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The Nexus Between Subjective Well-Being and Labour Productivity: Evidence from Selected Asia-Pacific Economies

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Abstract

The current study investigates the nexus between subjective well-being and labour productivity growth in the context of select Asia-Pacific economies, viz., Bangladesh, China, India, Indonesia, Malaysia, Philippines, Thailand, Australia, New Zealand, Singapore, South Korea and Japan over the period 2011-2023. Considering Cantril Ladder Score and negative affect score published by the World Happiness Report 2024 as a measure of subjective well-being and using panel fixed effects and random effects techniques, the study finds statistically significant evidence of a positive impact of subjective well-being on labour productivity growth. The results are further reiterated when the Panel Ganger non-causality tests by Juodis *et al*. (2021) are used. The results are stronger for emerging and developing economies than for the developed ones. The study also shows statistically significant evidence of an inverted U-shaped relationship between subjective well-being and productivity growth.

Keywords: Emerging and Developing Asia, Labour Productivity, Panel Granger Causality, Random Effects, Subjective Well-Being

JEL Classification Codes: C230; Z130; O530; O470

1. Introduction

The Asia-Pacific[1] region has emerged as the largest in terms of share in global Gross Domestic Product (GDP) over the last three decades, to the extent that its share in the world GDP (approximately 44%) is higher than that of the major advanced economies of the G7 (approximately 29%), (IMF, World Economic Outlook, April, 2024). While the increase in inputs is necessary to increase output and its growth, it is important to increase productivity to sustain growth in output in the long run. Despite the vast literature on the determinants of productivity, the nexus between subjective well-being or happiness and productivity remains largely unexplored, especially at the macro level.

Furthermore, the literature suggests that if employees are happy, they may be more creative and, consequently, perform better at the workplace (Amabile *et al*., 2005). Similarly, studies done at the micro level find significant evidence of the positive impact of higher job satisfaction on the productivity and performance of employees (Bockermann & Ilmakunnas, 2012; Bryson *et al*., 2017; Walsh *et al*., 2018). While all these micro-level studies give insights into the relationship between subjective well-being

[1] As per World Economic Outlook, IMF, the Asia-Pacific region comprises 30 emerging and developing economies viz. Bangladesh, Brunei, Bhutan, Derussalam, Cambodia, China, Fiji, India, Indonesia, Kiribati, Laos PDR, Malaysia, Marshall Islands, Maldives, Micronesia, Mangolia, Myanmar, Nauru, Nepal, Palau, Papua New Guinea, Philippines, Samoa, Soloman Isands, Sri Lanka, Thailand, Timor-Leste,Tonga, Tuvalu,Vanautu, and Vietnam and seven developed economies viz., Australia, New Zealand, Hong Kong, Singapore, South Korea, Japan and Taiwan.

and productivity, studies at the macro level may be more relevant for policymakers (DiMaria *et al.*, 2020).

Against this backdrop, this study econometrically investigates the nexus between subjective well-being and labour productivity growth of selected Asia-Pacific economies, viz., Bangladesh, China, India, Indonesia, Malaysia, Philippines, Thailand, Australia, New Zealand, Japan, Singapore and South Korea over the period 2011-2023. These countries together account for approximately 94% of the GDP of the entire Asia-Pacific region and more than 38% of world GDP. IMF, World Economic Outlook, April, 2024. Hence, they represent a large proportion of the entire Asia-Pacific region. The study further examines the relationship between the two variables for the major emerging and developing Asia-Pacific and the developed Asia-Pacific economies in two separate panels and makes a comparison of results across the two sub-panels. The study employs panel econometric techniques of Fixed Effects, Random Effects and panel Granger causality tests by Juodis *et al*. (2021) for the same. The study also explores non-linearity in the relationship between subjective well-being and productivity by introducing a quadratic term in the regression equation. To the best of our knowledge, this is the first study that examines the impact of subjective well-being on labour productivity growth at a macro level in the context of Asia-Pacific economies in the recent period. The study contributes to the literature in the following ways- *firstly*, by examining the impact of subjective well-being or happiness on labour productivity in the presence of control variables, the study contributes to the empirical literature[2] on determinants of productivity; *secondly,* the study also explores the possibility of non-linearity in the relationship between happiness and productivity, which has largely been ignored in the literature[3]; *thirdly,* by applying novel techniques of panel Granger causality by Juodis *et al.* (2021), the study finds robust evidence of the impact of subjective well-being on labour productivity and thus has important implications for policymakers.

The rest of the paper is organised as follows. Section 2 discusses the data and descriptive statistics. Section 3 explains the possible mechanism through which subjective well-being may affect productivity and vice versa, followed by a review of empirical literature and the empirical model used to conduct the study. The econometric methodology is discussed in section 4, followed by results in section 5 and conclusions and policy implications in section 6.

2. Data and Descriptive Statistics

2.1 Data

The study considers labour productivity growth (log changes) as the dependent variable in the context of major Asia-Pacific economies, viz., Australia, New Zealand, Hong Kong, Singapore, Japan, Bangladesh, China, India, Indonesia, Malaysia, Philippines and Thailand, over the period 2011-2023[4]. These economies together account for approximately 38% of the world GDP (in PPP terms) and around 94% of the GDP of the entire Asia-Pacific region and hence represent nearly the entire region (IMF, World Economic Outlook, April, 2024). Labour productivity is defined as GDP per person employed for each country and is sourced from the Conference Board's Total Economy Database (TED).

As a measure of subjective well-being or happiness, the Cantril ladder score, as computed and published by the World Happiness Reports that use data from the Gallup World Poll surveys, was considered. Cantril ladder[5] score is a score between one and ten based on the overall evaluation of the life of an individual in the Gallup World Poll Surveys. Helliwell *et al.* (2024). Further, we also consider negative affect as an alternative measure of subjective well-being. Negative affect is a score between 1 and 10 and is defined as the average of individual yes or no answers about three emotions: worry, sadness, and anger (Helliwell *et al.*, 2024). The data on the Cantril ladder score and the negative affect[6] were kindly provided by the World Happiness team.

