate client base and wider access to alternative funding sources, the asset-liability profile of rural banks is simpler. Notwithstanding the relative smallness of the collective asset base of rural banks compared to bigger and highly diversified universal and commercial banks, there is also huge variation across the spectrum of rural banks, ranging from stand-alone rural banks to those with extensive branch networks. Thus, even within their ranks, the impact of central bank policy actions on their lending behavior would differ.

3. Perspectives from the literature on Philippine rural banking system

There are only a small number of studies on the Philippine rural banking system. The study by Aragon, Kakinaka, and Kim (2011) analyzed lending behavior of rural banks under capital regulation with prompt corrective action (PCA). The study found that the effectiveness of the combined capital regulations and PCA diminishes in the case of undercapitalized banks. A capital shock in the presence of more risk-sensitive capital reduces loan for undercapitalized banks, contributing to credit crunch in the rural area. Mendoza and Rivera (2017), on the other hand, looked at the determinants of bank profitability. They found that credit risk, measured by the loan loss reserves-to-total loan portfolio, has negative and significant effect on the profitability of rural banks than capital adequacy requirement.

Meslier-Crouzille, Nys, and Sauviat (2012) studied the contribution of rural banks to regional economic development for the period 1993 – 2005. They generally found no clear evidence of a banking-led economic development for the Philippines. However, when they

specifically accounted for the presence of rural banks, their estimates showed positive impact on the economic development of intermediate and less developed regions, with a stronger impact for intermediate regions. Their findings lend credence to the important function of rural banks in fostering regional economic development.

For a central bank like the Bangko Sentral ng Pilipinas (BSP) that is responsible for both monetary policy and regulatory supervision of the banking system, it is vital to have an empirical support to its understanding of the lending response of banks to its policy actions. Over time, significant macroeconomic and regulatory developments may have either supported or constrained rural banks from fulfilling their mandate to be agents of rural growth through credit facilitation. The encompassing reforms in the regulatory milieu such as the introduction of Basel regulatory standards, the Consolidation Program for Rural Banks (CPRB), the establishment of microfinance business offices, and branch lite concept in banking, among others, may have spawned differential impact of monetary policy on the credit intermediation function of rural banks. Given that banking supervision is about safeguarding prudential soundness, the BSP follows the principle of proportionality, in which supervisory practices are adapted to the risk profile, business model and size of the bank.[2]

4. Data

The study uses balance sheet indicators of rural banks in the Philippines, which are sourced from the Department of Supervisory Analytics– Financial Supervision Sector of the BSP. The dataset has an unbalanced panel data structure due to closures, mergers of some banks, upgrading of some rural banks into thrift banks, and establishment of new rural banks over time.

The dataset includes only accounts of 609 head offices of rural banks as of 2018Q2. This is in view of consolidated approach to supervisory examination of rural banks, which encompasses the bank's branch network. The period covered by the study spans 40 quarters, i.e., 2010Q1 – 2018Q2, for which risk-weighted capital adequacy ratio (CAR) is available. The dataset covers 16,606 observations for balance sheet indicators and 16,588 observations for profitability indicators, which include income statement indicators such as return on assets (ROA) and net interest margin (NIM).[3]

The variables used for the empirical estimation of the bank lending channel have been log transformed since the base form, in level, tends to increase or grow exponentially as in the case of stock variables like balance sheet indicators. The selection of most of the variables used in this paper was largely based on widely-referenced bank lending literature (Kashyap & Stein (1995); Zulkhibri (2013); Ananchotikul & Seneviratne (2015) and Ehrmann et al. (2001). Table 1 describes the variables in the dataset used for the empirical estimation of the bank lending channel.

[2] The goal of prudential regulation is to internalize the externalities from the distress or failure of individual banks and the banking system. Since externalities depend on the risk profile of each bank, proportionality is defined as setting prudential standards that are tailored to the bank's risk profile, business model, cross-border activity and systemic importance (Basel Committee on Banking Supervision, 2019; Hakkarainen, 2019).

[3] Annex 1 provides the complete list of indicators used for the profitability regression.

Table 1: Description of variables

	Variables	***Definition***	***Reference***
response variable	Total loan portfolio	Sum of (i) loans to BSP, (ii) loans to other banks, (iii) loans and receivables-others, and, (iv) loans and receivables arising from repurchase agreements/certificate of assignment/participation with recourse/securities lending and borrowing transactions, net of amortization.	Bangko Sentral ng Pilipinas (BSP)
monetary policy indicator	Overnight reverse repurchase rate	Borrowing rate of the Bangko Sentral ng Pilipinas' (central bank of the Philippines). It is the central bank's main monetary policy tool in absorbing excess liquidity from the banking system.	BSP
bank-specific variables	Total assets	Sum of total assets, net of due to head office/branches/agencies and non-performing assets cover.	BSP
	Liquid assets	Sum of cash and cash items, due from banks, and financial assets (net of amortisation, accumulated market gains/losses, allowance for credit losses excluding equity investment in subsidiaries/associates/joint ventures).	BSP
	Size	Measured as log of total assets of bank *i* at time *t*.	BSP
	Liquidity	Liquid asset ratio, i.e., liquid assets divided by total assets of bank *i* at time *t*.[4]	
	Capitalization	Capital adequacy ratio, i.e., ratio of qualified capital to risk-weighted assets of bank *i* at time *t*.	
control variables	Real GDP	GDP at constant prices (2000-based).	Philippine Statistics Authority (PSA)
	Consumer Price Index (CPI)	CPI measured using 2006 prices as the base year.	BSP

