

REVIEWER'S REPORT

Manuscript No.: IJAR- 58738

Title: ***Impact de la politique d'utilisation des semences améliorées sur la productivité rizicole au Sénégal.***

Recommendation:

Accept as it is

Accept after Minor revision.....

Accept after major revision

Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance			✓	

Reviewer Name: **ANAPANA GOPAL**

Reviewer's Comment for Publication.

General Comments

The manuscript addresses an important agricultural-policy question: whether adoption of improved rice varieties contributes to productivity and technical efficiency in Senegal. The study uses a relatively substantial dataset of 617 rice farms from the 2022 DAPSA/ISRA/AfricaRice survey, with 25.9% reported adoption of improved seeds. It combines Stochastic Frontier Analysis (SFA) and Propensity Score Matching (PSM).

The topic is relevant and the econometric framework has potential. However, Minor methodological and interpretational problems need to be addressed before the manuscript can be considered for publication. The most important concern is the interpretation of the second-stage SFA coefficients, followed by insufficient reporting of PSM diagnostics and an overstatement of causal inference.

Minor Comments

1. Minor problem in the interpretation of the SFA inefficiency model

The manuscript specifies:

where represents **technical inefficiency**.

Under this specification, a **positive coefficient generally indicates an increase in inefficiency**, whereas a negative coefficient indicates a reduction in inefficiency.

However, Table 3 reports positive coefficients for:

- Improved seeds: **0.0318**
- Access to credit: **0.0422**
- Farmer organization: **0.0711**

while the manuscript interprets these variables as reducing inefficiency.

This is a **substantive interpretation error** unless the authors used a different coding/specification than the equation indicates.

The authors must:

- verify the actual econometric specification/software output;
- verify the sign convention for ;

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- explain whether the dependent variable in the second stage is inefficiency or efficiency;
- correct Table 3 and its interpretation accordingly.

This issue should be resolved before the results can be considered reliable.

2. H2 is incorrectly linked to the SFA second-stage results

The manuscript states that the second-stage SFA results confirm H2, which is: improved seed varieties increase rice productivity.

But the second-stage model is explicitly a model of **technical inefficiency**, not a direct productivity model.

Therefore, the authors should distinguish:

- effect on productivity;
- effect on technical efficiency;
- determinants of technical inefficiency.

H2 should preferably be evaluated using the productivity/PSM results rather than claiming that a coefficient in the inefficiency equation directly confirms a productivity hypothesis.

3. The claim of “causal” effect from PSM is too strong

The manuscript repeatedly describes the PSM result as a **causal effect** and states that PSM “confirms a causal positive and robust effect.”

However, the study uses **cross-sectional observational data from 2022**. PSM can reduce observable selection differences, but by itself it does not eliminate:

- unobserved confounding;
- reverse causality;
- omitted-variable bias;
- selection on unobservable characteristics.

Therefore, the manuscript should use wording such as:

“estimated treatment effect under the conditional independence/unconfoundedness assumption”

rather than presenting the result as definitively causal.

The authors should explicitly state the assumptions required for causal interpretation.

4. PSM balance diagnostics are missing

The manuscript reports that 613 of 617 observations lie within common support after nearest-neighbor matching with a caliper of 0.05.

However, **common support alone is not sufficient to demonstrate that matching was successful**.

The authors should report:

- standardized mean differences before and after matching;
- variance ratios, where appropriate;
- propensity-score distribution before and after matching;
- a balance plot/Love plot;
- number of treated and control observations actually matched;
- whether matching was with or without replacement;
- matching weights, if applicable.

Without balance diagnostics, the quality of the matching procedure cannot be adequately assessed.

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5. The sample size changes from 617 to 613 after matching and requires explanation

The original sample contains 617 farms, while the PSM analysis reports 613 observations in common support. Table 5 subsequently reports:

- ATT: N = 156
- ATC: N = 457
- ATE: N = 613.

Since the original number of adopters is 160, the authors should clearly explain:

- why four adopters were excluded;
- whether four non-adopters were also excluded;
- whether these observations were outside common support;
- whether the reported ATT corresponds to 156 matched treated observations.

A participant/sample flow diagram would improve transparency.

6. ATT is significant, but ATE is not—this needs more cautious interpretation

The reported results are:

- **ATT = 1,331 kg/ha**, significant;
- **ATC = 641 kg/ha**, not significant;
- **ATE = 816 kg/ha**, not significant.

This is an interesting result and potentially an important contribution.

However, the manuscript should avoid stating broadly that:

“adoption improves rice productivity”

without immediately specifying that the statistically supported result is for the **estimated effect among adopters**, whereas the population-level ATE is not statistically significant.

The Abstract should be revised accordingly. The present Abstract describes adoption as having a positive and significant effect while subsequently noting that ATE is nonsignificant.

7. The relationship between SFA and PSM is overstated

The manuscript states that the convergence of SFA and PSM “reinforces internal validity.”

I do not consider this sufficiently justified.

SFA and PSM answer related but different questions:

- SFA estimates production/technical efficiency under a specified frontier model.
- PSM estimates differences in outcomes between matched adopters and non-adopters under matching assumptions.

Agreement between the two does **not independently establish causal validity**.

