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Does Circular Economy Play a Key Role in Economic Growth?

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Abstract

The effects of the circular economy are highly debated, and its conceptualization has been accompanied by several controversies among policy-makers and businesses. In this work, we give an empirical contribution to the debate by focusing on the association of the circular economy with some socio-economic variables showing that, regardless of the environmental benefits, measures in favour of the implementation of circular economy practices can significantly and directly contribute to economic growth.

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1. Introduction

The debate on the opportunities and challenges arising from the circular economy (CE) and its suggested approaches on alternative production and consumption models are gaining increasing relevance worldwide. A growing body of literature is showing the various theoretical, methodological and empirical aspects of the circular economy (Heshmati, 2015) focusing, in particular, on its relative benefits for resource efficiency, innovation, job creation and productivity in both developed and developing countries (Wilts, 2017; EC, 2015; Ellen MacArthur Foundation, 2015; Porter and Kramer, 2006; Yuan *et al*. 2006). The transition towards a circular economy is, nowadays, considered crucial and is central in the agenda of policy-makers, especially since the European Commission (2015) published its Circular Economy Action Plan, of which the main objectives are those relative to job creation, environmental protection, sustainable growth and enhancement of industrial (and economic) competitiveness at the European level. Recent literature has highlighted that a shared understanding of the concept of the circular economy has yet to be established (Reike *et al*. 2018) and this is due to the fact that fundamental questions of circular economy conceptualization still remain unresolved (Blomsma and Brennan, 2017). When looking at its framing scholars are quite unanimous in viewing the circular economy as a "new perspective" (Bonciu, 2014), a "new path of industrialization" (Xiao and Huang, 2010), and a new model that needs "a paradigm shift in the way things are made" (Preston, 2012; EMAF, McKinsey & Company, 2014). Nevertheless, when looking at the potential impacts of the circular economy, the literature consistently holds that the circular economy is linked to increased global competitiveness, new opportunities for innovation, resource efficiency and economic growth (Ellen MacArthur Foundation *et al*., 2017; OECD, 2011; WEF, 2014). So, in addition to the environmental benefits (i.e., waste avoidance, decrease in the total demand for primary raw materials, re-use, eco-design strategies, etc.), the move away from the current predominant economic models, which are highly resource-intensive and dependent, represents a long term and sustainable solution for innovative approaches that can generate economic and social benefits (UN, 2015; EC, 2014a,b).

However, while new jobs and technological opportunities will be created in many economic sectors, employment and economic activity could even become worse especially in those more vulnerable sectors (such as the manufacture and sales of products with low durability, resource extraction, waste incineration, etc.) which are directly tied to the current linear production and consumption patterns (Becque *et al*., 2016). Despite these multi-faceted arguments, a gap emerges in the literature on the role of employment in the circular economy and on its nexus with economic growth, poverty and the labour market as a whole. Our analysis becomes particularly important in the current economic transition context where the level of implementation of the circular economy needs to be accelerated. More specifically, the main motivation behind this research is to deepen our understanding of the relationship between the circular economy and three socio-economic variables (i.e., unemployment, the human development index and the poverty index), making a contribution towards filling this gap in the literature. Using a Fixed Effects (FE) model, our findings show that employment in the circular economy is strongly associated with better socio-economic and development indicators. Moreover, the application of a Granger causality test for panel data, as proposed by Dumitrescu and Hurlin (2012), suggests the existence of a uni-directional causality running from the circular economy to employment.

2. Data and Methodology

In order to analyse whether the circular economy has the potential to contribute to the creation of jobs and socio-economic growth, we test the relationship between the number of persons employed in the recycling, repair and re-use sectors (CE, used by the European Commission to proxy the level of occupation in the circular economy industry) and three different socio-economic variables which, respectively, measure the unemployment rate ($UNEM$), the Human Development Index (HDI) and the percentage of people at risk of poverty or social exclusion (POV). Based on available data, we build a balanced panel dataset composed of 23 European countries (Austria, Belgium, Bulgaria, Cyprus, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom) during the period 2008-2017. The two-following fixed-effects (FE) regressions with robust standard errors are estimated:

$$SE_{i,t} = \beta SE_{i,t-1} + \theta CE_{i,t-1} + \gamma_i + \mu_t + \varepsilon_{i,t} \quad (1)$$

$$CE_{i,t} = \beta CE_{i,t-1} + \theta SE_{i,t-1} + \gamma_i + \mu_t + \varepsilon_{i,t} \quad (2)$$

