# Determinants and impacts of agricultural commercialization: The case of small-scale rice farmers in Vietnam

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**ABSTRACT**

This paper analyzes the relationship between market access and the level of agricultural commercialization among smallholder rice farmers in Vietnam. The objective is to identify key determinants of market participation and estimate the impact of commercialization on productivity and crop prices. Using panel data from the Vietnam Access to Resources Household Survey (VARHS) for 2014 and 2016, we apply fixed-effects and Instrumental Variable (IV) regressions to control for unobservable characteristics and endogeneity. Results indicate that distance to the main rice buyer is negatively associated with commercialization, while distance to input markets is not statistically significant. Higher levels of commercialization are associated with increased productivity. While commercialization appears negatively related to output prices, the relationship reverses when we account for heterogeneity in production levels, suggesting economies of scale among more market-oriented farmers. The findings underscore the importance of reducing transaction costs and improving physical access to output markets. Policy efforts should prioritize rural road infrastructure and support for high-volume producers to enhance integration and farm profitability.

## 1. Introduction

Increasing productivity in small-scale agriculture remains one of the most effective strategies to reduce poverty and promote inclusive rural development, especially in countries where a large proportion of the population still relies on agriculture for subsistence. Beyond enhancing farmers' capabilities to increase yields, access to well-functioning markets - both for inputs and outputs - is a key determinant of household welfare. However, rural areas in developing countries are often characterized by fragmented and imperfect markets, which can hinder participation in commercial agriculture (Jayne et al., 2010). For small-scale farmers in particular, high transaction costs, limited access to credit and extension services, and weak infrastructure can significantly reduce incentives to engage in market activities (Casinillo & Seriño, 2022; Foster & Briceño-Garmendia, 2019; Key et al., 2000).

In the case of Vietnam, the Doi Moi reforms initiated in 1986 marked a substantial shift toward a more market-oriented agricultural system, reversing the collectivization policies and granting land use rights to individual households. While these reforms spurred significant productivity gains, levels of commercialization remain uneven across regions and farmer types (Markussen et al., 2011). Data from the 2016 Vietnam Access to Resources

Household Survey (VARHS) show stark contrasts: while small-scale rice producers in the southern province of Lang An sold on average 90 percent of their output, farmers in the northern provinces of Phu Tho and Lai Chau marketed only around 10 percent. Understanding the drivers behind these disparities is essential for designing policies that foster inclusive growth in the agricultural sector.

Recent studies in Southeast Asia, particularly in the Philippines, have highlighted how farmer income, productivity, and market engagement are influenced by structural factors such as infrastructure, access to extension agents, and local institutional support (Casinillo, 2022; Casinillo et al., 2023). These findings underscore the importance of localized and disaggregated approaches in analyzing commercialization patterns. However, despite growing interest in these themes, few studies in the Vietnamese context have employed panel data techniques or accounted for potential endogeneity in estimating the effects of market integration.

This paper aims to fill that gap by providing rigorous econometric evidence on the determinants and impacts of commercialization among smallholder rice farmers in Vietnam. Using two waves (2014 and 2016) of the VARHS dataset, we focus on rice farmers who consistently grew rice in both years. This allows for better comparability in transaction costs and market behavior. Unlike previous studies, we address potential endogeneity in commercialization decisions using an Instrumental Variable (IV) approach and explore heterogeneous effects by production quintile, thereby identifying how the relationship between market participation, prices, and productivity varies across scale.

Our findings show that proximity to output markets is a key determinant of commercialization, while distance to input markets (specifically seed suppliers) is not. We also find that increased commercialization is positively associated with productivity and, when accounting for heterogeneity by production level, with higher unit values received by farmers. These results have important policy implications for targeting infrastructure investment, extension services, and market integration strategies.

The remainder of the paper is organized as follows: Section 2 reviews the literature on agricultural market access and commercialization. Section 3 describes the data and key variables. Section 4 outlines our empirical strategy. Section 5 presents the main results, and Section 6 concludes with policy recommendations.

## 2. Conceptual framework

The decision of smallholder farmers to participate in agricultural markets is shaped by a combination of production-related factors, household characteristics, and access to infrastructure and institutions. Grounded in transaction cost economics (Coase, 1937; Williamson, 1989), our study conceptualizes commercialization as a decision driven by both fixed transaction costs (e.g., searching for buyers, contract negotiation, enforcement) and variable transaction costs (e.g., distance to market, transport costs, price fluctuations).