Given the identification problem inherent in using aggregate data, this study applies panel econometric techniques on bank-level data to isolate banks' balance sheet information that affects credit intermediation function of banks. The bank indicators used in the study specifically pertain to size, liquidity, and capitalization. Larger asset size may indicate more diverse sources of funds and bigger client base, thus, helping banks accommodate contractionary monetary policy. Capitalization, which is measured as total qualifying capital relative to risk-weighted assets, provides funding flexibility and accords lower external finance premium. While it represents a cost to the bank, it also signals the adequacy of standby capital to cover losses to avert insolvency risk. Lastly, the liquidity position of the bank lends additional

[4] Another definition of liquidity used in bank examination is liquid assets-to-total liabilities.

cushion to insulate rural banks' lending portfolio in the face of contractionary monetary policy. The specification also controls for macroeconomic factors that influence loan demand, i.e., GDP growth and inflation.

However, higher capitalization and higher liquid assets could also imply limited funding sources and higher risk aversion of rural banks, which could eventually constrain their lending to the public, especially during periods of financial stress. When they fall of short of the regulatory minimum, banks would be subjected to more intense supervisory actions. These would include prohibition or limit on the distribution of net profits. There may be times that they may be required to allocate a portion or all of net profits to prop up capital until the minimum requirements are fulfilled. With equity being more expensive that debt, additional capital is seen to reduce the ability to expand lending activities.

4.1 Profile of the financial condition of the rural banking system

On average, rural banks maintain capital adequacy ratio (CAR) in excess of the 10 percent prudential limit set by the BSP. Liquid assets account for an average of 32.5 percent of total assets. The liquid asset ratio translates into 58 percent of the total loan portfolio-to-asset ratio and 47 percent of deposit-to-asset ratio. The average return-on-asset is positive but less than one percent with significant variation across rural banks. The net interest margin is also quite high at 10.6 percent.

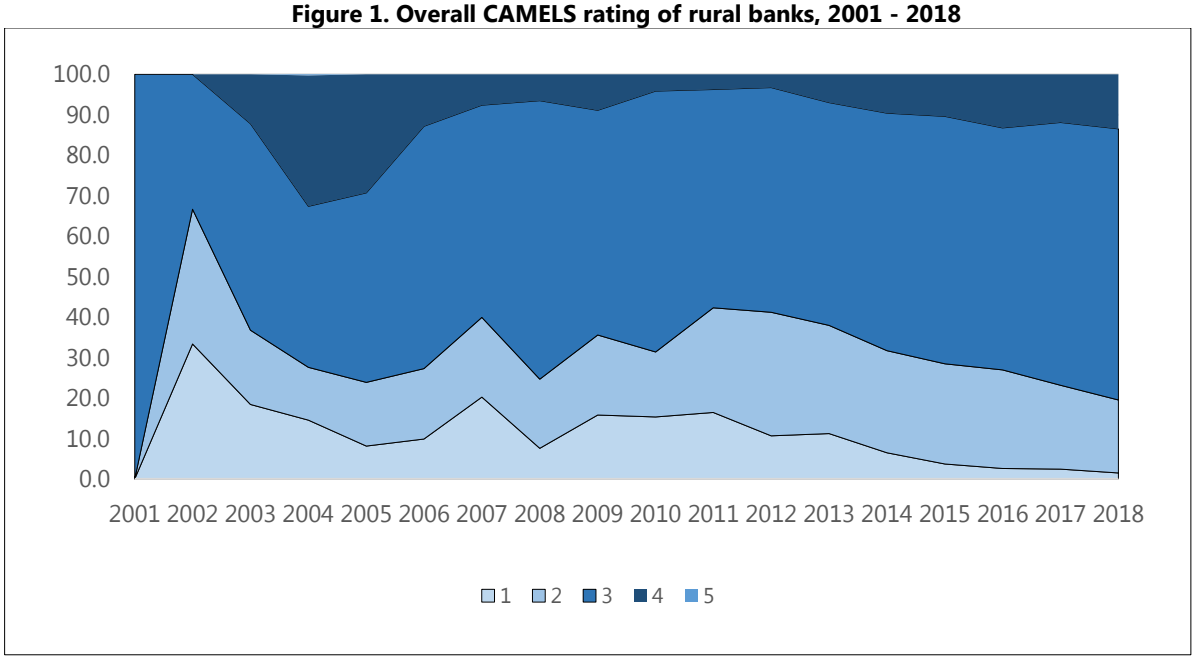
Table 2. Selected Performance Indicators

Indicators	Average
Capital adequacy ratio (CAR)	21.65
Excess CAR over prudential limit	11.64
Total loan-to-total asset ratio	56.32
Liquid asset-to-total asset ratio	32.51
Deposit-to-asset ratio	69.13
Return on assets (%)	0.91
Net interest margin (%)	10.57

Authors' estimates based on quarterly data from 2010Q1 to 2018Q2
Source of basic data: Department of Supervisory Analytics, Financial Supervision Sector, Bangko Sentral ng Pilipinas

Based on confidential reports of examination for the period 2001 – 2018, there has been a notable decline in the number of rural banks with critically deficient rating that requires strong remedial measures (Figure 1). Annex 2 shows that the largest decline in the number of rural banks with critically deficient rating has been observed for liquidity (L) and sensitivity to market risks (S). It must be noted, however, that smaller rural banks have low exposure to market risks such as repricing risk since their activities are limited to deposit taking and lending, with mostly fixed rates to maturity. However, asset quality (A), management (M), and earning capacity (E) are still largely constrained, with a larger proportion having less satisfactory rating and below. This is possibly symptomatic of high-risk aversion and lack of diversification among rural banks.

