DOI: 10.15838/esc.2023.2.86.11
UDC 314, LBC 60.7

Reassessment of the Todaro Paradox: An Extended Panel Data Analysis on Developing Countries

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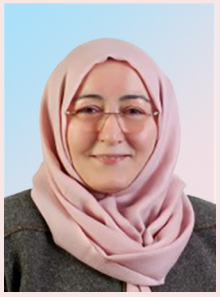

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Abstract. This paper empirically analyzes the Todaro Paradox for eight developing countries for the period from 1992 to 2019. Having different data characteristics, we apply three different panel approaches (Fixed Effect, Random Effect, and Full Modified Ordinary Least Square) by using distinct models. Our findings from different models depict that the Todaro Paradox is valid for the sample economies. Specifically, we observe a negative relationship between the price level ratio of purchasing power parity conversion factor (GDP) to market exchange rate and urban population contrary to the price level ratio of the purchasing power parity conversion factor (GDP) to the market exchange rate – rural population nexus. Thanks to obtaining these links, we apply the third empirical model to verify the Todaro Paradox. The analysis of the price level ratio of the purchasing power parity conversion factor (GDP) to the market exchange rate and total unemployment in the urban population provides strong evidence for the validity of this paradox. Deviated from the previous literature, this paper

For citation: Yilmaz E., Sensoy F. (2023). Reassessment of the Todaro Paradox: An extended panel data analysis on developing countries. *Economic and Social Changes: Facts, Trends, Forecast*, 16(2), 203–215. DOI: 10.15838/esc.2023.2.86.11

applies the price level ratio of the purchasing power parity conversion factor (GDP) to the market exchange rate since the higher the purchasing power parity of a country, the lower the rate of rural-urban migration is expected. By using one extra variable (unemployment), we test the Todaro Paradox. This combination of variables as well as different panel techniques (Fixed Effect, Random Effect, and Full Modified Ordinary Least Square) allow us to draw more robust conclusions. To address the challenges posed by rural-urban migration, policies should be designed to promote sustainable development in both urban and rural areas. This can include measures to create employment opportunities and improve the quality of life in both areas, as well as policies to regulate migration and manage the pressures caused by rapid urbanization.

Key words: migration, purchasing power parity, Todaro Paradox, urban economy, unemployment, rural economy.

Introduction

The concept of migration encompasses different perspectives. Internal migration refers to mobility within the borders of a nation (Puhani, 2001), whereas external migration refers to mobility between settlements in two or more countries (Bell et al., 2002). An individual who migrates from one country to another for employment purposes is considered an immigrant (Gimeno-Feliu et al., 2019; Jean, Jiménez, 2011; Kemnitz, 2003; Wong, 1991). Ravenstein studied the behavior patterns of individuals in relation to migration and noted that the movements of immigrants tend to be short-distance and directed towards large commercial and industrial centers (Ravenstein, 1889). As a result, migration from areas close to big cities is on the rise and has become a popular destination for immigrants seeking employment. On the other hand, residents of urban areas tend to migrate less frequently compared to their rural counterparts, leading to a higher rate of rural-to-urban migration (Ravenstein, 1889). Migration that involves leaving one's country for a different region for employment purposes can result in differences between the sending and receiving regions in terms of their economic and social characteristics (Castles, 2000). The issue of employment is crucial in this context. Many studies have shown that unemployment is a major motivator for migration (Herzog, Schlottmann, 1984; Kingma, 2007; Potts, Mutambirwa, 1990; Zhang, Song, 2003). Employment, as an economic concept, refers to the use of production factors for the purpose of generating income. In addressing the problem of unemployment, countries implement various policies and strategies.

Policies aimed at enhancing employment in cities can lead to migration from rural to urban areas, particularly in developing countries. Todaro and Harris modeled the factors that drive rural-to-urban migration in developing nations (Todaro, 1969; Harris, Todaro, 1970). In their model, the determining factors are wage differences between rural and urban areas and employment opportunities in cities. As long as expected urban wages, adjusted by the probability of finding a job, are higher than rural wages, migration from rural to urban areas will persist. In developing countries, it takes place in two stages. Initially, migrants are unable to secure formal sector employment due to a lack of qualifications, but they find work in the informal sector. In the second stage, they switch to formal sector employment. As a result, unemployment is both a cause and a consequence of migration and will persist as long as there are wage and employment disparities between rural and urban regions (Harris, Todaro, 1970; Todaro, 1969). The

duration of time required to secure formal sector employment and the availability of employment opportunities are important factors in triggering migration (Todaro, 1969). Todaro introduced the concept of the "Todaro Paradox", which suggests that the positive effect of increasing employment opportunities in urban areas on unemployment is offset by the negative effect of rural-to-urban migration. Investments aimed at reducing urban unemployment may lead to higher unemployment, emphasizing the importance of rural development in addressing the issue (Todaro, 1976).