where $SE_{i,t}$ is a set of socio-economic variables ($UNEM$, HDI or POV) in country i in year t, $CE_{i,t}$ is our measure of circular economy, γ_i and μ_t control respectively for country and time fixed effects, $\varepsilon_{i,t}$ represents the error term assumed to be identical, independent and normally distributed. In such a framework, we attempt to determine whether a change in a variable is associated with the future path of the other variable, i.e., if the forecast of $SE(CE)$ improves when the lagged variable for $CE(SE)$ is taken into account. The decision to use a panel data model with fixed effects allows us to increase both the number of observations and the degrees of freedom and it is especially suitable in our case, given the relatively short observational period (ten years) and a supranational European institutional setting with a common political agenda for sustainable development. We also investigate the causality issue by applying the non-causality Granger test (1969) for heterogeneous panel data models, developed by Dumitrescu and Hurlin (2012). The causality test, where the null hypothesis is the absence of a causal relationship for all units in the panel, is performed on the first difference of our variables with one lag (the maximal lag order due to the time dimension of our dataset), using the *xtgcause* STATA package (see Lopez and Weber, 2017).

According to Domenech and Bahn-Walkowiak (2019), the analysis of European national policies on environmental resource efficiency reveals a complex and rather fragmented picture characterized by heterogeneous strategies, targets and policy instruments that often reduce the effectiveness of resource efficiency's policies and hamper the transition towards a uniform implementation of the circular economy action plans. As a matter of fact, European environmental policies have been traditionally led by environmental leading countries and the enlargement of the EU to Central and Eastern European countries (with weaker environmental frameworks) has intensified the leader-laggard dynamics and increased national divergences in the implementation of the common legislative frameworks (Liefferink and Andersen, 2005). Hence, given the large and still persistent differences in performance, we test the robustness of our findings by sub-dividing our sample between the leading countries in environmental protection and all the other countries. In order to do so, we split our dataset into two groups of countries according to the latest available

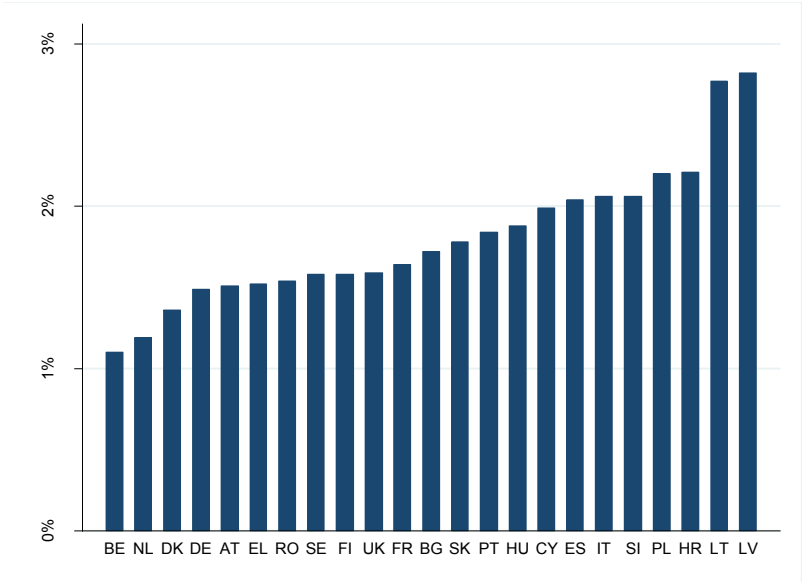
Environmental Performance Index (EPI, 2020):[1] in the leaders group appear Denmark, UK, France, Austria, Finland, Sweden, Germany, Netherlands, Spain, Belgium, Slovenia, in the other group appear Italy, Greece, Slovakia, Portugal, Cyprus, Romania, Hungary, Croatia, Lithuania, Latvia, Poland, Bulgaria. This will allow us to check if, and for which countries, the circular economy could have a greater impact: for instance, the laggards could seize the opportunities arising from the circular economy to a greater extent than the leaders that, indeed, have already significantly improved their CE national strategies and achieved some pioneering advantages (Domenech and Bahn-Walkowiak, 2019).

Descriptive statistics of the variables employed are shown in Table 1. As we can see, the variables present values of high amplitude and the difference between the minimum and the maximum values is often very high (the variable CE ranges from a minimum of 1.07 in 2009 in Slovakia to a maximum of 2.89 in 2016 in Latvia); figure 1 ranks the European countries by the share of employment in the circular economy industry in 2017.

