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Is There a Link between Remittances, Capital Formation, Structural Transformation and Economic Growth? A Dynamic Panel Analysis for Latin America under the PVAR Approach

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Abstract: The literature has mainly focused on analyzing the relationship of remittances with economic growth and social welfare, neglecting more complex aspects where remittances can have relevant implications. To contribute to the literature, the objective of this research is to examine the dynamic relationship between remittances, capital formation, structural transformation and economic growth in 15 Latin American countries during the period 1996–2019. To meet the objective, a panel vector autoregressive regression (PVAR) model was estimated, focusing on the analysis of the impulse-response function and variance decomposition. The results show a positive effect of remittances on economic growth and capital formation and a negative effect of remittances on structural transformation for initial periods and positive for later periods, framing a non-linear relationship. In addition, it was determined that structural transformation does not have a significant impact on economic growth. Finally, it was found that capital formation has a partial positive effect on economic growth. It is concluded that public policies should generate support mechanisms for the efficient channeling of these resources so that they become engines of growth.

Keywords: remittances; capital formation; structural transformation; economic growth; PVAR

JEL Classification: F24; E22; F43

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1. Introduction

Historical patterns of economic and social development have been characterized by a complex structural transformation (Saviotti and Pyka 2013). This transformation involves the reorganization of economic activities between the agricultural, manufacturing and service sectors, both at the aggregate level and disaggregated by each sector (Herrendorf et al. 2014). The main rationale for this shift lies in the transition to a modern economy, with the transfer of resources from labor-intensive and low-efficiency activities to capital-intensive ones with higher efficiency and productivity (Tasneem and Khan 2024). As a result of this transition, an increase in the overall productivity of the economy is generated (Vu 2017). However, this transformation, leading to the creation of sophisticated production lines that diversify the value chain, is based on a continuous process of incremental changes that requires optimal channeling of resources (Khan 2020; Rohit 2023).

A significant body of the literature has supported the positive effects of structural transformation on economic conditions. These developments have led to a marked improvement in living wages and an increase in labor productivity and output. Taken together, these factors have had a determining impact on the dynamics of economic growth and development (Lewis 1954; Chenery 1960; Kaldor 1966; Chenery and Syrquin 1980; Chenery 1982; Kuznets 1973; Young 1995; Berthélemy and Söderling 2001; Li 2009; Keho 2018). One of

the most influential studies in this area was developed by Denison (1967), who, using decomposition techniques, determined that the reallocation of resources from agricultural to non-agricultural activities was one of the main factors that contributed to explain why the United States outperformed the United Kingdom in terms of growth between 1950 and 1962. Nelson and Pack (1999) showed that the accelerated growth of several Asian economies in the 1960s was driven by the growth of the modern sector. In a recent perspective, Vu (2017), by developing a novel measure of effective structural change focusing on Asian economies, reinforced the hypothesis that reallocation of productive resources drives GDP growth through productivity growth.

Since the last wave of globalization in the 1980s, which brought about a reorganization of the productive system, developing countries experienced relatively positive economic performance (Were 2015). According to World Bank data (WDI 2022b), during the period from 1980 to 2019, upper middle-income and middle-income countries grew at an average rate of over 4% per year. During this period, the share of the agricultural sector in the GDP of developing countries declined from about 17% in 1980 to 7% in 2019 (WDI 2022a). In contrast, the modern sector, especially the service sector, became more relevant and experienced high growth (Abbas et al. 2023). For example, in Asia, agricultural employment declined from 48% in the early 1960s to 21% in 2010, while employment in the service sector showed continuous growth, exceeding 50% in 2010 (Matthess and Kunkel 2020). In the case of India, agriculture went from accounting for 36% of value added in 1980 to 17.9% in 2011, at the same time as employment in this sector declined from 69.8% to 48.1% (Erumban et al. 2019). On the other hand, countries such as Pakistan and Bangladesh exhibited inferior economic performance compared to other Asian economies during the period from 1970 to 2012, characterized by mild contractions in the agricultural sector (Vu 2017). Moreover, in many developing countries, the low-productivity agricultural sector has remained expanding, becoming one of the main factors behind limited economic growth (Gollin 2010).

Despite these advances, structural transformation has lost momentum in developing countries in recent years, resulting in stagnant industrialization and hindering economic development processes (Haraguchi et al. 2017; Ibrahim 2020). Latin American countries have not been oblivious to this trend, since although the agricultural sector in the last decade has maintained a low average share of GDP (5.75%), the industrial sector has been weakening, from representing 36% of GDP in the late 1980s to 29% in 2020, while the services sector has not undergone significant changes (WDI 2022a, 2022e, 2022g).

Given the dynamic implications of structural transformation in the economy, there has been a growing interest in understanding what factors are associated with this process. Pasinetti (1983) identified that income elasticities of demand significantly influence patterns of structural transformation. This implies that changes in consumer income affect output levels across sectors. Under this premise, Święcki (2017) built a quantitative model to determine the main driving forces of structural change and found that non-homothetic preferences are the second most important channel, only behind sector-biased technological progress, explaining this change. So, as incomes increase, households tend to restructure their expenditures, allocating fewer resources to agricultural products and more toward services. Moreover, as these incomes rise, there is the potential for resources to be channeled into investment, improving economic efficiency and driving structural change (Harada 2015).

In this context, remittances can be related to structural transformation in at least two ways. First, remittances allow stabilizing household consumption and, subsequently, redirecting their budget towards value-added goods (Combes and Ebeke 2011; Kikkawa et al. 2024). Thus, under the income elasticity of demand approach and non-homothetic preferences, remittances could influence structural transformation. Second, remittances by relieving budgetary pressures incentivize the transfer of capital from rural to urban areas, generating an increase in productive investments (Manic 2017). In this way, remittances could be related to structural transformation by improving consumption and investment levels. However, although the literature recognizes that remittances improve the conditions

of recipient households, the debate of their effects on economic development is still ongoing (Acosta et al. 2009; Cazachevici et al. 2020). In this sense, studies such as that of Qutb (2022) point out that if remittances are destined to activities that are not very productive, their effects tend to be negative in the long term on economic growth. Thus, a high dependence on remittances could have adverse effects on the economy, similar to the "Dutch disease". Guha (2013) points out that an increase in the flow of remittances results in an increase in the demand for non-tradable goods. This increase causes the prices of these goods to increase compared to tradable goods, which can trigger a shift of labor from the tradable goods sector to the non-tradable sector. In the long run, this dynamic may lead to a contraction of the manufacturing and tradable sector, thus stalling the structural transformation process.

Despite the relevance of this topic, so far, the relationship between remittances and capital formation and their possible implications for structural transformation has not been studied jointly, thus neglecting the complex interaction of these variables at the macroeconomic level. Given the current challenges related to economic development processes, this research seeks to somewhat fill this gap by focusing on the case of Latin America. The economic, social and political instability that the region has faced have been causal for international migration patterns, which intensified since the 1980s with the process of economic liberalization (Delgado-Wise 2014). Since then, remittances have grown steadily from 0.58% of GDP in 1981 to 2.61% in 2021 (WDI 2022f). Thus, remittances have positioned themselves as one of the main sources of external financing for the Latin American region, causing countries such as Honduras, Guatemala and the Dominican Republic to become dependent on these resources (Ekanayake and Moslare 2020). At the same time, structural change in the region has been heterogeneous. The industrial sector in Argentina went from representing 40% of GDP in 1981 to approximately 23% in 2021. Similarly, in countries such as Colombia, Bolivia and Brazil, industry has weakened. On the other hand, Ecuador, Paraguay, Peru, Mexico and Honduras have experienced an increase in their industrial sector, but of low magnitudes (WDI 2022e). The services sector has made the largest contribution to GDP, with an average of 59% between 1989 and 2021 (WDI 2022g).