On the other hand, considering Purchasing Power Parity (PPP), which represents a rate of change that equalizes the purchasing power of different currencies by removing price level disparities between countries is crucial for the analysis of the Todaro paradox[1]. The study of PPP began several decades ago, with the most well-known method of calculation being the Geary-Khamis dollar. This method, introduced by Roy C. Geary in 1958 and developed by Salem H. Khamis in the early 1970s (Brunt, Fidalgo, 2018), combines PPP and international average prices of goods. The calculation of PPP in the USA is based on the years 1990 or 2000, and international comparisons of per capita income in Geary-Khamis dollars provide a more meaningful comparison of standard of living than per capita income at current prices (Nordhaus, 2007). The US dollar serves as the common currency in these calculations (Dornbusch, 1985).

The Todaro Paradox and purchasing power parity are two related economic concepts. The Todaro Paradox is caused by the fact that, despite high levels of urban unemployment, people still migrate from rural to urban areas in search of work. This contradicts the classical theory of migration, which states that people should only move if there are more job opportunities in the destination location (Haas et al., 2019). PPP, on the other hand, is a theory that states that the exchange rate between two currencies is equal to the ratio of the prices of a basket of goods in each country (Samuelson, 1964). In other words, PPP states that the same goods should cost the same amount in different countries after adjusting for exchange rates. The relationship between the Todaro Paradox and PPP lies in the fact that PPP is often used to measure the purchasing power of different currencies in different countries. When PPP is applied to the Todaro Paradox, it becomes clear that people are moving to urban areas not just because of the availability of jobs, but also because they believe that their purchasing power will be higher in the city, even if they are unemployed. PPP helps to shed light on the motivations behind migration in the context of the Todaro Paradox, and can help economists better understand the forces driving rural-urban migration.

In this study, the "Price level ratio of PPP conversion factor (GDP) to market exchange rate" is employed as a variable to test the correlation and causality between this factor and the rate of rural-urban migration. This relationship has not been previously examined in the existing literature on the subject. The study aims to contribute to the field by incorporating a unique variable and conducting econometric analysis using three different techniques: Fixed Effect (FE), Random Effect (RE) and Full Modified Ordinary Least Square (FMOLS).

Several propositions motivated us to conduct this investigation.

First, we aim to address the socio-economic problems associated with migration, which are crucial for development, within the context of the Todaro Paradox. The purpose of the paper is to emphasize the importance of this critical topic and to consider comprehensively its implications, which have been overlooked by the empirical literature.

[1] Francois-Seeney D.J. (2013). *Macrodeterminants of Labor Migration from CEE Accession Countries to Select EU Countries*, Doctor of Philosophy Thesis. Mississippi: The University of Southern Mississippi.

Second, the Todaro Paradox explains why people in developing countries migrate from rural areas to urban areas despite worsening economic conditions in the latter. Focusing on the Todaro Paradox by using the correct variables can provide insights into the motivations behind rural-urban migration and the push and pull factors that influence this phenomenon.

Third, policymakers can better target interventions aimed at reducing rural-urban migration and promoting sustainable development in developing countries by understanding the Todaro Paradox.

Fourth, rural-urban migration can have both positive and negative effects on the development of a country. By studying the Todaro Paradox, researchers can better understand the results of rural-to-urban migration and identify ways to mitigate its negative effects while enhancing its positive effects.

Our contributions to the literature can be divided into two folds. First, we use the price level ratio of the PPP conversion factor (GDP) to the market exchange rate since the higher the PPP of a country, the lower the rate of rural-urban migration is expected. By using one extra variable (unemployment), we test the Todaro Paradox. This combination of variables allows us to draw more meaningful conclusions and have the potential to reveal new insights into economic literature.