[2] Refer to Dua and Garg (2019), Syverson (2011) for details on determinants of labour productivity.
[3] See for instance, Lester *et al.* (2022).
[4] Time period is governed by the availability of data.
[5] "In these surveys, respondents are asked to imagine a ladder, the top of which indicates best possible life with a score of 10 while the bottom being worst life with a score of 0. They are then asked to imagine themselves at a position in that ladder and give themselves a rating from 0 to 10. The final score for each country is based on an average of around 1000 people surveyed in each country. It may be noted that number of people and countries vary from year to year. Weights are used to construct population-representative national averages for each year in each country. The happiness rankings are based on a three-year average of these life evaluations, since the larger sample size enables more precise estimates." *Helliwell et al. (2024).*
[6] The researcher attempted to use positive affect as an additional proxy for subjective well-being; however, since its coefficient was found to be highly insignificant, it was subsequently dropped from the analysis.

The data on the average annual mean temperature(°C) was drawn from the World Climate Change Knowledge Portal as the measure of climate change. Information and Communication Technology (ICT) infrastructure is measured by the proportion of the population using internet and is sourced from World Development Indicators (WDI). Please refer to Table 1 below for definitions of variables used and sources of data.

2.2 Descriptive Statistics

The summary statistics of the variables, as shown in Table 2, suggest that while the minimum productivity growth rate is only -6 %, the maximum is 11.6% indicating a considerable amount of heterogeneity in the data. Further, the mean productivity growth is 2.5%. As far as the Cantril ladder score is concerned, it ranges from 3.6 to 7.4 and has a mean level of 5.6.

As is evident from the scatter plot (Figure 1) between Cantril ladder score and labour productivity growth of selected Asia-Pacific economies over 2011-2023, the relationship (with Cantril ladder on the X-axis and labour productivity growth on the Y-axis) mimics an inverted-U. It may be inferred that increases in subjective well-being may improve labour productivity growth initially, but labour productivity growth may start falling after subjective well-being reaches a particular level, indicating a non-linear relationship between the two variables. This possibility is examined and reported more formally in the econometric analysis done in Section 5 below.

Further, trends in the Cantril ladder score for selected Asia-Pacific economies over 2011-2023 indicate a mixed picture. Figure 2 shows that while Australia, New Zealand and Singapore have maintained their high levels of Cantril ladder score throughout the period, China, Indonesia and the Philippines have shown signs of catch-up. On the other hand, other economies have shown volatility in the score, plausibly due to the pandemic. However, they returned to their initial levels except for Bangladesh, where the score has fallen over the period 2011-2023. The trends in negative affect, as depicted in Figure 3, suggest a volatile behaviour across countries in the Asia-Pacific over the period 2011-2023.

The theoretical and empirical evidence on the relationship between subjective well-being and productivity is subsequently explored in this research.

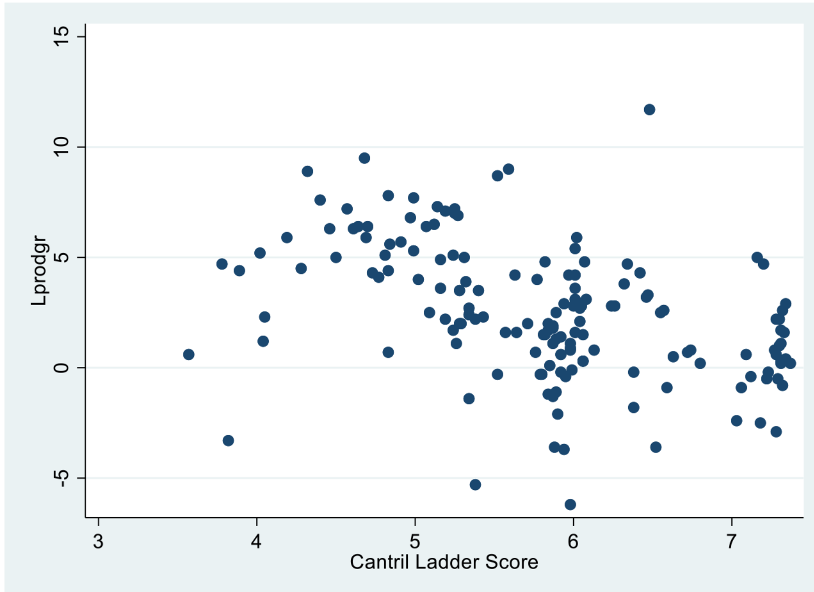
Table 1. Definitions of variables and sources of data.

Variable	Definition	Source of Data
$Prodgr_{it}$	Log changes in Labour Productivity; Labour Productivity = $\frac{GDP}{Total\ Employment}$	The Conference Board Total Economy Database April, 2023.
$SWB1_{it}$	Cantril Ladder Score (a number between 1 and 10)	Helliwell *et al.* (2024).
$SWB2_{it}$	Negative Affect (a number between 1 and 10)	Helliwell *et al.* (2024).
Meantemp	Average Annual Mean Temperature	World Climate Change Knowledge Portal.
SWB^2_{it}	Square of Cantril Ladder Score	Author's computation using data from Helliwell *et al.* (2024).
ICT	Proportion of the population using internet	World Bank, World Development Indicators, 2024

Table 2. Summary statistics.

