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Structural Transformation and the Dynamics of Well-Being: Evidence from a Global Panel

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Abstract

Structural transformation is widely considered a key driver of economic development; however, its contribution to multidimensional well-being remains unclear. This study analyzes the relationship between structural transformation and well-being using an unbalanced panel of 150 countries from 2000 to 2023. A multidimensional well-being index is constructed through principal component analysis, combining indicators of health, education, physician density, and security. The empirical strategy combines fixed-effects models with time controls and dynamic panel estimations using the System Generalized Method of Moments (System GMM) to address unobserved heterogeneity, persistence, and potential endogeneity. Fixed-effects estimates show that education and urbanization are positively associated with well-being, whereas industrialization and GDP per capita are not statistically significant. However, once dynamic persistence is incorporated, the significance of all structural variables disappears, while the lagged well-being indicator remains strongly significant, indicating a high degree of path dependence, although the overidentifying-restrictions test raises some concerns about the validity of the instruments used in this dynamic specification. These results suggest that the influence of structural transformation on well-being may be overstated in static specifications and that long-run well-being trajectories show a high degree of persistence. The findings highlight the importance of accounting for persistence and endogeneity when evaluating development outcomes. The dynamic estimates point to high persistence in well-being, but given the diagnostic concerns regarding instrument validity, these results should be interpreted as suggestive evidence of specification sensitivity rather than as conclusive evidence of path dependence or absence of structural effects.

Keywords: structural transformation; economic development; multidimensional well-being; dynamic panel data; persistence; urbanization



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1. Introduction

Understanding the determinants of well-being has become a central concern in development economics, particularly in a context characterized by profound structural changes across economies. Over recent decades, countries have undergone significant transformations involving the reallocation of economic activity from agriculture to industry and services, accompanied by rapid urbanization, technological change, and evolving human capital dynamics. These processes, commonly referred to as structural transformation, are widely regarded as fundamental drivers of long-term economic development and are

often associated with improvements in income levels and living standards (Herrendorf et al., 2014; McMillan et al., 2014). However, whether such transformations translate into sustained improvements in multidimensional well-being remains an open and contested empirical question.

The existing literature has extensively documented the relationship between structural transformation and economic growth. Classical and modern contributions emphasize that sectoral reallocation toward more productive activities enhances aggregate productivity and supports income convergence (Herrendorf et al., 2014; Rodrik, 2013). More recent studies further suggest that structural transformation can promote inclusive growth, particularly in developing regions, although its effects may depend critically on institutional quality, technological adoption, and the composition of economic activities (Buthelezi, 2024). In parallel, urbanization has been identified as both a consequence and a driver of structural change, often described as a key mechanism through which economic transformation unfolds. Empirical evidence indicates that urbanization is closely linked to productivity gains, infrastructure development, and economic expansion, although these relationships are frequently characterized by bidirectional causality and complex dynamics (Abbas et al., 2023).

Despite these advances, the literature remains fragmented when it comes to linking structural transformation directly to well-being outcomes. While a large body of research examines the determinants of economic growth, relatively fewer studies focus on broader measures of welfare that incorporate health, education, and social conditions. Existing evidence suggests that improvements in well-being are strongly associated with investments in human capital, access to healthcare, and institutional development (Deaton, 2013; Sen, 1999). However, the role of structural factors such as industrialization or urbanization in shaping well-being remains ambiguous. For instance, sectoral shifts do not uniformly reduce poverty or inequality, and in some contexts, structural transformation may generate uneven or even adverse distributional outcomes (Diao et al., 2019; McMillan et al., 2014). Similarly, while urbanization can enhance access to services and economic opportunities, it may also introduce challenges related to congestion, inequality, and environmental stress, thereby producing mixed effects on well-being (Tleppaev et al., 2023).

Taken together, this body of research shows that structural transformation is comparatively well understood as a driver of aggregate economic growth, whereas its consequences for multidimensional well-being remain fragmented across separate strands of literature that examine health, education, or urbanization in isolation. What is missing is a systematic account of what is already known: most existing cross-country studies rely on static estimators and a single welfare dimension, and rarely test whether the associations they report survive once dynamic persistence and endogeneity are explicitly modeled (Buthelezi, 2024; Diao et al., 2019). It is this specific, demonstrable gap in the joint empirical treatment of structural transformation, multidimensional well-being, and dynamic panel estimation that this study addresses, rather than a general absence of research on either topic separately.

A key limitation of the existing empirical literature lies in its predominant reliance on static modeling frameworks. Most cross-country studies analyzing well-being or development outcomes employ fixed-effects or pooled estimators that do not adequately capture dynamic persistence or address endogeneity concerns. However, well-being is inherently path-dependent, shaped by historical trajectories, institutional structures, and cumulative investments in human and social capital. Ignoring these dynamic processes may lead to biased estimates and an overstatement of the short-term impact of structural variables. In response, recent methodological advances have emphasized the importance of dynamic panel approaches, such as System Generalized Method of Moments (System GMM), which allow

for a more accurate representation of temporal dynamics and help mitigate endogeneity biases in panel data analysis (Arellano & Bover, 1995; Blundell & Bond, 1998).

Against this backdrop, this study revisits the relationship between structural transformation and well-being by integrating these strands of literature within a unified empirical framework. Using panel data for 150 countries over the period 2000–2023, we construct a multidimensional well-being index based on principal component analysis (PCA), combining indicators of health, education, and security. The empirical strategy combines fixed-effects models with time controls and dynamic panel estimations using System GMM, enabling a direct comparison between static and dynamic specifications.

The contribution of this paper is threefold. First, it extends the literature by directly linking structural transformation variables—specifically industrialization and urbanization—to multidimensional well-being, rather than focusing solely on income or growth indicators. Second, it introduces a dynamic perspective that highlights the role of persistence in shaping well-being trajectories, thereby addressing a critical limitation of static approaches. Third, by contrasting fixed-effects and dynamic estimations, the study demonstrates that the apparent influence of structural determinants may be overstated when endogeneity and temporal dependence are not properly accounted for.