Figure 1. Overall CAMELS rating of rural banks, 2001 - 2018



Authors' estimates. Graph depicts proportion of rural banks with a specific rating. BSP CAMELS rating scale ranges from 1 – 5, with 5 being the highest. [5]
Source of basic data: BSP's Department of Supervisory Analytics, Financial Supervision Sector

5. Empirical methodology

The empirical analysis follows the influential works of Gambacorta (2005), Kashyap & Stein (2000), Zulkhibri (2013), and Ananchotikul & Seneviratne (2015). The baseline specification of the paper is as follows:[6]

$$\Delta L_{it} = \alpha \Delta L_{it-1} + \sum_{j=0}^{1} \beta_j \Delta MP_{t-j} + \sum_{k=1}^{3} \omega_k X_{i,t-1} + \sum_{k=1}^{3} \tau_k X_{i,t-1} * \Delta MP_{t-1} + \theta \Delta Y_t + \delta \Delta P_t + \Delta \vartheta_i + \Delta \mu_{it} \quad (1)$$

The first difference operator is given by Δ; $i = 1,2, \dots N$ and $t = 1,2, \dots T$, N is the total number of banks while T is the number of time series observations. The response variable is the change in the logarithm of total loan portfolio of bank i in period t (ΔL_{it}). Among the regressors, MP is the monetary policy indicator used in this paper to test for the contemporaneous (at $t = 0$) and delayed (at $t = 1$) effects of policy rate shocks to bank loans. This is measured by the overnight reverse repurchase rate (RRP), which is the monetary policy rate of the Bangko Sentral ng Pilipinas (BSP). The vector X_{it} represents the three bank-specific characteristics (k): (i) size, (ii) liquidity, and (iii) capitalization. The interaction term between the monetary policy indicator and bank-specific factors ($MP * X$) captures the bank lending channel of monetary policy where the impact of monetary policy adjustment differs with bank-specific features.

[5] The rating scale is defined as follows: 1 – critically-deficient and inadequate risk management practices; 2 – serious financial and management deficiencies that warrant close supervision; 3 – some degree of supervisory concern but the magnitude of deficiencies will not cause any component to be rated more severely than 2; 4 – fundamentally sound with none of the component ratings falling below 3; 5 – sound in every respect with component ratings between 4 and 5 (BSP-Financial Supervision Sector).

[6] This full model specification is the difference Generalized Method of Moments (GMM) transformation (as shown by the first difference operator).

The model also includes real GDP (Y) and consumer price index (P) to control for the demand-side impact on loans as well as to capture the cyclical movements in the economy (Hernando & Martínez-Pagés, 2003). These control variables for the demand aspect of loans is independent of bank-specific features and is dependent upon macroeconomic factors only.

The total error term, e_{it}, is categorised into: (i) ϑ_i captures the unobserved bank-specific fixed effects; and (ii) μ_{it} which is the observation specific errors (time varying unobservables). Both ϑ_i and μ_{it} follows an independent, identical distribution (IID), with zero mean and constant variance $\sim IID\ (0, \sigma^2)$.

5.1 Accounting for bank-specific characteristics

To assess the impact of each bank-specific characteristic on rural banks' loan supply growth, the following models, with simplified notations, are estimated independently:

$$\Delta L_{it} = \alpha \Delta L_{it-1} + \sum_{j=0}^{1} \beta_j \Delta MP_{t-j} + \varphi Size_{it-1} + \emptyset \Delta MP_{t-1} * Size_{it-1} + \theta \Delta Y_t + \delta \Delta P_t + \Delta \vartheta_i + \mu_{it} \quad (2)$$

$$\Delta L_{it} = \alpha \Delta L_{it-1} + \sum_{j=0}^{1} \beta_j \Delta MP_{t-j} + \eta Liquidity_{it-1} + \psi \Delta MP_{t-1} * Lqd_{it-1} + \theta \Delta Y_t + \delta \Delta P_t + \Delta \vartheta_i + \mu_{it} \quad (3)$$

$$\Delta L_{it} = \alpha \Delta L_{it-1} + \sum_{j=0}^{1} \beta_j \Delta MP_{t-j} + \lambda Capital_{it-1} + \rho \Delta MP_{t-1} * Cap_{it-1} + \theta \Delta Y_t + \delta \Delta P_t + \Delta \vartheta_i + \mu_{it} \quad (4)$$

If any of the parameters $\emptyset, \psi$, and ρ are negative, it can be concluded that the bank lending channel (BLC) of monetary policy is functioning in the country through the rural banks. If the same parameters are positive, it can be concluded that bank-specific characteristics help shield rural bank lending from the contractionary effect of monetary policy.