To broaden the debate on the impact of remittances on economic development, the objective of this research is to shed light on the dynamic relationship between remittances, capital formation, structural transformation and economic growth in 15 Latin American countries over the period 1996–2019. This research seeks to contribute to the literature in three key ways. First, it analyzes the dynamic relationship between the variables, delving into issues that are often not captured in traditional static analyses. Second, it explores the possible effect of remittances on structural transformation, looking specifically at the value added of industry and services as percentages of GDP, as well as examining the interconnectedness of these with capital formation (gross fixed capital formation % GDP) and economic growth (GDP per capita at constant 2010 prices). Finally, the research provides robust empirical evidence for public policy makers, providing information that allows them to design strategies that help the regional economy to productively absorb these resources, avoiding possible growth traps, i.e., growth at low rates. To achieve these objectives, methodologically, a Panel Vector Autoregressive Regression (PVAR) model is estimated, whose main implications are centered on the analysis of the impulse-response function and variance decomposition, which allow determining changes in a variable in the face of a shock in another variable of the system.

This article is organized as follows. Section 2 presents a brief review of the relevant literature, the gaps in the literature and the hypotheses. Section 3 presents the study data and the methodology used. Section 4 presents the results and discussion of the results. Section 5 contains the conclusions and some key recommendations.

2. Review of the Literature

2.1. Structural Transformation and Economic Growth

In economic theory, various approaches and postulates have attempted to explain the different determinants of long-term economic growth. Among them, structural transformation emerges as an important driver of development by facilitating increased productivity and economic efficiency in the reallocation of resources across sectors (Kurose 2021). Clark (1940) was one of the first to outline aspects of structural transformation, highlighting the differential in productivity changes during sectoral transition. This shift from an agricultural to an industrial and then to a tertiary economy promotes productivity, a crucial element of economic development (Kurose 2021).

Lewis (1954) formalized the dual economy model of two sectors, a traditional one of low efficiency and a modern one of higher productivity. This model assumes an unlimited labor force in the traditional sector, which allows migration to the modern sector without affecting the production level of the traditional sector. As labor migration increases, the high-productivity modern sector expands, positively influencing economic growth (Gabardo et al. 2017). Along these lines, Kuznets (1973) emphasized that the reallocation of activities between economic sectors drives not only technical progress but also changes in the market structure towards goods from more efficient sectors, shaping a regular pattern towards a modern economy. These fundamental arguments gave way to the theory of structural change proposed by Pasinetti (1983), which describes the economic system as an organization of various interdependent activities, generating a sectoral division, where the speed at which resources are transferred is the determinant of economic growth (Cardinale et al. 2023; Peneder 2003).

In empirical terms, several studies have addressed this relationship between structural transformation and economic growth with different methodological approaches. Some descriptive studies, such as Nguyen (2018) for Vietnam, show that rapid expansion of the modern sector coincides with high economic performance. Other studies have investigated this relationship through equilibrium models. For example, Moro (2012) by constructing a two-sector model calibrated to the United States finds that structural transformation reduces the volatility of total factor productivity (TFP) and GDP, generating steady and regular growth. Khan (2020) quantifies the impacts of trade- and productivity-focused structural transformation in Nepal at the macroeconomic and microeconomic levels over the period 2007–2008. By setting up a computable general equilibrium (CGE) model, he evidences that structural change positively affects economic progress. Tasneem and Khan (2024), using a computable general equilibrium (CGE) model, analyze the economic impacts of structural transformation. Their results reveal that this change significantly influences overall and household-level economic progress. This group of studies has limitations, mainly in the calibration of models, which makes them difficult to replicate in other countries with dissimilar environments and structures.

Research with an econometric approach has deepened this relationship. Fan et al. (2003) examine the impact of structural change on economic growth in China at the regional level between 1978 and 1995. Their results show that 17% of aggregate GDP in China is explained by structural change. Szirmai and Verspagen (2015), using panel estimations with fixed and variable effects, investigate the role of manufacturing in economic growth in different developing countries between 1950 and 2005. Their results show that a 10% increase in the share of the manufacturing sector increases economic growth by 0.5%, a positive but relatively moderate impact. Ferreira and Ribeiro (2019) assess the impact of the manufacturing sector on economic growth in 115 countries between 1990 and 2011. By estimating a vector autoregressive (VAR) model, their findings indicate that the manufacturing sector drives economic growth in the long run, especially in developing economies. For 95 developing economies between 1980 and 2018, Abbas et al. (2023) estimated a panel VAR model and found bidirectional causality between structural transformation and economic growth. This result implies that there must be initial economic progress driving structural transformation. Doré and Teixeira (2023), on the other hand, investigate the

impact of human capital, structural change and institutionalism on economic growth in Brazil between 1822 and 2019. Estimating an ARDL distributed lags model, they show that the shift to a more developed manufacturing base promotes economic growth in the long run.

However, although there is evidence of a positive link between structural transformation and economic growth, the heterogeneity of economic and institutional conditions across countries conditions this link. Teixeira and Queirós (2016) incorporate the nexus between structural change and human capital as determinants of economic growth. Making use of dynamic panel estimations, they find that the effect is sensitive to the temporal and spatial sample. Considering developed countries between 1960 and 2011, structural change and human capital have a positive and significant impact on economic growth. However, in transition countries, this effect vanishes, indicating that inefficient industries are not able to absorb skilled labor, impacting negatively on economic progress. Likewise, research such as Chen and Xie (2019) for China and Hausmann (2012) for Latin America, reveals that the effects of structural transformation on growth are dependent on the industrial policy stance to promote efficiency in the transition of resources, which is not guaranteed by market mechanisms. On the other hand, Guo et al. (2021), find that the service sector in China has been the sector with the greatest expansion and, therefore, the main determinant of structural transformation. Therefore, since the service sector has lower productivity than the manufacturing sector, the implications of structural transformation on economic growth may not be significant.

Table 1 presents some additional empirical studies that relate structural transformation to economic growth.

Table 1. Additional empirical studies: structural transformation and economic growth.

Author(s)	Country(ies), Data, Methodology	Endogenous Variable	Independent Variable(s)	Results
Ndiaya and Lv (2018)	Senegal; 1969–2017; Ordinary Least Squares (OLS)	Economic growth measured by GDP	Industrial production, inflation, foreign direct investment, exchange rate	Industrialization promotes economic growth.
Opoku and Yan (2019)	37 African countries; 1980–2014; generalized method of moments (GMM).	Logarithm of GDP per capita	Manufacturing value added, trade openness, population, inflation, government spending, education.	Industrialization positively impacts growth.
Nwogwugwu et al. (2021)	Nigeria; 1970–2018; Error Correction Vectors (ECV) model.	GDP per capita	Industry value added disaggregated by sector	Manufacturing positively influences economic growth.
Andriansyah et al. (2023)	Indonesia; 2005–2018; panel data estimation by generalized method of moments (GMM).	Rate of change in GDP per capita	Index of structural change, human capital, capital formation	Positive impact of structural change on economic growth.

2.2. Remittances, Capital Formation and Structural Transformation

Much of the research on the link between remittances and economic development has focused on assessing their effects on economic growth, without reaching a definite consensus (Jouini 2015; Kadozi 2019; Meyer and Shera 2017; Ekanayake and Moslare 2020). However, remittances, representing one of the main sources of financing (Ahmed et al. 2021), can influence deeper changes, mainly in those countries with a high dependence on these flows. Classical theory indicates that migrants' motivations for sending remittances to their country of origin lie in altruistic attitudes to support their families, self-interest to invest and security for future planning (De Haas 2005). Thus, the impact of remittances on the economic structure depends on households' decisions about their final use.