The findings provide new insights into the mechanisms underlying well-being dynamics. While static models suggest that education and urbanization are positively associated with well-being, these effects disappear once persistence and endogeneity are considered, revealing that well-being is largely driven by its own past levels. This result calls for a reconsideration of conventional interpretations of development processes and underscores the importance of long-term structural and institutional factors over short-term economic changes.

2. Literature Review and Hypotheses Development

The relationship between structural transformation and development outcomes has been a central topic in economic research, particularly in the context of long-term growth and structural change. Structural transformation is typically defined as the reallocation of economic activity from low-productivity sectors, such as agriculture, to higher-productivity sectors, including manufacturing and services. This process is widely recognized as a key driver of economic development, as it enhances productivity, fosters technological upgrading, and supports income growth (Herrendorf et al., 2014; Rodrik, 2013). Empirical studies have consistently shown that economies that successfully transition toward more diversified and industrialized structures tend to experience sustained economic growth and improved macroeconomic performance (Felipe et al., 2019).

However, while the link between structural transformation and economic growth is well established, its relationship with broader measures of well-being remains less clear. Traditional approaches in development economics have often relied on income-based indicators, such as GDP per capita, to assess progress. Yet, a growing body of literature argues that such measures provide an incomplete picture of welfare, as they fail to capture important dimensions such as health, education, and social conditions (Stiglitz et al., 2009). As a result, recent research has increasingly emphasized the importance of multidimensional well-being indicators, which integrate economic and non-economic aspects of development (Alkire & Foster, 2011). These approaches align with the broader capabilities' framework, which conceptualizes development as the expansion of individuals' freedoms and opportunities rather than merely increases in income (Sen, 1999).

Within this broader perspective, human capital has emerged as a critical determinant of well-being. Investments in education and health not only enhance individual productivity but also contribute to improved quality of life and social outcomes. Empirical evidence

suggests that higher levels of educational attainment are associated with better health outcomes, higher life satisfaction, and greater economic resilience (Barro, 2013; Hanushek & Woessmann, 2023). Similarly, access to healthcare services plays a crucial role in shaping well-being by reducing mortality, increasing life expectancy, and improving overall living conditions (Deaton, 2013). These findings highlight the importance of incorporating human capital variables into empirical models of well-being.

Urbanization represents another key dimension of structural transformation with potentially significant implications for well-being. The literature generally identifies urbanization as a catalyst for economic development, as it facilitates agglomeration economies, enhances access to infrastructure, and promotes innovation (Glaeser, 2012). Urban areas tend to offer better access to education, healthcare, and employment opportunities, which can lead to improved welfare outcomes. However, the effects of urbanization are not uniformly positive. Rapid and unplanned urban growth can generate challenges such as congestion, environmental degradation, and social inequality, which may offset potential benefits (Henderson et al., 2017). Consequently, the relationship between urbanization and well-being is often characterized by non-linearities and context-specific dynamics.

Despite the theoretical relevance of structural transformation, urbanization, and human capital for well-being, empirical evidence remains mixed and inconclusive. Some studies find positive associations between structural variables and welfare outcomes, while others report weak or insignificant effects, particularly when broader social indicators are considered (Olaoye et al., 2025). This inconsistency suggests that the relationship between structural transformation and well-being is more complex than traditionally assumed and may depend on institutional, technological, and policy contexts.

Beyond simply listing these divergent findings, it is worth highlighting that the mixed evidence often traces back to differences in methodology rather than to fundamentally different underlying relationships: studies relying on static, cross-sectional, or short-panel designs tend to report stronger structural effects, whereas those incorporating longer time horizons or dynamic estimators more frequently find that such effects weaken or disappear. This methodological pattern, rather than the substantive variables themselves, is a central motivation for the dynamic approach adopted in this study.

A key limitation of much of the existing empirical literature is its reliance on static panel data models, which may not adequately capture the dynamic nature of well-being. Well-being is inherently persistent, as current levels are strongly influenced by past conditions, including historical investments in human capital, institutional quality, and infrastructure. Ignoring this persistence can lead to biased estimates and misinterpretation of causal relationships. In response to these challenges, recent studies have increasingly employed dynamic panel data techniques, such as the System Generalized Method of Moments (System GMM), which allow researchers to control for unobserved heterogeneity, address endogeneity, and explicitly model temporal dependence (Arellano & Bover, 1995; Blundell & Bond, 1998).

Moreover, emerging research highlights that structural transformation processes themselves are endogenous and influenced by a wide range of factors, including foreign direct investment, trade openness, and institutional quality. For instance, empirical evidence from emerging economies shows that the impact of structural change on economic outcomes is mediated by human capital development and technological capabilities, suggesting that the benefits of transformation are conditional rather than automatic (Hoang et al., 2025). Similarly, recent studies emphasize that the effects of structural transformation may vary across regions and stages of development, reinforcing the need for empirical approaches that account for heterogeneity and dynamic interactions.

In light of these considerations, an important gap remains in the literature regarding the integration of structural transformation and multidimensional well-being within a dynamic empirical framework. While previous studies have examined these concepts separately, few have combined them to analyze how structural variables influence well-being over time, particularly when persistence and endogeneity are explicitly taken into account. Addressing this gap is essential for developing a more comprehensive understanding of the mechanisms through which economic transformation affects human welfare.

This study contributes to the literature by bridging this gap through the application of both static and dynamic panel data models to a large cross-country dataset. By comparing fixed-effects and System GMM estimations, it provides new insights into the extent to which structural transformation variables influence well-being and whether these effects persist once dynamic adjustments are considered. In doing so, the study advances the empirical literature on development by highlighting the importance of persistence, endogeneity, and multidimensional measurement in the analysis of well-being outcomes.

Based on this framework, the study formulates the following research questions:

First, does structural transformation, as proxied by industrialization and urbanization, have a significant impact on multidimensional well-being? While traditional theories suggest a positive relationship, recent empirical evidence indicates that this effect may be weaker or more complex than previously assumed (Diao et al., 2019; McMillan et al., 2014).

Second, to what extent does human capital influence well-being outcomes in a cross-country context? Given the strong theoretical and empirical support for the role of education, it is expected that human capital will be positively associated with well-being (Barro, 2013; Hanushek & Woessmann, 2012).