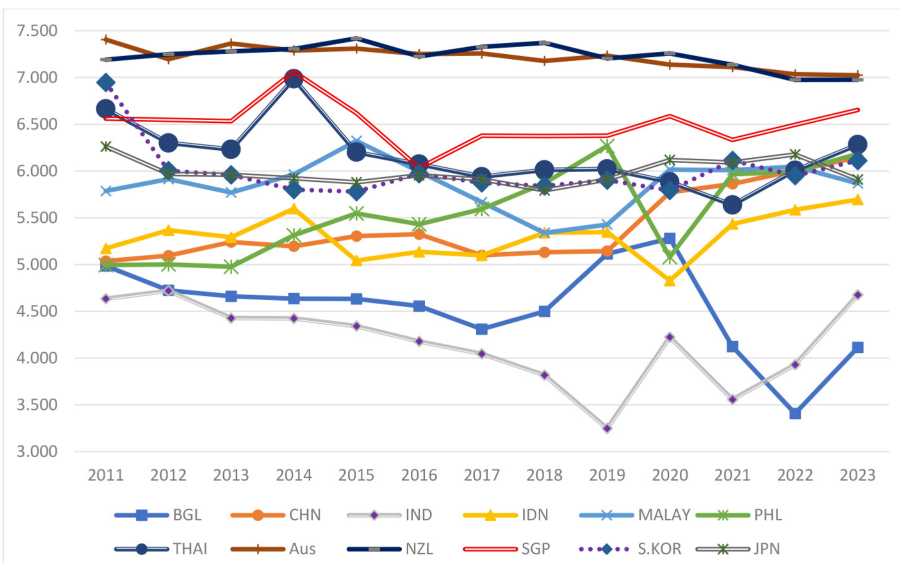
Variable	Observations	Mean	Std Deviation	Minimum	Maximum
Prodgr(%)	156	2.51	3.05	-6.20	11.70
Meantemp(°C)	156	20.86	7.17	7.34	27.48
Negative Affect(0<x<1)	156	0.24	0.08	0.11	0.47
Cantril Ladder(0<x<10)	156	5.81	0.92	3.57	7.37
ICT(%)	156	10.72	11.81	0.63	49.66

Notes: The total number of observations is N*T=12*13. Source: Author's elaborations based on data from The Conference Board's Total Economy Database (TED), Helliwell *et al.* (2024) and World Climate Change Knowledge Portal.



Source: Author's elaboration based on data from TED and World Happiness Report (WHR,2024).

Figure 1. Scatter plot of labour productivity growth against Cantril ladder score.

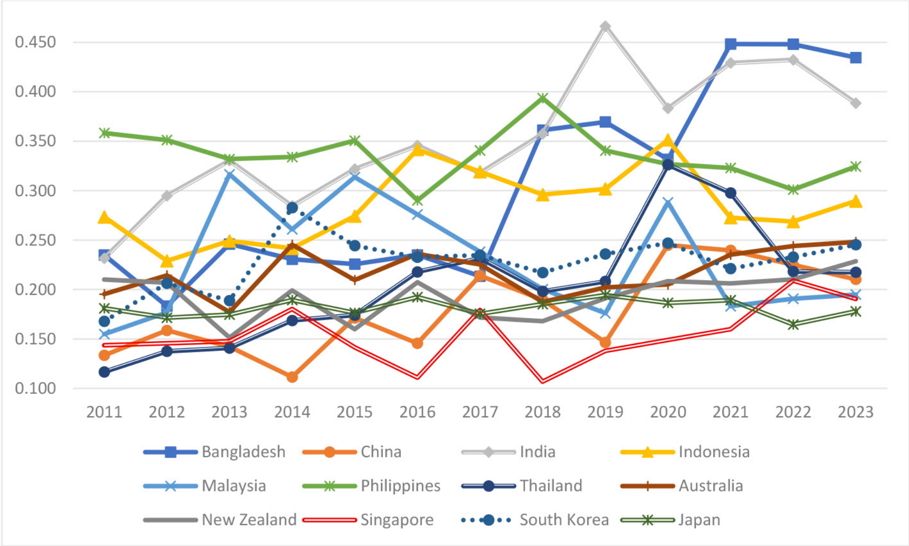


Source: Author's elaboration from WHR (2024).

Figure 2. Trends in Cantril ladder score(0<x<10) over 2011-2023.

3. Literature Review on the Nexus Between Subjective Well-Being or Happiness and Labour Productivity

Subjective well-being may be defined as people's cognitive and affective evaluations of their lives (Diener, 2002). Veenhoven (2008, 2011) defines overall happiness as the degree to which an individual judges the overall quality of his/her own life favourably. Thus, subjective well-being and overall happiness may be used interchangeably to imply overall life satisfaction of an individual. It may be noted that while happiness may be different across individuals, everyone may be expected to evaluate whether he/she is overall satisfied with his/her life or not.



Source: Author's elaboration from WHR (2024).

Figure 3. Trends in negative affect (0<x<1) over 2011-2023.

This overall measure of life evaluation as subjective well-being or happiness is considered in the current study.

The nexus between subjective well-being and productivity may be explained by the human relations theory that suggests that higher employee well-being may lead to more job satisfaction, which may in turn boost morale and thus induce him/her to work more efficiently (Strauss, 1968). More recently, Oswald *et al.* (2015) developed a microeconomic model to explain the nexus between subjective well-being or happiness and productivity. In their model, they considered a labourer who is trying to maximise his utility (u_1) subject to the availability of his psychological resources. His utility is a function of his ability to work (z), the price of his work (p), the effort he puts in to solve a task at work (e) and the effort he puts in to worry about things like failure to do a task at the workplace (w) and a happiness shock (h). In particular, the objective of the worker is to choose the work effort (e) to maximise his total utility

$$\int u_1(z,p,e,h)g(z)+u_2(w,h) \text{ subject to } e+w \le R \qquad \textbf{(1)}$$

where $g(z)$ refers to the probability density function of z which is a random variable, u_2 refers to the utility that an individual gets by devoting his effort to worrying about things at work and R is total psychological resources available to the worker.