According to Pasinetti's (1983) theory of structural change, one of the determinants of structural transformation is the income elasticity of domestic demand. In this sense, as per capita income increases, the structure of demand undergoes changes, which implies a redistribution of spending among different goods. For example, Pan and Sun (2024) found that remittances, by increasing the income of recipient households, cause an alteration in the consumption pattern. This translates into a reduction in agricultural consumption and an increase in the consumption of non-tradable goods. Therefore, remittances would have an impact on structural transformation through the non-homothetic preferences of recipient households over time.

The consumption pattern of households is adequately sized in micro-level studies. Mishra et al. (2022) by applying OLS and 2SLS regressions on data from 5987 households from the 2011 Nepal Living Standards Survey, analyze the impact of remittances on different household expenditure categories. Their results show that remittances tend to impact non-food expenditures, such as clothing and personal care, as well as health and education services, to a greater extent. In addition, they show that remittances are not correlated with agricultural expenditures and conclude that these resources act as an initial impulse to exit this sector. Mahapatro et al. (2015) examine the impact of remittances, both domestic and international, on the distribution of household expenditures in India. Using matching techniques, the study findings reveal that households receiving remittances spend less on basic consumer goods and more on services such as education and health. These results are consistent with the study by Mohanty et al. (2014), where evidence was found that remittance-receiving households in India reduced their spending on food and expanded their spending on services. Other research has found that remittances boost energy consumption, such as electricity, which would have important implications for this sector to grow (Das et al. 2021; Das and McFarlane 2022). These results reinforce the argument of remittance-led change in domestic demand described by Pan and Sun (2024), directly connecting these flows to structural transformation. However, Abbas et al. (2023) using a panel vector autoregressive model for 95 developing countries over the period 1980–2018, find that remittances are not causal in the short run of structural transformation. This is evidence that the positive implications of remittances can be generated in the long run.

On the other hand, according to endogenous growth theory, investment, both in human and physical capital, is a fundamental determinant of long-term economic growth (Jones and Manuelli 1997). Then, investment plays a fundamental role as a dynamizer of the local economy, increasing production, employment and aggregate demand (Yuliana et al. 2019). Some research, such as that of Harada (2015), through the development of an inter-sectoral endogenous innovation model, concludes that specific investment between sectors strengthens the industrial structure and, therefore, improves social welfare and the development process. In turn, Li et al. (2022), by estimating a panel regression by quartiles for the G-7 group for the period 1990–2020, show that capital formation has a positive and significant impact at all levels. Other studies support these findings, showing that capital formation has positive effects on economic growth processes (e.g., Zaman et al. 2021; Bal et al. 2016; Emeka et al. 2017). Additionally, at the aggregate level, capital investment drives technological progress (Liang et al. 2023), which is the main determinant of structural change (Święcki 2017). Under this dynamic, capital formation would be closely related to structural change, promoting the transfer of resources toward efficient sectors. Additionally, some research has determined that the resignation of capital to urban areas and investment, both public and private, can promote structural transformation (Bustos et al. 2020; Perez-Sebastian and Steinbuks 2017; Emako et al. 2022; Guo et al. 2021). These studies show that investment reduces agricultural employment and increases the share of employment in the modern sector (industry and services), which has a positive impact on the productivity of this sector, allowing it to grow and expand over time.

In addition, the literature has also paid great attention to the impact of remittances on investment, as it has been observed that from the 2000s onwards, these flows ceased to be used solely to finance subsistence consumption (Vaaler 2013). Su et al. (2021) analyze the

role that remittances and institutional quality play in private investment in seven emerging economies (E7) between 1990 and 2019. Using second generation unit root tests, Westerlund cointegration and an ARDL model, they evidence that remittances have a positive effect on private investment, mitigating possible Dutch disease effects from an increase in these external resource flows. Dash (2020) investigates the impact of remittances on domestic investment in six South Asian countries. To address endogeneity and heterogeneity issues, they use advanced panel techniques, incorporating unit root, cointegration and causality tests. Their results show that remittances not only favor an increase in consumption but also promote investment in physical capital. For a set of Sub-Saharan African countries, Lartey (2013), through dynamic models, finds that remittances through an investment channel positively and significantly affect economic growth. Manic (2017) evaluates the effect of remittances on the economy of the Republic of Moldova. By means of a multinomial logit model to control for selectivity and endogeneity biases, he points out that remittances promote productive investments, indicating that resources are transferred from areas of low productivity (rural area) to areas of higher productivity (urban area). In this line, Shapiro and Mandelman (2016), under an economic cycle model, mention that remittances are used to finance the initial costs of microenterprises, contributing positively to self-employment. For 63 countries over the period 1981–2011, Nanyiti and Sseruyange (2022) examine the effect of remittances on entrepreneurial activities. The results show that remittances promote entrepreneurial activities, mainly in low-income countries. However, research by Kakhkharov (2018) applied in the case of Uzbekistan finds that families receiving remittances invest in family businesses only when these are complemented by other resources, mainly those from savings. These findings show how remittances have been a factor in improving economic performance by promoting domestic investment.

Table 2 presents some additional empirical studies linking remittances, investment and structural transformation.

Table 2. Additional empirical studies: remittances, capital formation and structural transformation.

Author(s)	Country(ies), Data, Methodolog	Endogenous Variable	Independent Variable(s)	Results
Lartey and Nigatu (2021)	35 sub-Saharan African (SSA) countries; 1990–2015; generalized method of moments (GMM).	Manufacturing value added (% GDP)	Remittances	Positive impact of remittances on manufacturing growth only if financial development is taken into account.
Asongu and Odhiambo (2022)	25 sub-Saharan African (SSA) countries; 1980–2014; generalized method of moments (GMM).	Value added of the three economic sectors	Remittances	Positive effects of remittances.
Dzansi (2013)	Top 40 remittance recipient countries; 1991–2004; panel Ordinary Least Squares (OLS) by fixed effects and two-stage least squares (2SLS).	Growth rate of the manufacturing sector	Remittances	Positive impact of remittances on the manufacturing sector.
Rahman et al. (2021)	Pakistán; Pakistan; 1972–2017; distributed lags model (ARDL)	Manufacturing sector growth	Private domestic investment	Positive impact of domestic investment.
Dash (2023)	24 low-income countries; 2004–2008; fully modified ordinary least squares (FMOLS).	Gross Fixed Capital Formation (% GDP)	Remittances	Remittances attract private domestic investment

2.3. Gaps in the Literature

In the literature reviewed in this section, there has been a predominant focus on the interaction between structural transformation and economic growth. However, it has overlooked relevant factors such as remittances and capital formation, variables that have been identified as key drivers of growth in both the short and long term. Furthermore, the relationship between remittances, capital formation and structural transformation has been studied in isolation, focusing particularly on the manufacturing sector, without due attention to the service sector, whose activities represent the largest contribution to GDP. Moreover, empirical studies have shown interest in structural transformation in African and Asian countries or have constructed large data panels that include developing economies. Therefore, a significant gap identified in the literature is the lack of studies that comprehensively cover the dynamic relationship of these variables in the Latin American region, which faces considerable challenges in terms of development. This research seeks to close this gap and provide relevant information for the community as a whole.

2.4. Hypothesis Construction

Figure 1 describes the basic outline of the research hypotheses.

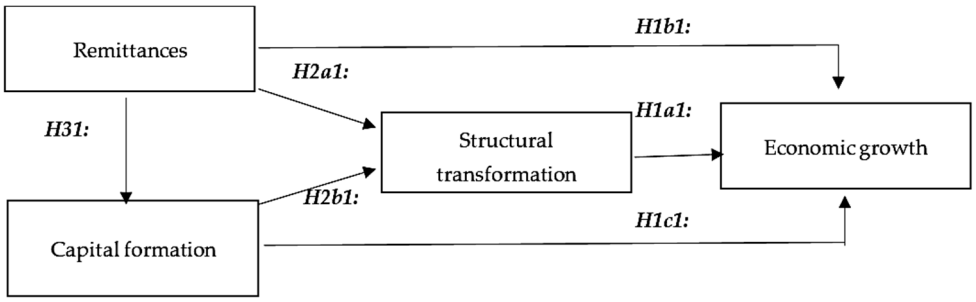

Figure 1. Outline of research hypotheses.

