**Response to Reviewers**

**Manuscript title:**

**“Testing for convergence clubs in real wage across Indonesian provinces from 2008-2020”**

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This report concerns our moderate corrections of the manuscript with original title: “Convergence in regional wage: new evidence from Indonesian provinces” submitted to the Regional Statistics. We would like to thank Reviewers for taking the time and effort necessary to review the manuscript. We sincerely appreciate all valuable comments and suggestions, which helped us to improve the quality of the manuscript. Since we found that the title suggested by Reviewer is more appropriate, we changed the title of the revised manuscript accordingly by including the years of investigation. We also highlighted in yellow all parts in the revised manuscript to indicate the changes from the original version. We hope the responses are satisfactory and the manuscript is acceptable for publication.

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**Comments from Reviewer 1**

**[1.1]** Is the conclusion chapter clear in presenting the conclusions?

Yes, but is must be improved with: (1) similar studies confirming/ infirming the results; (2) limits of study (if the case) and further directions of research.

***Response:***

Thank you for the suggestion. We improved the conclusion section by adding the following sentences:

*The presence of club convergence from our result is similar to the finding of Neagu (2020) in the context of regional wages analysis in Romania.*

*Our findings are not only compatible with the theoretical underpinnings of the convergence concept, but they are also comparable to past club convergence investigations (Bartkowska & Riedl, 2012; Cutrini, 2019; Von Lyncker & Thoennessen, 2017).*

We also added the following paragraph regarding the limitation of our study and further research avenue:

*One limitation of this study, however, is the relatively short observation timeframe to study wage convergence. This may have an impact on the estimation of club convergence, as the power of the log t-test falls as the time dimension shortens (Phillips & Sul, 2007, 2009; Von Lyncker & Thoennessen, 2017). Furthermore, based on the geographical distribution of the clubs, one is tempted to conclude that real wage in Sumatra island converge perfectly to club 3, except Riau islands. This might not be the case when the spatial unit used is at the district level, as observed in the context of regional income convergence in Indonesia (Santos-Marquez et al., 2021). Therefore, future studies could investigate regional wage convergence at the district level across Indonesia, subject to data availability. Such studies would allow to look more deeply at the role of spatial dependence within a province and between adjacent districts belongs to different provinces in shaping regional wage.*

*Please see the improved conclusion section on page 19-21.*

**[1.2]** Are the references adequate?

Yes, but they must be improved. The section of literature review must be a little bit extended with more recent studies on wage convergence

***Response:***

Thank you for these observations. As suggested, we extended the section of literature review with more recent studies on wage convergence. We discussed the literature on wage convergence evaluated from two different perspectives; first, convergence in wage across workers and, second, across locations. *Please see the extended literature review section on page 4 in the revised manuscript*.

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**Comments from Reviewer 2**

**[3.1]** Is the title clear enough? Not quite so. I honestly do not see much of convergence in the result. The title, therefore, should be more open. Like Evaluating... Also, it should include the years of investigation. Also, it should say that it is regional real wages that are being investigated.

***Response:***

Thank you for your clear suggestion. We accordingly changed the title of manuscript. The new title is:

**“Testing for convergence clubs in real wage across Indonesian provinces from 2008-2020”**

**[3.2]** Is the abstract clear enough and does it reflect the contents of the article? Again, be explicit about real wages. And mention first that you do not find convergence as a whole but for groups of countries.

***Response:***

We adjusted the abstract by explicitly mention about real wages. Also, we added sentence to mention that we do not find overall convergence (please see the underlined parts in the revised abstract below):

*This paper aims to empirically evaluate convergence in real wages across 34 Indonesian provinces. We apply the club convergence test (Phillips & Sul, 2007, 2009) on real wage data at the province level from 2008-2020. We do not find overall convergence in real wages. Instead, we identify three significant club convergence. Furthermore, using the ordered logit model, we investigate regional factors that influence the club convergence formation. We find that club convergence formation is jointly influenced by the following factors: share of employment in the manufacturing sector, investment share to GDP, labor force participation rate, and the initial level of wage. Our findings support the evidence of club convergence studies that emphasize the role of the initial condition and regional characteristics on the formation of club convergence. From a policy standpoint, our results should alert national and provincial governments to synchronize policies promoting sound and competitive labor markets across provinces*

**[3.3]** Are the key words suitable? Include also »Indonesia«.

***Response:***

We added “Indonesia” in the key words.