The above equations (2 to 4) are also estimated to test for the following alternative hypotheses:

a. larger banks are less vulnerable to changes in policy interest rate vis-à-vis smaller banks.
b. more liquid banks react less to monetary tightening than less liquid banks.
c. adequately capitalized banks are less sensitive to monetary policy shocks than low-capitalized banks.

5.2. Estimation method

In estimating the model, this study accounts for the persistence of bank loans by employing a linear dynamic panel Generalized Method of Moments (GMM) technique.[7] Hence, the lagged dependent variable is included as one of the regressors. The GMM technique, which was initially proposed by Arellano & Bond (1991), Arellano & Bover (1995), and later extended by Blundell & Bond (1998), was chosen due to some econometric and specification problems that can potentially arise from the untransformed version of model (eqn. 5), as shown below:

[7] The panel regression is undertaken using Stata 16.

$$L_{it} = \alpha L_{it-1} + \sum_{j=0}^{1} \beta_j \Delta MP_{t-j} + \sum_{k=1}^{3} \omega_k X_{it-1} + \sum_{k=1}^{3} \tau_k X_{it-1} * MP_{t-1} + \theta Y_t + \delta P_t + \vartheta_i + e_{it} \quad (5)$$

Estimating equation (5) instead of the baseline model given by equation (1) will result in biased and inconsistent coefficient estimates due to problem of reverse causality or simultaneity bias.[8] This is because bank-specific determinants are not strictly exogenous and are likely to be correlated with the composite error process given by $\vartheta_i + \mu_{it}$. Moreover, the inclusion of lagged dependent variables (L_{it-1}) as one of the regressors in equation (5) gives rise to Nickell bias (Nickell, 1981). This bias arises in equation (5) since the lagged value of loans is correlated with e_{it-1}, which is a function of the unobserved bank-specific fixed effects, ϑ_i. Thus, the *"resulting correlation creates a large-sample bias in the estimate of the coefficient of the lagged dependent variable, and which is not mitigated by increasing the number of N" (Baum 2016, p. 236).* If the regressors are correlated with the lagged dependent variable, their coefficients will be biased as well. This bias arises even if the error process is identically independently distributed (i.i.d). While getting the first difference of the untransformed version of the model removes the constant term and individual effects, there is still correlation between the lagged dependent variable and the disturbance process.

In order to address the aforementioned econometric issues, the dynamic panel GMM will be used. The estimation procedure uses "internal" instruments i.e., lagged differences of endogenous variables in the model to solve the endogeneity problem associated with the endogenous regressors. These instruments must be strongly correlated with the endogenous variables but uncorrelated with the error term, hence, exogenous. The exogeneity condition will be examined using the Hansen test for a two-step difference GMM, given its known property of generating consistent coefficient estimates and robust standard errors (Roodman, 2006). Moreover, the Hansen test ensures that the number of internal instruments used in the regression is limited by using one to four lags only.[9] To detect whether or not there is autocorrelation, second order autocorrelation test, AR (2), is also carried out.

5.3 Robustness of the model

There are two types of difference-GMM technique that are used as the yardsticks for assessing robustness of estimates in this study. These are (i) standard difference-GMM and the (ii) difference-GMM with orthogonal deviations. The latter, proposed by Arellano & Bover (1995), is a type of GMM procedure that preserves the sample size especially with strong unbalanced panel data structure because it subtracts the past observation from the average of all *available* observations (Roodman, 2006). As a reiteration, interaction terms between the monetary policy indicator (RRP) and bank-specific characteristics are included in testing the existence of bank lending channel in the Philippine rural banking system.

To account for possible differential impact of monetary policy across the spectrum of rural banks, rural banks are categorized into several quantiles based on asset size, liquidity, and

[8] Reverse causality or simultaneity occurs when changes in the explanatory variables cause the variations in dependent variable and vice-versa.

[9] Referred to as collapsing the instruments.

capitalization, for which separate regressions were undertaken. The categorization is structured such that the bottom 25 percentiles of the distribution constitute the "small, less liquid and less capitalized" rural banks while "big, highly liquid and well-capitalized" rural banks comprise those that fall in the upper 75 percentiles of the distribution (Zulkhibri 2013). For each bank-specific regression, a dummy variable is created, which assumes a value of 0 is classified as small and 1 if classified as big.

6. Empirical results

The baseline model of this paper, as specified in equation (1) under Section 4, is tested first for robustness by estimating it using the DPD models. Based on the estimates, the orthogonal deviation difference-GMM model is selected as the best DPD technique (See Annex 3).

Baseline model. The estimation results affirm the appropriateness of GMM as shown by the statistical significance of the lagged dependent variable. The results of baseline model indicate presence of bank lending channel in the Philippine rural banking system, with asset size providing a cushion against contractionary monetary policy (eq. 1). The results, however, may be skewed by the big rural banks. Thus, different regressions that separate each of the bank characteristics were conducted.