Several studies have shown that economic growth can be driven by structural transformation (Pasinetti 1983; Fan et al. 2003; Ferreira and Ribeiro 2019; Doré and Teixeira 2023), remittances (Meyer and Shera 2017; Ekanayake and Moslare 2020; Delessa et al. 2024) and capital formation (Zaman et al. 2021; Bal et al. 2016). Therefore, the first hypothesis is disaggregated as follows: H1a: A shock in structural transformation is positively associated with a change in economic growth. H1b: A shock in remittances is positively associated with a change in economic growth. H1c: A shock in capital formation is positively associated with a change in economic growth.

Bearing in mind Pasinetti's (1983) theory of structural change, where structural transformation is determined by the income elasticity of demand, and supported by studies such as those of Dzansi (2013), it can be mentioned that remittances can be positively related to this change. In addition, investment has been catalogued as another incident variable in this process, according to Rahman et al. (2021). Based on this background, the second hypothesis is established: H2a: A shock in remittances is positively associated with a change in structural transformation. H2b: A shock in capital formation is positively associated with a change in structural transformation.

Finally, remittances have been associated as an important determinant for attracting private investment (Manic 2017). Thus, the third hypothesis is established: H3: A shock in remittances is positively associated with a change in capital formation.

3. Methodology

3.1. Description of Variables and Data

Based on the literature reviewed in Section 2.3, certain variables have been selected to model the dynamic relationships described in Figure 1. The variables to be used are as follows: workers' remittances and employee compensation received (% of GDP); gross

fixed capital formation (% of GDP); structural transformation (modern sector value added % of GDP); and economic growth (real GDP per capita). Table 3 summarizes the description of each variable, unit of measurement and source.

Table 3. Description of variables.

Variable	Measurement	Source
Remittances (Rm)	Workers' remittances and employee compensation, received (% of GDP)	World Bank Indicators (WDI 2022f).
Capital formation (Fc)	Gross fixed capital formation (% GDP)	World Bank indicators (WDI 2022d).
Structural transformation (Te)	Value added of industry and services (% of GDP)	World Bank Indicators (WDI 2022e, 2022g).
Economic growth (Ce)	GDP per capita at constant 2015 prices	World Bank Indicators (WDI 2022c).

International remittances are those transfers of funds made by migrant workers to their communities of origin (Yoshino et al. 2020). Several studies based on panel data use the percentage of remittances with respect to GDP with the objective of capturing the weight of these resources in the economy, allowing their importance to be measured (Meyer and Shera 2017; Delessa et al. 2024; Ortega et al. 2024; Anarfo et al. 2020).

Fixed capital formation has been used to measure domestic investment and its implications for the economy (Topcu et al. 2020). More specifically, it comprises fixed asset outlays and net changes in inventories. This indicator can figure as a proxy measure of innovation (Destefanis and Rehman 2023), which is a fundamental factor of structural change patterns (Święcki 2017).

In terms of structural transformation indicators, recent studies (Ibrahim 2020) use an aggregation of sectoral values of the economy (agriculture, manufacturing and services) to capture net output levels by sector. However, our objective is to comprehensively define structural transformation. Therefore, and following Abbas et al. (2023), the share of value added of industry and services in GDP is used as a whole. This measure allows us to dimension the pattern of change towards the modern sector of the economy.

Finally, taking as a reference different studies (Delessa et al. 2024; Ekanayake and Moslare 2020; Szirmai and Verspagen 2015), GDP per capita at constant 2015 prices is used as an indicator of economic growth.

Based on the above background, the intention of this study is to find evidence on the dynamic relationship between the variables described in Table 3. Due to data availability and information limitations, an unbalanced panel is constructed for 15 Latin American countries between 1996 and 2019 (see Appendix A.1 for details of the countries). Additionally, the statistical software STATA version 16 is used to develop the estimates. Table 4 below summarizes the descriptive statistics for each variable. Columns (1) to (5) contain information on the mean, median, standard deviation, minimum and maximum of the variables. The mean value of remittances, capital formation, structural transformation and economic growth are 4.91% (of GDP), 21.11% (of GDP), 83.06% (of GDP) and $5825.6, while the median values are 2.16% (of GDP), 21.19% (of GDP), 83.84% (of GDP) and $4955.2, respectively. The variability of remittances, capital formation and structural transformation are in similar parameters; however, where the greatest dispersion exists is in economic growth. A marked heterogeneity is observed in structural transformation, since the value added of the minimum modern sector represents 67.24% (of GDP), while the maximum value exceeds 94% (of GDP). This gives a preliminary picture of the economic structure that characterizes the Latin American region.

Table 4. Descriptive statistics of the variables.

Variables	Obs	Mean	Median	Std. Dev.	Min	Max
		(1)	(2)	(3)	(4)	(5)
Remittances (Rm)	360	4.91	2.16	5.65	0.02	21.80
Capital formation (Fc)	358	22.11	21.19	5.80	10.85	44.31
Structural transformation (Te)	360	83.06	83.84	5.65	67.24	94.59
Economic growth (Ce)	360	5825.6	4955.2	3362.5	1266.9	15,166.9

3.2. Panel Vector Autoregressive Regression (PVAR) Model

Inspired by the work of Abbas et al. (2023), the panel vector autoregressive regression (PVAR) estimation method is employed. The PVAR model was first introduced by Holtz-Eakin et al. (1988) based on the work of Chamberlain (1984). This method establishes a system of equations that considers all variables to be simultaneously endogenous, which allows exploring dynamic relationships between them over time (Anarfo et al. 2020). In addition, the PVAR facilitates the control of unobserved differences between panel units (Abbas et al. 2023), improving the specification and making it more efficient compared to traditional static panel models. On the other hand, one of the advantages of the model is that it allows visualizing the dynamic effect of a shock in one variable on the other variables of the system (Holtz-Eakin et al. 1988). These characteristics are well aligned to investigate the hypotheses detailed in Section 2.4.

Based on Anarfo et al. (2020) and Sigmund and Ferstl (2021), the base form of the PVAR model is established, where the previously defined variables are considered:

$$G_{i,t} = \sum_{j=1}^{P} B_j G_{i,t-j} + k_i + w_t + \mu_{it} \quad (1)$$

From Equation (1), i denotes the country (i = 1, …, 15) and t the time period of study (t = 1996, …, 2019). $G_{i,t}$ is an N × 1 vector of endogenous variables (remittances, capital formation, structural transformation and economic growth) of country i in period t, B_j represents an m × m matrix of estimated coefficients for each $G_{i,t}$, $G_{i,t-j}$ is the matrix of exogenous variables with n lags, P is the number of optimal lags to include, k_i is the vector of fixed effects of the cross section, w_t is the vector of fixed effects of the time section and μ_{it} is the error term of the model. However, in order to make the model estimates rigorous, it is necessary to work with variables that are stable in variance. To verify this stability, Levene's test is used (results are described in Appendix A.2). The results show that the series are not stable in variance, which could generate inconsistent results. For this reason, the logarithmic transformation is used as a strategy to stabilize the variance of the variables (Box and Cox 1964).