The authors should describe the two approaches as **complementary evidence**, rather than treating their agreement as proof of causal robustness.

8. The SFA model requires more complete specification

The manuscript uses a Cobb-Douglas production frontier with seed, fertilizer and labor inputs.

The authors should provide more information about:

- units of measurement for each input;
- exact definition of output;

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- treatment of zero values;
- logarithmic transformation;
- distributional assumption for ;
- distributional assumption for ;
- estimation method/software;
- likelihood function;
- whether heteroskedasticity was considered;
- diagnostic tests.

This is especially important because the paper's principal conclusions depend heavily on the SFA specification.

9. The interpretation of $\gamma = 0.78$ should be made more precise

The manuscript states that $\gamma = 0.78$ demonstrates that technical inefficiency explains an important proportion of residual variance.

The authors should provide the **standard error, test/statistical significance and exact definition of γ** in the SFA output.

It would also be useful to report the likelihood-ratio test or another formal test supporting the use of SFA over an ordinary regression model.

10. The zone-level comparison requires caution

The manuscript reports technical efficiency ranging from **33.0% in the irrigated valley zone to 64.6% in Haute Casamance**.

The zone sample sizes are highly unequal:

- Zone 1: 435
- Zone 2: 146
- Zone 3: 30
- Zone 4: 6.

The conclusion concerning Zone 4 is particularly weak because it is based on only **six observations**.

The authors should provide confidence intervals or statistical tests for differences between zones rather than relying only on descriptive differences.

11. "Effective household" classification needs reconsideration

The manuscript classifies a farm as effective when its efficiency score exceeds the **sample mean of 0.561**.

This is an arbitrary threshold and does not necessarily represent a meaningful economic or statistical definition of technical efficiency.

The authors should either:

- justify this threshold theoretically/statistically; or
- present the continuous efficiency score as the principal measure and treat the binary classification only as a descriptive supplementary analysis.

12. The model's $R^2 = 0.064$ should be discussed

The second-stage model reports:

$F(7,609) = 5.99$, $p < 0.001$; $R^2 = 0.064$.

Although the overall model is statistically significant, the reported R^2 indicates that the included variables explain only a relatively small proportion of variation in the dependent variable.

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The manuscript should avoid language suggesting that the model provides a strong explanation of inefficiency.

Minor Comments

13. Separate Results and Discussion

The section is currently titled **"3. Résultats et discussions."**

I recommend separating it into:

3. Results

and

4. Discussion

This will improve scientific organization.

14. The Introduction is excessively long

The Introduction contains extensive background, theoretical discussion and literature review before reaching the research gap. The manuscript would be stronger if the Introduction were shortened and the research gap stated more explicitly.

15. Literature review should be more critical

The literature review is broad, but much of it is presented as a sequence of studies reporting positive effects.

The authors should explicitly discuss:

- studies finding weak or heterogeneous effects;
- methodological differences between studies;
- limitations of previous adoption studies;
- why the present SFA + PSM approach provides additional knowledge.

16. Theoretical framework is overextended

The manuscript invokes several theories:

- neoclassical production theory;
- diffusion of innovation;
- Schumpeterian innovation;
- institutional theory;
- capability/access-to-resources theory;
- human-capital theory;
- risk theory;
- behavioral economics.

This is excessive for the empirical model actually estimated.

The authors should retain only theories that directly inform the variables and hypotheses tested.

17. Reference quality and completeness need attention

Several references are institutional reports, conference communications or less readily verifiable sources. For example, some references are listed as conference presentations or institutional documents rather than peer-reviewed journal articles.

The authors should:

- verify every reference;
- provide complete bibliographic information;
- ensure every cited source appears in the reference list;

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- ensure every reference-list item is actually cited;
- add recent peer-reviewed literature where appropriate.

18. Language editing is required

There are numerous typographical and formatting problems, for example:

- “Lescored’efficacitémoyendesproducteurs...”
- inconsistent spacing;
- inconsistent use of abbreviations;
- “régression de seconde étape” terminology requiring clarification;
- inconsistent punctuation and accents.

The manuscript requires thorough French language and formatting revision.

19. Abstract needs methodological precision

The Abstract should clearly distinguish:

- technical efficiency estimate;
- ATT;
- ATC;
- ATE;
- statistical significance.

The current wording may give readers the impression that improved seed adoption has a statistically significant effect for the whole population, whereas the reported ATE is nonsignificant.

20. The conclusion should be revised after correcting Table 3

Because the interpretation of the SFA inefficiency coefficients appears problematic, the conclusions concerning organizations, credit and improved seeds should **not be finalized until the underlying model coding and coefficient signs have been verified**.

Recommendation to the Editor

Decision: MINOR REVISION

The manuscript has a **relevant research question, a reasonably large dataset (n = 617), and an interesting combination of SFA and PSM**. The reported ATT of 1,331 kg/ha together with a nonsignificant ATE of 816 kg/ha could potentially provide a useful contribution concerning heterogeneity in the impact of improved rice seeds.

However, the manuscript currently has a **Minor statistical interpretation issue in the SFA inefficiency model**, insufficient PSM balance diagnostics, and overly strong claims regarding causality. These are substantive rather than merely editorial problems.

Overall: Minor Revision.