Table 1. Variable description, data sources and descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Source
CE	230	1.746	0.399	1.07	2.89	Eurostat - code cei_cie010
$UNEM$	230	9.816	4.757	3.70	27.5	Eurostat - code tps00203
HDI	230	0.868	0.041	0.77	0.94	United Nations Development Programme
POV	230	25.305	7.865	14.9	49.3	Eurostat - code sdg_01_10

Figure 1. Employment in the circular economy industry (2017)



Source: authors' elaboration on Eurostat data

[1] EPI is a biennial index released by Yale University and Columbia University in collaboration with the World Economic Forum. It offers a ranking that highlights leaders and laggards in environmental performance and provides practical guidance for countries aiming to move toward a sustainable growth.

3. Empirical Results and Discussion

Tables 2-4 exhibit our estimation results respectively for $UNEM$, HDI and POV. Equation (1) shows that the lagged level of employment in the circular economy industry is negatively correlated with the unemployment rate in the full sample. The coefficient of CE_{t-1} is equal to -3.66 and is statistically significant at the 0.01 level: this means that an additional point of employment in the circular economy is associated with the reduction of the unemployment rate of over three and a half times. In contrast, in (2) the lagged value of unemployment does not contribute to the prediction of the level of employment in the circular economy (the coefficient of $UNEM_{t-1}$ is equal to 0.005 and is not statistically significant). However, when we take into account the sub-samples of i) leader countries (i.e., best environmental performers) and ii) laggards (i.e., worst environmental performers), a sharp heterogeneity emerges: the results remain robust and even strengthen in the worst performers sample, while the lagged level of employment in the circular economy has no impact on the unemployment rate in the best performers sample. This is in line with the insight that circular economy strategies might improve the economy and open up new opportunities of sustainable growth paths especially for the laggard countries.

A similar result appears when we take into account other socio-economic variables that are not strictly linked with employment. The pair of equations (7) and (8) in table 3 show that the lagged value of the circular economy is positively associated with the HDI (*p-value* < 0.05), while the coefficient of HDI_{t-1} does not statistically affect the employment rate in the circular economy. Equation (13) in table 4 demonstrates that the circular economy is correlated with a decreasing level of people at risk of poverty or social exclusion (the coefficient of CE_{t-1} is equal to -1.79 and is statistically significant at the 0.10 level), and not vice-versa (the p-value of POV_{t-1} in eq. (14) is higher than 0.10). With regard to the restricted samples of best and worst environmental performers, the same conclusions as those previously discussed apply also for both HDI and POV. The overall positive association between the circular economy and socio-economic variables seems to affect only the countries with the worst environmental performance.

Table 5 shows the results of the panel Granger causality analysis, where the homogeneous non-causality hypothesis is tested. Although one would expect a bi-directional relationship between employment in the circular economy industry and the total unemployment rate, the test fails to reject the null hypothesis of absence of causality for all countries when the causality comes from $UNEM$ to CE. On the other hand, CE appears to Granger-cause $UNEM$ in both the full and the worst environmental performers samples (the test rejects the null hypothesis respectively at 0.05 and 0.01 level). This supports the argument that the circular economy can foster a process of job creation. A similar result appears when we take into account the other socio-economic variables that are not strictly linked with employment (CE Granger-cause both HDI and POV in both the full and the worst environmental performers samples), although a bidirectional relationship is found.

Table 2. Estimation results - variable $UNEM$

	Full sample		Best performers		Worst performers	
Variables	$UNEM$	CE	$UNEM$	CE	$UNEM$	CE
	(1)	(2)	(3)	(4)	(5)	(6)
$UNEM_{t-1}$	0.745***	0.005	0.644***	0.011***	0.774***	0.003
	(0.048)	(0.004)	(0.038)	(0.002)	(0.058)	(0.005)
CE_{t-1}	-3.659***	0.480***	-2.993	0.527***	-3.278**	0.450***
	(1.231)	(0.112)	(2.720)	(0.121)	(1.282)	(0.127)
Time dummies	YES	YES	YES	YES	YES	YES
Country FEs	YES	YES	YES	YES	YES	YES
Cons.	10.070***	0.802***	8.478*	0.608***	10.306***	0.950***
	(2.450)	(0.185)	(4.191)	(0.177)	(2.886)	(0.233)
Obs.	207	207	99	99	108	108
Countries	23	23	11	11	12	12
R-squared	0.764	0.461	0.742	0.610	0.788	0.447

Notes: ***, **, * denote significance at the 1%, 5% and 10% level. Robust standard errors in parentheses.