A first-order condition upon solving the above maximisation problem becomes:

$$\frac{\partial Eu_1}{\partial e}-\frac{du_2^7}{dw}=0 \qquad \textbf{(2)}$$

Using comparative statics, we may find from equation (2), the rate of change of effort at the optimal point (e*) of the employee with respect to a positive happiness shock, that is,

$$\frac{de^*}{dh}=Eu_{1eh}-u_{2wh}. \qquad \textbf{(3)}$$

The sign of the numerator $\frac{de^*}{dh}$ may be positive or negative depending upon the relative magnitudes of the two terms in eq. (3)[8]. Thus, a positive happiness shock may either increase or reduce worker productivity as measured by their effort, e, to do tasks at the workplace. Under certain restrictions on the utility function of the individual, one can explain the positive impact of happiness on productivity. Oswald *et al.* (2015) argue that stress in the workplace (for instance, a fear that one may not be able to finish his/her assigned task by the deadline) may distract that worker from putting in the effort to finish a task, in turn reducing their productivity. However, happier workers do not need to do this, and hence they may be more productive at work. On the other hand, it may be the case that too much happiness may make the worker content and hence may demotivate him or her to put in more effort, thus reducing his productivity. While the above model is a microeconomic model, it suggests

[7] Eq. (2) is derived by differentiating total utility with respect to work effort (e) given that $w = R - e$.

[8] Refer to Appendix in Oswald *et al.* (2015) for more details.

that higher satisfaction at the workplace, and hence higher well-being, may improve employees' productivity and therefore that of the company. This improvement in company productivity may in turn, translate into improvements in aggregate productivity of the economy (Ocasal *et al*., 2024). Similarly, Zertuche and Figuorea (2021) argue that good working conditions ensure employee well-being and help raise their productivity at work.

In fact, Oswald *et al*. (2015) conducted four kinds of experiments to study the impact of happiness on employee productivity on 713 educated individuals and found that happier employees were more productive. More precisely, the study found that happiness treatments improve the productivity of employees by 10 to 12%. In another recent macroeconomic study, Cui *et al*. (2019) investigated the impact of leisure time on labour productivity in the context of 21 Organisation for Economic Cooperation and Development (OECD) economies over the period 1980-2013 and found a non-linear relationship between leisure time and labour productivity. On the other hand, DiMaria *et al*. (2020, 2022) found a positive and statistically significant impact of happiness (measured by overall life satisfaction) on the total factor productivity (TFP) of 20 European economies over the period 2004-2010 using non-parametric techniques of data envelopment analysis. They also found evidence of only one-way causality from happiness to productivity in these economies.

Bellet *et al*. (2024) examined the impact of happiness (measured by positive affect) on employees' productivity in the context of 1793 telesales workers of British Telecom, one of the largest private employers in the UK. They measured happiness by asking a question to each employee about how happy he/she felt over a particular week and then linked that data with the performance data of these employees and found a systematic, positive and significant impact of happiness on employee performance and hence productivity.

Several micro-level studies found a positive and significant impact of employees' subjective well-being and job satisfaction on their productivity or work performance (Bockermann & Ilmakunnas, 2012; Bryson *et al*., 2017; Walsh *et al*., 2018). Lester *et al*. (2022) found a positive and strong impact of high positive and low negative affect on the performance of 908096 US Army soldiers using logistic regression techniques. They further found an inverted U-shaped relationship between the well-being and performance of the soldiers.

Further, Anjum *et al*. (2018) find a negative and statistically significant impact of a toxic workplace environment (as measured by workplace ostracism, workplace incivility, workplace harassment and workplace bullying) on job productivity in the context of staff members of seven private universities in Pakistan.

While the above studies consider happiness as a determinant of productivity and provide theoretical and empirical evidence to that, there also exists literature that focuses on how economic variables like productivity and income of an individual may explain his or her happiness (Piekałkiewicz, 2017; Costa *et al*., 2024). Most of the studies that advocate a positive impact of higher productivity on subjective well-being are based on the microeconomic phenomenon in which subjective well-being or happiness is considered a normal good. If productivity goes up, it increases the income *ceteris paribus*, which in turn may increase subjective well-being or happiness. In fact, Stevenson and Wolfers (2008) find statistical evidence for such a positive relationship in a cross-country analysis over the period 1970-2007.

On the other hand, Easterlin (1974,1995) in his seminal papers found weak evidence of a positive impact of higher incomes on higher subjective well-being in cross-country comparisons. As argued by Easterlin (1974), this may be because a person's happiness or subjective well-being is a function of his income relative to the income of the society rather than his absolute income. Hence, an increase in everyone's income (as implied by an increase in GNP per capita) may not increase the happiness of all. Isham *et al*. (2021) further argue that higher productivity implies higher and more pressurised job demands that may, in turn, affect the subjective well-being or happiness of workers adversely. For instance, Carter *et al* (2011) find statistical evidence that more than 80% of the employees felt an increase in volume, pace and intensity of pressure after the introduction of lean management through surveys of staff across multiple sites of processing centres within the UK government's civil service in the year 2008-09.

Thus, a review of the literature on subjective well-being and productivity done above suggests that while several studies have been conducted to study the impact of subjective well-being and happiness on productivity at a micro level, the subject largely remains unexplored at the macro level[9]. Further, while the literature suggests a linear relationship between subjective well-being and productivity, the possibility of non-linearity has not

[9] See for instance, Costa *et al*. (2024).

been studied much[10]. Finally, while a few studies have examined the relationship between subjective well-being and productivity at the macro level, they are confined to only European economies, for instance, the studies by DiMaria *et al*. (2020, 2022). The current study makes an attempt to fill these gaps and examines the impact of happiness on aggregate labour productivity growth of 12 major Asia-Pacific economies, including both developing and developed countries. The possibility of non-linearity in the relationship between the two variables is examined by adding a quadratic term. Thus, we estimate the following regression equation:

$$\Pr odgr_{it} = \beta_0 + \beta_1 SWB_{it} + \beta_2 X_{it} + \varepsilon_{it} \quad \textbf{(4)}$$

where *Prodgrit* refers to the growth rate of the labour productivity of country *i* at time t,

SWB_{it} is an indicator of subjective well-being (SWB) or happiness for country *i* at time t,

X_{it} is a control variable for country *i* at time t while ε_{it} is the random error term.