Second, the FE, RE and FMOLS methods allow for a more comprehensive and nuanced examination of the relationship between the price level ratio of PPP conversion factor and other variables related to rural-urban migration, leading to more robust results and a better understanding of the underlying causal relationships. Moreover, these techniques allow for the control of potential omitted variable bias, cross-sectional dependence, and endogeneity.

Literature review

This paradox has been studied by numerous researchers, some of whom have found support for Todaro's conclusion that urban employment growth does not lead to increased unemployment, while others, such as (Zarembka, 1970) and (Blomqvist, 1978), found that growth of urban employment may result in increased migration and therefore higher unemployment in the long run. The lack of data in underdeveloped and developing countries has made it challenging to test the validity of the Todaro Paradox, so more empirical studies are needed (Blomqvist, 1978; Zarembka, 1970). Takagi modeled the Todaro Paradox according to differences in decision-maker expectations and determined the conditions under which the paradox would occur (Takagi, 1984). Todaro (Todaro, 1969) concluded that job opportunities created in the modern sector would not increase unemployment (Fields, 1975), but Blomqvist and Zarembka revealed that unemployment rate could increase in the long run if a different migration function was assumed (Arellano, 1981). Nakagome conducted a study on the Todaro Paradox within a spatial context, advancing the model to encompass a spatial labor market. He argued that an increase in expected income, due to increased employment opportunities, would result in either a rise in unemployment through the expansion of the labor market or through migration from rural to urban areas (Nakagome, 1989). Stark et al. posited that if the demand for urban labor is inelastic, then an increase in urban employment will lead to a decrease in urban unemployment. The Todaro Paradox arises from certain assumptions, such as the inability of underdeveloped and developing countries to achieve a significant increase in employment with a minor decrease in wages. In these countries there is often a low elasticity of the demand curve, which means that the paradox may

not occur (Stark et al., 1991). Raimondos created a Harris – Todaro model, in which the rural labor market is characterized by monopolistic behavior. This study suggests that if the number of workers in the city exceeds the number of unemployed, then creating employment in the city would decrease unemployment and eliminate the Todaro Paradox. Moreover, Raimondos asserts that urban growth in countries with monopolistic rural labor markets will not cause excessive rural migration and is more likely to decrease unemployment (Raimondos, 1993). Brueckner, Thisse, and Zenou modified the Harris – Todaro model by incorporating the land market (BZ model). According to their model, growth in the formal sector will not lead to rural-urban migration, as high land rents in the city will counteract the increase in job prospects (Brueckner et al., 1999). Brueckner and Kim noted that sector growth would increase the urban population and, in turn, the land rent, which would reduce the expected income level and benefits (Brueckner, Kim, 2001). Zenou evaluated the Todaro Paradox within the context of effective wage theory and matching models, determining that the Todaro Paradox would not occur in models with an effective wage add-on. However, in the matching model, Zenou found that a decrease in unemployment benefits, as a policy tool, would increase both urban employment and urban unemployment. This research emphasized that employment policies implemented in cities would cause mobility from rural areas or smaller cities to metropolitan cities, resulting in the paradox (Zenou, 2005).

The research (Espindola et al., 2006) interpretes workers' migration as a social learning process by imitation, shaped by a computational model. Using the simulation model, the dynamics of transition toward an equilibrium with continued growth in the urban segment of the total population are observed. Such an equilibrium is characterized by a balance between rural and urban wage expectations (the generalized Harris – Todaro equilibrium condition), urban population concentration, and urban unemployment. These results, originally obtained by Harris and Todaro, are new features of our model (Esp ndola et al., 2006). Chaudhuri explores the discrepancy between the negative effects of foreign capital as predicted by the Harris – Todaro model and the liberalized investment and trade policies pursued by developing countries. Using the example of the three sector Harris – Todaro model with agricultural dualism and a non-traded final commodity, the paper argues that foreign capital inflows can actually improve welfare and alleviate unemployment, explaining why many developing countries have experienced "jobless growth" in the liberalized regime (Chaudhuri, 2007).