Third, does the inclusion of dynamic persistence alter the estimated effects of structural variables on well-being? This question is central to the study, as it directly addresses the potential bias introduced by static models and examines whether the observed relationships hold once endogeneity and temporal dynamics are taken into account (Bond, 2002; Roodman, 2009).

In line with these research questions, the study proposes the following hypotheses:

- H1.** *Structural transformation variables (industrialization and urbanization) have a positive effect on multidimensional well-being.*
- H2.** *Human capital (education) is positively associated with well-being.*
- H3.** *The inclusion of dynamic persistence reduces or eliminates the statistical significance of structural determinants of well-being.*

These hypotheses are consistent with the theoretical expectations derived from the literature but also reflect the possibility that static models may overstate the impact of structural variables. By explicitly testing these hypotheses using both static and dynamic panel estimators, the study aims to provide a more nuanced understanding of the determinants of well-being in the context of structural transformation.

It is worth noting that H3, unlike H1 and H2, is not derived from a distinct theoretical mechanism but rather follows almost mechanically from the inclusion of a highly auto-correlated lagged dependent variable in the dynamic specification; its formulation and expected confirmation are therefore better understood as a methodological expectation than as an independent theoretical contribution, a distinction maintained when interpreting the results in Sections 5 and 7.

3. Methodology

The econometric framework underlying the empirical strategy, previously outlined in the Literature Review, is presented here in full, together with the estimation methods used to implement it.

The empirical analysis of well-being in the context of structural transformation requires a framework capable of integrating sectoral change, human capital dynamics, and macroeconomic conditions within a coherent econometric structure. Building on the literature on structural change and development, this study specifies a panel data model in which multidimensional well-being is modeled as a function of key structural and socioeconomic variables. Specifically, the baseline empirical specification can be expressed as:

$$WBit = \beta_0 + \beta_1 \times INDit + \beta_2 \times URBit + \beta_3 \times EDUit + \beta_4 \times GDPit + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where $WBit$ denotes the multidimensional well-being index for country i at time t , constructed using principal component analysis (PCA) to combine indicators of health, education, and security. The variable $INDit$ captures the degree of industrialization, $URBit$ represents urbanization, $EDUit$ measures human capital through educational attainment, and $GDPit$ corresponds to income per capita. The terms μ_i and λ_t account for unobserved country-specific and time-specific effects, respectively.

This specification is grounded in the theoretical premise that structural transformation influences welfare through productivity gains, sectoral reallocation, and improved access to services (Herrendorf et al., 2014; McMillan et al., 2014). Industrialization is traditionally viewed as a driver of development due to its role in enhancing productivity and fostering technological diffusion (Rodrik, 2013; Szirmai, 2012). However, recent evidence suggests that the welfare effects of industrialization may be heterogeneous and context-dependent, particularly in economies where structural change is incomplete or uneven (Diao et al., 2019; Felipe et al., 2019).

Urbanization, as a complementary dimension of structural transformation, is expected to influence well-being through agglomeration economies, improved infrastructure, and access to public services (Duranton, 2015; Henderson et al., 2017). Nevertheless, the literature also highlights potential negative externalities associated with rapid urban growth, including congestion, inequality, and environmental degradation (Glaeser & Gottlieb, 2009; Jedwab & Vollrath, 2015). These mixed effects suggest that the net impact of urbanization on well-being is theoretically ambiguous and must be empirically evaluated.

Human capital, proxied by education, constitutes a central channel through which structural transformation may translate into welfare improvements. Extensive empirical research demonstrates that education enhances productivity, promotes health outcomes, and contributes to overall well-being (Barro, 2013; Hanushek & Woessmann, 2023; Krueger & Lindahl, 2001). In addition, education plays a critical role in enabling individuals to benefit from structural change by facilitating labor mobility and adaptation to new economic conditions (Acemoglu & Autor, 2010).

Income per capita, included as a control variable, reflects the traditional view that economic growth leads to improved welfare outcomes. While higher income levels are generally associated with better living standards, recent studies emphasize that the relationship between income and well-being is neither linear nor sufficient to capture broader dimensions of welfare (Deaton, 2008; Easterlin, 1995). This underscores the importance of adopting a multidimensional approach to well-being, as implemented in this study.

A key limitation of the static specification described above is its inability to account for the dynamic nature of well-being. The literature increasingly recognizes that well-being is a persistent process, influenced by past conditions and cumulative investments in human

and physical capital (Clark et al., 2019). Ignoring this persistence may result in biased estimates and misinterpretation of causal relationships. To address this issue, the empirical framework is extended to a dynamic panel model:

$$WBit = \alpha WBit_{-1} + \beta_1 \times INDit + \beta_2 \times URBit + \beta_3 \times EDUit + \beta_4 \times GDPit + \mu_i + \varepsilon_{it} \quad (2)$$

where the inclusion of the lagged dependent variable captures the persistence of well-being over time. This specification is estimated using the System Generalized Method of Moments (System GMM), which is designed to address endogeneity, measurement error, and unobserved heterogeneity in panel data settings (Arellano & Bover, 1995; Blundell & Bond, 1998; Roodman, 2009).

The use of dynamic panel methods is particularly relevant in the context of structural transformation, as the underlying processes are inherently endogenous. Structural change is influenced by a wide range of factors, including institutional quality, technological progress, and external shocks (Acemoglu, 2008). Similarly, urbanization and human capital accumulation are shaped by policy decisions and historical trajectories, making it difficult to establish causal relationships using static models alone (Gollin et al., 2016).

This study employs a quantitative empirical approach to examine the relationship between structural transformation and multidimensional well-being using cross-country panel data. The analysis is based on data from the World Development Indicators (World Bank, 2023) database compiled by the World Bank, covering the period from 2000 to 2023. The final sample consists of an unbalanced panel of 150 countries, determined by data availability across all variables included in the analysis.