According to Key et al. (2000), these transaction costs significantly influence whether a household enters the market and to what extent. More recently, studies such as Casinillo and Seriño (2022) and Casinillo (2022) emphasize that market access, extension services, and infrastructure development are critical enablers of commercialization and productivity in rice-based systems. Similarly, Casinillo et al. (2023) show that both farm-level and institutional determinants shape commercialization decisions in the Philippine context, underscoring the need for local, empirical evidence.

Building on this literature, we posit that the level of commercialization, defined as the proportion of output sold, is determined by:

- Market access: measured by distance to the main output buyer, road infrastructure, and rice seed supplier;
- Production potential: proxied by land size, labor, and livestock;
- Socio-demographic characteristics: gender, age, education, and marital status of the household head.

We further examine the impacts of commercialization on two key outcomes:

- Productivity, as increased commercialization may incentivize investment and improve efficiency;
- Unit price received, which could either increase due to better market access or decrease due to larger volumes sold at lower margins.

However, the relationships between commercialization, productivity, and price may be endogenous: more productive or better-connected farmers may choose to commercialize more. To address this, we instrument commercialization using exogenous variation in distance to output markets, input suppliers, and road infrastructure.

There is a vast empirical literature concerned with the effects that access to markets has on rural development. Improvements in road infrastructure have been linked with higher crop yields and wages in Bangladesh (Khandker et al., 2009). In Vietnam, Mu and van de Walle (2011) find that roads are positively related to food availability, school completion rates, and agricultural wages. De Janvry and Sadoulet (2001) found a positive relationship between rural road indicators and farm and non-farm employment. Proximity to urban centers has been positively correlated with specialization of production and labor (Fafchamps & Shilpi, 2003). More recent evidence reinforces the importance of infrastructure and connectivity: Casinillo et al. (2023) emphasize the role of physical location and institutional access in shaping commercialization outcomes in the Philippines. Similarly, Nakamura et al. (2020) find that road infrastructure significantly enhances welfare indicators and market participation among rural Ethiopian households, while Anega and Alemu (2023) show that upgrading local roads to all-weather standards can increase average real household consumption per capita by up to 10%, highlighting how infrastructure improvements support welfare gains and market connectivity for rural communities.

The empirical evidence regarding market access does not unanimously support the idea that better roads mean better access. It is possible for remote places to have good access to markets if traders behave as if in a competitive framework. Chamberlin and Jayne (2013) provide a comprehensive review of the literature on market access and conclude that market access is affected as much by the behavior of key market agents as by access to physical infrastructure. Using data from Tigray, Ethiopia, Kruseman et al. (2006) conducted a factor analysis of several market access variables (distance and travel times to towns, all weather roads, and bus service), and found all of these variables to be highly correlated with a single composite market access factor. This factor was found to be associated with significantly more production of teff (the most important cash crop in the region), less production of relatively subsistence-oriented sorghum, less ownership of livestock, but a higher indicator of household wealth (proportion of houses with metal roofs). A panel study from Kenya finds that agricultural

commercialization significantly increases annual per capita household expenditure, with the gap between commercialized and non-commercialized households largely explained by differences in resources owned and efficiency of resource use (Muricho et al., 2017).

## 3. Methods

### *3.1. Research design*

This study uses a quantitative panel data approach to analyze the determinants and impacts of rice commercialization among smallholder farmers in Vietnam. The research design is non-experimental, longitudinal, and observational. The design allows for controlling for household-level unobserved heterogeneity using Fixed-Effects (FE) models and addresses endogeneity concerns through Instrumental Variable (IV) techniques. We examine two primary relationships:

- The determinants of rice commercialization - measured as the proportion of rice output sold or bartered.
- The impact of commercialization on two outcomes: farm productivity and prices received per unit of rice.

We begin with a household fixed-effects model:

$$Comm_{it} = Access_{it} + Farm_{it} + HH_head_{it} + \theta_i + \varepsilon_{it} \quad (1)$$

where $Comm_{it}$ refers to the proportion of rice output that was sold or battered in household $i$ at time $t$, $Access_{it}$ is a vector of variables related to market access, $Farm_{it}$ relates to characteristics of the household related to agricultural production, $HH_head_{it}$ are a set of socio-demographic variables about the head of the household, $\theta_i$ is the household fixed-effect and $\varepsilon_{it}$ is the error term.