The study includes control variables in the regression equation to avoid any omission bias. It is argued that climate change, as measured by an increase in mean temperature, may cause various diseases like dehydration, fatigue and even death in extreme cases, affecting productivity adversely (Kovats & Hajat, 2008). In fact, various studies conducted both at the micro and macro levels have established a negative impact of climate change on productivity (Somanathan *et al*., 2021; Dua & Garg, 2024; Kumar & Maiti, 2024; Mate *et al*., 2021; Chen & Gong, 2021; Lai *et al*., 2023). Further, climate change indicates the physical working conditions, and controlling for it may avoid omitted variables bias and bring out a consistent relationship between well-being and productivity growth. Moreover, literature[11] shows that the development of ICT infrastructure, like internet availability, fixed broadband growth and mobile subscriptions, boost labour productivity. Thus, we also include ICT infrastructure as another control variable in the model[12].

Based on the discussion above, we expect, $\beta_1 > 0, \beta_2 > / < 0$. As suggested by the literature, to examine the possibility of non-linearity of the relationship between SWB and productivity, we introduce a quadratic term for subjective well-being or happiness[13] in equation (4) to have,

$$Prodgr_{it} = \beta_0 + \beta_1 SWB_{it} + \beta_2 X_{it} + \beta_3 SWB_{it}^2 + \varepsilon_{it} \quad \textbf{(5)}$$

where SWB_{it}^2 refers to the square of happiness indicator in country *i* at time t.

Thus, in the presence of nonlinearity, we expect the coefficient of $SWB\,(\beta_1)$ to be positive, while that of $SWB^2(\beta_3)$ to be negative. This indicates that while initially greater happiness and hence higher subjective well-being may improve aggregate productivity growth, productivity growth may start falling after subjective well-being reaches a peak.

The econometric methodology used to estimate the above equation is discussed in the next section.

4. Econometric Methodology

The study estimates the equations depicted in section 3 above using panel fixed effects and random effects techniques discussed below.

4.1 Panel Fixed Effects and Random Effects Estimation

To estimate the regression equation set out in equation (4), the panel fixed effects approach is used. Consider the panel regression equation set out in equation (4) above in vector notation as follows:

$$\Pr odgr_{it} = \alpha_i + \beta' x_{it} + \varepsilon_{it} \quad (6)$$

where β' and x_{it} are $1 \times k$ vector of unknown coefficients and $k \times 1$ vector of independent variables for the *ith* country at time *t* respectively while α_i is the unobservable individual country-specific effect. Under the fixed effects approach, $\alpha_i' s$ are assumed to be free

[10] The only study that we could find in this context is by Lester et al. (2022).

[11] See for instance, Ladha *et al.* (2022), Jung and Lopez-Bazo (2020) for details.

[12] It may be noted that while literature suggests variables like human capital, health, unemployment, etc. as the potential determinants of productivity as well as subjective well-being, these could not be incorporated in the study due to lack of availability of consistent data across all countries in the study.

[13] It may be noted that happiness here does not indicate that a person is happy per se but rather his own evaluation of life on a scale of 1 to 10.

parameters rather than random realisations. Thus, β can be estimated as

$$\hat{\beta}_{FE} = [\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}-\bar{x}_i)')(x_{it}-\bar{x}_i)]^{-1}\sum_{t=1}^{T}\sum_{i=1}^{N}(x_{it}-\bar{x}_i)(y_{it}-y_l) \quad (7)$$

While the panel fixed effects specification assumes that $\alpha_i's$ are free parameters, the random effects specification allows them to be random realisations Refer to Page no. 639-640 of Pesaran (2015). Thus, we also conduct Hausman's specification test to choose between the two specifications as follows:

$H = \hat{d}'\widehat{\text{var}(\hat{d})}\hat{d}$ which is distributed as χ_k^2 with N sufficiently large. (8)

$$\hat{d} = \hat{\beta}_{FE} - \hat{\beta}_{RE} \quad (9)$$

And $\widehat{\text{var}(\hat{d})}$ is the estimated variance of $\hat{d}$. Given the null hypothesis that the fixed effects estimator and random effects estimator are not systematically different, if we reject the null for sufficiently high values of the statistic, we may accept the fixed effects estimator as the correct specification.

4.2 Panel Granger Causality Tests

To further check the robustness of our results, panel Granger causality tests by Juodis *et al.* (2021) were conducted to find if productivity growth is affected by lags of the subjective well-being indicator or not and hence if changes in subjective well-being may predict those in labour productivity growth or not. In a simple linear dynamic panel data model with a single variable, SWB on the right-hand side,

$$\text{Pr}\,odgr_{it} = \alpha_{0,i} + \sum_{p=1}^{P}\alpha_{p,i}\,\text{Pr}\,odgr_{i,t-p} + \sum_{q=1}^{Q}\beta_{q,i}SWB_{i,t-q} + \varepsilon_{i,t} \quad (10)$$

The null hypothesis tests that $SWB_{i,t}$ does not Granger-cause $Prodgr_{it}$ which is equivalent to testing the hypothesis,

$$H_0 : \beta_{q,i} = 0 \;\; for\, all\, i\, and\, q$$

Against the alternative,

$$H_A : \beta_{q,i} \neq 0 \;\; for\ some\ i\ and\ q$$

Juodis *et al.* (2021) suggest using the Wald statistic that corrects the bias using the panel jackknife (HPJ) estimator as follows:

$$\widehat{W}_{HPJ} = NT\tilde{\beta}'\left(\hat{J}^{-1}\hat{V}\hat{J}^{-1}\right)^{-1}\tilde{\beta} \quad \textbf{(11)}$$

which is distributed as $\mathcal{X}^2(Q)$ with Q degrees of freedom. The econometric results are reported and interpreted in the subsequent section.