The dependent variable is a composite index of multidimensional well-being constructed using principal component analysis (PCA). This approach allows for the aggregation of multiple dimensions of welfare into a single index while minimizing information loss and avoiding arbitrary weighting schemes (Jolliffe, 2025). Specifically, the index incorporates indicators of life expectancy, education, physician density, and homicide rates, capturing key aspects of health, human capital, and security (Table A1). Prior to estimation, the homicide variable is transformed to ensure that higher values consistently reflect higher levels of well-being.

PCA is conducted on standardized variables to ensure comparability across indicators measured on different scales. The first principal component is retained as the well-being index, as it explains the largest share of total variance in the data. This approach is widely used in the literature to construct composite indicators of development and welfare (Filmer & Pritchett, 2001; Vyas & Kumaranayake, 2006).

The first component is retained following the standard Kaiser criterion (eigenvalue greater than one), which in this case corresponds to the component explaining the largest share of variance reported in Table 1. All four indicators load positively on this component, consistent with a common underlying well-being dimension; the corresponding factor loadings are reported alongside the variance decomposition in Table 1 to allow readers to assess the relative contribution of each indicator to the index.

The main explanatory variables capture different dimensions of structural transformation. Industrialization is proxied by the share of industry in gross domestic products, reflecting the extent to which economic activity is concentrated in manufacturing and related sectors. Urbanization is measured as the percentage of the population living in urban areas, capturing spatial transformation and access to infrastructure and services. Human capital is proxied by secondary school enrollment rates, representing the accumulation of educational attainment. Finally, GDP per capita (in constant terms) is included as a control variable to account for overall economic development.

Table 1. (a) Principal Component Analysis Results. (b) Factor Loadings of Well-Being Indicators on the First Principal Component.

(a)			
Component	Standard Deviation	Proportion of Variance	Cumulative Proportion
PC1	1.5496	0.6003	0.6003
PC2	0.9432	0.2224	0.8227
PC3	0.6701	0.1123	0.9350
PC4	0.5099	0.0650	1.000
(b)			
Indicator		Loading on PC1	
Life expectancy		0.83	
Education		0.81	
Physician density		0.79	
Homicide rate (inverted)		0.72	

Note: All four indicators load positively and substantially on the first principal component, with life expectancy and education contributing the largest weights, followed by physician density and the inverted homicide rate. This pattern supports the interpretation of PC1 as a common well-being dimension combining health, human capital, and security.

It is worth clarifying that education enters the analysis in two conceptually distinct ways: as a component of the well-being index, where it is proxied by an outcome-oriented indicator of educational attainment, and as an explanatory variable, where it is proxied by secondary school enrollment, a flow measure of current educational participation. Although both indicators relate to human capital, they capture different aspects of it, and this distinction is maintained throughout the analysis to avoid conflating the dependent and explanatory dimensions of education. Nevertheless, the partial conceptual overlap between these two indicators is acknowledged as a limitation of the current specification.

The analysis is conducted on a single pooled sample of 150 countries spanning a wide range of income levels and stages of development. This choice follows common practice in cross-country panel studies of well-being, but it implicitly assumes that the relationships between structural transformation and well-being are homogeneous across very different economies, an assumption that is not formally tested here and is revisited as a limitation in Section 8.

The empirical strategy combines static and dynamic panel data models to account for unobserved heterogeneity, persistence, and potential endogeneity. As a first step, the study estimates a fixed-effects (FE) model, which controls for time-invariant country-specific characteristics that may influence well-being. The FE estimator exploits within-country variation over time, thereby eliminating bias arising from unobserved heterogeneity correlated with the explanatory variables (Wooldridge, 2010). Time fixed effects are also included to capture common shocks affecting all countries in a given year, such as global economic cycles or technological changes.

The choice of the fixed-effects model over random effects is supported by the Hausman test, which indicates that the null hypothesis of no systematic difference between estimators is rejected. This suggests that country-specific effects are correlated with the regressors, making the fixed-effects specification more appropriate (Hausman, 1978).

While the FE model provides consistent estimates under strict exogeneity assumptions, it does not account for the dynamic nature of well-being. To address this limitation, the analysis is extended to a dynamic panel framework by including the lagged dependent variable as a regressor. This specification captures persistence in well-being and allows for a more realistic representation of its temporal evolution. However, the inclusion of a

lagged dependent variable introduces endogeneity due to correlation with the error term, rendering standard estimators biased and inconsistent.

To overcome this issue, the study employs the System Generalized Method of Moments (System GMM), as developed by [Arellano and Bover \(1995\)](#) and [Blundell and Bond \(1998\)](#). This estimator combines equations in levels and first differences, using internal instruments derived from lagged values of the variables. System GMM is particularly suitable for panels with a large number of cross-sectional units and a relatively short time dimension, as is the case in this study ([Roodman, 2009](#)).

In the estimation, the lagged dependent variable is treated as endogenous and instrumented using its second and third lags. The remaining explanatory variables are treated as predetermined or weakly exogenous, consistent with the assumption that they may be influenced by past shocks but are not contemporaneously correlated with the error term. To avoid instrument proliferation, which can weaken the validity of overidentification tests, the instrument matrix is collapsed following standard practice in the literature ([Roodman, 2009](#)).

The classification of industrialization, urbanization, education, and GDP per capita as predetermined rather than strictly exogenous reflects the assumption that these structural variables may respond to past realizations of well-being (for example, through policy feedback or resource reallocation) even though they are not expected to react contemporaneously to current shocks in the error term. The second and third lags are used as instruments for the lagged dependent variable because the first lag is mechanically correlated with the differenced error term, while deeper lags reduce instrument relevance without materially improving validity; this choice follows standard practice in the System GMM literature and is applied consistently across specifications to support replication.

The validity of the dynamic panel model is assessed using standard diagnostic tests. The Arellano–Bond test for autocorrelation is used to examine the presence of serial correlation in the error terms. While first-order autocorrelation is expected in first-differenced equations, the absence of second-order autocorrelation is required for the consistency of the estimator ([Arellano & Bond, 1991](#)). In addition, the Sargan test of overidentifying restrictions is employed to assess the validity of the instruments. Although the results suggest some limitations in instrument validity, this is not uncommon in macro panel applications involving highly persistent and endogenous variables.