Alternative specifications. Unlike the baseline specification, asset size becomes insignificant and the interaction term between monetary policy rate and asset size turns out to be negative and statistically insignificant. Partial elasticities show that the delayed effect of monetary policy (ΔMP_{t-1}) causes the growth of loan supply to react positively while the contemporaneous impact of policy rate (ΔMP_t) affects growth negatively, albeit statistically insignificant (eq. 2). Consistent with theory and most of the empirical studies, the availability of more liquid assets leads to higher growth in rural banks' loan supply (eq. 3). Quite interesting is the significant and negative interaction term between liquid asset ratio and monetary policy. This may signify that rural banks prefer to preserve their liquid assets more than their lending portfolio in the presence of contractionary monetary policy. In all specifications, demand condition, as proxied by GDP growth, is not a significant factor in determining loan supply growth. This could also broadly suggest insufficient effective demand that may also be limiting factor.[10]

[10] In a separate regression, non-performing asset as proxy for demand condition was insignificant. Nonetheless, the main narrative of the results remains. The signs and size of the estimated coefficients did not materially change.

Table 2. Results of baseline model and bank indicator regressions
Dependent variable: *first difference log of total loan portfolio*

	ALL (eq. 1)	**SIZE (eq. 2)**	**LIQUIDITY (eq. 3)**	**CAPITAL (eq. 4)**
ΔL_{it-1}	-3.26***	-1.73***	0.08**	-0.60*
	(1.85)	(0.98)	(0.04)	(0.14)
ΔMP_t	1.01	1.33	0.40	0.22
	(0.85)	(0.88)	(0.43)	(0.42)
ΔMP_{t-1}	-21.39	2.34	6.93*	2.67
	(18.82)	(16.03)	(3.42)	(6.19)
Impact of bank-specific characteristics				
$Size_{it-1}$	0.65	2.43		
	(2.08)	(2.00)		
$Liquidity_{it-1}$	-2.16		2.96**	
	(3.75)		(1.48)	
$Capital_{it-1}$	1.82			1.23
	(3.54)			(2.81)
Existence of bank lending channel of monetary policy				
$\Delta MP_{t-1} * Size_{it-1}$	2.07**	-0.30		
	(0.98)	(1.30)		
$\Delta MP_{t-1} * Lqd_{it-1}$	0.46		-2.25*	
	(2.13)		(0.97)	
$\Delta MP_{t-1} * Cap_{it-1}$	-2.01			-1.02
	(2.41)			(2.00)
Control variables				
ΔY_t	-0.02	-0.13	-0.15	0.11
	(0.34)	(0.30)	(0.28)	(0.36)
ΔP_t	0.88	-1.31	-0.96	0.09
	(1.13)	(1.20)	(0.83)	(0.80)
No. of IV	23	12	13	13
Hansen p-value	0.92	0.42	0.16	0.65
AR (2) p-value	0.35	0.50	0.16	0.00
No. of banks	609	609	609	609
No. of observations	14,640	14,999	14,999	14,640

*Note: Robust standard errors in parentheses; ***, **, * denotes significance at the 10%, 5% and 1% level, respectively. The Hansen and AR (2) tests show that the instruments are valid and there is no autocorrelation, respectively (p-value is greater than 0.10, 0.05, and 0.01).*

6.1 Differential impact of monetary policy

To account for potential differential impact of monetary policy, rural banks are categorized into *"small, less liquid, and low-capitalized"* and *"big, highly liquid, and well capitalized"* rural banks, as shown in Table 3. Whereas in the baseline specification (eq. 1), monetary policy rate is insignificant on its own, the new results (eq 1.a) show that a one percentage point increase in lagged monetary policy rate (ΔMP_{t-1}) leads to a reduction in rural bank lending growth by 0.71 ppt. This result is consistent with the standard impact of monetary tightening on bank lending (Table 4).

Table 3. Bank-specific characteristic by category (*in logs*)[11]

Percentiles	Size		Liquidity		Capitalization	
	small	*large*	*less liquid*	*highly-liquid*	*poorly capitalized*	*well-capitalized*
1%	9.26		0.91		1.39	
5%	9.91		1.91		2.18	
10%	10.35		2.33		2.36	
25%	11.03		2.85		2.65	
50%	11.79		3.40		2.96	
75%		12.60		3.82		3.34
90%		13.35		4.08		3.72
95%		13.89		4.20		3.93
99%		15.04		4.34		4.31

Authors' estimates.

Moreover, the regression that has only asset size as bank characteristic shows that lending of rural banks with smaller asset base is adversely affected during period of contractionary monetary policy whereas higher asset base of larger banks enables them to insulate their bank lending activity from the impact of contractionary monetary policy (eq. 2a). This is not surprising since smaller rural banks also presumably face tougher competition from branch network and branch-lite operations of bigger universal and commercial banks as well as from government lending programs.

Meanwhile, the interaction between policy rate and capital ($\Delta MP_{t-1} * HCAP$) reveals that highly capitalized banks are more inclined to protect their capital than their lending portfolio in the face of contractionary monetary policy and higher capital requirement (eq. 4a). This may possibly indicate that regulatory compliance and its concomitant reputational effect may be a factor.

Similar to findings in equations 1-4, demand condition, as proxied by GDP growth, is of the wrong sign and not a significant factor in determining loan supply growth.