The estimation of the PVAR model by ordinary least squares (OLS) can lead to biased and inconsistent estimates due to its limitation to mitigate Nickell's bias (Nickell 1981). According to Sigmund and Ferstl (2021), a solution to this problem is to employ the generalized method of moments (GMM) to estimate the PVAR model, a technique developed by Hansen (1982). Thus, to maintain orthogonality in the model, the GMM is used to estimate the PVAR using the lagged values of the regressors as instruments. Thus, the matrix form of Equation (1) could be rewritten in the following system of 4 equations, Equations (2)–(5), considering the variables in their logarithmic form, as follows:

$$Rm_{i,t} = \sum_{j=1}^{P} b_{1j} Rm_{i,t-j} + \sum_{j=1}^{P} b_{2j} Fc_{i,t-j} + \sum_{j=1}^{P} b_{3j} Te_{i,t-j} + \sum_{j=1}^{P} b_{41j} Ce_{i,t-j} + k_i + w_t + \mu_{it} \quad (2)$$

$$Fc_{i,t} = \sum_{j=1}^{P} b_{1j} Rm_{i,t-j} + \sum_{j=1}^{P} b_{2j} Fc_{i,t-j} + \sum_{j=1}^{P} b_{3j} Te_{i,t-j} + \sum_{j=1}^{P} b_{41j} Ce_{i,t-j} + k_i + w_t + \mu_{it} \quad (3)$$

$$Te_{i,t} = \sum_{j=1}^{P} b_{1j} Rm_{i,t-j} + \sum_{j=1}^{P} b_{2j} Fc_{i,t-j} + \sum_{j=1}^{P} b_{3j} Te_{i,t-j} + \sum_{j=1}^{P} b_{41j} Ce_{i,t-j} + k_i + w_t + \mu_{it} \quad (4)$$

$$Ce_{i,t} = \sum_{j=1}^{P} b_{1j} Rm_{i,t-j} + \sum_{j=1}^{P} b_{2j} Fc_{i,t-j} + \sum_{j=1}^{P} b_{3j} Te_{i,t-j} + \sum_{j=1}^{P} b_{41j} Ce_{i,t-j} + k_i + w_t + \mu_{it} \quad (5)$$

The procedure for estimating the PVAR model follows the following steps: (1) stationarity tests of the variables; (2) cointegration test; (3) non-collinearity and non-multicollinearity verification tests; and (4) optimal choice of the number of lags. After these tests, the PVAR is estimated using the Generalized Method of Moments (GMM), along with the impulse-response function (IRF) and forecast error variance decomposition (FEVD). The objective is to understand how a variant changes in the face of a shock to another variable. Since these functions are sensitive to the order of the variables in the model, they have been set from the most exogenous to the most endogenous. This is to ensure an adequate representation of the effects.

4. Empirical Results

4.1. Pre-PVAR Estimates

To determine the stationarity of each series, we start by applying unit root tests. Since we work with a panel data structure, we use first generation unit root tests, which are based on the assumption of cross-sectional independence, as well as second generation unit root tests, which consider the possibility of cross-sectional dependence. It is essential to perform these types of tests when the assumption of cross-sectional independence has not been confirmed (Abbas et al. 2023). Despite being widely used, the first generation tests, by assuming cross-sectional independence, may overlook certain patterns among the series individually, which could lead to the incorrect acceptance of stationarity or non-stationarity of the series (Pesaran 2007). Therefore, by incorporating second generation tests, greater accuracy in the assessment of stationarity is achieved.

Specifically, the first generation unit root tests employed have been two: Im et al. (2003) and Maddala and Wu (1999), whereas a second generation unit root test has been used: Pesaran (2007). Table 5 presents the results, both for the variables in their levels and in first differences. It is determined that the remittances and capital formation variables are stationary in their levels, i.e., integrated of order zero I(0), while the structural transformation and economic growth variables are stationary in first differences, i.e., integrated of order one I(1). In this way, we work with series with different orders of integration.

Table 5. Tests for stationarity in levels and first differences.

		[a] First Generation Test	[a,b] Second Generation Test		
	Variables	**Im, Pesaran and Shin**	**Maddala and Wu**	**Pasaran Z-t-bar**	**Conclusion**
In levels	Remittances (lnrm)	−5.46 ***	38.33	−4.39 ***	I(0)
	Capital formation (lnfc)	−3.40 ***	52.25 ***	−3.27 ***	I(0)
	Structural transformation (lnte)	−2.21 **	36.81	−0.048	-
	Economic growth (lnce)	4.59	49.65 **	0.13	

Table 5. *Cont.*

		[a] First Generation Test	[a,b] Second Generation Test		
In first differences	Remittances (lnrm)	-	-	-	-
	Capital formation (lnfc)	-	-	-	-
	Structural transformation (lnte)	−12.11 ***	133.59 ***	−4.30 ***	I(1)
	Economic growth (lnce)	−7.96 ***	69.75 ***	−2.11 **	I(1)

a. H_0: presence of unit roots; reject if p-value < 0.05; b. Specifications with trend due to the behavior of the variables. Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The complex interaction over time between remittances, capital formation, structural transformation and economic growth could imply possible long-run equilibrium relationships, which could be analyzed by means of cointegration tests. To determine the existence of such a relationship, the cointegration tests proposed by Westerlund (2007) for panel data have been used. Both the G_τ and G_α tests and the P_τ and P_α tests have the null hypothesis of no cointegration between the series. Table 6 presents the results of both tests. Since the p-values of G_τ and G_α and P_τ and P_α are greater than the 5% significance level, there is sufficient evidence to indicate that the series are not cointegrated.

Table 6. Cointegration test.

Statistic	Value	Z-Value	*p*-Value
G_τ	−2.239	−0.025	0.490
G_α	−2.030	4.920	1.000
P_τ	−6.946	0.466	0.679
P_α	−1.610	3.455	1.000

Once the order of integration of each series and non-cointegration had been determined, we proceeded to analyze collinearity and multicollinearity. For this purpose, the correlation matrix and the variance inflation factor (VIF) were used, the latter calculated using economic growth as the endogenous variable. The results are presented in Table 7, where it is observed that there is a low intensity in the correlation between the variables, and the VIF values are below the reference threshold value of 10 (O'brien 2007). Therefore, it is evident that the model does not present problems of collinearity and multicollinearity.

Table 7. Correlation matrix and variance inflation factor (VIF) test.

	Remittances (Rm)	Capital Formation (Fc)	Structural Transformation (Te)	Economic Growth (Ce)
Remittances (lnrm)	1			
Capital formation (lnfc)	0.1271	1		
Structural transformation (lnte)	−0.0544	0.2131	1	
Economic growth (lnce)	−0.6561	−0.0046	0.5634	1
[a] VIF	1.02	1.07	1.06	
[a] VIF average	1.05			

a. Economic growth (EC) has been used as an endogenous variable.

The preliminary step to estimate the PVAR model is to determine the optimal number of lags to adequately incorporate the necessary dynamics of the system, since an erroneous selection would lead to either omission bias due to the inclusion of a few lags or overparameterization due to the inclusion of many lags (D'Andreamatteo et al. 2024). Akaike's

Moment of Information Criterion (MAIC), Bayesian Moment of Information Criterion (MBIC) and Hannan and Quinn's Moment of Information Criterion (MQIC) were used for lag selection (Abrigo and Love 2016). Following Andrews and Lu (2001), the optimal choice of lags should result in the minimization of the mentioned criteria. According to the results in Table 8, the lag that minimizes the criteria is 1. Therefore, a PVAR is estimated by incorporating a lag.

Table 8. Criteria for selection of optimal lags.

lag	MAIC	MBIC	MQIC
1	−38.76595	−213.7474	−108.9275
2	−25.26858	−141.9229	−72.04294

4.2. Evidence from the PVAR Estimation

In this section, the dynamic relationships between remittances, capital formation, structural transformation and economic growth are presented. However, before presenting the estimation results, it is essential to assess the stability of the model. The modulus of each eigenvalue has been calculated, which are within the unit circle, indicating that the system satisfies the stability condition (Table 9 and Figure 2). Therefore, working with variables in different orders of integration is not a problem, since the stability in the system ensures the consistency of the estimates, particularly in relation to the impulse-response function and variance decomposition.