Table 3. Estimation results - variable HDI

	Full sample		Best performers		Worst performers	
Variables	HDI	CE	HDI	CE	HDI	CE
	(7)	(8)	(9)	(10)	(11)	(12)
HDI_{t-1}	0.656***	-1.051	0.525***	0.643	0.708***	-2.335
	(0.047)	(1.413)	(0.100)	(2.095)	(0.048)	(2.608)
CE_{t-1}	0.005**	0.481***	-0.000	0.563***	0.005***	0.462***
	(0.001)	(0.111)	(0.004)	(0.159)	(0.001)	(0.130)
Time dummies	YES	YES	YES	YES	YES	YES
Country FEs	YES	YES	YES	YES	YES	YES
Cons.	0.285***	1.734	0.423***	0.051	0.230***	2.872
	(0.040)	(1.190)	(0.091)	(2.065)	(0.040)	(2.071)
Obs.	207	207	99	99	108	108
Countries	23	23	11	11	12	12
R-squared	0.909	0.453	0.896	0.572	0.930	0.448

Notes: ***, **, * denote significance at the 1%, 5% and 10% level. Robust standard errors in parentheses.

Table 4. Estimation results - variable POV

	Full sample		Best performers		Worst performers	
Variables	POV	CE	POV	CE	POV	CE
	(13)	(14)	(15)	(16)	(17)	(18)
POV_{t-1}	0.769***	0.003	0.471***	0.025**	0.771***	0.002
	(0.040)	(0.004)	(0.102)	(0.010)	(0.067)	(0.005)
CE_{t-1}	-1.788*	0.479***	0.905	0.499***	-2.052*	0.444***
	(1.032)	(0.113)	(0.896)	(0.101)	(1.181)	(0.128)
Time dummies	YES	YES	YES	YES	YES	YES
Country FEs	YES	YES	YES	YES	YES	YES
Cons.	8.688***	0.761***	8.641***	0.232	10.757***	0.919**
	(2.064)	(0.251)	(1.311)	(0.251)	(3.1456)	(0.344)
Obs.	207	207	99	99	108	108
Countries	23	23	11	11	12	12
R-squared	0.673	0.453	0.534	0.620	0.738	0.444

Notes: ***, **, * denote significance at the 1%, 5% and 10% level. Robust standard errors in parentheses.

Table 5. Granger non-causality test results

	Full sample		Best performers		Worst performers	
	W-bar	Z-bar	W-bar	Z-bar	W-bar	Z-bar
$CE \rightarrow UNEM$	1.696	2.361**	0.786	-0.500	2.207	2.958***
$UNEM \rightarrow CE$	1.174	0.592	1.138	0.325	1.530	1.299
$CE \rightarrow HDI$	2.022	3.467***	1.466	1.094	2.531	3.752***
$HDI \rightarrow CE$	1.815	2.767***	0.745	-0.597	2.797	4.402***
$CE \rightarrow POV$	1.627	2.128**	1.236	0.555	1.985	2.415**
$POV \rightarrow CE$	1.623	2.113**	0.704	-0.693	2.465	3.589***

Notes: ***, **, * reject the null hypothesis of HNC at the 1%, 5% and 10% level. The causality test is performed with one lag using the *xtgcause* STATA package (Lopez and Weber, 2017).

4. Conclusions

This study has taken some promising first steps in studying the relationship between the circular economy and three different socio-economic variables. The results obtained recommend strengthening the promotion of circular economy practices and, according to the current European Commission's economic policy, governments should foster them by encouraging positive attitudes among businesses and consumers towards circular economy approaches. We believe these results can be of great value to policy-makers when evaluating the strategies for implementing the circular economy because of their relationship with job creation, economic growth and reduction of poverty. The circular economy can play a key role in the actual phase of transition, given that countries which attained higher levels of employment in the circular economy sectors would create the conditions for achieving not only an overall improvement of the labour market, but also poverty alleviation alongside higher levels of economic growth. Moreover, our findings show that the circular economy can be beneficial especially for those European countries that are lagging behind in terms of both environmental performance and policies; narrowing the gap between the best performing and the worst performing Member States could help to gradually increase convergence over ways and means at EU level. It seems advisable, therefore, to emphasize the importance of linking the circular economy to labour market impacts, economic growth and poverty reduction. Nonetheless, more empirical work is needed to find out if this correlation implies a proper causal relationship, and this work took a first, preliminary step in that direction.

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