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Subjective well-being and regional productivity in the European Union

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Abstract

In this study, we examine the relationship between total factor productivity (TFP) and subjective well-being (SWB) in European regions. Using OLS and Lewbel IV estimators, we find a significant and positive effect of SWB on TFP. On average, regions that score 1-point higher on SWB report 19% higher TFP levels. Since TFP is an important driver of economic growth, these findings indicate that promoting SWB will benefit economic growth at the regional level.

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1 Introduction

In recent years, the economic consequences of subjective well-being received growing attention (Fang et al. 2025). Here, subjective well-being (SWB) can be defined as '*the degree to which an individual judges the overall quality of his/her own life-as-a-whole favorably*' (Veenhoven 1984: 22). SWB encompasses both evaluative (life satisfaction) and emotional (positive/negative affect) dimensions. While there is now ample evidence that SWB is associated with higher productivity at the individual level (Fang et al. 2025), fewer studies have examined this relationship at a macro- or regional level (DiMaria et al. 2020; Peroni et al. 2022).

This paper investigates whether regional differences in SWB can explain disparities in productivity across European regions. Specifically, we explore the relationship between SWB and total factor productivity (TFP), a widely recognized measure of economic performance and efficiency driver of economic growth. This research aligns with emerging policy interest in incorporating well-being metrics into regional development strategies (Fudge et al. 2021; OECD 2025; Sarracino & O'Connor, 2025)).

This study contributes to existing literature in three important ways. First, the study highlights the importance of SWB as an input to economic processes, and not just as an outcome. Second, the study shifts the analytical lens from countries (see DiMaria et al. 2020) to subnational regions, highlighting the relevance of intra-country disparities in both well-being and productivity. Third, the research offers a quasi-longitudinal perspective by averaging annual SWB data over a 13-year span and using IV methods for causal identification. In particular, we use data on 228 European regions for the period 2008–2021. Data on SWB are obtained from the Gallup World Poll, while data on TFP are obtained from the European Commission's Joint Research Centre (Kostarakos 2023). We find that SWB is associated with significantly higher TFP across 228 European NUTS-1 and NUTS-2 regions. Our results hold when controlling for reverse causation using Lewbel IV estimation.

The remainder of this paper is organized as follows. Section 2 provides the theoretical framework. Section 3 describes the empirical strategy and data. Section 4 presents the empirical findings. Conclusion and discussion follow in Sect. 5.

2 Background

2.1 Spatial disparities in TFP

Productivity, defined as the amount and quality of outputs divided by the amount and quality of resources invested in producing them (Prokopenko 1987), reflects how much output can be produced given the resources available; it is a measure of how efficiently things are done. Total factor productivity (TFP) is one the main indicators of productivity, it reflects the efficiency of the production process, and it is considered one of the leading indicators of economic performance of countries and regions.

Over the past decades, the economic literature devoted considerable attention to the analysis of TFP and of its causes, including how national and regional conditions affect total factor productivity (see e.g., Klenow and Rodriguez-Clare 1997; Hall and Jones 1999; Caselli 2005).[1] Some of the pivotal factors driving TFP differences across countries and regions include the degree of knowledge creation (R&D), availability of transmission channels, human capital, quality of political and economic institutions, and the physical location of countries (Isaksson 2007). TFP differences between European countries seem to be primarily driven by human capital, information and communication technologies, and cost savings (Gehringer et al. 2016) as well as innovation and technology spillovers (Radicic et al. 2023).

Initially, most studies on TFP focused on country-level estimations due to data limitations. However, there is now a burgeoning literature on TFP differences among European regions. This is partly fueled by contemporary regional EU Cohesion policy that emphasizes the importance of technological progress, innovation, and knowledge externalities (McCann and Ortega-Argilés 2015) to achieve productivity gains. TFP is regarded as strategic to promote social cohesion and regional economic development and to reduce economic disparities among EU regions (European Commission 2010).[2]

Several empirical studies on TFP differences across regions revealed a considerable gap in TFP between West and East-European regions (Beugelsdijk et al. 2018; Kijek and Matras-Bolibok 2020; Kostarakos 2023). Such disparity can be explained by differences in the education level of the workforce (Männasoo et al. 2018), knowledge endowments (Capello and Lenzi 2015; Cortinovis and Van Oort 2019), technological progress (Rehman and Nunziante 2023), institutional quality (Rodríguez-Pose and Ganau 2022), and openness of the regional economy (Cortinovis and Van Oort 2019; Siller et al. 2021).

2.2 The relationship between SWB and TFP

There are several reasons to believe that there is an association between SWB and productivity at both the individual and regional levels.

At the individual level, high SWB may decrease the amount of time people spend worrying about negative aspects in their lives, thus freeing mental resources required for productivity (Oswald et al. 2015). Broaden-and-build theory (Fredrickson 2001) posits that experiencing positive emotions signals a safe environment, which in turn broadens individuals' thought–action repertoires and helps them build enduring personal resources. Feeling good makes people more curious and open to innovation,

[1] In this literature, it has generally been found that spatial productivity can be attributed to differences in TFP and not to differences in factor endowments (Easterly and Levine 2001).

[2] In line with the literature on national differences in productivity, it has been shown that TFP differences primarily drive productivity differences between European regions (Beugelsdijk et al. 2018; Kostarakos 2023).

new social contacts, receptive for feedback, training, and so on. As a result, people that feel well build more sustainable resources than unhappy people, such as more knowledge and skills, a better career, a stronger social network, and better health, which all contribute to greater productivity at work.[3] In addition, following motivational theories and the PERMA (positive emotions, engagement, relationships, meaning, and accomplishment) model (Seligman 2011), employees who experience positive emotions may be more motivated to perform (Wright and Staw 1999) and are less likely to experience burnout, reducing absenteeism and errors. Translating these insights to the regional level, higher average SWB may enhance regional productivity by improving human capital quality and fostering R&D.