Given these considerations, the dynamic model is interpreted as a robustness check rather than the primary source of inference. The main results are based on the fixed-effects estimates, while the System GMM results are used to evaluate the role of persistence and to assess the sensitivity of the findings to endogeneity and dynamic adjustments.

Cross-sectional dependence, panel unit root tests, and structural break tests were not formally applied to the panel series in the present analysis. Given the global scope of the sample and the long time span covered, common shocks and structural breaks affecting subsets of countries cannot be ruled out, and their absence from the diagnostic battery is acknowledged here as a methodological limitation and an avenue for future refinement of the model, discussed further in Section 8.

4. Results

The construction of the multidimensional well-being index is based on principal component analysis (PCA) applied to four standardized indicators: life expectancy, education, physician density, and homicide rates (inverted). The results indicate that the first principal component explains a substantial proportion of the total variance, supporting its use as a composite indicator of well-being.

As shown in Table 1, the first principal component captures approximately 60% of the total variance, indicating a strong latent structure underlying the selected indicators. This result confirms that the constructed index provides a consistent and parsimonious measure of multidimensional well-being.

The baseline results are obtained using a fixed-effects model with time controls, which accounts for unobserved country-specific heterogeneity and global shocks. The Hausman test strongly supports the use of fixed effects over random effects, indicating that unobserved country characteristics are correlated with the explanatory variables.

The results reported in Table 2 indicate that education has a positive and highly statistically significant effect on well-being. The magnitude of the coefficient suggests that improvements in educational attainment are strongly associated with increases in multidimensional well-being within countries over time. Similarly, urbanization exhibits a positive and statistically significant effect, indicating that higher levels of urban population are associated with better well-being outcomes.

Table 2. Fixed Effects Estimation Results.

Variable	Coefficient	Std. Error	t-Value	p-Value
Industry	−0.00105	0.00195	−0.541	0.589
Urbanization	0.00766	0.00250	3.069	0.002
GDP per capita	0.00000125	0.00000215	0.582	0.561
Education	0.02376	0.00082	28.917	<0.001

Note: Model statistics: $R^2 = 0.804$; adjusted $R^2 = 0.780$; F-statistic = 217.754 ($p < 0.001$).

In contrast, industrialization does not show a statistically significant relationship with well-being, suggesting that the share of industry in economic activity does not directly translate into welfare improvements. Likewise, GDP per capita is not statistically significant, reinforcing the idea that income alone may not adequately capture broader dimensions of well-being.

The relatively high R^2 (0.804) indicates that the model explains a substantial portion of the within-country variation in well-being, suggesting that the included variables, together with time effects, capture relevant dynamics in the data.

To account for persistence and potential endogeneity, the analysis is extended to a dynamic panel framework estimated using System GMM. This specification includes the lagged dependent variable, allowing for a more realistic representation of well-being dynamics.

As shown in Table 3, the lagged dependent variable is positive and highly significant, with a coefficient close to unity. This result indicates a strong degree of persistence in well-being over time, suggesting that current levels of well-being are largely determined by past conditions.

Table 3. System GMM Estimation Results.

Variable	Coefficient	Std. Error	z-Value	p-Value
Lagged well-being	0.9705	0.0746	13.01	<0.001
Industry	0.00285	0.00666	0.428	0.668
Urbanization	−0.00439	0.00403	−1.088	0.277
GDP per capita	0.00000096	0.00000298	0.323	0.747
Education	0.00268	0.00307	0.873	0.383

A coefficient of this magnitude (0.97) is close enough to unity that it also raises the possibility of a near unit-root process, which would have implications for the stability, long-

run interpretation, and mean-reversion properties of the estimated model. This possibility is not fully explored in the present analysis and is noted explicitly as an interpretive caveat and a direction for further diagnostic testing.

In contrast to the fixed-effects results, none of the structural variables—industrialization, urbanization, education, or GDP per capita—are statistically significant in dynamic specification. This finding implies that the effects observed in the static model may be driven by omitted dynamics or endogeneity, and that once these factors are properly accounted for, the direct impact of structural variables on well-being is no longer statistically distinguishable from zero in the applied dynamic specification. The validity of the System GMM estimates is evaluated using standard diagnostic tests.

The results reported in Table 4 indicate that the AR(1) test is significant, as expected in first-differenced models, while the AR(2) test is not statistically significant at the 5% level, suggesting the absence of second-order serial correlation. This supports the consistency of the estimator. However, the Sargan test rejects the null hypothesis of instrument validity at conventional significance levels, indicating potential limitations in the instrument set. This issue is not uncommon in macro panel applications involving highly persistent and endogenous variables. Consequently, the dynamic results should be interpreted with caution and considered as a robustness check rather than definitive evidence.

Table 4. System GMM Diagnostic Tests.

Test	Statistic	<i>p</i> -Value
Arellano-Bond AR(1)	−4.52	<0.001
Arellano-Bond AR(2)	−1.70	0.089
Sargan test	13.87	0.031

Because the instrument set fails this overidentification test, the System GMM coefficients reported above—including the estimated persistence parameter—are presented as suggestive rather than fully validated, and any interpretation of them as definitive evidence of path dependence should be tempered accordingly.

Taken together, the results reveal a clear contrast between static and dynamic specifications. While the fixed-effects model suggests that education and urbanization are significant determinants of well-being, these effects disappear once persistence and endogeneity are explicitly accounted for. The dynamic model instead points to a substantial degree of path dependence, suggesting that well-being is closely tied to its own historical trajectory; however, given the instrument validity concerns noted above, this pattern is best read as suggestive of specification sensitivity rather than as conclusive evidence that contemporaneous structural changes play no role.

5. Discussion

The empirical findings of this study offer a refined perspective on the relationship between structural transformation and multidimensional well-being, particularly when comparing static and dynamic modeling approaches. The fixed-effects results initially suggest that education and urbanization exert positive and statistically significant effects on well-being, whereas industrialization and GDP per capita do not show robust associations. However, these relationships disappear once persistence and endogeneity are addressed through the dynamic System GMM framework. This contrast is central to interpreting the validity of the proposed hypotheses.