Table 9. Stability condition of the PVAR model.

Eigenvalue		
Real	**Imaginary**	**Modulus**
0.9273893	0.0605133	0.9293615
0.9273893	−0.0605133	0.9293615
0.6630309	−0.1424017	0.6781506
0.6630309	0.1424017	0.6781506

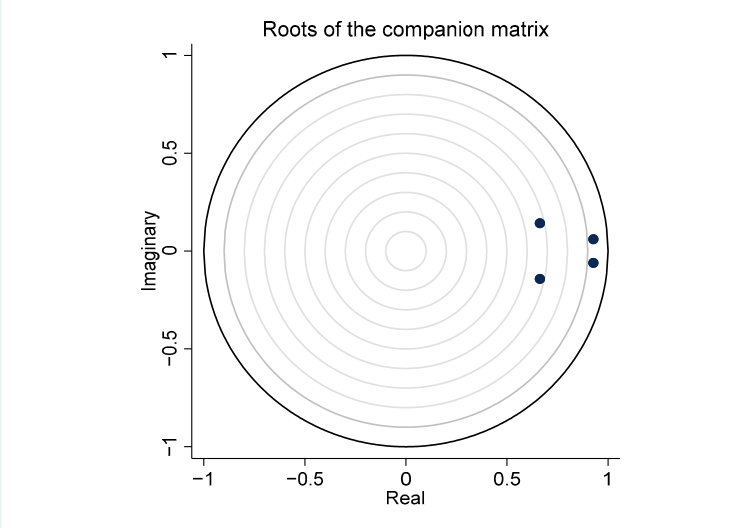

Figure 2. Roots of the companion matrix.

To estimate a PVAR using the GMM method, it is crucial to determine the validity of the instruments used. In this regard, the overidentification test proposed by Hansen (1982)

was used, whose null hypothesis is based on the validity of the instruments (Sigmund and Ferstl 2021). Since the *p*-value of the overidentification test (Hansen's J chi2) is greater than the standard significance value of 5%, there is sufficient evidence not to reject the null hypothesis (Table 10). Therefore, the instruments included for PVAR estimation are adequate and are not correlated with the error term.

Table 10. Hasen's overidentification test.

Hansen's J chi2	*p*-Valor
57.23	0.170

4.2.1. Analysis of the Impulse-Response Function

Since the objective of the analysis is to understand the dynamic relationships over time, we have chosen to omit the presentation of the elasticities of the PVAR model and instead directly display the impulse-response function (IRF). The IRF provides a representation of the behavior of an endogenous variable in a given period of time in response to a shock to another variable in the system (Abbas et al. 2023). For the estimation of the IRF, the Cholesky decomposition approach has been used, and 300 Monte Carlo simulations have been run for ten periods for greater reliability in the results. Figure 3 presents the estimated IRF at a 95% confidence interval.

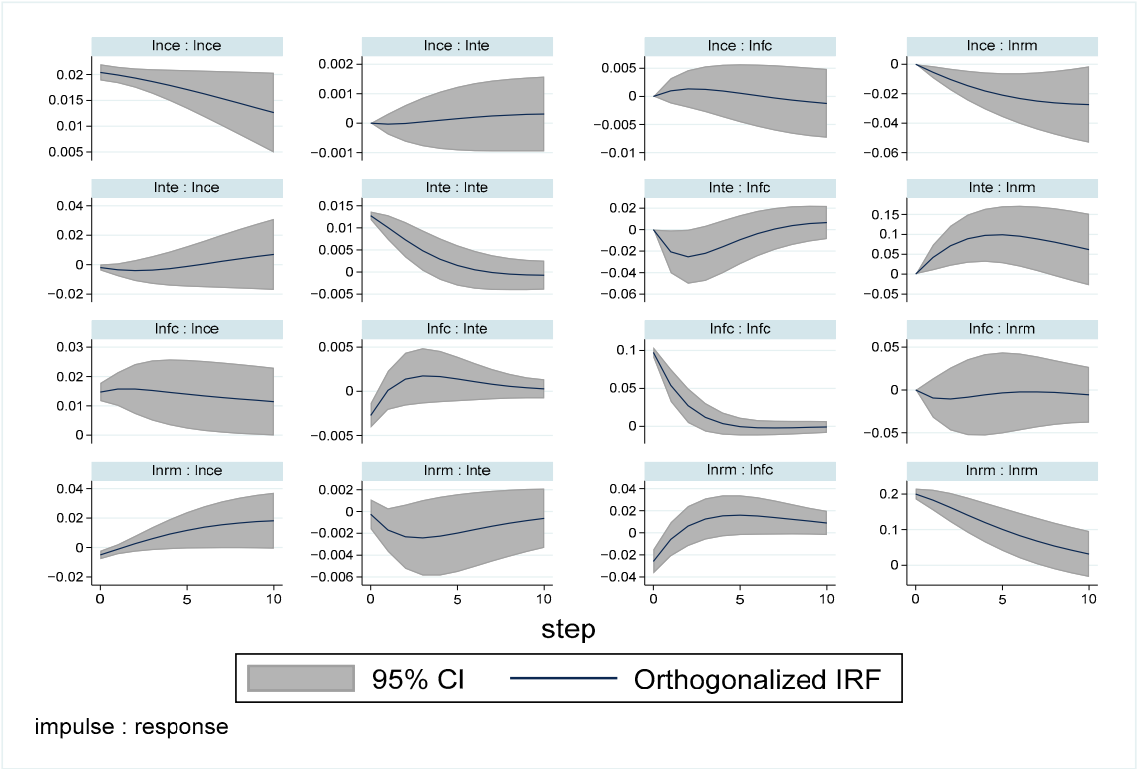

Figure 3. Impulse-response function (IRF), remittances, capital formation, structural transformation and economic growth.

The IFR estimated in Figure 3 shows that a structural transformation shock does not generate a significant effect on economic growth during the first periods; then for the final periods, it grows marginally. This finding suggests that, so far, structural transformation in Latin America has not been able to drive adequate economic growth processes. Therefore, there is evidence to support the rejection of hypothesis H1a. The poor productivity performance of the modern sector, caused by inefficient resource allocation (Bartelsman et al. 2013), could partially explain this result. Also, the dependence of several countries in the

region on the boom in primary products may have contributed to the contraction of the manufacturing sector (Barbier and Bugas 2014), resulting in weak productive structures. On the other hand, it is observed that in the face of a shock in remittances, growth responds positively, and this effect is maintained until it stabilizes in the final periods. This provides evidence that supports the non-rejection of hypothesis H1b, highlighting the importance of remittances in the Latin American economy and corroborating the findings of Ekanayake and Moslare (2020) on their long-term effects. In addition, a positive response to a shock in capital formation is observed in the early periods of economic growth, which then gradually declines to zero. This evidence supports the non-rejection of hypothesis H1c, suggesting that domestic investment initially boosts economic growth but that this effect stabilizes over time.

Figure 3 also shows the relationship between remittances and capital formation with structural transformation. Specifically, it is observed that during the early periods, a shock in remittance flows is negatively related to structural transformation. However, in later periods, the relationship is positive. This shows a non-linear relationship, which can be explained as follows: remittances, when sent for altruistic reasons, allow recipient families to improve their living conditions. In this sense, remittances, in the first instance, would be considered resources that help recipients stabilize their basic food consumption (Combes and Ebeke 2011) and, subsequently, allow them to add manufactured goods to the basic food basket (Kikkawa et al. 2024), as well as to make improvements to their homes that provide greater access to basic services such as electricity, water and internet. This finding supports the non-rejection of hypothesis H2a. On the other hand, in the presence of a shock to capital formation, structural transformation responds positively in the early periods and, then, gradually falls to zero. This finding supports the non-rejection of hypothesis H2b. This result indicates that the initial transfer of resources to the modern sector (industry and services) boosts its growth, which in turn improves output and employment levels, which are factors that influence the dynamization of the economy (Yuliana et al. 2019).