In spatial terms, SWB can also affect TFP indirectly, through factors such as agglomeration economies and social cohesion. Regions with high levels of SWB may attract and retain skilled workers and innovative firms more easily, thus creating a virtuous cycle of growth and development (Cortinovis and Van Oort 2019). Moreover, high SWB can foster interpersonal trust through social cohesion and collaboration (Glatz and Eder 2020), enhancing knowledge spillovers in clusters. These benefits would particularly stem from the fact that social contacts and civic engagement are higher among happier individuals compared to others (Diener and Seligman 2002). The clustering of talent in high SWB areas can, in turn, also increase demand for better infrastructure (e.g., efficient transit and cultural amenities) and become attractive places for real estate development.

Although cities are not necessarily characterized by high SWB, especially in western countries (Easterlin et al. 2011; Okulicz-Kozaryn 2015; Burger et al. 2020), urban agglomerations seem to benefit the SWB of highly educated individuals. Morrison (2021) suggests that cities in developed countries offer large and diverse economic and cultural activities that benefit those with high levels of education and high wages. This, in turn, draws in less-educated workers to support services in non-tradable sectors. These less-educated workers often face low wages and long commuting time due to gentrification, with consequent pressure on their personal time and lower SWB—which then becomes geographically segregated. Empirical research backs this up: Morrison and Weckroth (2018) found that cities boost both income and well-being for the highly educated. Burger et al. (2020) and Migheli (2017) similarly observed that well-educated, high-income individuals in Western Europe and North America tend to be happier in urban environments.

In addition, SWB can increase political stability since happy populations are more law-abiding (Ciziceno and Pizzuto 2022) and are less likely to cause social unrest (Arampatzi et al. 2018; Witte et al. 2020). According to Inglehart (1999), this effect could be driven by the fact that high SWB increases the legitimacy of political regimes and further fosters democracy through more civic engagement. Empirically, this is supported by the fact that happy individuals are more likely to vote

[3] In this regard, Tenney et al. (2016) argue that subjective well-being is particularly indirectly related to individual and organizational performance via increased health, self-regulation, motivation, creativity, positive relationships, and lower absenteeism and turnover rates.

for incumbent parties (Liberini et al. 2017; Ward 2020) and non-populist parties (Burger and Eiselt 2023).

This wealth of studies provides reasons to expect a positive relationship between SWB and productivity at regional level. This issue, however, has received little attention in the literature. In particular, there are no studies that have examined the relationship between regional SWB and TFP, especially over a long period. A handful of studies at the national level examined the relationship between SWB and TFP.

Using representative data from the European Social Survey (ESS) and AMECO macro-economic data for 20 European countries, DiMaria et al. (2020) find that SWB is positively associated with labor productivity and should be considered an input rather than an output of production. In addition, Peroni et al. (2022) focus on job satisfaction and labor productivity in 30 European countries and find that industries with higher worker well-being levels have also higher labor productivity levels (+5%) and labor productivity growth (+6%). At the same time, the study by Rasheed et al. (2011) finds a positive relation between life satisfaction and productivity for the United States, but not for other countries in their sample. This paper contributes to the literature by analyzing the relationship between SWB and TFP across European regions.

3 Empirical strategy

3.1 Measuring TFP

We calculate TFP for NUTS-2 regions using a standard sources-of-growth (or, growth accounting) approach as in Solow (1957). A similar approach has also been followed by Beugelsdijk et al. (2018) and Kostarakos (2023). The starting point of the estimation is a Cobb–Douglas production function of the form:

$$Y_{it} = A_{it} K_{it}^{\alpha_{it}} (h_{it} L_{it})_{it}^{1-\alpha_{it}} \tag{1}$$

where Y_{it} denotes the level of real gross value added (GVA) at constant prices in region i and period t, h_{it} is the human capital index, L_{it} is the number of hours worked, and K_{it} is the level of physical capital stock (at constant prices). Lastly, α_{it} denotes the region-specific, time-varying share of capital income. This specification rests on several strong assumptions, such as perfect competition and the existence of a single homogeneous capital good, that have been the object of well-documented critiques. However, the limited availability of high-resolution regional data constrains our ability to specify a more granular and flexible production function. We thus proceed using Eq. (1), which offers a tractable and informative framework given the data limitations. Using Eq. (1), the level of TFP A_{it} can be obtained as:

$$A_{it} = \frac{Y_{it}}{K_{it}^{\alpha_{it}} (h_{it} L_{it})_{it}^{1-\alpha_{it}}} \tag{2}$$

We estimate A_{it} for 228 regions covering the 2008–2021 period. Data on output (GVA in 2015 prices) and two factors of production—namely, labor (hours worked) and physical capital stock (in 2015 prices)—are readily available in the Annual Regional Database of the European Commission's Directorate General for Regional and Urban Policy (ARDECO). However, the human capital index and the factor income shares at regional level need to be calculated.