5. Results

This research explores the econometric results in the current section. Results for the complete panel of 12 Asia-Pacific economies were analysed, and then the panel was divided into developed countries and emerging countries. Results of the two sub-panels are subsequently reported and interpreted.

5.1 Subjective Well-being and Productivity: Full Sample

The study estimates the regression equation set out in Eq. (4) in section 3 above using fixed effects and random effects approaches and then conducts the Hausman test for misspecification to choose more consistent estimates. The results using fixed effects estimation indicate that subjective well-being or happiness has a positive and significant impact on labour productivity growth of Asia-Pacific economies in the recent period, even after controlling for climate change[14] (Table 3).

The results shown in Table 3 (see second and third columns) suggest that subjective well-being may boost labour productivity growth of Asia-Pacific economies positively and significantly[15] over the period 2011-2023. The results further indicate that an increase in temperature above normal may adversely affect labour productivity growth. The study uses negative affect as an alternative indicator of subjective well-being, estimates equation (4) in section 3 and concludes that all the coefficients conform to economic theory and are statistically significant (Table 3). In particular, the results suggest that low negative affect is beneficial for productivity growth in Asia-Pacific economies, while an increase in temperature above average may not be good for the economies over the period 2011-23. The negative affect result corroborates with the findings of Lester *et al.* (2022) who find similar results in the context of army soldiers of the US economy.

[14] A model with both climate change and ICT as control variables was also tried but was dropped as the coefficient of ICT was statistically insignificant (p-value>0.50). We also tried inflation and trade openness as control variables in the model but dropped them as the model was not robust.

[15] While the p-value for the coefficient of SWB1 is 0.24, the t-statistic is above 1 and hence we retain the model.

Thus, the results suggest that an increase in the subjective well-being of the society may improve labour productivity of the aggregate economy in the context of major Asia-Pacific economies over the period 2011-2023. The result corroborates with the study by DiMaria *et al.* (2020), who found a positive and significant impact of life satisfaction on productivity (measured by TFP) in the context of European economies.

The Hausman test was used to check for the specification and found that the null hypothesis that the two estimates (fixed effects and random effects) are not systematically different may be rejected at 1% level of significance. Hence, the fixed effects model can be chosen to be the final specification (Table 4).

5.2 Non-linearity: Full Sample

The literature[16] suggests that just like excess of everything is bad, too much happiness may rather harm the productivity of labour. This may lead to the possibility of a curvilinear relationship between subjective well-being and productivity growth. This study examines such a possibility by augmenting equation (4) by a quadratic term for the subjective well-being indicator (as set out in equation (5)) and investigates the signs and significance of linear as well as quadratic terms. The estimation results of regression equation (5) in Table 5 indicate that both subjective well-being or happiness as well as its squared term are statistically significant at conventional levels of significance. Further, while the coefficient of subjective well-being is positive, that of the square of subjective well-being is negative, indicating strong evidence of an inverted U-shaped relationship between subjective well-being and productivity growth.

Equation (5) is then estimated using a random effects specification. It concludes that while the results are quantitatively different, they are the same qualitatively. To finally choose a model, the Hausman test is conducted for misspecification, and it is found that the test may be rejected at 5% level of significance, and hence our assumption that individual effects may be random and come from normal realisations may be rejected. Thus, the fixed effects estimates may be retained. The results using fixed effects, as depicted in column 2 of Table 5, suggest that all the coefficients conform to economic theory and are statistically significant.

Thus, it may be concluded that while initial improvements in subjective well-being may be beneficial for society and hence may encourage workers to work more efficiently, it becomes a drain after a certain point and starts having adverse impacts on the productivity of labour.

The sample was split into developed and developing groups, and the regression equation (4) set out in section 3 above was estimated. Results of the two sub-samples are discussed in the subsequent section.

5.3 Comparison of Results Across Sub-Samples

This section reports and interprets the results separately for the developing economies, viz., Bangladesh, China, India, Indonesia, Malaysia, Philippines and Thailand, and those of the developed economies, viz., Australia, New Zealand, Singapore, Japan and South Korea.

First, the results for developing countries are discussed. The regression equation (4) is estimated using fixed and random effects specification (Table 6), and then the Hausman test for misspecification is conducted. As reported in Table 7, the Hausman test results indicate that the hypothesis that the two estimates are systematically different may be rejected, and hence the fixed effects specification is retained. Thus, the results suggest that subjective well-being has a positive and statistically significant impact on labour productivity growth (refer to column 2 of Table 6). Furthermore, the sign of the coefficient of climate change as measured by temperature is as expected and is statistically significant. Thus, the results indicate that if people feel more satisfied with their lives (as indicated by the Cantril ladder score), they may work more efficiently and hence may help raise output per worker. At the same time, climate change, as indicated by an increase in temperature above average, may reduce productivity growth.

When equation (4) is estimated using an alternative measure of subjective well-being, it is found that results are unaltered, at least qualitatively. Thus, the results are robust to the measure of subjective well-being.

The results for developed economies, as reported in columns 6 to 9 of Table 6, suggest that fixed effects and random effects specifications give qualitatively similar results, though they are very different quantitatively. The result of the Hausman test conducted to check misspecification further indicates that the null hypothesis that the two estimates are not systematically different may

[16] Refer to Lester *et al.* (2022) and Pierce and Auginis (2013) for further details.

Table 3. Fixed effects and random effects estimation results for the complete panel.