**[3.4]** Is the conclusion chapter clear in presenting the conclusions? The role of policy could be expanded. It is not clear to me what are conclusions on policy that the authors draw. What are those so-called regional-based approaches that the authors mention?

***Response:***

The following paragraph in the conclusion section has been added to discuss policy implications:

*Taken together, our results suggest four key points concerning policy implications in reducing wage disparity across Indonesian provinces. First, it is imperative to promote the development of manufacturing industries throughout all provinces. Manufacturing sectors would attract skilled workers from different places and could bring positive technical spillovers to local workers. In turn, this would create a trickle-down effect that tends to help reduce wage disparity, as in the case of India (Jain, 2018). Second, boosting investment is equally important, not to mention attracting inward FDI. Technology spillovers and demand creation effects brought by FDI firms would positively influence the productivity of local firms and workers, leading to improved wage levels. Third, reducing wage differentials across regions requires convergence in education. Therefore, improving education quality in less developed regions should become a priority and promote industrialization and investment to guarantee the provision of educated labor and skilled workers. Finally, the Indonesian government needs, both national and locals, to continue enhancing healthy competition in the regional labor market to promote efficiency in resource allocation across regions.*

**[3.5]** What is the level of text used in the article? The level of English certainly needs to be improved.

***Response:***

We improved the English by the help of English editing system.

**[3.6]** Which figures are not necessary? I would like to see also the coefficient of variation for nominal regional wages. It could be included in Fig 1.

***Response:***

We added the coefficient of variation for nominal regional wages in Fig 1 and adjusted the explanation accordingly. *Please see the improved Fig 1 on page 10.*

**[3.7]** I have some major concerns with this paper that I will discuss below. One is that the time frame is very short. The authors frame the paper as a test of the »Law of one price«. But testing the law of one price for labour across 12 years seems completely pointless. This fallacy is illustrated in Fig 1, which shows the coefficient of variation between 2008 and 2020. The series begins at ca 20.5% and ends at 21%. These changes are inconsequential. The possible conclusion based on this illustration is that there is nothing interesting going on during these years. There is no so-called sigma convergence. Also, the coefficient of variation is very sensitive to changes in the denominator (the mean). It may suffice with a few observations whose wage levels bump up or down to create a change in the coefficient of variation. Also, the y-axis of Fig 1 begins at 0.18 which creates the impression that the changes are very large. They certainly are not and that will become apparent if the axis, as it should, begin at zero.

Since the coefficient of variation is a scale-free measure of dispersion it is possible to compare the level in Indonesia with the levels of other countries. This is one way to justify the importance of studying Indonesian labour market integration closer. Looking at developed countries, one would probably find levels that are much lower.

***Response:***

Thank you for the comment. We agree with the issue of short time period for the investigation. Unfortunately, to the best of our knowledge, the wage data at for 34 provinces in Indonesia is available from 2008. We also agree that the coefficient of variation plotted in Fig 1 implies the absence of sigma convergence. In fact, the first result of our econometric model also concludes that there is no overall convergence. This preliminary conclusion justifies our goal, that is, to further investigate whether club convergence present amidst the absence of overall convergence. In addition, as suggested, we also added the coefficient of variation plot of regional wage in China and India in Fig 2. Interestingly, the trend of regional wage dispersion in Indonesia is different from that in China and India. Unlike in Indonesia, the dispersion in regional wage in China and India exhibits a declining trend during the same observation period. In other words, regional wage disparity in Indonesia is more persistent than in China and India. This becomes another justification for us to study Indonesian labor market integration closer.