To estimate the effects of commercialization on productivity and prices, we use a two-stage least squares (2SLS) model, instrumenting commercialization:

$$Y_i = \alpha + Comm*_i + Farm_i + HH_head_i + \epsilon_i \quad (2)$$

where $Y_i$ is our outcome variable of interest (productivity or prices), $Comm*_i$ refers to the household's level of commercialization and is instrumented using the variables previously mentioned, $Farm_i$ are controls for the production potential of the household, $HH_head_i$ is a vector of socio-demographic features of the household head, and $\epsilon_i$ is the error term.

### *3.2. Respondents, sampling procedure, and ethics*

The empirical analysis will be based on the Vietnam Access to Resources Household Survey (VARHS), covering the period 2014 - 2016. [1]The balanced panel survey includes observations from 2,131 rural households in 476 communes and 12 provinces, and is representative of the rural population in Viet Nam. We only include households that report to

[1] The survey was developed in collaboration between the Development Economics Research Group (DERG), Department of Economics, University of Copenhagen, and the Central Institute of Economic Management (CIEM), the Institute for Labour Studies and Social Affairs (ILSSA), and the Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD), Hanoi, Viet Nam. The provinces included are, by region: Red River Delta: Ha Tay; North East: Lao Cai, Phu Tho; North West: Lai Chau, Dien Bien; North Central Coast: Nghe Anh; South Central Coast: Quang Nam, Khanh Hoa; Central Highlands: Dak Lak, Dak Nong, Lam Dong; and Mekong River Delta: Long An. The survey is carried every second year

produce rice in both of these years, leaving the final dataset to be of 1,709 rural households. We focus on rice farmers to ensure consistency in production and transaction characteristics. The dataset was obtained through formal channels and is anonymized. No additional fieldwork or interventions were conducted by the authors, so no Institutional Review Board (IRB) approval was required for this secondary data analysis.

### *3.3. Research instrument and data collection*

The VARHS contains detailed modules on household demographics, agricultural production, market transactions, and asset ownership. For this study, we extract:

- Commercialization (share of rice output sold or bartered),
- Market access indicators (distance to main buyer, seed supplier, and all-weather roads),
- Inputs (land, labor, livestock),
- Outcomes (yield per hectare, average price received),
- Household head characteristics (gender, age, education, marital status).

For more detailed information on the sampling design and data collection procedures of VARHS, please refer to Tarp (2017).

### *3.4. Data analysis and statistical methods*

The determinants of commercialization are estimated using fixed-effects regression models to control for time-invariant unobserved heterogeneity. To address potential endogeneity of commercialization in the outcome equations (productivity and price), we use a 2SLS instrumental variable approach. The instruments are: 1) distance to the nearest main output buyer, 2) distance to the nearest rice seed supplier, and 3) distance to the nearest all-weather access road.

These instruments are theoretically valid, as they affect commercialization via transaction costs but are plausibly exogenous to productivity and price outcomes. Standard errors are clustered at the commune level to correct for intra-cluster correlation.

### *3.5. Descriptive statistics*

We are interested in farmer's market participation, so we analyze the level of commercialization of each rice farmer (i.e., the proportion of total output that was sold or battered). In Table 1, we can observe the level of commercialization divided by the gender of the household head and the level of production. We see that there is a clear positive relation between the level of production and the participation in output markets. Moreover, female household heads trade on average around 2 percent more of their production in relation to their male counterparts. In the second and third columns, we see the mean distance for rice seed supplier and market for output. When looking at the distance for inputs, we can see that this variable does not change significantly with the level of production; this might be an indication that access to inputs (at least rice seeds) is not a binding restriction to commercialization and production. On the other hand, the remoteness of markets to sell your produce does seem to be different for farmers with higher levels of output. Additionally, we observe that female-headed households tend to be further away from output markets.