As Pi and Yin note, an increase in partial privatization can affect unemployment and social welfare differently, depending on whether the capital is sector-specific or sector-mobile. In the short run, when capital is sector-specific, partial privatization may lead to higher unemployment, but the impact on social welfare will depend on the market share of the public firm and the level of privatization. In the long run, when capital is mobile, partial privatization may reduce unemployment, but again, the impact on social welfare will depend on the market share of the public firm and the degree of privatization. Overall, the authors note that in the real world, both public and private firms often compete with each other (Pi, Yin, 2016). Kondoh and Kurata studied the impact of policy changes and improvements in the agritourism sector in a developing country. They found that labor outflow from urban to rural areas can be beneficial, but the impact of wage changes or foreign capital investment is uncertain. They also concluded that a greater focus on agricultural goods in the agritourism sector can lead to improved domestic welfare and lower urban unemployment, and that environmentally friendly agritourism can have positive impact on both welfare and employment (Kondoh, Kurata, 2021).

Sancar conducted a research to assess the validity of the Harris – Todaro model in 12 regions of Turkiye using panel data methods over the period 2008–2019. The results showed that the Harris – Todaro model was valid in six regions, but not valid in the other six regions (Sancar, Akbaş, 2022). Sevencan used vector error correction model (VECM) methodology to analyze the short-run dynamics and causal relationships between GDP and remittances in three groups of countries: low-income, lower-middle-income, and upper-middle-income. The results showed that in low-income countries, GDP causally affects remittances in the short run. Additionally, the study found that the long-term positive impact of unemployment on human development index (HDI) highlights the significance of underutilized labor in low-income nations. Despite this, unemployment in the country of origin does not significantly affect the relationship between remittances and development in low-income countries (Sevencan, 2023).

Models, data and methodology

In order to test if there is a correlation or causal relationship between this factor and the rate of rural-urban migration, this study uses a measure of the "Price level ratio of the PPP conversion factor (GDP) to the market exchange rate" as a variable. We conduct econometric analyses using three different methods (FE, RE and FMOLS). The data used in this study consists of annual observations from eight developing countries[2] over the period from 1992 to 2019, annually.

Since migration data for eight selected developing countries could not be reached, we use "Urban population (% of the total population)" covering the period 1992–2019. As independent variables, we consider: "Rural population (% of the total population)", "Employment in agriculture (% of total employment) (modeled ILO estimate)", "Unemployment, total (% of the total labor force) (modeled ILO estimate)" and "Price level ratio of PPP conversion factor (GDP) to market exchange rate". All data were obtained from the World Bank database[3].

The first two models aim to econometrically analyze the effect of "Price level ratio of the PPP conversion factor (GDP) to market exchange rate" on the rural and urban populations. The purpose of the third model is to analyze the relationship between unemployment, rural population and Price level ratio of the PPP conversion factor (GDP) to market exchange rate and Employment in agriculture within the framework of the Todaro Paradox *(Table 1)*.

Model I: $lntnikn_{it} = \partial_1 + \partial_2 lnsagp_{it} + \varepsilon_{it}$

Model II: $lntnisn_{it} = \partial_1 + \partial_2 lnsagp_{it} + \varepsilon_{it}$

Model III: $lntnisn_{it} = \partial_1 + \partial_2 lnsagp_{it} + \\ + \partial_3 lntnikn_{it} + \partial_4 lntiiti_{it} + \partial_5 lntnitu_{it} + \varepsilon_{it},$

where:
i – the selected country,
t – the time in the models,
ε – the error term.

Table 1. Descriptions of the variables

Variable	Definition	Source
tnitu	Employment in agriculture (% of total employment) (modeled ILO estimate)	World Bank Database, World Development Indicators
tnikn	Rural population (% of total population)	
tiiti	Unemployment, total (% of total labor force) (modeled ILO estimate)	
sagp	Price level ratio of PPP conversion factor (GDP) to market exchange rate (%)	
tnisn	Urban population (% of total population)	
Note: All data cover the period 1992–2019 and are included in the model annually.		

[2] Russian Federation, Argentina, Brazil, India, Turkey, Czechia, China, Egypt, Arab Rep.
[3] Available at: https://data.worldbank.org/ (accessed: February 1, 2023).

Findings

Cross-section dependence test

The consideration of cross-section dependence between the series plays a significant role in affecting the results of the analysis (Breusch, Pagan, 1980; Pesaran, 2004). Before conducting the analysis, it is necessary to test for the presence of cross-section dependence and cointegration equations in the series. This is crucial in determining the appropriate unit root and cointegration tests to be employed, as failing to do so may result in erroneous findings (Yilmaz, Sensoy, 2022). The Breusch – Pagan Lagrange Multiplier (LM) test is used to detect the presence of cross-section dependence when the time dimension of the panel is larger than the cross-section dimension (Breusch, Pagan, 1980). In cases where both dimensions are substantial, the Pesaran Cross-Section Dependence (CD) test can be applied (Pesaran, 2004). This study employed the LM test, as the panel consisted of eight countries over 27 years. However, this test is subject to error if the group mean is zero and the individual mean is non-zero. Pesaran et al. corrected this error by incorporating the variance and mean into the test statistic, leading to the deviation-corrected LM test (LMadj) (Pesaran et al., 2008). The results of the cross-section dependence tests can be found in the *Table 2*.

