The impact of converting waste into resources on the regional economy, evidence from the south of Poland

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Abstract

Recently we observe a growing interest in the Circular Economy (CE) concept among scholars and practitioners all around the world. One of the CE goals is to increase the resource efficiency by converting more waste into resources. The introduction of such changes in the long term perspective will affect the regional economy. In this paper the Dynamic Stochastic General Equilibrium (DSGE) model designed to simulate the expected impact of increase resource efficiency on the regional economy is developed. The model is built on the assumption that a part of current consumption returns back from consumers to producers in the form of supplies used later in the production process. Structural parameters of the proposed model were calibrated to Małopolska, region in southern Poland, the study used the bayesian estimation method in process. A computer simulation confirms the positive impact of the increase of resource efficiency on the economy, which eventually will improve the quality of life of the population.

Methodology and results

The difficulty in collecting a necessary empirical database results in situation where the environmental policy feedback mechanism stil doesn't seems to be fully integrated into a GE model.

Agents in the presented model are producers, consumers and the government. Manufacturers maximize profit, consumers maximize utility, and the government taxes transactions and redistributes profits. Consumption is divided into private and government, the Calvo sticky prices mechanism is also present. Available resources are divided into primary and secondary (recovered from past consumption). The production function depends on capital, labor and materials. The model has been linearized and the variables used de facto illustrate deviations from equilibrium.

Fig. 3 Conceptual model of flows related to the CE as implemented in DSGE model

Introduction

CE replaces old linear business model by an idea of economy where material flow is closed and goods circulate among users as rented or leased instead of owned, damaged items are repaired not replaced and wastes are limited to absolute minimum (Geissdoerfer et al., 2017; Korhonen et al., 2018). At the moment this idea is an utopia, but certain steps are made in order to move into that direction. The cold facts are that we live on planet with finite amount of resources and growing number of recipients. Moreover humanity reached level of development which influenced the Earth climate and the pollution is a global concern. A shortage in resources already became imminent threat to world biggest producers. As a result China adopted CE as the core strategy for national development (Geng et al., 2012). Concerns in seeking resource efficiency are present in Europe as well (Welfens et al., 2017). At first individual countries (Germany, France, Finland, Denmark among others) and thus the EU. Europe is focused on resource efficiency, waste, new business models, new jobs, eco-innovations, social innovations, etc. (McDowall et al. 2017).

Fig. 1 The Circular Economy - what does that mean?

Preston - 2012

Circular economy is an approach that would transform the function of resources in the economy. Waste from factories would become a valuable input to another process – and products could be repaired, reused or upgraded instead of thrown away

Sauvé et al. - 2016

Circular economy refers to the "production and consumption of goods through closed loop material flows that internalize environmental externalities linked to virgin resource extraction and the generation of waste (including pollution)".



Based on the quarterly data from 2008-2017parameters of the model were estimated. As a result reliable estimates and confidence intervals for simulations were possible to made. The source of economic fluctuations in DSGE models are shocks. Therefore, attention was focused on shocks related to the increase in the amount of available materials resulting from the recovered resources. Figure 4 illustrates effects of that shock to GDP and wages. GDP is clearly growing and growth is spread over time. Wages are also increased in the short term, although values below equilibrium are possible in the

European Environment Agency - 2014

Circular economy "refers mainly to physical and material resource aspects of the economy – it focuses on recycling, limiting and re-using the physical inputs to the economy, and using waste as a resource leading to reduced primary resource consumption". European Commission - 2015

The circular economy is an economy "where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised". The transition to a more circular economy would make "an essential contribution to the EU's efforts to develop a sustainable, low-carbon, resource-efficient and competitive economy".

Preventing the generation of wastes with association of converting them into resources additionally combined with increased resource efficiency will significantly impact the environment, society and economy. Consequently CE serves the purpose of developing an understanding new processes and business models which could be later adopted in economy).

Fig.2 Principles of the Circular Economy

LESS PRIMARY
DESCURCES IN USEPRODUCT LIFE
DESCURCES IN USEALTERATION IN
CONSUMPTION
DATTERNSmore efficiency
recyclingimprove of durability
redistribution
refurbishmentimprove of durability
redistribution
refurbishmentproduct as a service
user instead of consumer

long term.

Fig. 4 Impulse response function to material shock



Conclusion

The presented article attempts to answer the question how converting waste into resources will impact regional economy in Małopolska. To this end, a Dynamic Stochastic General Equilibrium Model with an implemented resource recovery mechanism was constructed. Presented simulations show that a increase in the amount of materials resulting from an increase in the level of recovery leads to economic growth. However, one should remember that the results obtained are specific to the used model, i.e. the assessment of shocks and their impact on the economy may change when a different DSGE model or other parameters (data set) are used.

Literature

In this research a special attention is directed to modification of existing macroeconomic models of production and consumption. The most common approach to modeling impact of CE on economy involves quantitative models of computable general equilibrium. The concept of general equilibrium makes those models most suitable for such an analysis because it is expected that some parts of economy will benefit from changes and other will not (Wijkman & Skånberg , 2015). Existing studies use few kinds of decoupling mechanisms. Researchers most commonly introduce some kind of technological change in production function. In this approach parameters of production function are altered in a way which results in better overall efficiency of production (Tuladhar et al., 2015). The second approach is related to term of substitution substitution between materials, substitution between production factors and substitution on demand side (Godzinski, 2015). Some recent studies assume that in future consumers liberally will shift to products which are less material intensive. Such exogenous alterations in consumption patterns will result in reductions in natural resource extraction (Bosello et al., 2016; Meyer et al., 2015). In this paper we assume that part of consumption is recovered in form of materials and is used again in production process.

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