**Table 1**

*Distance to Seed Purchase Location and Main Output Buyer*

| | Output traded (percent) | Distance to main rice seed supplier (km) | Distance to main rice buyer (km) |
|---|---|---|---|
| **Gender of Household Head** | | | |
| Female | 32.6 | 11.7 | 23.3 |
| Male | 30.7 | 12.8 | 20.4 |
| **Production Quintile** | | | |
| Lowest | 4.8 | 10.7 | 36.3 |
| Second lowest | 14.1 | 11.5 | 26.7 |
| Middle | 27.5 | 12.5 | 17.6 |
| Second highest | 39.8 | 16.2 | 16.1 |
| Highest | 69.3 | 12.1 | 8.3 |
| **Total** | **31.1** | **12.6** | **20.9** |
| **Number of observations** | 3,279 | 3,043 | 3,184 |

*Note.* The sample includes only households growing at least some rice. Author's calculations using the VARHS 2014 - 2016

## 4. Results

In this section, we explore the determinants of commercialization, placing special attention to the effect of market access in farmer's participation in the market. In this analysis, we take advantage of the panel structure of the dataset to control for omitted characteristics that are fixed in time, which allows us to correct for omitted variables bias. However, this technique does not address all sources of endogeneity because it is possible that some time-varying unobservable features can also be driving the level of farmer commercialization. To measure market access, we rely on three different variables that are common in the literature (Babulo et al., 2008; Bezu & Holden, 2008; Feleke & Zegeye, 2006; Escobal, 2001) as well as more recent studies that emphasize road and market access as key drivers of agricultural transformation (Casinillo et al., 2023): distance to an all-year-round access road, distance to the main rice seed supplier, and distance to the main buyer (all measured in kilometers). The empirical model also includes time-varying features that we expect are correlated with the level of farmers' commercialization, such as estimated prices, productivity, land holdings, labor, livestock, production quintile, and household head socio-demographic variables.

The first three rows in Table 2 relate to variables that proxy market access; the only variable that is significant is the distance to the output market. The sign indicates that increases in the distance to a farmer's main buyer reduce the level of commercialization. This is consistent with theory and previous empirical findings as distance to output markets is expected to affect significantly transaction costs (Dercon et al., 2009; Jacoby & Minten, 2009; Mu & van de Walle, 2011). These results are also in line with more recent evidence showing that rural road improvements and local market development continue to play an essential role in agricultural engagement (Belete & Nigatu, 2023).

The level of productivity, prices, and production quintile are all positive and statistically significant. This is not surprising given that more market-oriented farmers tend to be more productive and obtain a higher price on their crops. Similar patterns have been documented in Southeast Asia, where market-oriented rice producers were found to benefit from better technical efficiency and higher revenues (Casinillo, 2022). Moreover, changes in labor and livestock seem to have a negative impact on the level of commercialization. It is possible that these two variables are related to changes in household activities that are not related to agriculture.

**Table 2**

*Market Access and Commercialization*

| | **FE** |
|---|---|
| | **Commercialization** |
| Distance to road | 0.003<br>(0.002) |
| Distance to rice seed supplier | < 0.001<br>(< 0.001) |
| Distance to the main buyer | **- 0.001*****<br>**(0.000)** |
| Price | **0.021****<br>**(0.009)** |
| Productivity | **0.005***<br>**(0.003)** |
| Land holdings | < 0.001<br>(< .001) |
| Labor | **- 0.026*****<br>**(0.008)** |
| Livestock | **- > 0.001***<br>**(< 0.001)** |
| Production Quintile | **0.099*****<br>**(0.008)** |
| Control for HH head characteristics | Yes |
| N | 2,931 |
| R-squared | 0.393 |

*Note.* Standard Errors are in parentheses and are clustered at the commune level (46 communes)
*** denotes significance at 1%, ** denotes significance at 5%, * denotes significance at 10%. Author's calculations using the VARHS 2014 - 2016

Now we move on to analyze the impact commercialization has on two key aspects of agricultural production: prices and productivity. In the first three columns of Table 3 we can see the results from the OLS regression. In the first column, we see that commercialization is positively related to the productivity levels, land holdings seem to have a small negative effect on productivity, and the human capital of the household head, surprisingly, is negatively related

to the productivity of rice farmers. This pattern may be explained by labor reallocation toward off-farm activities among more educated households, a finding consistent with the structural transformation literature (De Janvry & Sadoulet, 2001).