[11] Interpretation: The 25 percentile of rural banks have an asset size equivalent to 11.03 in logs.

Table 4. Differential Impact of Monetary Policy
Dependent variable: *first difference log of total loan portfolio*

	ALL (eq. 1a)	**SIZE (eq. 2a)**	**LIQUIDITY (eq. 3a)**	**CAPITAL (eq. 4a)**
ΔL_{it-1}	0.14**	0.13*	0.20**	0.18**
	(0.07)	(0.04)	(0.11)	(0.10)
ΔMP_t	0.43	0.84*	15.09	0.19
	(0.28)	(0.24)	(12.91)	(0.53)
ΔMP_{t-1}	-0.71**	-1.08*	-15.37	-0.30
	(0.33)	(0.26)	(12.69)	(0.58)
Impact of bank-specific characteristics				
$Size_{it-1}$	-0.12	-0.10*		
	(0.08)	(0.04)		
$Liquidity_{it-1}$	0.05***		0.01	
	(0.03)		(0.05)	
$Capital_{it-1}$	-0.01			0.88
	(0.03)			(0.81)
Existence of bank lending channel of monetary policy by category				
$\Delta MP_{t-1} * SMALL$	-0.83*	-0.75*		
	(0.18)	(0.17)		
$\Delta MP_{t-1} * LARGE$	1.21*	0.94*		
	(0.21)	(0.17)		
$\Delta MP_{t-1} * LLIQUID$	0.38*		0.35	
	(0.15)		(0.44)	
$\Delta MP_{t-1} * HLIQUID$	-0.05		2.10	
	(0.22)		(1.50)	
$\Delta MP_{t-1} * LCAP$	0.16			1.08
	(0.17)			(0.71)
$\Delta MP_{t-1} * HCAP$	-0.06			-1.14**
	(0.24)			(0.63)
Control variables				
ΔY_t	-0.13	-0.243***	-4.10	-0.05
	(0.14)	(0.15)	(3.61)	(0.37)
ΔP_t	0.36	0.12	7.73	0.99
	(0.40)	(0.33)	(6.20)	(0.84)
# of IV	31	21	13	18
Hansen p-value	0.33	0.17	0.36	0.15
AR (2) p-value	0.93	0.22	0.29	0.21
# of banks	609	609	609	609
# of obs	14,640	14,999	14,999	14,640

*Note: Robust standard errors in parentheses; ***, **, * denotes significance at the 10%, 5% and 1% level, respectively. The Hansen and AR (2) tests show that the instruments are valid and there is no autocorrelation, respectively (p-value is greater than 0.10, 0.05, and 0.01).*

The preceding findings may also be ascribed to the limited sources of funds, which could also affect the profitability and ability of rural banks to intermediate credit whenever there is a contractionary monetary policy alongside risk-focused regulatory requirements. Thus, a separate robustness test on rural bank profitability was also undertaken. With available data on

ROA for earlier periods, regressions corresponding to the global financial crisis (GFC) and pre-GFC periods were also estimated.[12]

For the comparable estimation period i.e., 2010 – 2018Q2, capital to risk-weighted assets (CAR) and liquid asset-to-total assets are the key drivers of profitability, whereby higher CAR enhances profitability while higher liquid asset-to-total assets leads to lower profitability (Table 5). This is in stark contrast to the pre-GFC period wherein asset size, credit risk, and inflation are the principal determinants of profitability. During the GFC, however, both credit risk and liquidity risk have a dampening effect on profitability, possibly reflecting propensity to maximize cost efficiency by reducing expenditures on credit investigation of borrowers but which could lead to higher credit exposures in the future (the "skimping" hypothesis by Berger and de Young, 1997).

Table 5. Drivers of Profitability

VARIABLES	***Dependent variable: Return on Assets*** (ΔROA_{it})		
	Pre-GFC (2001Q4-2007Q2)	**GFC (2007Q3-2009Q4)**	**Post-GFC (2010Q1-2018Q2)**
ΔROA_{it-1}	0.21*	-0.31**	0.06**
	(0.03)	(0.15)	(0.02)
Bank-specific variables			
$\Delta Bank\ Size_{it}$	0.54*	0.17	-0.30
	(0.21)	(0.24)	(0.28)
ΔCAR_{it}[13]		-0.50	1.63**
		(0.41)	(0.76)
$\Delta Funding\ Risk_{it}$	0.70	-0.13	-0.73
	(0.48)	(0.66)	(1.14)
$\Delta Credit\ Risk_{it}$	0.50**	-0.93***	0.26
	(0.23)	(0.52)	(1.91)
$\Delta Liquidity\ Risk_{it}$	-0.13	-0.60**	-1.46**
	(0.11)	(0.27)	(0.84)
Macroeconomic determinants			
ΔY_t	-0.26	-0.25	0.05
	(0.38)	(0.33)	(0.38)
ΔP_t	-4.04*	1.73	-0.28
	(0.93)	(1.34)	(1.96)
ΔR_t	-0.02	-0.07	0.13
	(0.03)	(0.05)	(0.12)
# of IV	18	23	24
Hansen p-value	0.28	0.75	0.15
AR (2) p-value	0.22	0.27	0.95
# of banks	742	584	589
# of obs	8,693	2,418	7,415

*Note: Robust standard errors in parentheses; ***, **, * denotes significance at the 10%, 5% and 1% level, respectively. The Hansen and AR (2) tests show that the instruments are valid and there is no autocorrelation, respectively (p-value is greater than 0.10, 0.05, and 0.01).*

[12] Refer to Annex 1 for the indicators used in the profitability regression. The indicator return on asset (ROA) from income statement of rural banks is available over longer period, i.e., 2001 – 2018. However, comparable dataset for balance sheet indicator "CAR" used in the bank lending regression is not available for earlier periods.