As the results show, all probability values are below 0.05, implying the rejection of H_0 and the acceptance of the existence of cross-section dependence between the variables.

Panel unit root tests

In this study, Levin – Lin – Chu and Augmented Dickey – Fuller (ADF) – Fisher Chi-square unit root test methods (Dickey, Fuller, 1981; Levin et al., 2002).

Null hypotheses assume that there is a common unit root process as the basic hypothesis at their own level in the variables applied to Levin – Lin – Chu, ADF – Fisher Chi-square tests, which are non-stationary panel unit root tests. However, we can see that there is no unit root and they are static. The results are presented in *Table 3*.

Panel cointegration test results

All variables are stationary in Model I and have cross-section dependence between them. Pedroni, Kao and Fisher and Johansen panel cointegration tests can be applied to determine whether there is a long-term equilibrium relationship between the series in Model 3 (Kao, 1999; Pedroni, 1999, 2004). According to the results of the tests of the series in which three separate panel tests are applied, the p values of most statistics are less than 0.10, 0.05, and 0.01 *(Tab. 4)*. In summary, it can be concluded, that there is evidence of a long-run relationship between the variables of both our models.

Table 2. Cross-section dependence test

Variable *(ln)*	Test	Statistic	Prob.*
tnitu	Breusch – Pagan LM	5055,988	0.0000
	Pesaran Adj. LM	163,1826	0.0000
tnikn	Breusch – Pagan LM	1656,567	0.0000
	Pesaran Adj. LM	43,8863	0.0000
tiiti	Breusch – Pagan LM	4151,596	0.0000
	Pesaran Adj. LM	131,4447	0.0000
tnisn	Breusch – Pagan LM	5055,988	0.0000
	Pesaran Adj. LM	163,1826	0.0000
sagp	Breusch – Pagan LM	4203,963	0.0000
	Pesaran Adj. LM	133,2824	0.0000

Note: (*) indicates 1% significance level.
Source: own compilation based on Eviews 10 (IHS Global Inc).

Table 3. Panel unit root tests

Variable*(ln)*		Method	Level	*I(1)*
tnitu	Individual Intercept	Levin – Lin – Chu	0.0823***	0.0420**
		ADF – Fisher Chi-square	0.3465	0.0000*
	Individual Intercept and Trend	Levin – Lin – Chu	0.9575	0.0001*
		ADF – Fisher Chi-square	0.9595	0.0000*
tnikn	Individual Intercept	Levin – Lin – Chu	0.0627***	0.0010*
		ADF – Fisher Chi-square	0.1461	0.0000*
	Individual Intercept and Trend	Levin – Lin – Chu	0.0138**	0.0000*
		ADF – Fisher Chi-square	0.2631	0.0000*
tiiti	Individual Intercept	Levin – Lin – Chu	0.3735	0.0056*
		ADF – Fisher Chi-square	0.6541	0.0026*
	Individual Intercept and Trend	Levin – Lin – Chu	0.0000*	0.0000*
		ADF – Fisher Chi-square	0.0000*	0.0000*
sagp	Individual Intercept	Levin – Lin – Chu	0.0990	0.0000*
		ADF – Fisher Chi-square	0.4101	0.0000*
	Individual Intercept and Trend	Levin – Lin – Chu	0.8880	0.0005*
		ADF – Fisher Chi-square	0.9397	0.0000*
tnisn	Individual Intercept	Levin – Lin – Chu t*	0.5359	0.0465**
		ADF – Fisher Chi-square	0.4786	0.6706
	Individual Intercept and Trend	Levin – Lin – Chu t*	0.0016*	0.0486**
		ADF – Fisher Chi-square	0.2316	0.7585

Note: (*), (**) and (***) indicate 1%, 5% and 10% significance level, respectively.
Source: own compilation based on Eviews 10 (IHS Global Inc).