To estimate the human capital index, we build on the work by Beugelsdijk et al. (2018) and use the following procedure. First, we convert data on the share of regional population aged 25–64 by level of educational attainment into average years of schooling using the approach by Barro and Lee (2013). Second, we convert the years of schooling into a human capital index using a standard Mincerian human capital function. Specifically, following Hall and Jones (1999) and Caselli (2005), the Mincerian function takes the form:

$$h_{it} = e^{\varphi(s_{it})} \tag{3}$$

where h_{it} denotes human capital in region i and period t, s_{it} are the average years of schooling, and $\varphi()$ is a piecewise linear function.[4]

Rather than assuming the standard value of 1/3 for the capital share (and 2/3 for the labor share), we opt for calculating the factor shares using National Accounts data. The labor share of income can be easily calculated using data on the compensation of employees and GVA. Specifically, the labor share is defined as

$$1 - \alpha_{it} = \frac{Compensation}{GVA} \tag{4}$$

The capital share, α_{it}, is then residually calculated. In the calculation of the levels of TFP, we use Divisia indices (two-year averages) of the factor shares, i.e.,

$$\widetilde{\alpha_{it}} = \frac{\alpha_{it} - \alpha_{i,t-1}}{2} \tag{5}$$

Although in the regional economics literature, regional TFP has also been estimated using a fixed effects approach (e.g., Van Oort and Cortonovis 2019; Ouwehand et al. 2022), a drawback of this method is that it assumes that the factor shares in the Cobb–Douglas production function are homogeneous across regions, and unobserved common factors are insufficiently accounted for (Kostarakos 2023). The advantage of our approach is that it allows for region-specific Cobb–Douglas production functions as well as time-varying factor elasticities. It is important to note that the limited data available at the regional level prevent us from employing a more complex and detailed production function, one that could, for instance, differentiate between tangible and various forms of intangible capital assets.

[4] Specifically, the function is defined as: $\varphi = 0.134 * s, s \leq 4$, or $\varphi = 0.134 * 4 + 0.101 * (s - 4), 4 \leq s \leq 8$ or $\varphi = 0.134 * 4 + 0.101 * 4 + 0.068 * (s - 8), s \geq 8$.

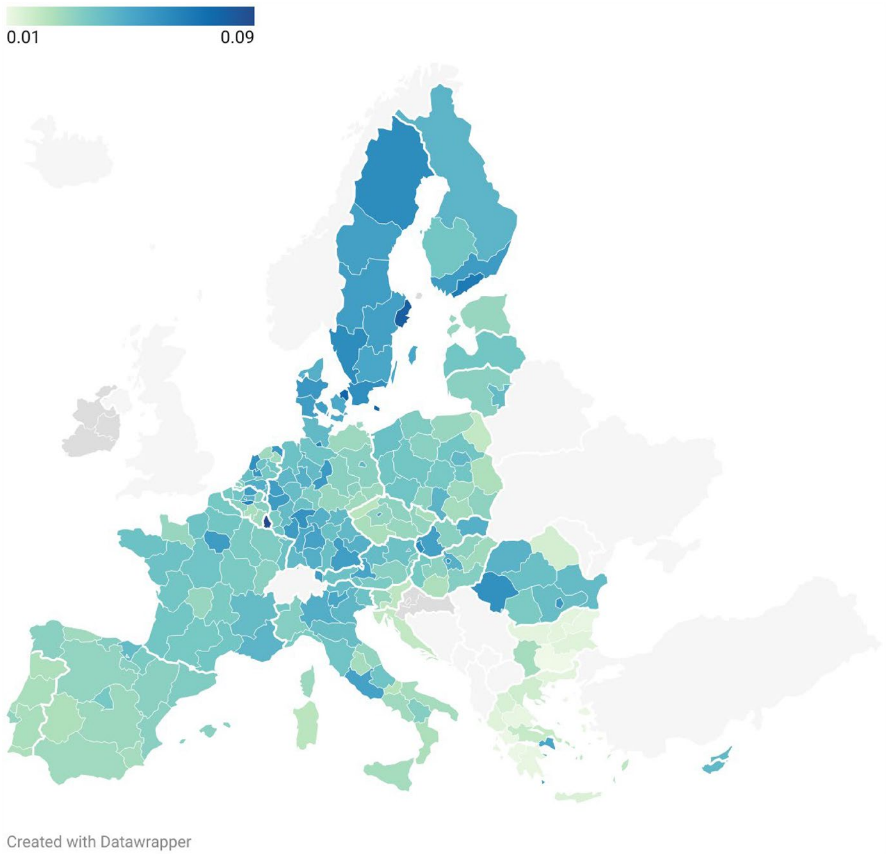

Fig. 1 TFP in European regions, 2021

Figure 1a shows the distribution of TFP (2021). The highest TFP levels are reported in Luxembourg, Denmark (Copenhagen), Sweden (Stockholm), and Belgium (Brussels), while the lowest TFP can be found in Bulgaria and Greece.

3.2 Measuring SWB

SWB at the regional level is measured using the life evaluation measure obtained from the Gallup World Poll, which yearly surveys a nationally representative sample of individuals in more than 160 countries. In most European countries, the interviews are conducted over the phone and the sample size is typically 1,000 respondents per country-year.

Specifically, life evaluation is measured using the Cantril Ladder (Cantril 1965), asking respondents to answer the following question: *"Please imagine a ladder with steps numbered from zero at the bottom to ten at the top. Suppose we say that the top of the ladder represents the best possible life for you and the* *bottom of the ladder represents the worst possible life for you. If the top step is 10 and the bottom step is 0, on which step of the ladder do you feel you personally stand at the present time?*" This SWB measure is in line with the definition of SWB adopted in this paper, and it has been the focus of most work on SWB in economics (Clark 2018).

Since it may take time for SWB to exert its effect on TFP of a NUTS-2 region (Siller et al. 2021), we include the average life evaluation over the period 2008–2021 in our regressions. The pooling of different survey waves also helps to overcome the problem that the yearly data from the Gallup World Poll are representative at the national level and not necessarily at the regional level.