[13] For the periods covering Q4 2001 to Q2 2007, the variable "CAR" was dropped in the regression due to data unavailability.

7. Conclusion

The empirical analysis has shown that bank lending channel, in general, operates in the Philippine rural banking system through rural banks' asset size. The non-neutral effects of monetary policy are more evident in the lending behavior of smaller rural banks. While big rural banks are able to protect their lending portfolio from contractionary monetary policy by the strength (size) of their balance sheet, small rural banks with less diversified funding portfolio cannot. Moreover, highly capitalized banks are more inclined to protect their capital than their lending portfolio with contractionary monetary policy and higher capital requirement, possibly indicating that regulatory compliance and its concomitant reputational effect may be a factor. The finding on non-neutral effects lends credence to the principle of proportionality embodied in the BSP's regulatory framework.

The weakness in effective and productive loan demand may reflect lack of diversification that could have also impinged on the earning capacity of rural banks, as supported by initial estimates on the drivers of rural bank profitability. An interesting area for future study is one which would account for region-specific characteristics that may influence the lending behavior of rural banks.

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ANNEX 1.
Indicators in the Profitability Regression

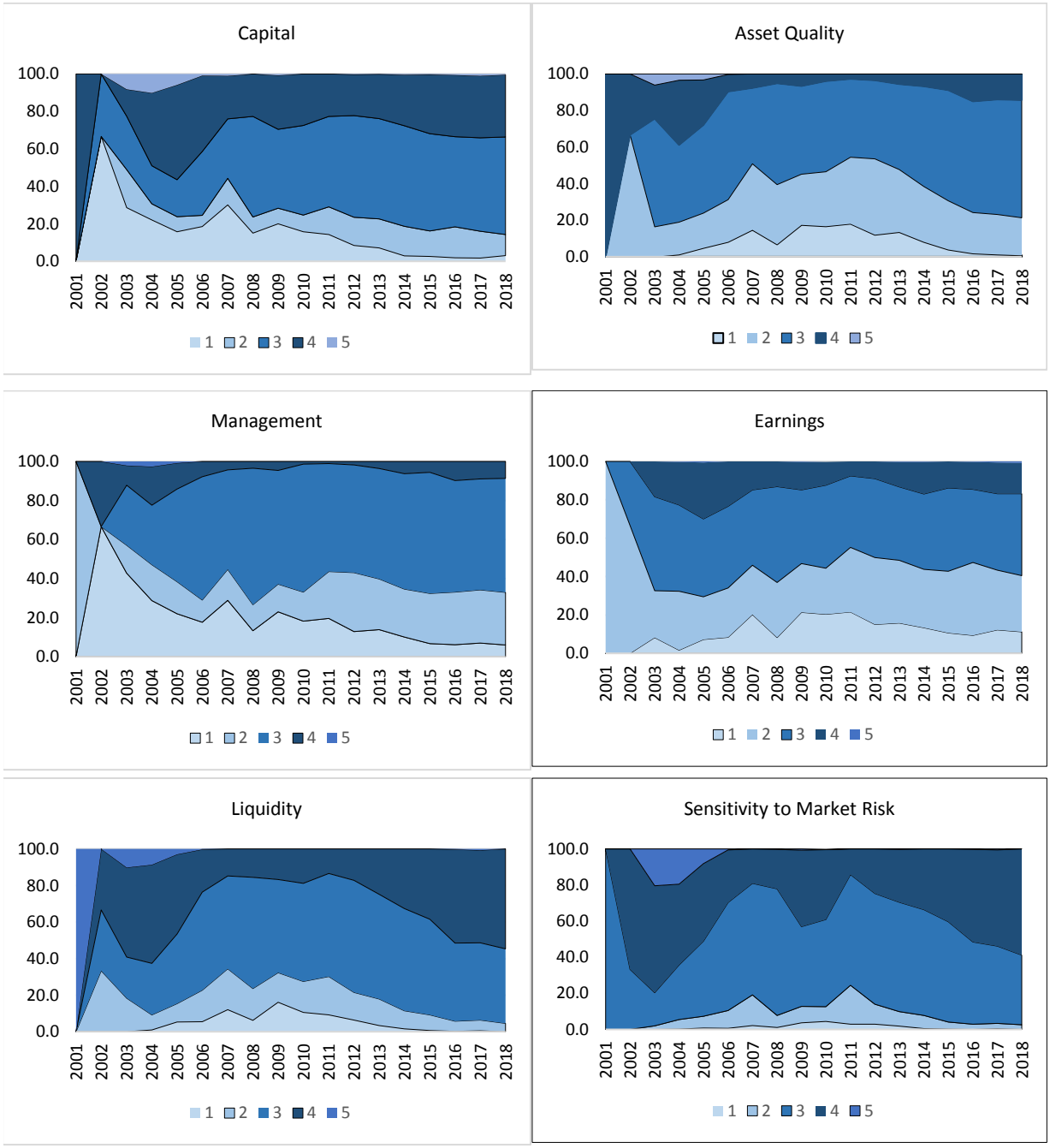
Variables		***Definition***	***Expected Sign***	***Reference***
Dependent variable	Return on Assets (ROA)	Computed as net profit of bank i at time t divided by total assets of bank i at time t.		Al-Homaidi et al. (2018)
Bank-specific variables	Bank size (BS)	Bank size is measured as the log of total assets of bank i at time t.[14]	±	Adusei (2015)
	Capital Adequacy Ratio (CAR)	Refers to the ratio of total qualifying capital to total risk weighted assets.	+	BSP
	Credit Risk (CR)	Computed as log of total loan portfolio of bank i at time t divided by the log of total assets of bank i at time t.[15]	+	Adusei (2015)
	Liquidity Risk (LR)	Calculated as log of liquid assets of bank i at time t divided by log of total assets of bank i at time t.[16]	-	
	Funding Risk (FR Z-score)	Computed as deposit liabilities-to-assets ratio of bank i at time t plus equity-to-assets ratio of bank i at time t divided by the standard deviation of deposit liabilities-to-assets ratio of bank i at time t. $Funding\ Risk\ (Z-score)_{it} = \left[\frac{\left(\frac{Deposits}{Assets}\right)_{it} + \left(\frac{Equity}{Assets}\right)_{it}}{\sigma\left(\frac{Deposits}{Assets}\right)_{it}}\right]$ The funding risk z-score measures the extent to which a bank needs to recapitalize based on the extent of the needed reduction in the volatility of the bank's deposit liabilities (i.e., customer deposits). Thus, the stability of the bank's funding source is reflected in a higher z-score of a bank.	+	
Macro-economic variables	Real GDP growth (Y)	The estimates for the constant price of GDP are obtained by expressing the values in terms of a base period (i.e., 2000).	±	Philippine Statistics Authority (PSA)
	CPI inflation (P)	CPI is measured using 2006 prices as the base year.	+	BSP
	Bank average lending interest rate (R)	Reflects the annual percentage equivalent of all commercial banks' actual interest income on their peso-denominated loans to the total outstanding levels of their peso-denominated loans, bills discounted, mortgage contract receivables and restructured loans.	+	