It is worth clarifying how the two specifications are weighted in the discussion that follows. As stated in the Methodology, the fixed-effects results are treated as the primary source of inference, while the System GMM results are used as a robustness check given the

diagnostic concerns raised by the Sargan test. Accordingly, the dynamic findings discussed below—including the evidence on persistence—are presented as an important, but not conclusively validated, complement to the fixed-effects evidence, rather than as the central finding of the study.

With respect to H1, which posits that structural transformation variables positively influence well-being, the evidence is weak. While urbanization appears significant in the static specification, its effect becomes statistically insignificant in the dynamic model. Industrialization is consistently insignificant across both specifications. These findings are consistent with recent literature questioning the universal welfare benefits of structural transformation. For instance, [Haraguchi et al. \(2017\)](#) show that manufacturing-led growth does not necessarily translate into broad welfare gains in late-developing economies. Similarly, [Rodrik \(2017\)](#) highlights the phenomenon of premature deindustrialization, whereby structural change occurs without sustained productivity growth. Recent cross-country analyses further indicate that sectoral shifts may fail to improve welfare when they are not accompanied by institutional strengthening or technological upgrading ([De Vries et al., 2015](#); [Lavopa & Szirmai, 2014](#)). Urbanization exhibits similar ambiguity: while it may foster agglomeration economies, it can also exacerbate inequality and social fragmentation ([Behrens & Robert-Nicoud, 2014](#); [Castells-Quintana, 2018](#)). Thus, the results suggest that structural transformation alone is insufficient to generate direct improvements in well-being, providing only partial support for H1.

Regarding H2, which proposes a positive relationship between human capital and well-being, the results again offer limited support. Education is highly significant in the fixed-effects model, aligning with extensive empirical evidence linking human capital to improved welfare outcomes. Studies such as [Chetty et al. \(2014\)](#) and [Case and Deaton \(2021\)](#) demonstrate that education strongly correlates with life expectancy, income stability, and social mobility. Moreover, human capital is widely recognized as a key mechanism enabling individuals to benefit from structural transformation ([Autor, 2014](#); [Gollin et al., 2016](#)). However, the disappearance of significance in the dynamic model suggests that the observed relationship is not contemporaneous but rather reflects accumulated long-term effects. This interpretation is consistent with findings from [Benhabib and Spiegel \(2005\)](#) and [Cervellati and Sunde \(2005\)](#), who show that the impact of education on development outcomes materializes through slow-moving institutional and demographic processes. Therefore, while H2 is supported in static terms, it is not robust under dynamic estimation.

It should be noted that this cumulative-effects interpretation is not directly tested by the empirical model; it is offered as a plausible reading of the contrast between the static and dynamic results rather than as an empirical finding in its own right.

The strongest evidence is found for H3, which hypothesizes that the inclusion of dynamic persistence reduces or eliminates the statistical significance of structural determinants. The System GMM results are consistent with this hypothesis, although this should be read as suggestive rather than conclusive given the instrument validity concerns discussed below. The lagged dependent variable is highly significant, with a coefficient approaching unity, indicating that well-being is a highly persistent and path-dependent process. This result is consistent with recent literature emphasizing the role of historical trajectories and cumulative dynamics in shaping socio-economic outcomes ([Acemoglu & Robinson, 2019](#); [Milanovic, 2016](#); [Piketty, 2014](#)). Studies on life satisfaction and well-being also highlight persistence driven by adaptation mechanisms and institutional continuity ([Clark et al., 2008](#); [Powdthavee, 2010](#); [Tella & MacCulloch, 2006](#)).

This support should nonetheless be qualified: because H3 essentially predicts that adding a highly autocorrelated lagged dependent variable will absorb the explanatory power of other regressors, its confirmation is, to some extent, a near-mechanical conse-

quence of the model specification rather than a strong independent theoretical result, and is interpreted accordingly.

The divergence between static and dynamic results also reflects broader econometric concerns. Static panel models may overstate relationships due to omitted dynamics and reverse causality (Baltagi, 2021; Nickell, 1981). The disappearance of significance in the GMM framework supports the argument that conventional estimators may produce biased results when persistence is ignored. This finding aligns with recent critiques in macro-panel econometrics emphasizing the need for dynamic modeling to properly identify causal relationships (Bun & Sarafidis, 2015; Everaert & Pozzi, 2007).

The lack of significance of GDP per capita across both models further reinforces the limitations of income-based measures of welfare. This result is consistent with a growing literature demonstrating that economic growth does not necessarily translate into improvements in well-being, particularly in the presence of inequality and institutional constraints (Deaton, 2016; Fleurbaey & Blanchet, 2013; Stiglitz et al., 2009). Multidimensional approaches to well-being, such as those adopted in this study, provide a more comprehensive framework for understanding welfare dynamics beyond income alone (Alkire et al., 2015; Decancq & Lugo, 2013).

Overall, the findings suggest that structural transformation variables—industrialization, urbanization, and human capital—do not exert strong direct effects on well-being in the short run. Instead, their influence appears to be mediated by long-term structural and institutional processes. This interpretation is supported by recent research emphasizing the complexity and non-linearity of development trajectories (Aghion et al., 2021; Hausmann et al., 2007; Rodrik, 2017). Consequently, the results call for a reconsideration of standard empirical approaches and highlight the importance of persistence, endogeneity, and multidimensional measurement in the analysis of well-being.

6. Implications

The findings of this study carry important implications for both academic research and public policy, particularly in the context of development strategies aimed at improving multidimensional well-being. The central result—that well-being is highly persistent and not directly driven by contemporaneous structural transformation variables—suggests a need to reconsider conventional assumptions about the mechanisms through which development policies affect welfare outcomes.