Figure 2a and b shows the distribution of SWB across (Fig. 2a) and within (Fig. 2b) European regions. Average SWB is typically highest in Scandinavia, The Netherlands, and Austria, while regions with the lowest average SWB can be found in Eastern European regions. Although the map in Fig. 2a obscures strong differences in SWB between regions that are located within the same country, these differences are present (Fig. 2b) and are more ubiquitous in (1) large and/or heterogenous countries such as Belgium, Germany, and Italy as well as in (2) countries that exhibit lower levels of SWB, such as Bulgaria, Poland, and Greece, in which there are large urban–rural differences in SWB (Burger et al. 2020).

3.3 Confounder variables

We control for several variables that can possibly confound the relationship between TFP and SWB (see also Beugelsdijk et al. 2018; Siller et al. 2021; Ouwehand et al. 2022; Burger & Arampatzi, 2025. For most control variables, we estimated averages for the period 2008–2021. Specifically, we add the confounders-related (un)employment rate, institutional quality, health, economic structure, and demographic structure as these variables are expected to affect both SWB and TFP. An overview of all variables included in the analysis is found in Appendix A.

Economic structure: There can be considerable productivity differences across sectors and, hence, TFP differences between regions can be driven by sectorial composition. We control for the share of employees in agriculture, fishing, mining, and manufacturing. We control for generally TFP-enhancing activities by including the amount of R&D investment per inhabitant, as these activities generate positive spillover effects (e.g., Jaffe et al. 1993).

Health: We control for health differences between regions by accounting for life expectancy at birth, which is widely used in health assessments and captures the cumulative impact of various health determinants.

Institutional quality: To account for regional differences in quality of institutions, we utilize the European Quality of Institutions Index from the Regional Competitiveness Index. These data originate from the Quality of Governance indicators of the University of Gothenburg (Charron et al. 2012; 2020). The Quality of Institutions Index indicates how a regional government delivers its policies and consists of three elements: quality and accountability of government services, corruption, and impartiality of governance.

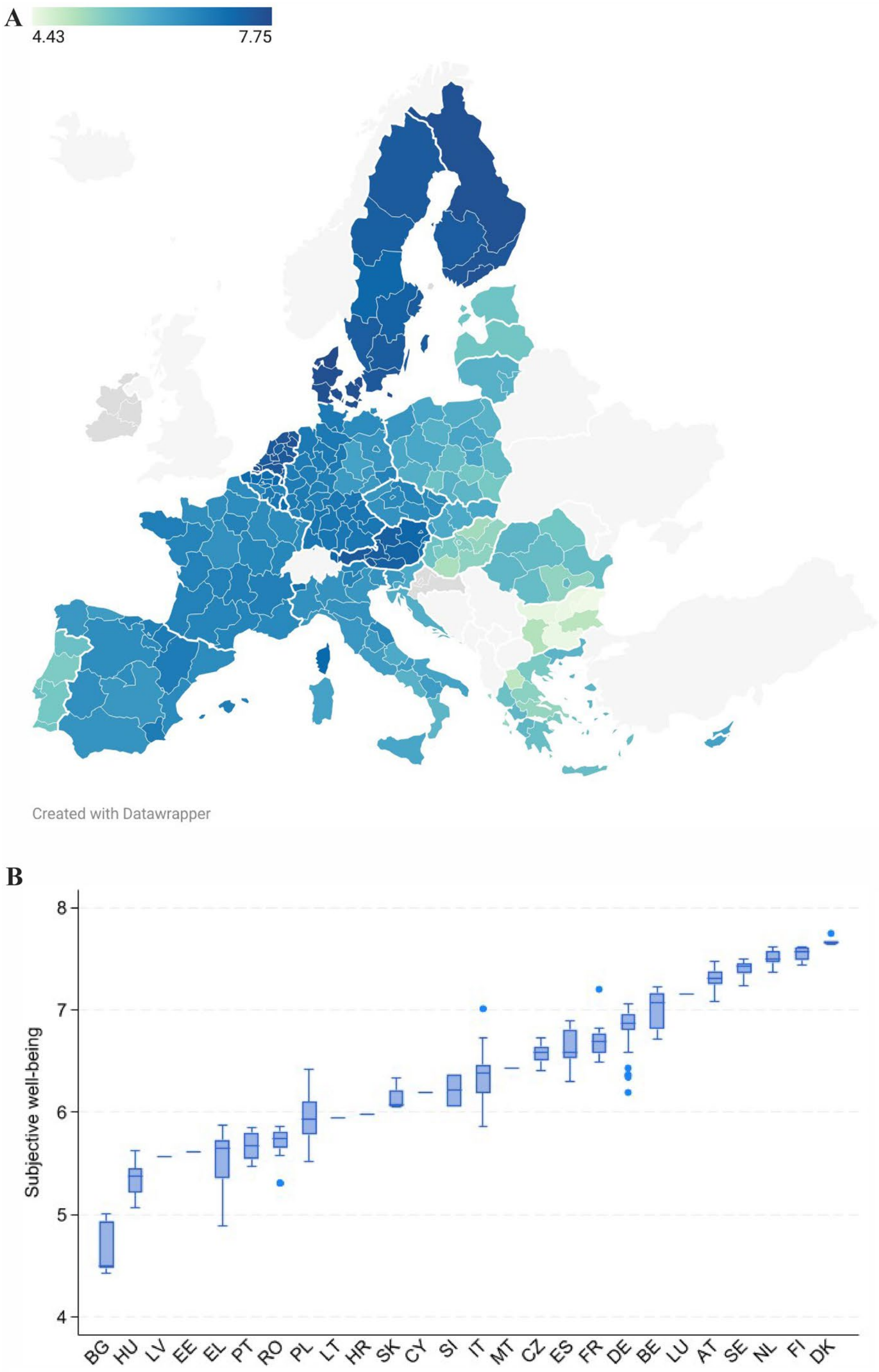

Fig. 2 **a** Life evaluation in EU regions, average from 2008 to 2021. **b** Dispersion of average SWB within regions by country

Economic geography: In terms of differences between regions, we control for presence of agglomeration economies by including a population density variable as well as variables related to accessibility by air, road, and rail from the regional competitiveness report. Despite that higher SWB can result in more people wanting to move to a specific NUTS-2 region (increasing urban density and accessibility), herewith fueling TFP through scale economies, typically urban density changes slowly. Hence, it is reasonable to treat these variables as contextual confounders.