Table 4. Model III cointegration test results

Test author	Test	Statistic	Prob.	Weighted Statistic	Prob.
Pedroni	Panel v-Statistic	11.48871	0.0000*	5.318.920	0.0000*
	Panel rho-Statistic	1.242299	0.8929	2.048.779	0.9798
	Panel PP-Statistic	-0.921806	0.1783	1.127.582	0.8703
	Panel ADF-Statistic	-5.921875	0.0000*	-2.829.234	0.0023*
	Group rho-Statistic	2.930425	0.9983	N	N
	Group PP-Statistic	1.671212	0.9527	N	N
	Group ADF-Statistic	-5.060226	0.0000*	N	N
Kao	Statistic		Prob.		
	-2.018001		0.0218**		
Fisher, Johansen	Hypothesized	Fisher Stat. (from trace test)	Prob.	Fisher Stat. (from max-eigen test)	Prob.
	None	348.6	0.0000*	200.7	0.0000*
	At most 1	190.2	0.0000*	93.08	0.0000*
	At most 2	126.3	0.0000*	69.62	0.0000*
	At most 3	82.64	0.0000*	74.18	0.0000*
	At most 4	30.65	0.0149**	30.65	0.0149*

Note: (*), (**) indicate 1% and 5% significance level, respectively.
Source: own compilation based on Eviews 10 (IHS Global Inc).

Findings on panel models

As a result of the cointegration test, we can infer that there is a long-term relationship between all series in Model III. The coefficients of all variables in the models can be calculated with three separate panel data approaches. Fixed Effect (FE), Random Effect (RE), and full modified OLS (FMOLS) methods can be used in the models. Since there is no consensus on panel cointegration estimation, it would be more appropriate to use all methods to obtain a more robust result. Findings can be found in *Table 5*.

Econometric analysis of the relationship between "Price level ratio of PPP conversion factor (GDP) to the market exchange rate (%)" and "Rural population (% of the total population)" and "Urban population (% of the total population)" have been analyzed in Models I and II. We analyze Models I and II with three different estimation methods.

According to the results obtained from Model I, 1% increase in "Price level ratio of PPP conversion factor (GDP) to the market exchange rate (%)", "Rural population (% of total population)" is increased by 17.1% (=Exp(0,158102)-1), according to the result of RE estimator, and increased by 17.9% (=Exp(0,165136)-1) according to the result of FE estimator. According to the FMOLS estimator, it decreases by 17.7% (=Exp(-0.190196)-1). According to these results, the 1% increase in the 'sagp' variable is the reason for an approximately 5.9%[4] increase in the 'tnikn'.

According to the estimator results applied to Model II, a 1% increase in "Price level ratio of PPP conversion factor (GDP) to the market exchange rate (%)" made "Urban population (% of the total population)" is increased according to RE, FE and FMOLS estimators, respectively, 13.4%, (=Exp(-0.14447)-1), 14.3% (=Exp(-0.154457)-1) and 16.5% (=Exp(-0.180467)-1). These results tell us that the 1% increase in the 'sagp' variable is the reason for the approximately 14.7%[5] average increase in the 'tnisn'.

The reason behind creating Models I and II is to determine the econometric effect of "Price level ratio of PPP conversion factor (GDP) to the market exchange rate (%)" on migration from rural to urban and from urban to rural. The econometric findings provide us with strong evidence that supports the expected effect. According to the estimator results applied to Model III, a 1% increase in "Employment in agriculture (% of total employment)" is upon "Urban population (% of the total population)" according to RE, FE, and FMOLS estimator results, causes an increase of 0.8% (=Exp(0.008173)-1),

Table 5. Panel models estimations results

Case	Variable	Random Effect	Fixed Effect	FMOLS
Model I	*lnsagp*	0.158102 (0.00)*	0.165136 (0.00)*	-0.190198 (0.00)*
	Adj. R^2	*0.118497*	*0.973315*	*0.974000*
Model II	*lntnisn*	-0.144470 (0.00)*	-0.154457 (0.00)*	-0.180467 (0.00)*
	Adj. R^2	*0.154292*	*0.950499*	0.956395
Model III	*lntnitu*	0.008173 (0.0861)***	0.013227 (0.0252)**	0.015935 (0.0883)***
	lntnikn	-0.557084 (0.00)*	-0.514098 (0.00)*	-0.486613 (0.00)*
	lntiiti	-0.019146 (0.0191)**	0.055604 (0.0291)**	0.071823 (0.0310)**
	lnsagp	-0.067522 (0.0001)*	-0.069450 (0.00)*	-0.081447 (0.0028)*
	Adj. R^2	*0.622765*	*0.977288*	*0.977471*

Note: (*), (**) and (***) indicate 1%, 5% and 10% significance level, respectively.
Source: own compilation based on Eviews 10 (IHS Global Inc).