*Please see the extended explanation in Section 4.1 on page 9 and improved sentences highlighted in yellow on page 10.*

**[3.8]** I agree, though, that it might be worthwhile to continue looking for convergence among groups of provinces. Perhaps one group of countries marched towards convergence, but another group marched towards divergence. Then it becomes a matter of great weight to understand the factors behind that lack of uniformity. The authors should bring their econometric results to bear on a longer discussion of these factors. Among the suggested candidates are the initial wage level. This sounds very trivial, though. How could convergence take place without a negative relationship between the initial wage and convergence? This does not tell us anything about underlying mechanisms. In addition, the authors never discuss magnitudes. What do these factors (coefficient) mean in substantive terms? It is pointless to use advanced econometrics if the results cannot be translated to anything tangible.

***Response:***

We agree and have improved the paragraph on the importance to include initial wage level in the ordered logit model to study the influencing factors of club convergence. *Please see the improved paragraph on page 16:*

*In this section, we examine and discuss important conditioning factors that theoretically influence club convergence formation. The club convergence hypothesis puts a large weight on the crucial roles of the initial condition and structural characteristics in influencing the convergence process; that is, countries or regions will only converge to a common steady-state if they depart from similar initial conditions and share same structural characteristics (Galor, 1996). Therefore, in addition to the level of real wage in 2008 to control for the initial condition, we also include sectoral and labor market indicators to capture the role of structural characteristics in club convergence formation. Not only to be consistent with the theoretical foundation of convergence framework, the selection of variables in our ordered logit model is also comparable with previous club convergence studies (Bartkowska & Riedl, 2012; Cutrini, 2019; Von Lyncker & Thoennessen, 2017).*

We also improved the paragraph on interpreting the coefficients of ordered logit model by discussing both sign and magnitude of the coefficients. *Please see the improved paragraph on page 17-18:*

*All ordered logit coefficients show the expected signs. However, the magnitude of coefficients deserves special attention. Our results clearly show that structural characteristics have higher explanatory power than the initial condition in shaping club convergence formation. Specifically, the share of employment in the manufacturing sector is the most important influencing factor of club convergence. One point increment in the manufacturing employment ratio would significantly raise the probability of a province converging to the middle-wage club (club 2) by 18% while reducing the likelihood of a province converging to the low-wage club (club 3). In this respect, our findings appreciate the conventional view that claims labor productivity is generally higher – therefore, higher wage – in the manufacturing sector. The investment share to GDP and labor force participation rate are the other important structural determinants, to a lesser extent than the share of employment in the manufacturing sector but larger effect than the initial level of real wage in 2008. Overall, our results imply that the mechanism of club convergence formation in real wage across Indonesian provinces mainly works through underlying attributes in regional labor market conditions. Next, we elaborate on the effects of each factor in more detail.*

**[3.9]** Since the timeframe is so short it cannot be a test of the so-called law of price, originally developed as an analytical tool to understand price convergence for goods. Workers, however, are not the same as matters. They are not shuffled around from sellers to buyers through the means of market forces. They make, instead, their own decisions based on several circumstances one of which is relative wages. This is not to say that the law of one price does not apply at all to labour markets, but these circumstances clearly affect the ideal design of the investigation. We cannot expect convergence of wages to occur as effortlessly as price convergence of goods. Since the time frame is too short to test the law of one price, the framing of the introduction should be changed.

***Response:***

As suggested, we adjusted the framing of the introduction. More specifically, we contextualized our study in two dimensions as the background. The first dimension comes from the literature that persuade testing wage convergence within a country is more reasonable than across the countries given a more unrestricted mobility of people *–* in addition to lower transportation costs and the use of a common currency (Dayanandan & Ralhan, 2005) and the important implication on regional imbalances, resources misallocation, and differences in the cost of living (González, 2020). The second dimension is the relevance of studying regional wage convergence in Indonesia in the context of improved regional connectivity and people mobility over the past decade.