Country dummies: Finally, we control for differences in climates, price levels and political history, as well as differences in education systems, labor laws, and tax regimes through the inclusion of country dummies. The country dummies also account for response style differences across countries (see, e.g., Brulé and Veenhoven 2017) in SWB surveys. Although country fixed effects do not offer a perfect solution, they help to reduce biases stemming from these systematic differences in reporting style.

3.4 Econometric estimation

We specify a simple reduced-form model to examine the relationship between SWB and TFP across regions:

$$\ln A_i = \alpha_0 + \vartheta SWB_i + \theta X_i + \varepsilon_i (6)$$

in which A_i is the regional TFP in 2021, SWB is the average level of subjective well-being over the period 2008–2021, and *X* is a vector of control variables accounting for factors that potentially affect TFP beyond traditional production factors. Please note that because the production factors—including human capital—are already included in the estimation of TFP, they are excluded from the above model. Overall, we have relevant information on 228 NUTS-1 or NUTS-2 regions.[5]

3.5 Endogeneity of controls

In regression analysis, the objective is typically to control for confounders (variables that influence both SWB and TFP), while avoiding the inclusion of mediators, which lie on the causal pathway from SWB to TFP. However, a key challenge is that for some control variables, it is unclear whether they function purely as confounders or as mediators. For instance, health does not only affect both TFP and SWB, but SWB can also increase health and, hence, affect life expectancy. Similarly, population density and regional accessibility can be considered confounders, as they affect both SWB (through access to amenities and potential stress) and TFP (through agglomeration economies and external scale effects). Yet, they may also act as mediators

[5] We do not have all relevant information for the following NUTS-2 regions: FI20 (Åland), ES63 (Ceuta), ES64 (Melilla), FRA1 (Guadeloupe), FRA2 (Martinique), FRA3 (French Guiana), FRA4 (La Réunion), FRA5 (Mayotte), and all NUTS regions in Ireland and Croatia. In addition, for Germany and France, subjective well-being data were aggregated to the NUTS-1 level given limited number of respondents per NUTS-2 region.

because higher SWB can attract more people to a locality (Hendriks and Burger 2021), thereby placing population density and accessibility on the causal pathway between SWB and TFP. Likewise, R&D investments may simultaneously influence SWB (by creating economic opportunities) and TFP (by improving production efficiency). However, SWB itself can foster creativity and innovation, potentially leading to higher levels of R&D investment. Also wage and unemployment raise similar concerns: While higher TFP affects both variables, wages and employment increase SWB. Given these complexities, our empirical strategy begins by sequentially introducing clear confounders into the regression models. We then gradually incorporate potentially endogenous variables to test the robustness of our findings.

3.6 Reverse causality

Endogeneity concerns related to reverse causality might affect the estimates of Eq. (2). In our case, however, traditional IV estimation is limited by the availability instruments. All potential candidate variables considered were only weakly correlated with SWB (i.e., did not have enough explanatory power in the first-stage regression; road accidents, land use) or did not exist at the regional level (e.g., historical suicide rates and mental health expenditures by the government).

Our specification partly addresses this concern because it is conceptually implausible that TFP in 2021 affects the average SWB of the previous 13 years. Nonetheless, to address endogeneity concerns in general, we adopt an IV approach that uses heteroskedasticity-based instruments for cross-sectional data, known as the Lewbel IV estimator (Lewbel 2012) that has been extensively used in the economics of well-being literature (e.g., Arampatzi et al. 2018; O'Connor 2020; Burger et al. 2022; Tubadji et al. 2025). The Lewbel (2012) approach generates instruments that are used in otherwise traditional two stage least squares (2SLS) estimations. Please note that the instruments do not have an economic meaning, which means we cannot interpret the local average treatment effect. However, we prefer this approach over the standard 2SLS method due to the lack of suitable external instruments. When instruments are only weakly correlated with the endogenous variables, the 2SLS estimator tends to be biased.

4 Empirical results

Figure 3 and Table 1 show the results from the regressions of SWB on TFP. In line with our expectations, we find a positive and significant effect of SWB on TFP, also after controlling for economic structure, institutional quality, and economic geography. After inclusion of confounders beyond country fixed effects (Column 3–5), a 1-point increase in average SWB score is associated with an increase in TFP by about 19%.[6] We emphasize that a 1-point increase in SWB is substantial and would

[6] To interpret the magnitude of the relationship between SWB and TFP, we calculate a semi-elasticity. Here, it is assumed that SWB increases by 1-point, which is associated with an increase in TFP by $(e^{0.178}-1)*100\% = 19\%$