**Table 3**

*Impact of Commercialization on Productivity and Prices*

| | **OLS** | | | **IV** | | |
|---|---|---|---|---|---|---|
| | **Productivity** | **Price** | | **Productivity** | **Price** | |
| Commercialization | **3.08*** (0.421)** | **-0.933*** (0.052)** | **0.994*** (0.162)** | **2.51*** (1.42)** | **-0.468*** (0.168)** | **3.115*** (0.871)** |
| Land | **> -0.001*** (< 0.001)** | **> -0.001*** (< 0.001)** | >-0.001 (< 0.001) | **> -0.001*** (< 0.001)** | **> -0.001*** (< 0.001)** | < 0.001 (< 0.001) |
| Labor | 0.137 (0.107) | **-0.025* (0.013)** | -0.004 (0.013) | 0.171 (0.120) | -0.020 (0.014) | 0.026 (0.017) |
| Livestock | > 0.001 (< 0.001) | >-0.001 (< 0.001) | >-0.001 (< 0.001) | >-0.001 (< 0.001) | >-0.001 (< 0.001) | >-0.001 (< 0.001) |
| HH head is male | 0.324 (0.585) | **0.122* (0.073)** | **0.121* (0.071)** | 0.343 (0.651) | 0.092 (0.077) | 0.089 (0.076) |
| HH head is married | 0.020 (0.628) | -0.096 (0.078) | -0.052 (0.076) | -0.004 (0.698) | -0.045 (0.077) | 0.035 (0.084) |
| HH head age | -0.020* (0.012) | > -0.001 (0.001) | 0.000 (0.001) | -0.019 (0.014) | -0.001 (0.001) | < 0.001 (< 0.001) |
| HH head education | **-0.336** (0.164)** | **0.033* (0.020)** | 0.028 (0.020) | **-0.411** (0.184)** | 0.025 (0.021) | 0.017 (0.021) |
| Commer*Quintile[1] | - | - | **-0.453*** (0.036)** | - | - | **-0.906*** (0.184)** |
| N | 3,274 | 3,274 | 3,274 | 2,946 | 2,945 | 2,945 |
| Adj. R-squared | 0.017 | 0.101 | 0.142 | 0.044 | 0.974 | 0.974 |

*Note.* Standard Errors are in parentheses. *** denotes significance at 1%, ** denotes significance at 5%, * denotes significance at 10%. Interaction between quintile production level and a commercialization dummy. Author's calculations using the VARHS 2014 - 2016

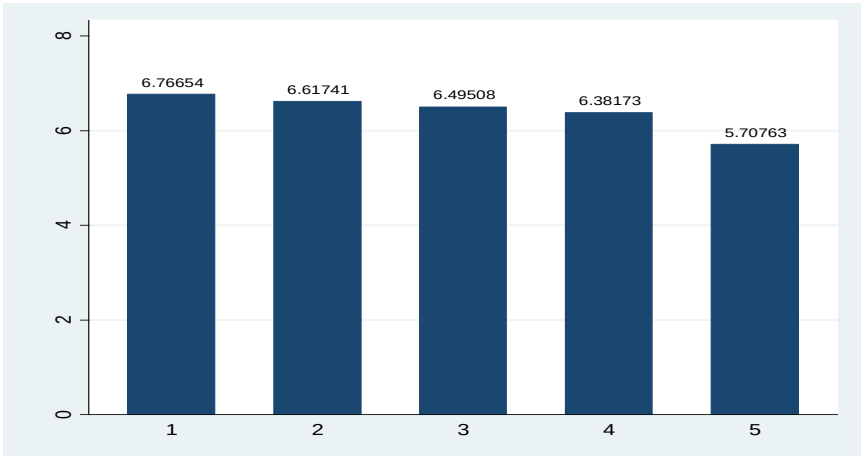
In the second and third columns, we analyze the average price obtained by the farmer. In the second column, we observe that a higher level of commercialization is negatively related to the price farmers obtain for their product. One reason behind this finding may be that higher levels of production imply a lower price per kg because at that point the farmers can be taking advantage of some economies of scale (see Figure 1). Moreover, we expect farmers with higher levels of production to be also more market-oriented. For these reasons, when the level of production is ignored we obtain a negative effect of commercialization in the prices obtained by rice growers; to account for such differences we allow for heterogeneous effects of commercialization based on production level (column 3) by interacting a dummy for commercialization and the production quintile. Once we allow for heterogeneous effects on commercialization based on the level of production, the sign of the commercialization parameter

becomes positive and remains statistically significant. This can be interpreted as more market-oriented farmers obtain a higher value for their products, although the individual price diminished because they are able to sell higher quantities of rice. Additionally, it is worth noting that male-headed households tend to obtain higher prices for their products in relation to households where women are in charge.