*Please see the improved paragraph 1 – 4 of the Introduction on page 1-2.*

**[3.10]** I have also a measurement issue. The cost-of-living indices are set to 100 in 2005. This means that the authors assume that cost of living is the same across all provinces in 2005. This is certainly not a correct assumption. And it is weird because this year is also outside of the investigated timeframe. Instead, the authors should have, if such information exists, estimated the cost-of-living differentials (in absolute levels) for any year between 2008 and 2020, and using the indices for each province to extrapolate these differentials across the whole time-period. For similar applications see for instance Jeffrey Williamson’s (1995) The evolution of the global labour markets (Explorations in Economic History) or Collin, Lundh and Prado (2019) (cited in the paper under review).

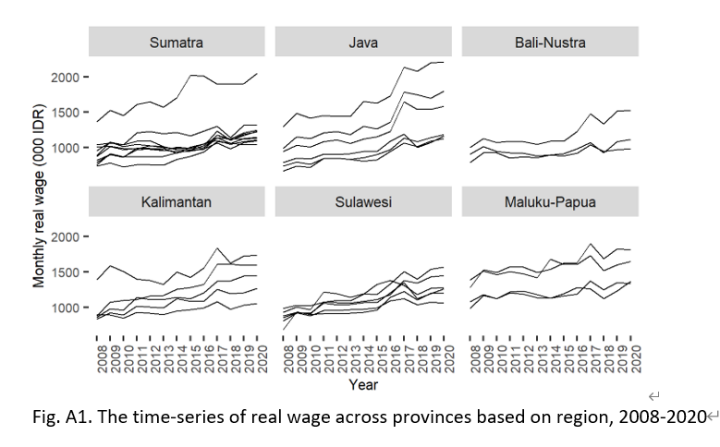
***Response:***

Thank you very much for these observations. We improved the explanation of Section 3.2 on Data as follow:

*The original wage data is in nominal terms, and its statistical measurement is uniform across provinces and consistent over time. Given the uniformity in the statistical measurement, the cross-sectional variation of the original nominal wage reflects cost-of-living differentials (in absolute levels) across provinces. To convert into real terms, following common technique, we deflate nominal wage using provincial Consumer Price Index (CPI) of 2005 as the base year (2005=100). The range of our observation is from January 2008 to December 2020. We intentionally select the year outside of our investigated interval as the base year to avoid using of the same wage level (nominal equals real wage) at a particular year. In this way, we can to keep the inherent cross-sectional variability of regional real wage and, at the same time, allow the wage to be comparable across time, as clearly demonstrated by Figure A1 in the Appendix. The summary statistics of real wage is provided in Table A1 Appendix.*

*Please see the improved content of Section 3.2 on page 8-9.*

We do not see setting 2005=100 as the base year equals to assuming the cost of living is the same across all provinces in 2005. Instead, the real wage of a province in 2005 is equal to its nominal wage. Thus, there is cross-sectional variation of real wage between provinces in 2005. To illustrate the validity of the measurement of real wages in our study, we added Fig A1 (copied below) in the Appendix that shows non-uniformity of real wage across regions at the initial period.



To check the robustness of our results, we implement an extended test in three steps. First, we repeat the conversion from nominal to real wage by altering the base year from 2005 to 2008 and get the new real wage data for all provinces. Second, we re-investigate club convergence using the new measurement of the real wage. Third, we re-estimate the effects of influencing factors of club convergence formation using the same variables. The complete results of our robustness analyses are reported below. The results of the log t-test reported in Table A2 show the rejection of overall convergence, confirming the results from our baseline computation discussed earlier. Furthermore, as reported in Table A3, the club convergence test also indicates the presence of three significant clubs, consistent with the result in our baseline analysis. Moreover, we observe stability in terms of club membership where only two provinces (West Java and Papua) are clustered in different club, that is, from club 2 to club 1. While more than half of provinces are clustered in club 3, its membership does not change to the alternative measurement of the real wage. Lastly, we obtain persistent results from the ordered logit model shown in Table A4. Share of the employee in the manufacturing sector, investment to GDP ratio, and labor force participation rate are the leading regional factors that influence the club convergence membership, ordered by the relative importance implied by their coefficient, respectively. Overall, the results from robustness analyses are consistent with the results from our baseline investigation.