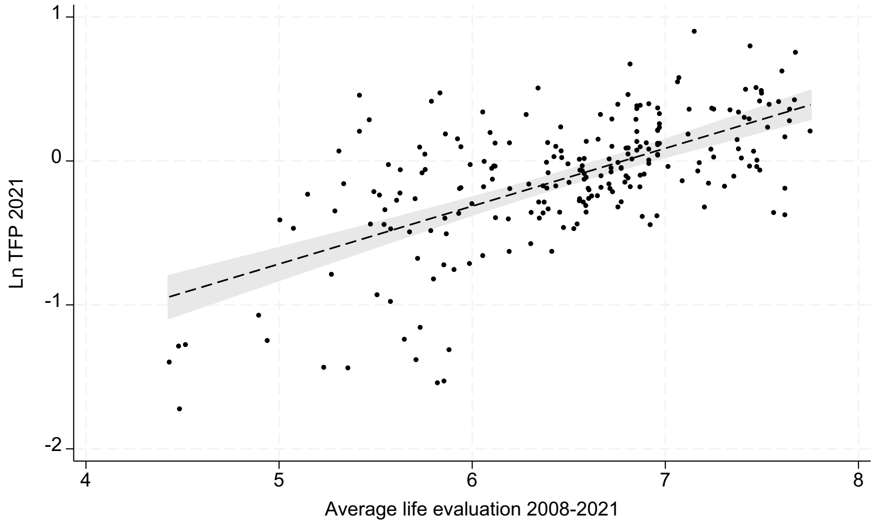

Fig. 3 Relationship between level of TFP and life evaluation

take a considerable amount of time to materialize. Most of our control variables have the expected signs, where particularly regional R&D expenditures, accessibility, and wages explain differences in TFP levels.

Results hold when re-estimating our model using the Lewbel estimator (Column 6, Table 1), where the instrumental variable diagnostics indicate that instruments are relevant and valid. The Hansen J test is insignificant, while as can be seen from Table 3, the value of the Kleibergen–Paap rk Wald statistic exceeds the critical values provided by Stock and Yogo (2002).

4.1 Sensitivity analyses

Multicollinearity was assessed using VIF statistics after estimating column (5) in Table 1. With regard to the SWB variable, we found a VIF statistic of lower than 5, indicating moderate but acceptable multicollinearity (Shrestha 2020). For some control variables—wage and R&D expenditures—we found higher levels (VIF > 5), but excluding these variables did not yield different results (see Table 2, Column 1). An additional concern is that some regional level estimates of SWB are based on more surveys than other regional level estimates of SWB. This problem is partly addressed in Table 1 by aggregating SWB to NUTS-1 level for some countries and omitting some regions from the regressions. As additional robustness check, we removed the regions with less than 100 observations for the SWB variable (Table 2, Column 2) and less than 400 observations (Table 2, Column 2)[7] for the SWB variable from the analysis. Removing these observations did not yield different findings.

[7] These numbers are based on hypothetical sample size calculations where we allow for a 10% and 5% margin of error, respectively.

Table 1 Regression of level of TFP on SWB

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) Lewbel
SWB	0.402***	0.422***	0.212**	0.225***	0.178**	0.224**
	(0.041)	(0.096)	(0.101)	(0.082)	(0.090)	(0.098)
% Agriculture employment			−0.021***	−0.014**	−0.011	−0.009
			(0.006)	(0.007)	(0.008)	(0.007)
% Manufacturing emp			0.010*	0.004	0.004	0.006
			(0.005)	(0.005)	(0.003)	(0.004)
% KIS employment			0.019*** (0.007)	0.002 (0.007)	0.001 (0.008)	0.002 (0.007)
Quality of institutions			0.074	0.051	0.023	0.011
			(0.053)	(0.052)	(0.061)	(0.050)
Life expectancy				0.002	−0.005	−0.017
				(0.020)	(0.022)	(0.017)
Ln R&D investments				0.096***	0.083**	0.089***
				(0.035)	(0.034)	(0.030)
Accessibility air (ln)				0.047***	0.041**	0.047***
				(0.016)	(0.017)	(0.015)
Accessibility rail/road (ln)				0.084*	0.077	0.056
				(0.049)	(0.053)	(0.048)
Ln population density				0.036	0.039	0.045**
				(0.026)	(0.026)	(0.023)
Ln household income					0.039**	0.331***
					(0.017)	(0.133)
Unemployment rate					0.000	0.003
					(0.009)	(0.006)
Kleib.–Paap rk LM (*p*-value)						0.00
Kleibergen–Paap rk Wald F						35.82
Stock–Yogo weak ID test CV 10% max IV relative bias						11.32
Hansen J test (*p*-value)						0.299
Country fixed effects	NO	YES	YES	YES	YES	YES
Observations	228	228	228	228	228	228
R^2	0.39	0.70	0.80	0.85	0.86	0.85

Table 1 (continued)

Robust standard errors in parentheses

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

In the other robustness checks, we re-estimated Column 6 in Table 1, but now with weak external instruments. We instrument SWB using the following two instruments: Road accidents in the period 2008–2019 and percentage of land used for arts, entertainment, and recreation in 2008. Road accidents are known to decrease well-being via injury, stress, and perceived safety (Reardon and Abdallah 2013). While accidents may reflect infrastructure quality (for which we control through our accessibility by road and rail variable), they are less likely to directly increase or decrease TFP, except through their impact on SWB. Land cover in arts, entertainment, and recreation is expected to be positively related to SWB through leisure opportunities and social cohesion. In this regard, the literature has found that green spaces and cultural amenities are associated with higher levels of SWB (Samavati and Veenhoven 2024). Since we control in our models for population density, education, and sectoral employment, direct effects on TFP are likely limited.

Column 4A in Table 2 shows the effects of a standard 2SLS using road accidents and percentage land use for arts, entertainment, and recreation as instruments. The Kleibergen–Paap rk Wald F statistic indicates the presence of weak instruments, potentially explaining the inflated coefficient. Re-estimating the models using the jackknife IV estimator by Angrist et al. (1999) implemented by Poi (2006) in Stata (Table 2, Column 4B) and using the Lewbel estimator including both the external instruments and generated instruments (Baum and Lewbel 2019; Table 2, Column 5), our main conclusions hold and estimated coefficients are more in line with our preferred specifications presented in Columns 5 and 6 in Table 1.