From a theoretical and empirical perspective, the results highlight the limitations of static modeling approaches in the analysis of well-being. The disappearance of significant effects for education and urbanization in the dynamic specification suggests that many empirical findings in the literature may be sensitive to model specification, particularly when persistence and endogeneity are not adequately addressed. This reinforces the importance of adopting dynamic panel data techniques in development research, as these allow for a more accurate representation of temporal processes and reduce the risk of biased inference (Bond, 2002; Roodman, 2009). Moreover, the strong persistence observed in well-being aligns with recent advances in the literature emphasizing path dependence and the cumulative nature of development processes (Acemoglu & Robinson, 2019; Aghion et al., 2021). Future research should therefore prioritize dynamic frameworks and explore non-linearities, threshold effects, and interaction mechanisms that may better capture the complexity of structural transformation.

From a policy perspective, the results suggest that structural transformation alone—whether through industrialization or urbanization—is unlikely to generate immediate improvements in well-being. While these processes remain important for long-term economic development, their direct short-term effects on welfare appear limited. This finding is

consistent with recent evidence indicating that structural change does not automatically lead to inclusive or welfare-enhancing outcomes, particularly in contexts characterized by weak institutions or unequal access to opportunities (Diao et al., 2019; McMillan et al., 2014; Rodrik, 2017). As a result, policymakers should avoid over-reliance on sectoral transformation as a standalone strategy for improving living conditions.

This recommendation should be read with an important qualification: the absence of a statistically significant short-term effect of structural transformation in the dynamic specification, particularly given the instrument validity concerns discussed above, is not equivalent to evidence that structural transformation has no effect on well-being. The more defensible reading of the results is that no robust short-term effect was identified under the applied specification, not that such an effect does not exist.

Instead, the results underscore the importance of long-term, complementary investments, particularly in human capital and institutional quality. Although education does not retain statistical significance in the dynamic model, its strong association in the static specification and its well-documented role in the literature suggest that its effects are cumulative and operate over extended time horizons (Hanushek & Woessmann, 2023; Psacharopoulos & Patrinos, 2018). This implies that education policies should be viewed as long-term investments rather than short-term interventions, with benefits that materialize gradually through improvements in productivity, health, and social mobility.

The strong persistence of well-being also has important implications for policy timing and sequencing. If current well-being levels are largely determined by past conditions, then early interventions become crucial. Policies targeting health, education, and social protection in earlier stages of development may have long-lasting effects, reinforcing the idea that initial conditions play a fundamental role in shaping future outcomes (Currie & Almond, 2011; Heckman, 2006). This perspective supports the prioritization of early-life investments and long-term development planning.

From a practical standpoint, these findings can inform how development organizations and national governments structure their decision-making processes. Because well-being is shown to be highly persistent, resource allocation decisions benefit from being framed as long-term commitments rather than annual or electoral-cycle interventions: budgeting frameworks that lock in multi-year funding for health and education programs, monitoring systems that track cumulative rather than only year-on-year progress, and institutional arrangements that protect early-life and human-capital investments from short-term budget cuts are all more consistent with the persistence documented here than approaches built around expectations of immediate, structural-transformation-driven gains. This suggests a management approach that treats well-being outcomes as a long-horizon investment problem, prioritizing the efficient and sustained allocation of resources toward human capital and institutional quality over the pursuit of short-term structural indicators.

These implications extend naturally to territorial and urban management. Since urbanization is one of the structural dimensions considered here, local and regional authorities responsible for managing urban growth can draw on the persistence of well-being documented in this study to justify sustained, rather than short-term, investment in the infrastructure and services that support quality of life in cities. This is also relevant for destination management, insofar as territories that rely on tourism or place-based development strategies benefit from treating resident well-being as a long-term asset to be cultivated alongside, rather than subordinated to, short-run visitor-driven growth objectives.

From a destination marketing perspective, the results also suggest that place-branding strategies should not rely exclusively on short-term visitor attraction, but should incorporate resident well-being, urban quality of life, and long-term territorial sustainability as core elements of destination competitiveness.

Furthermore, the lack of significance of GDP per capita reinforces the growing consensus that economic growth alone is not sufficient to improve well-being. This finding aligns with multidimensional approaches to development, which emphasize the importance of health, education, inequality, and institutional factors in shaping welfare outcomes (Fleurbaey & Blanchet, 2013; Stiglitz et al., 2009). Policymakers should therefore adopt broader evaluation frameworks that go beyond income-based indicators and incorporate multiple dimensions of well-being in the design and assessment of development strategies.

Finally, the results suggest that the impact of structural transformation on well-being may be indirect and mediated by other factors, such as institutional quality, governance, and technological capabilities. This opens important avenues for future research and policy design, particularly in exploring how these mediating variables interact with structural change to produce long-term welfare improvements (Acemoglu, 2008; Rodrik, 2013).

It should be acknowledged that some of the recommendations above, particularly those emphasizing early-life interventions, are grounded in the broader literature on human capital formation rather than derived directly from the results of this study; they are included here as complementary policy context rather than as findings generated by the present data.

In sum, the findings of this study imply that improving well-being requires a long-term, multidimensional, and institutionally grounded approach. Structural transformation remains a necessary component of development, but it is not sufficient on its own. Sustainable improvements in well-being depend on cumulative processes, early interventions, and the interaction between economic, social, and institutional factors.

7. Conclusions

This study reexamines the relationship between structural transformation and multidimensional well-being using a combined static and dynamic panel data approach. The results provide a consistent message: while traditional determinants such as education and urbanization appear significant in fixed-effects models, their effects vanish once persistence and endogeneity are properly accounted for. Instead, well-being is shown to be highly persistent and largely driven by its own past levels, highlighting the importance of path dependence in development processes.

This should be understood as evidence of high persistence rather than as proof that a single mechanism dominates well-being outcomes; the results are consistent with, but do not by themselves establish, a strictly primary role for historical trajectories over all other determinants.

In relation to the proposed hypotheses, the findings offer only partial support for **H1** and **H2**, and preliminary, suggestive support for **H3**. Structural transformation variables—industrialization and urbanization—do not exhibit robust effects on well-being, particularly in the dynamic specification. This challenges conventional views that sectoral shifts and spatial transformation directly translate into welfare improvements (Rodrik, 2017; Timmer et al., 2015). Similarly, while human capital shows a strong association with well-being in the static model, its lack of significance in the dynamic framework suggests that its impact is largely cumulative and long-term rather than contemporaneous (Hanushek & Woessmann, 2023; Psacharopoulos & Patrinos, 2018). By contrast, the high persistence of well-being lends preliminary support to **H3**, indicating that welfare outcomes are shaped by historical trajectories and structural conditions that evolve gradually over time (Acemoglu & Robinson, 2019; Clark et al., 2008).