Variables	Model 1 (Fixed Effects)	Model 2 (Random Effects)	Model 3 (Fixed Effects)	Model 4 (Random Effects)
$SWB1_{it}$	$0.89^{*}(1.16)$	$-1.08^{**}(-2.63)$		
$SWB2_{it}$			$-12.78^{***}(-3.04)$	$-11.04^{**}(-2.80)$
$Temp_{it}$	$-5.53^{***}(-3.32)$	-0.038(-0.66)	$-4.20^{**}(-2.51)$	0.03(0.41)
Const.	112.7^{***} (3.23)	$9.63^{***}(3.28)$	$93.23^{***}(2.69)$	$4.44^{**}(2.35)$
Obs.	$12^{*}13=156$	$12^{*}13=156$	$12^{*}13=156$	$12^{*}13=156$
R^2	0.07	0.00	0.12	0.08

Note: SWB1 and SWB2 refer to Cantril Ladder score and Negative Affect, respectively. t-statistics in parentheses. ***, **, * refer to p<.01, p<.05 *and* p<.10 respectively.

Table 4. Hausman test.

Model	Statistic (p-value)
Model 1 vs Model 2	$16.96^{***}(0.00)$
Model 3 vs. Model 4	$3.28^{***}(0.00)$

Note: p-values in parentheses. ***, **, * refer to p<.01, p<.05 *and* p<.10 respectively.

Table 5. Fixed effects and random effects estimation result for the complete panel (non-linearity).

Variables	Model 1 (Fixed Effects)	Model 2 (Random Effects)
SWB_{it}	$8.21^{*}(1.50)$	$4.12^{*}(1.13)$
$Temp_{it}$	$-5.56^{***}(-3.35)$	0.039(-0.65)
$SWB1^2_{it}$	$-0.70^{*}(-1.35)$	$-0.45^{*}(-1.42)$
Const.	$95.10^{**}(2.56)$	-4.83(-0.46)
Obs.	$12^{*}13=156$	$12^{*}13=156$
Hausman Test	17.06^{***} (0.00)	

Note: p-values in parentheses. ***, **, * refer to p<.01, p<.05 *and* p<.10 respectively.

not be rejected (Table 7). The results from the fixed effects (and random effects) specification indicate that the impact of subjective well-being on labour productivity growth of developed countries of the Asia-Pacific is not statistically significant. The results remain qualitatively similar even if we change the measure of subjective well-being.

Thus, a comparison of results across the two sub-samples indicates that while subjective well-being improves productivity growth for emerging economies, it may not be the case with developed economies of Asia-Pacific over the period 2011-23.

5.4 Panel Granger Causality Test Results

To further check the robustness of the results, this study tests whether subjective well-being as measured by Cantril ladder score Granger causes productivity growth or not and thus examines if subjective well being can predict changes in productivity using the novel

Table 6. Fixed effect and random effects estimation results dependent variable.

	Developing Asia				Developed Asia			
Variables	Model 1		Model 2		Model 1		Model 2	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
$SWB1_{it}$	1.35^{*} (1.70)	-1.10^{***} (02.61)			-0.16 (-0.06)	-0.28 (-0.60)		
$SWB2_{it}$			-9.98^{**} (-2.14)	-7.59^{*} (-1.83)			-12.1 (-1.01)	-5.05 (-0.60)
$Meantemp_{it}$	-11.9^{***} (-4.51)	-0.19^{***} (-4.53)	-9.07^{**} (-3.23)	-0.16^{**} (-0.81)	-1.69 (0.41)	0.047 (1.09)	-1.48 (-0.73)	0.03 (0.75)
Cons.	276.8^{***} (4.49)	14.04^{**} (5.81)	218.4^{***} (3.35)	9.52^{***} (5.68)	31.33 (0.72)	1.94 (0.64)	28.97 (0.83)	1.30 (0.64)
Obs.	$7^{*}13=91$	$7^{*}13=91$	$7^{*}13=91$	$7^{*}13=91$	$5^{*}13=65$	$5^{*}13=65$	$5^{*}13=65$	$5^{*}13=65$

Note: SWBI refers to the Cantril Ladder Score, while SWB2 refers to Negative Affect. Note: t-statistics in parentheses. ***, **, * refer to p<.01, p<.05 *and* p<.10 respectively.

panel Granger non-causality technique by Juodis *et al.* (2021). The results are reported in Table 8 and suggest that while subjective well-being or happiness Granger causes productivity growth insignificantly at lag one, it causes productivity growth significantly at lag 2. A plausible explanation for that could be that it may take time for subjective well-being to show its impact on the productivity of labour.

Table 7. Hausman test.

Country Group	Model 1 Statistic (p-value)	Model 2 Statistic (p-value)
Developing Asia	21.40***(0.00)	18.42***(0.00)
Developed Asia Models	0.78(0.67)	1.47(0.48)

Note: ***, **, * refer to p<.01, p<.05 and p<.10 respectively.

The results on panel Granger non-causality on the two sub-samples further suggest that subjective well-being Granger causes productivity growth for both developing and developed economies of Asia-Pacific over the period 2011-23. However, the results are significant at a lag length of two (Table 8). The results find support from the findings of DiMaria *et al.* (2022), who found a positive and statistically significant impact of life satisfaction on total factor productivity for European economies over the period 2004-2010.

The reverse Granger causality tests further suggest that productivity growth doesn't significantly affect subjective well-being (Table 9). The results are consistent across the two sub-samples and find support from studies like DiMaria *et al.* (2022) and Easterlin (1974,1995) in the context of cross-country studies. Thus, both the linear regression results and panel Granger causality tests suggest

Table 8. Juodis *et al* (2021) panel Granger non-causality results.