[4] It is calculated as the average of 15.8%, 16.5% and -19%.
[5] It is calculated as the average of -14.4%, -15.4% and -16.5%.

1.3% (=Exp(0.013227)-1) and 3.7% (=Exp (0.015935)-1), respectively. These results show that a 1% increase in 'tnitu' is the cause of a 1.2%[6] increase in 'tnisn'.

An increase by 1% in "Rural population (% of the total population)" in Model III causes a decrease in "Urban population (% of the total population)", by 42.7% (=Exp(-0,557084)-1), 40.1% (=Exp(-0,514098)-1) and 38.5% (=Exp (-0,486613)-1), respectively. According to the results, a 1% increase in 'tnikn' causes a 40.4%[7] decrease in 'tnisn'; 1% increase in "Unemployment, total (% of the total labor force) (modeled ILO estimate)", one of our two most important variables in Model III, decreases "Urban population (% of the total population)" according to the RE estimator result. According to the FE and FMOLS estimator results, 5.7% (=Exp(0,055604)-1) and 7.4% (=Exp(0,071823)-1) increase, respectively. In other words, a 1% increase in 'tiiti' causes a 3.7%[8] increase in 'tnisn'.

An increase by 1% in last variable "Price level ratio of PPP conversion factor (GDP) to the market exchange rate (%)", which is the main component of this study, has 6.5% (=Exp(-0,067522)-1), 6.7% (=Exp(-0,06945)-1) vs 7.8% (=Exp(-0,081447)-1) negative effect on "Urban population (% of the total population)", as a result of the analysis made on RE, FE and FMOLS estimators, respectively. We can conclude, that a 1% increase in 'sagp' causes a 7%[9] decrease in 'tnisn'.

In general, the findings show that the Todaro Paradox is valid for the sample economies we consider. We find a negative relationship between the price level ratio of the PPP conversion factor (GDP) to the market exchange rate and urban population. In contrast, the relationship between the price level ratio of the PPP conversion factor (GDP) to the market exchange rate and rural population is positive. The results of the analysis provided strong evidence for the validity of this paradox

Conclusion

In this study, we analyze the validity of the Todaro Paradox based on an annual basis over the 1992–2019 period, using various variables over eight selected developing countries. As independent variables we consider the price level ratio of the PPP conversion factor (GDP) to the market exchange rate and total unemployment (% of the total labor force), rural population, and employment in agriculture. Urban population is included in the model as a dependent variable. The first two models show the relationship between the price level ratio of the PPP conversion factor (GDP) to the market exchange rate and the urban and rural populations. The relationship is negative and positive, respectively. This confirms the Todaro Paradox, which states, that rural-urban migration in developing countries occurs due to a perceived higher standard of living in urban areas despite worsening economic conditions. After finding evidence for the relationship in the first two models, the third model carries out the main analysis. This model provides evidence for the Todaro Paradox, which can inform future research and policies aimed at reducing rural-urban migration and promoting sustainable development in eight developing countries, that we consider in this study.

Addressing rural-urban migration challenges requires the implementation of policies that promote sustainable development in both urban and rural areas, such as measures to create employment opportunities and improve the quality of life, and to regulate migration and manage the situation caused by rapid urbanization. Moreover, policies should promote sustainable development

[6] It is calculated as the average of 0.8%, 1.3% and 1.5%.

[7] It is calculated as the average of -55.7%, -48.6% and -51.4%.

[8] It is calculated as the average of -1.9%, 5.5% and 7.1%.

[9] It is calculated as the average of -6.7%, -6.9% and -8.1%.

and address the challenges posed by rural-urban migration in developing countries. It is significant to highlight the relationship between economic factors and urbanization and suggest, that efforts to address poverty and unemployment may also have an impact on migration patterns. Further research in this area could help to refine our understanding of the urbanization dynamics and policies that support sustainable development in developing countries.

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Received January 23, 2023.