As discussed in Section 5, this confirmation should be interpreted cautiously: it partly reflects the mechanical tendency of a highly autocorrelated lagged dependent variable to

absorb the significance of other regressors, and it rests on System GMM estimates whose instruments do not fully pass the overidentification test.

These findings contribute to the literature by demonstrating that static empirical models may overstate the influence of structural variables when dynamic processes are ignored. This aligns with methodological critiques emphasizing the importance of accounting for persistence and endogeneity in panel data analysis (Bond, 2002; Roodman, 2009). More broadly, the results reinforce the growing consensus that economic growth and structural change are not sufficient conditions for improving well-being, particularly when institutional quality, inequality, and social factors are not adequately considered (Fleurbaey & Blanchet, 2013; Stiglitz et al., 2009).

From a policy perspective, the findings suggest that short-term structural changes are unlikely to produce immediate improvements in well-being. Instead, sustained investments in human capital, institutional development, and long-term social policies are more likely to generate meaningful welfare gains. The strong persistence observed in well-being also implies that early interventions and long-term strategies are crucial, as initial conditions can have lasting effects on development trajectories.

In conclusion, this study highlights the need to rethink the determinants of well-being by moving beyond static frameworks and incorporating dynamic perspectives. By doing so, it provides a more realistic understanding of how structural transformation interacts with long-term development processes, offering valuable insights for both researchers and policymakers.

8. Limitations and Future Research

While this study provides new evidence on the relationship between structural transformation and multidimensional well-being, several considerations help contextualize the results. First, the analysis relies on an unbalanced cross-country panel derived from the World Development Indicators. Although this allows for broad coverage, differences in data availability across countries and years may affect comparability. Nevertheless, this type of dataset is widely used in macro-development research and provides a reasonable basis for identifying general patterns.

Second, the multidimensional well-being index is constructed using principal component analysis (PCA), which offers a transparent and data-driven way to combine multiple indicators. However, as with any composite measure, the results may depend on the specific variables included and their statistical properties. Future research could explore alternative constructions of well-being, including expanded dimensions or different weighting approaches, to assess the robustness of the findings (Decancq & Lugo, 2013).

Third, the dynamic panel approach using System GMM is well suited to addressing persistence and endogeneity, but its performance can be sensitive to instrument specification. The diagnostic results suggest that, while the model captures key dynamics, there is scope for further refinement in instrument selection and model specification. This does not invalidate the fixed-effects associations, but it substantially limits the inferential weight that can be assigned to the dynamic GMM estimates (Roodman, 2009).

More specifically, the Sargan test rejects the null hypothesis of instrument validity at conventional significance levels. This is a more serious issue than a matter of further refinement: it represents a genuine threat to the validity of the System GMM estimates, and by extension to any conclusions that rely on them, including the interpretation of the lagged well-being coefficient as strong evidence of path dependence. Relatedly, the magnitude of this coefficient (0.97) is close enough to unity to raise the possibility of a near unit-root process, which has direct implications for the interpretability and long-run stability of the dynamic model and is not further addressed in the current analysis. Both

issues should be regarded as substantive limitations of the dynamic results rather than as minor technical caveats.

An additional limitation concerns the assumption of homogeneity across a global sample of 150 countries spanning very different income levels and stages of development. The pooled specification used here does not allow the relationships between structural transformation and well-being to vary systematically between developed and developing economies. This is a substantive limitation of the current results, not merely a direction for future work, since unmodeled heterogeneity of this kind could affect both the magnitude and the interpretation of the estimated coefficients.

Finally, the study focuses on direct relationships between structural transformation variables and well-being. It is plausible that these effects operate through intermediate channels, such as institutional quality, inequality, or technological change, which are not explicitly modeled here. Incorporating these mechanisms could provide a more detailed understanding of the pathways through which structural change influences welfare (Acemoglu & Robinson, 2013).

Future research could build on this work by extending the set of explanatory variables, exploring non-linear relationships, and examining heterogeneous effects across regions or income groups. Additionally, alternative empirical strategies and longer time horizons may further enrich the analysis of well-being dynamics and structural transformation.

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Appendix A

Table A1. Variable Definitions and Data Sources.

Variable	Definition	Unit	WDI Indicator Code	Transformation	Role in Model
Life expectancy	Life expectancy at birth, total	Years	SP.DYN.LE00.IN	Standardized (z-score)	Component of well-being index (PCA)
Education (index component)	Adult literacy rate, total	% of people ages 15+	SE.ADT.LITR.ZS	Standardized (z-score)	Component of well-being index (PCA)
Physician density	Physicians per 1000 people	Per 1000 people	SH.MED.PHYS.ZS	Standardized (z-score)	Component of well-being index (PCA)
Homicide rate	Intentional homicides	Per 100,000 people	VC.IHR.PSRC.P5	Standardized (z-score); sign inverted so higher values indicate greater security	Component of well-being index (PCA)
Industrialization (INDit)	Industry (including construction), value added	% of GDP	NV.IND.TOTL.ZS	None	Explanatory variable (structural transformation)

Table A1. Cont.

Variable	Definition	Unit	WDI Indicator Code	Transformation	Role in Model
Urbanization (URBit)	Urban population	% of total population	SP.URB.TOTL.IN.ZS	None	Explanatory variable (structural transformation)
Education (explanatory, EDUit)	School enrollment, secondary	% gross	SE.SEC.ENRR	None	Explanatory variable (human capital)
GDP per capita (GDPit)	GDP per capita	Constant 2015 US\$	NY.GDP.PCAP.KD	None	Control variable

Note: All variables are drawn from the World Development Indicators (World Bank, 2023). The well-being index combines the first four rows through principal component analysis; the remaining rows enter the empirical models in Equations (1) and (2) as structural, human-capital, and control variables, respectively.

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