Additionally, it is possible to visualize the relationship between remittances and capital formation. It is observed that in the face of a shock in remittances, capital formation responds positively in the first periods and, then, stabilizes. It should be kept in mind that, although this effect is positive, its contribution is marginal. This result supports the non-rejection of hypothesis H3. This finding suggests that the motivation to send remittances to the region is based on the self-interest of migrants, who seek to translate the resources generated abroad into investments in their countries of origin (De Haas 2005).

In general, the results of the IRF suggest that remittances have positive impacts on economic growth and capital formation, while their effect on structural transformation is positive in the long run. However, their complementarity with capital formation can lead to a significant improvement in the conditions of the Latin American economy by providing initial resources that, accompanied by appropriate public policies, can promote a true development process and, thus, avoid the growth trap in which the region has stagnated.

4.2.2. Variance Decomposition Analysis

Variance decomposition allows the determination of the relative weight of a shock in a system variable in relation to changes in the other variables (Abbas et al. 2023). For this, the Cholesky decomposition approach has been maintained, and 1000 Monte Carlo simulations for ten periods have been used. The estimation results are summarized in Table 11.

The results in Table 11 suggest that a shock in remittances explains a tenth period change in economic growth, structural transformation and capital formation of 20%, 7% and 12%, respectively. On the other hand, a shock in capital formation explains the change in economic growth, structural transformation and remittances by 31%, 5% and 0.2%, respectively. It is observed that both the shock in remittances and the shock in capital formation explain a larger change in economic growth. Finally, structural transformation explains a change in remittances, capital formation and economic growth by 28%, 11% and 1.6%, respectively. This finding shows that a shock in structural transformation explains remit-

tances to a greater extent. This effect could be due to the fact that structural transformation generates a push effect of labor from rural to urban areas. This, in turn, causes an increase in the cost of living, which would lead to an increase in remittances to meet the needs of recipient families (Abbas et al. 2023).

Table 11. Variance decomposition, remittances, capital formation, structural transformation and economic growth.

	Response Variable			
Impulse Variable	**Remittances (lnrm)**	**Capital Formation (lnfc)**	**Structural Transformation (lnte)**	**Economic Growth (lnce)**
Remittances (lnrm)	0.71	0.12	0.07	0.20
Capital formation (lnfc)	0.002	0.77	0.05	0.31
Structural transformation (lnte)	0.28	0.11	0.88	0.016
Economic growth (lnce)	0.016	0.0004	0.0007	0.47

Note. The change in the variable before shock of another variable is in columns and has been taken in reference period 10.

4.2.3. Validation of Hypotheses

Table 12 summarizes the research findings and the (in)validation of the hypotheses described in Section 2.4.

Table 12. Validation of the hypotheses.

	Null Hypothesis	**Finding**	**Conclusion**
H1a	A shock in structural transformation is positively associated with a change in economic growth.	$Te \overset{NON}{\rightarrow} Ce$	Reject H1a
H1b	A shock in remittances is positively associated with a change in economic growth.	$Rm \overset{+}{\rightarrow} Ce$	Do not reject H1b
H1c	A shock in capital formation is positively associated with a change in economic growth.	$Fc \overset{+}{\rightarrow} Ce$	Do not reject H1c
H2a	A remittance shock is positively associated with a change in structural transformation.	$Rm \overset{-/+}{\rightarrow} Te$	Do not reject H2a
H2b	A shock in capital formation is positively associated with a change in structural transformation.	$Fc \overset{+}{\rightarrow} Te$	Do not reject H2b
H3	A remittance shock is positively associated with a change in capital formation.	$Rm \overset{+}{\rightarrow} Fc$	Do not reject H3

Variables: Te = Structural transformation; CE = Economic growth; Rm = Remittances; Fc = Capital formation. **Findings:** $\overset{NON}{\rightarrow}$ no effect; $\overset{+}{\rightarrow}$ positive effect; $\overset{-/+}{\rightarrow}$ non-linear effect, in the first periods negative and in later periods positive.

In contrast to the traditional literature on the relationship between structural transformation and economic growth (see, for example, Kuznets 1973; Pasinetti 1983; Fan et al. 2003; Nguyen 2018), we find a non-significant relationship between structural transformation and economic growth (H1a). The non-significance of this relationship is attributed to conditioning factors of structural transformation, as argued by Teixeira and Queirós (2016). Moreover, as argued by Hausmann (2012), industrial policy in Latin America has been a constraint for the expansion of the modern sector to promote an efficient transition of resources to more productive sectors. Likewise, it is observed that during the study period in the Latin American region, there has been a "servicification" of economic activities, meaning that a rapid transition from an agricultural economy to a service economy has been generated, which has not allowed a comprehensive development of the manufacturing industry, which is the fundamental pillar of the positive link between structural

transformation and economic growth (see, for example, Ndiaya and Lv 2018; Opoku and Yan 2019; Andriansyah et al. 2023).

On the other hand, we do not reject the hypotheses on the positive effect of remittances on economic growth (H1b) and capital formation (H2b), results consistent with previous research (see, e.g., Ekanayake and Moslare 2020; Dash 2023). In addition, it is important to note that this research contributes to the literature by examining the relationship of remittances and structural transformation. The findings validate the hypothesis that remittances have a positive effect on structural transformation (H2a), specifically from the medium term onwards. This finding is supported by research such as that of Dzansi (2013), where they show that remittances have a positive and significant impact on manufacturing growth. This effect can be explained by the theoretical approach of the income elasticity of domestic demand proposed by Pasinetti (1983) as a determinant of structural transformation.

Moreover, there is evidence not to reject the hypothesis on the positive effect of capital formation on economic growth (H1c) and structural transformation (H2b). According to the research of Zaman et al. (2021), Bal et al. (2016) and Liang et al. (2023), domestic investment promotes the transfer of resources to more efficient and productive sectors, which allows for the expanding of the modern sector and economic growth.

Finally, the hypothesis on the positive effect of remittances on capital formation is not rejected. As argued by De Haas (2005), one of the motivations of migrants to send remittances to their countries of origin is self-interest, where they seek to make investments and secure their future. This result is in line with research by Su et al. (2021) and Dash (2020), where they find a positive association between the two variables.

4.2.4. Discussion of Results

This study proposed a dynamic approach to analyze the relationships between remittances, capital formation, structural transformation and economic growth in Latin America. The findings of this study reveal that, contrary to traditional literature (Chenery and Syrquin 1980; Berthélemy and Söderling 2001; Vu 2017), structural transformation has not been a determining factor in economic growth in the Latin American region. Following McMillan et al. (2014), this result could be explained by at least two well-documented reasons. First, the high dependence of Latin American economies on primary resources has led to the fact that their exports consist mostly of natural resources and traditional goods. Consequently, the higher the share of these resources in exports, the lower the change in productivity within the modern sector. The essence of this argument is that, despite the importance of natural resource exploitation activities, they do not have the capacity to absorb surplus labor from traditional sectors. At the same time, this misallocation of human capital leads to a decline in the share of manufacturing in the economy, which in turn results in low efficiency in the modern sector. This argument finds support in the findings of Timmer and Vries (2009), who show that growth in the region is not explained by the reallocation of employment in productive sectors. Second, rigidity in labor markets conditions the processes of structural change. When there is no wage flexibility, companies demand less labor and seek mechanisms to satisfy efficiency wage conditions. Therefore, the labor that should be absorbed by the manufacturing industry becomes informal. Finally, industrial policies are an important determinant in the link between these two variables (Chen and Xie 2019; Hausmann 2012). Thus, Latin America faces a challenge in this aspect, essentially in the face of the rapid "servicification" of economic activities, which does not allow driving greater productivity in terms of resource utilization.

