Journal of Applied Economics. Vol XVIII, No. 2 (November 2015), 347-368

A FUZZY MODEL TO ESTIMATE THE SIZE OF THE UNDERGROUND ECONOMY APPLYING STRUCTURAL EQUATION MODELING

Mostafa Tahmasebi* **and Michel Rocca**
CREG, Université de Grenoble

Submitted December 2013; accepted September 2014

The underground economy is an ambiguous concept: the literature presents a wide variety of definitions about it; the activities it encompasses are mobile and dynamic; and its structure has displayed several variations as time goes by. The present work aims to estimate a fuzzy number (a possible interval) for the size of the underground economy by applying structural equation modelling with fuzzy data. The proposed fuzzy model applied here involves two main steps, changing the structural equation model to a reduced form, then making a non-linear model from reduced-form equations applying fuzzy linear regression concepts and solutions. Finally, the time series of the underground economy are obtained using the GAMS mathematical optimization software and compared with the findings of two MIMIC models and a microeconomic method.

JEL classification codes: O17, H26, C22, C51, E26
Key words: underground economy, structural equation modelling, fuzzy linear regression, estimation methods.

I. Introduction

Despite the government regulations in developing and developed countries, there are large numbers of market transactions (mostly in cash) in various activities and services which are not reported and declared to the government and make a phenomenon known as the underground economy. Most governments restrict

* Mostafa Tahmasebi (corresponding author): CREG, Université de Grenoble (UPMF), BP 47 - 38040 Grenoble cedex 9, Grenoble, France; tel.:+33 (0) 75 14 72 509; fax: +33 (0)4 76 82 56 76; e-mail: Mostafa.Tahmasebi@etu.upmf-grenoble.fr. Michel Rocca: e-mail: Michel.Rocca@upmf-grenoble.fr.

these activities by prosecuting, punishing and educating culprits, but the changes in the form of such activities have been considerable over the course of time (Jie et al. 2011).

Frey and Schneider (2000) discuss three major concerns about the existence and development of underground activities: reliance on official statistics may be misleading; underground activities avoid taxation, which reduces tax revenue; the existence of underground activities is an indicator of the unhealthy relations between citizens and government.

Various methods have been proposed and applied to measure the size of the underground economy. Schneider (2005) classifies these methods in three categories: direct methods, indirect methods and modelling methods. Direct methods or micro-methods build up estimates of the size of the underground economy based on the results of surveys, questionnaires, interviews and tax auditions of firms and/or households. These methods only yield estimates for a specific point in time; they do not provide a time series. They are correct at a specific point in time and can be regarded as low-end estimations. Difficulty in selecting appropriate samples, the possibility of selection bias and measurement errors regarding the surveys are among the defects of direct methods (Albu 1995; Elgin and Oztunali 2012).

Indirect or macroeconomic methods focus on the discrepancy between the official and actual criteria, such as differences between national income and expenditure, transactions and national income, and electricity consumption and GDP. As an example, if total labour force participation is assumed to be constant, a decrease in the official rate of participation can indicate an increase in underground activities. However, these methods are generally criticized for employing various simplifying and limiting assumptions, such as focusing on a specific aspect or indicator and neglecting the other causes which may also have a predominant effect on the underground economy (Albu 1995; Elgin and Oztunali 2012).

The most popular method used to estimate the underground economy is Multiple Indicators Multiple Causes (MIMIC). Similar to the other two methods, this approach is based on the use of simplified econometric conditions, making it vulnerable to statistical errors. Another deficiency of this approach is that it does not rely on any micro-foundations (Breusch 2005). On the whole, the evidence presented has failed to achieve a consensus on a reliable method for measuring the size of the underground economy without strong assumptions.