As it was previously mentioned, the dynamics between commercialization, productivity, and prices are complex since it is not clear if commercialization induces this behavior in farmers or farmers with higher ability to produce and negotiate prices tend to participate more in the market. To address some of the concerns on this endogenous issue, we use IV techniques; the level of commercialization is instrumented using three different variables that we expect are related to market access but uncorrelated with our outcomes of interest. Looking at column 1 and column 4, we can compare the results for productivity between the OLS and IV techniques. The commercialization coefficient remains positive and significant, however, it is not as high as the coefficient in the OLS estimation. This indicates that the OLS estimates have an upward bias on this variable. As expected, the method has corrected for upward bias. Similarly, when comparing the IV and OLS commercialization coefficients in the price equations (column 5), the interpretation of the results is similar since it maintains its significance and sign, but the IV estimate is smaller. In column 6, we see that the coefficient actually increases with respect to the OLS result. This shows that the impact of commercialization on prices is even greater when we account for the endogeneity of market participation and perceived prices.

**Figure 1**

*Average Price by Production Quintile*




*Note.* Author's calculations using the VARHS 2014 - 2016

## 5. Discussion and conclusive remarks

This study explores the determinants and consequences of market participation among smallholder rice farmers in Vietnam. By leveraging panel data and addressing endogeneity through fixed effects and instrumental variable techniques, our analysis sheds light on how market access influences commercialization and, in turn, affects farm-level productivity and prices.

The findings highlight the critical role of physical distance to output markets in shaping commercialization intensity. This supports the case for continued investment in rural infrastructure, particularly in regions where farmers remain disconnected from buyers. Improvements in roads, storage, and aggregation facilities could reduce transaction costs,

increase market participation, and ultimately raise rural incomes. Additionally, the fact that productivity and price responses vary by production scale suggests that tailored interventions-such as differentiated support for small, medium, and large rice producers-are more effective than one-size-fits-all policies.

The observed heterogeneity in price effects also implies that farmers with higher output can overcome initial price penalties associated with increased commercialization. This has implications for value chain development: enabling farmers to reach higher-volume or premium markets (e.g., through cooperatives or contract farming) may help them command better prices even in the face of large-scale production.

Beyond infrastructure, the results speak to the need for extension services that promote market orientation, not just productivity. Supporting farmers with information on price trends, negotiation tactics, and post-harvest quality management could enhance their ability to benefit from commercialization. Importantly, gender disparities observed in price outcomes reinforce the call for gender-sensitive programming, ensuring that female-headed households receive equitable support in accessing and negotiating in agricultural markets.

Despite its contributions, this study is not without limitations. First, it relies on self-reported distance and price data, which may be subject to measurement error. Second, while the IV strategy controls for some endogeneity, we cannot fully account for time-varying unobservable factors such as weather shocks, changes in local institutions, or household-specific aspirations. Additionally, our focus on rice farmers limits the generalizability of the findings to other crops or livelihood strategies.

Future research should expand the scope to include other agricultural systems and geographic regions to test the robustness of these relationships. It should also explore the role of informal networks, digital tools, and contract farming in facilitating market participation. Furthermore, studies should examine the long-term welfare impacts of commercialization, including effects on food security, income diversification, and household resilience to external shocks.

In conclusion, this study reinforces the notion that improving smallholder commercialization requires more than increasing yields-it requires a supportive market environment, inclusive infrastructure development, and nuanced, data-driven policy design.

## SCIENTIFIC CONTRIBUTION

The manuscript clearly identifies a research gap; the manuscript opens new directions for further research; the manuscript presents statistically and practically significant findings; the manuscript offers policy/managerial/technological implications; the manuscript opens new directions for further research.

## AUTHOR CONTRIBUTIONS

CRediT: **Luciano Ayala-Cantu**: Conceptualization, Methodology, Software, Formal Analysis, Investigation, Writing - Original Draft, Writing - Review & Editing.

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## NO CONFLICT OF INTEREST STATEMENT

All authors declare that they have no conflict of interest.

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