[14] Total assets (ta) refers to the sum of total assets, net of due to head office/branches/agencies and non-performing assets cover.

[15] Total loan portfolio (tlp) refers to the sum of (i) loans to BSP, (ii) loans to other banks, (iii) loans and receivables-others, and, (iv) loans and receivables arising from repurchase agreements/certificate of assignment/participation with recourse/securities lending and borrowing transactions, net of amortization.

[16] Liquid assets (la) are the sum of cash and cash items, due from banks, and financial assets (net of amortization, accumulated market gains/losses, allowance for credit losses excluding equity investment in subsidiaries/associates/joint ventures).

ANNEX 2
Evolution of CAMELS Component Ratings of Rural Banks



Rating scale ranges from 1 – 5, with 5 being the highest.
Source of basic data: BSP's Department of Supervisory Analytics, Financial Supervision Sector

ANNEX 3
Dynamic Panel Data Model Selection

The table below shows the estimates for equation (1) under the two types of DPD models, namely, standard diff-GMM and orthogonal diff-GMM.

VARIABLES	***Dependent variable: Total Loan Portfolio*** (ΔL_{it-1})	
	diff GMM orthogonal	diff GMM standard
ΔL_{it-1}	-3.26***	-2.21
	(1.85)	(1.60)
ΔMP_t	1.01	0.97
	(0.85)	(0.60)
ΔMP_{t-1}	-21.39	-5.34
	(18.82)	(33.90)
Impact of bank-specific characteristics		
$Size_{it-1}$	0.65	1.69
	(2.08)	(3.17)
$Liquidity_{it-1}$	-2.16	-0.05
	(3.75)	(5.55)
$Capital_{it-1}$	1.82	-3.14
	(3.54)	(5.71)
Existence of Bank Lending Channel of Monetary Policy		
$\Delta MP_{t-1} * Size_{it-1}$	2.07**	0.34
	(0.98)	(2.20)
$\Delta MP_{t-1} * Lqd_{it-1}$	0.46	-1.28
	(2.13)	(3.57)
$\Delta MP_{t-1} * Cap_{it-1_t}$	-2.01	1.45
	(2.41)	(4.29)
Control Variables		
ΔY_t	-0.02	-0.31
	(0.34)	(0.36)
ΔP_t	0.88	-0.17
	(1.13)	(1.78)
# of IV	23	23
Hansen p-value	0.92	0.60
AR (2) p-value	0.35	0.89
# of banks	609	609
# of obs	14,640	14,110

*Note: Robust standard errors in parentheses; ***, **,* denotes significance at the 10%, 5% and 1% level, respectively. The Hansen and AB autocorrelation tests show that the instruments are valid and there is no autocorrelation, respectively (p-value is greater than 0.10, 0.05, and 0.01).*

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