	Full Panel		Developing Asia		Developed Asia		Conclusion
Null Hypothesis	Model 1 (lag=1) HPJ Wald Statistic (p-value)	Model 2 (Lags=2) HPJ Wald Statistic (p-value)	Model 1 (Lag=1) HPJ Wald Statistic (p-value)	Model 2 (Lags=2) HPJ Wald Statistic (p-value)	Model 1 (Lag=1) HPJ Wald Statistic (p-value)	Model 2 (Lags=2) HPJ Wald Statistic (p-value)	
Subjective Well-being does not Granger-cause Productivity growth	1.79 (0.18)	15.64*** (0.00)	2.52 (0.11)	46.5*** (0.00)	0.06 (.79)	121.07*** (0.00)	The null hypothesis is rejected at 5% level of significance.

Note: ***, **, * refer to *p*<.01, *p*<.05 *and p*<.10 respectively.

Table 9. Juodis *et al* (2021) panel reverse Granger non-causality results.

	Full Panel		Developing Asia		Developed Asia		Conclusion
Null Hypothesis	Model 1 (lag=1) HPJ Wald Statistic (p-value)	Model 2 (Lags=2) HPJ Wald Statistic (p-value)	Model 1 (Lag=1) HPJ Wald Statistic (p-value)	Model 2 (Lags=2) HPJ Wald Statistic (p-value)	Model 1 (Lag=1) HPJ Wald Statistic (p-value)	Model 2 (Lags=2) HPJ Wald Statistic (p-value)	
Productivity growth doesn't Granger-cause Subjective well-being	0.087 (0.76)	5.37 (0.06)	0.81 (0.77)	108.19*** (0.00)	0.00 (0.99)	2.12 (0.34)	Null hypothesis not rejected at 5% level of significance.

Note: ***, **, * refer to *p*<.01, *p*<.05 *and p*<.10 respectively.

a positive and significant impact of subjective well-being on the productivity of labour of Asia-Pacific economies over the period 2011-2023. However, the results are more significant for emerging economies as compared to developed economies. Moreover, the panel Granger causality test results indicate unidirectional causality from subjective well-being to labour productivity growth.

6. Conclusions and Policy Implications

The current study empirically investigates the linkage between the subjective well-being or happiness level of individuals and the growth rate of productivity of labour at a macro level for the major Asia-Pacific economies over the period 2011-2023. The study considers 12 economies, viz., Bangladesh, China, India, Indonesia, Malaysia, Philippines, Thailand, Australia, New Zealand, Singapore, Japan and South Korea for the analysis. Using panel econometric techniques of fixed and random effects, this study finds evidence of a positive and statistically significant impact of subjective well-being on productivity growth in the presence of climate change as the control variable. The results are further reiterated when we conduct panel Granger non-causality tests.

Another key finding of the study is the robust evidence of an inverted U-shaped relationship between subjective well-being or happiness and the productivity growth of labour in Asia-Pacific economies over the recent period. Thus, subjective well-being may boost productivity growth initially, but after it reaches a threshold, it starts affecting productivity growth adversely.

The results on the separate panels of emerging or developing and developed economies suggest that while subjective well-being or happiness has a positive and statistically significant impact on the productivity growth of emerging economies, it is not the case with developed economies. Further, the results are robust to the measure of subjective well-being used in the study. The results are compatible with the results on non-linearity, which indicate that happiness may not boost productivity forever. Lester *et al.* (2022) find similar results in a micro-level study in the context of US Army soldiers over the period 2009-2016.

Thus, the study finds robust evidence of the relationship between happiness or subjective well-being and productivity at a macro level in the more recent period. While the study contributes to the literature on both determinants of productivity growth and comparative studies, it also has important implications for policymakers. A key finding of the study is that an increase in subjective well-being may improve productivity for the developing and emerging economies of the Asia-Pacific. This implies that governments of emerging and developing economies may take initiatives to improve the overall well-being of individuals. For instance, multiple employee wellness programmes have been introduced in the corporate firms of India with the help of providers such as Mantracare, HealthifyMe, Preva Care, etc. These programmes aim at health assessments, fitness programmes, chronic disease reversal, yoga practice, etc., that may improve the physical and mental health of employees and may boost their productivity in the long run. Moreover, the Government of India has increased the number of community health centres, primary health centres and district hospitals to improve the health of individuals holistically and encourage self-care under the National Ayush Mission. Similarly, "The Occupational Safety, Health and Working Conditions Code, 2020" introduced by the Government of India is supposed to ensure the health and safety of employees at work.

Similar initiatives have also been taken by other Asia-Pacific economies like Australia, Singapore, Japan, New Zealand, and China. Such initiatives are welcome as they may increase the productive capacity of the economy in the long run. The Sustainable Development Goals as adopted by United Nations stresses overall health and well-being of individuals. Further, the annual publication of the Quality-of-Life indicator by economies indicates the emphasis on improving such quality of life. OECD's, How is Life[17] initiative and its review and progress every year are a welcome step and should be encouraged. Thus, the current study finds a positive impact of happiness and subjective well-being on productivity, especially in developing economies and recommends policies that promote the overall well-being of individuals and countries.

7. Limitations of the Study

A major limitation of this study is the lack of control variables, like workplace conditions at the macro level and a more precise measure of happiness. Had these measures been available at the macro level, we could have incorporated them into the analysis. Further, as argued by

[17] See for instance, OECD (2024), "How is Life: Well being and Resilience in tomes of Crisis" for details.

Benjamin *et al*. (2024), the data on Cantril Ladder score and Negative Affect is survey-based and thus subject to biases on account of limited responses, sample self-selection, systematic effects of survey question order and hence any results based on this data ought to be interpreted with caution. Further, future studies may use more state-of-the-art technologies to examine the non-linear relationship between subjective well-being and productivity.

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9. Author Contribution

The author declares that the conceptualisation, data curation, analysis, and interpretation of results were solely done by me, Dr Niti Khandelwal Garg, Kirori Mal College, University of Delhi, Delhi, India. All authors have read and agreed to the published version of the manuscript.

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