4.2 Heterogeneity of results

Average effects of SWB on TFP may masque substantial differences across parts of Europe. Hence, we first examined whether the relationship between SWB and TFP holds across different macro-regions in Europe (Table 3, Columns 1 and 2).[8] Our results show a positive association between SWB and TFP for Northern and Western Europe and Central and Eastern Europe, but no positive association between SWB and TFP for Southern Europe. Further analysis learns that the non-significant effect

[8] Central and Eastern Europe: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia, and Slovak Republic (number of regions: 57). Northern and Western Europe: Austria, Belgium, Denmark, Finland, France, Luxembourg, the Netherlands, and Sweden ((number of regions: 110); Southern Europe: Croatia, Cyprus, Greece, Italy, Malta, Portugal, and Spain (number of regions: 61).

Table 2 Regression of level of TFP on SWB—robustness checks

	(1) OLS Dropping control vars that do not pass VIF test	(2) OLS Dropping obs with N < 100 with regards to SWB est	(3) OLS Dropping obs with N < 400 with regards to SWB est	(4A) Standard IV with weak instruments	(4B) Jackknife IV	(5) Adding instruments to Lewbel IV estimator
SWB	0.20** (0.10)	0.19* (0.10)	0.23** (0.12)	0.62* (0.34)	0.29** (0.14)	0.35** (0.09)
Kleibergen–Paap rk LM (*p*-value)				0.01		0.02
Kleibergen–Paap rk Wald F				3.88		31.43
Stock–Yogo weak ID test CV 10% max IV relative bias				19.93		11.32
Hansen J test (*p*-value)				0.27		0.32
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	228	225	198	204	204	204

Robust standard errors in parentheses

$^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$

Table 3 Regression of level of TFP on SWB—interaction effects

	(1) OLS	(2) OLS	(3) OLS
SWB	−0.051	0.009**	0.206**
	(0.152)	(0.004)	(0.082)
SWB*Central and Eastern Europe	−0.039	0.387**	
	(0.182)	(0.166)	
SWB*Southern Europe	−0.387**		
	(0.166)		
SWB*Northern and Western Europe		0.347*	
		(0.204)	
SWB*Quality of institutions			0.118**
			(0.047)
Control variables	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Observations	228	228	228

Robust standard errors in parentheses; *$p<0.10$, **$p<0.05$, ***$p<0.01$

for Southern Europe is particularly driven by Portugal and Greece and needs further exploration.

In addition, we ran an exploratory analysis in which we examine this heterogeneity by focusing on the interaction between SWB and various control variables. Overall, none of the interactions between the control variables and SWB were statistically significant. Only regarding institutional quality, we found that the positive association between SWB and TFP is stronger in regions within countries with a higher governance quality (Table 3, Column 3). The explanation for this is straightforward: High regional quality of governance can ensure that high SWB translates into higher regional TFP through efficient labor markets and property rights. When quality of governance is low, high SWB may not result in higher TFP due to bureaucratic inefficiencies and misallocated investments. In addition, higher SWB may be decoupled from TFP in such environments because the returns to effort and innovation are uncertain.

5 Discussion and conclusions

This article contributes to the existing evidence on the consequences of SWB by utilizing a new database that combines SWB and TFP data (Kostarakos 2023) for European regions. We find, overall, a positive association between SWB and TFP, a widely used measure of productivity: regions with higher levels of SWB, as measured with responses about individuals' life evaluation, experience, on average, higher levels of TFP. A 1-point difference in life evaluation between regions is associated with a difference of 19% in TFP. Our findings are broadly in line with the earlier studies of DiMaria et al. (2020) and Peroni et al. (2022) and the causal micro-level evidence provided by Oswald et al. (2015) and Bellet et al. (2024).

This study has various limitations that should be addressed in future research. First, the coverage of SWB data is less than fifteen years and annual representative data at the regional level is not available. This prevents us from conducting a panel data analysis. Solution here could be to combine and harmonize different surveys including the Eurobarometer, European Social Survey, and European Values Survey as proposed by Tomescu-Dubrow et al. (2023). Second, the relationship between SWB and TFP may be heterogeneous in that it can differ across industries, where SWB may be particularly conducive to TFP gains in knowledge-intensive industries and activities in which social skills are important. This was already echoed in early work on the service-profit chain (Heskett et al. 1997). Third, our research does not address the different mechanisms that are at play. For example, employee well-being could enhance productivity through increasing creativity, but also through better cooperation in teams (Fredrickson 2001). These different mechanisms should be scrutinized in future research. Fourth, future studies might further explore the specific conditions under which higher SWB translates into higher TFP. Our study pointed at the importance of quality of governance, but future research endeavors could focus on more specific institutional moderators such as corruptions, labor market quality, and corruption.

Appendix A

Control variables included in the analysis

Variable	Description	Source
% Agriculture employment	Share of employment in agriculture, fishing, and mining, 2008–2021 average	Eurostat
% Manufacturing employment	Share of employment in manufacturing, 2008–2021 average	Eurostat
% KIS employment	Share of employment in knowledge-intensive services, 2008–2021 average	Eurostat
Quality of institutions index	Quality of institutions index	Charron et al. (2012; 2020)
Life expectancy	Life expectancy at birth in years	Eurostat
Ln R&D Expenditures	Natural log of total R&D expenditures, 2008–2021 average	Eurostat
Income (ln)	Disposable income per inhabitant, average over the period 2008–2021	Eurostat
Accessibility air (ln)	Natural log of daily number of passenger flights in 2014	European Competitiveness Index