In addition, it is relevant to highlight the static dynamics of structural change in several developing countries. According to Erumban et al. (2019), given that the levels of GDP share in the services sector are higher than in manufacturing, resource mobility has not necessarily been allocated to sectors with higher productivity. For example, the construction sector requires less skilled labor compared to manufacturing industries, so despite its expansion, productivity growth would be limited or zero. This would be another explanation for why structural transformation has not had a significant impact

on development processes in Latin America. Finally, the loss of institutional quality may also explain this relationship, where public policies have not been sufficiently adequate to strengthen productive structures.

Regarding workers' remittances, their effects on economic growth, structural transformation and capital formation have been analyzed. First, similar to previous studies (Ekanayake and Moslare 2020; Kadozi 2019), a positive effect of remittances on economic growth has been found. This effect may be due to the implications of remittances in boosting social welfare, specifically by reducing poverty (Adams and Page 2005), improving human capital (Salas 2014) and boosting financial development (Aggarwal et al. 2011), crucial factors for the economy.

Second, it has been observed that remittances initially have a negative effect on structural transformation, which is reversed over time. This effect can initially be explained by the behavior of remittance recipients in relation to changes in consumption patterns. In this sense, remittances contribute to stabilizing household consumption, allowing them to access a basic food basket, especially during critical periods (Combes and Ebeke 2011). During this stage, the traditional sector benefits, as households increase their consumption of basic food goods, resulting in higher growth compared to the modern sector. This argument is reinforced by the findings of Abadi et al. (2018), where they evidence that remittances allow households to acquire food necessary to meet basic needs. Therefore, as families stabilize their consumption, they reallocate their budget towards higher value-added goods, reflecting a significant improvement in their quality of life (Kikkawa et al. 2024). This change in consumption patterns leads to the gradual mobilization of resources towards the modern sector, thus promoting its expansion. In addition, remittances not only promote consumption but also investment (Lartey 2013), which is a fundamental factor in structural change.

In this sense, another relevant research finding evidences a positive effect of remittances on capital formation. According to Le (2011), migrants are also motivated to send remittances to their country of origin for investment purposes, since they seek to obtain benefits over time. This finding is in line with the results found in the works of Shapiro and Mandelman (2016) and Nanyiti and Sseruyange (2022), where they argue that remittances, at the microeconomic level, serve to make investments in entrepreneurial activities, mainly to cover the initial costs of these investments. Moreover, their positive effects on domestic investment at the macroeconomic level have been supported by works such as Dash (2020) and Su et al. (2021). Therefore, remittances, when channeled to investments, may appear as adequate resources to promote economic development. Therefore, governments should ensure macroeconomic stability, which allows migrants to develop positive expectations about the future and, with this, ensure that their investment choices are motivated.

5. Conclusions and Policy Implications

Structural transformation and its implications at the macroeconomic level have been a subject of interest in the existing literature, with the aim of deciphering patterns of economic development. However, the relationships inherent in these processes are complex and conditioned by different economic, social and institutional factors. In this context, the present research complements the literature in an effort to comprehensively deepen the analysis of this process. To this end, the dynamic relationship between remittances, capital formation, structural transformation and economic growth has been investigated. Remittances have been included because of their growing importance in recent decades, both in terms of their role in improving social welfare and their impact on economic growth.

For the research, three sets of hypotheses were maintained: first, a shock in structural transformation, remittances and capital formation is positively associated with economic growth; second, a shock in remittances and capital formation is positively related to structural transformation; third, a shock in remittances is positively associated with capital formation. To examine the hypotheses, a PVAR model was estimated for 15 Latin American

countries over the period 1996–2019. In general, the estimation met the stability conditions, which makes the results robust.

The research findings revealed that structural transformation does not have a significant effect on economic growth, which was corroborated by variance decomposition analysis. This analysis showed that the contribution of structural transformation in explaining changes in economic growth in the region is marginal. This result is highly worrisome, as it reflects one of the causes of Latin America's low level of economic development and, consequently, its weak structure to comprehensively address sustained patterns of economic growth. High dependence on natural resources, rigid labor markets, and isolated public policies may be factors that explain this finding. In addition, there was evidence of a positive impact of remittances and capital formation on economic growth. More precisely, a shock to these variables explains a change in economic growth of 20% and 31%, respectively.

Another interesting finding was the relationship between remittances and structural transformation. A non-linear relationship was found, where remittances are negatively related to structural transformation in the early periods and positively in later periods. On the one hand, the result could indicate that remittances affect the development process by having a negative impact on the modern sector, a fundamental pillar of the economy. But, under a review of the literature, this relationship could be due to the stabilizing effect of remittances on the consumption of recipient households. Furthermore, by showing their positive effect on investment, the idea of the important role played by these resources for the Latin American region is reinforced. Thus, remittances have the potential to bring about positive changes for development.

Policy Implications

The results of this research offer relevant information for policy makers regarding the development challenges facing the region. In countries with a lower performance of the modern sector, where policies have not been effective, remittances can be significant resources to support households, mainly in stabilizing consumption and encouraging investment, factors that are usually an important part of the economy. Therefore, governments should not seek mechanisms to reduce these flows; on the contrary, they should establish an institutional framework to support the recipients, thus encouraging the efficient use of these resources, whether to improve the productivity of the agricultural sector or to carry out business opportunities, investments in real estate, etc. Also, financial development should be promoted where the private sector can support remittance recipients, allowing them to access more resources with which they can finance their projects in a comprehensive manner.

Based on the above, economic policies should focus on improving the efficiency of channeling remittances so that they contribute more effectively to economic growth. This could include measures to promote productive investment of remittances and encourage economic diversification, especially in sectors that can boost productivity and long-term sustainable growth. In addition, it is important to address the potential negative effects of remittances on structural transformation, such as over-reliance on non-productive sectors, through policies that encourage investment in more dynamic and forward-looking sectors.

Recommendations

Despite the novelty of the results, this research presents some limitations that may serve as a point of interest for the development of future empirical studies. Among the limitations is a lack of a comparison of the performance of the modern sector between countries according to their income levels. In this sense, possible studies could extend the research by segmenting the estimates by country, thereby taking into account the heterogeneity present among countries. Another limitation is the omission of variables that could affect the relationships between remittances, capital formation, structural transformation and economic growth. Future research could therefore consider including relevant variables such as economic integration, financial development, technological progress, foreign investment, etc. Given this, there is the possibility of using other econometric methodologies

to deepen the dynamic relationships, specifically in terms of short- and long-run partial elasticities by means of an Autoregressive Distributed Lag (ARDL) model or a model such as Fully Modified Least Squares (FMOLS), which takes into account possible endogeneity problems due to the correlation between the dependent variable and the independent variables. Finally, a valuable contribution that could be addressed from this research is the analysis of thresholds on the minimum and maximum effects between variables, which would allow for deepening of the relationships of these variables over time.

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Appendix A

Appendix A.1. List of Latin American Countries Used in the Research

Table A1. Selected countries.

Argentina	Costa Rica	Honduras	Peru
Bolivia	República Dominicana	Mexico	Paraguay
Brazil	Ecuador	Nicaragua	El Salvador
Colombia	Guatemala	Panama	

Appendix A.2. Levene's Test for the Analysis of the Variance Stability of the Series

The results in Table A2 show the Levene's contrast, whose null hypothesis is homogeneity of variance. The hypothesis is rejected since the *p*-values are less than 5%.

Table A2. Stability analysis of variance.

	Bartlett	**Levene**	**Brown-Forsythe**
Remittances (Rm)	20.99 ***	5.74 ***	5.21 ***
Capital formation (Fc)	14.98 ***	6.92 ***	5.22 ***
Structural transformation (Te)	30.44 ***	8.32 ***	7.68 ***
Economic growth (Ce)	27.08 ***	16.70 ***	11.92 ***

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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