Variable	Description	Source
Accessibility rail/road (ln)	Natural log of average of two variables: share of population in a 120 km radius accessible by road rail within 1h30 and share of population in a 120 km radius accessible by road within 1h30 in 2016	European Competitiveness Index
Ln population density	Natural log of population density, average over the period 2008–2021	Eurostat
Ln household income		ARDECO
Unemployment rate		ARDECO

Appendix B

Average SWB in European regions

Region	Average SWB	Observations
AT11	7.09	516
AT12	7.25	2827
AT13	7.24	3197
AT21	7.35	1095
AT22	7.31	2056
AT31	7.38	2445
AT32	7.41	992
AT33	7.47	1283
AT34	7.25	607
BE10	6.82	1752
BE21	7.12	2227
BE22	7.22	1068
BE23	7.18	1797
BE24	7.12	1400
BE25	7.17	1447
BE31	7.07	544
BE32	6.71	1582
BE33	6.79	1338
BE34	6.96	367
BE35	6.92	573
BG31	4.51	1108
BG32	4.48	1696
BG33	4.43	1902
BG34	4.94	1579
BG41	5.00	3964
BG42	4.48	2831

Region	Average SWB	Observations
CY00	6.19	13,648
CZ01	6.66	1687
CZ02	6.62	1477
CZ03	6.47	1396
CZ04	6.41	1275
CZ05	6.73	1652
CZ06	6.57	1873
CZ07	6.60	1374
CZ08	6.54	1373
DE1	6.97	4977
DE2	6.96	6381
DE3	6.59	1931
DE4	6.43	1509
DE5	6.85	349
DE6	7.06	926
DE7	6.81	2857
DE8	6.59	979
DE9	6.91	3705
DEA	6.85	7975
DEB	6.87	1949
DEC	6.75	485
DED	6.37	2304
DEE	6.19	1245
DEF	6.90	1423
DEG	6.34	1171
DK01	7.67	4170
DK02	7.64	1837
DK03	7.64	2725
DK04	7.67	2831
DK05	7.75	1234
EE00	5.61	14,338
EL30	5.47	4669
EL41	5.85	239
EL42	5.72	357
EL43	5.73	720
EL51	5.88	741
EL52	5.51	2246
EL53	4.89	331
EL54	5.65	441
EL61	5.36	902
EL62	5.23	199
EL63	5.82	821
EL64	5.27	690

Region	Average SWB	Observations
EL65	5.71	735
ES11	6.39	847
ES12	6.31	332
ES13	6.71	219
ES21	6.81	667
ES22	6.89	182
ES23	6.60	134
ES24	6.87	485
ES30	6.56	2483
ES41	6.56	814
ES42	6.39	674
ES43	6.53	327
ES51	6.59	2256
ES52	6.60	1442
ES53	6.82	287
ES61	6.45	2726
ES62	6.88	401
ES70	6.59	636
FI19	7.44	1549
FI1B	7.60	687
FI1C	7.54	2171
FI1D	7.62	3069
FR1	6.75	2726
FRB	6.50	572
FRC	6.67	602
FRD	6.55	668
FRE	6.57	1210
FRF	6.58	1209
FRG	6.71	466
FRH	6.83	648
FRI	6.77	1253
FRJ	6.72	1129
FRK	6.80	1677
FRL	6.65	984
FRM	7.20	84
HR00	5.99	2661
HU10	5.42	4047
HU21	5.49	1422
HU22	5.63	1349
HU23	5.07	1284
HU31	5.15	1529
HU32	5.29	1860
HU33	5.33	1646

Region	Average SWB	Observations
ITC1	6.50	1068
ITC2	7.01	73
ITC3	6.39	379
ITC4	6.46	2184
ITF1	6.06	274
ITF2	6.30	99
ITF3	5.93	1272
ITF4	6.19	971
ITF5	6.29	157
ITF6	5.87	425
ITG1	6.12	1115
ITG2	6.19	376
ITH1/ITH2	6.72	195
ITH3	6.39	1100
ITH4	6.46	289
ITH5	6.46	1029
ITI1	6.38	840
ITI2	6.35	214
ITI3	6.65	362
ITI4	6.28	1607
LT00	5.94	15,120
LU00	7.15	11,028
LV00	5.57	14,195
MT00	6.43	13,093
NL11	7.49	453
NL12	7.56	522
NL13	7.62	396
NL21	7.47	877
NL22	7.49	1633
NL23	7.39	343
NL31	7.59	1026
NL32	7.50	2431
NL33	7.46	2978
NL34	7.62	335
NL41	7.53	1893
NL42	7.37	908
PL21	5.86	1154
PL22	5.92	1815
PL41	6.11	1276
PL42	6.42	649
PL43	6.10	401
PL51	5.99	1175
PL52	5.63	389

Region	Average SWB	Observations
PL61	5.93	818
PL62	6.00	536
PL63	6.10	886
PL71	5.76	1032
PL72	5.55	484
PL81	5.79	813
PL82	5.52	828
PL84	5.91	518
PL9	6.12	2346
PT11	5.68	5197
PT15	5.58	633
PT16	5.47	3355
PT17	5.70	4198
PT18	5.54	985
PT20	5.85	370
PT30	5.80	346
RO11	5.86	1648
RO12	5.75	1530
RO21	5.58	2147
RO22	5.73	1656
RO31	5.31	1956
RO32	5.79	1658
RO41	5.74	1326
RO42	5.83	1177
SE11	7.44	3454
SE12	7.33	2550
SE21	7.43	1248
SE22	7.50	2064
SE23	7.42	2944
SE31	7.24	1195
SE32	7.38	558
SE33	7.47	772
SI03	6.05	6843
SI04	6.37	6710
SK01	6.34	1612
SK02	6.05	4196
SK03	6.06	2930
SK04	6.09	3374

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