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Decision Support

Sovereign debt markets in light of the shadow economy

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ABSTRACT

We investigate the controversial role of the informal sector in the economy of 64 countries between 2003 and 2007 by focusing for the first time on the impact it has on sovereign debt markets. In addition to a standard ordered probit regression, we employ two nonparametric neural network modeling techniques in order to capture possible complex interactions between our variables. Results confirm our main hypothesis that the informal sector has significant adverse effects on credit ratings and lending costs. MLP neural networks offer the best fit to the data, followed by the RBF neural networks and probit regression, respectively. The results do not change with respect to the stage of economic development of a country and contradict views about the possibility of significant economic benefits arising from the informal sector. Our study has important implications, especially in the context of the ongoing sovereign debt crisis, since it suggests that a reduction in the informal sector of financially challenged countries is likely to help in relaxing credit risk concerns and cutting down lending costs. Finally, a decision tree analysis is used to exploit the inherent discreteness in the data and derive intuitive rules with respect to the level of the informal sector.

1. Introduction

Tax evasion and the informal sector are highlighted in the press as the root of the sovereign debt crisis in certain countries such as Greece and Portugal[1]. Rating agencies also emphasize the protagonistic role of the informal sector by justifying recent downgrades of country credit ratings on the basis of pervasive tax evasion[2]. At an economic policy level, reducing tax evasion in Greece has been one of the key conditions set by the European Union and the International Monetary Fund (IMF) in order to provide a 110 billion euro bail-out from the debt crisis (e.g., see IMF Country Report No. 10/110, May 2010). Notwithstanding, some concerns have also been voiced about the possible negative side-effects from stamping out tax evasion[3]. These developments provide the dramatic background for the present paper along with a motivation to try and clarify the unexplored relationship between the informal sector and sovereign debt markets.

The inherently mysterious nature of the informal economy means that its drivers, consequences and theoretical underpinnings remain ambiguous. The term itself is controversial and is encountered also as the economy or sector which is black, grey, shadow, hidden, unrecorded, unreported, illegal, subterranean, underground, parallel, clandestine, second or household. Under a broad definition which focuses only on legal activities, it includes "*all economic activities that contribute to the officially calculated (or observed) gross national product but are currently unregistered*" (Schneider & Enste, 2000). As discussed in the literature, tax evasion is a key symptom and driver of activities in the informal sector. Much research attempts to understand the links between the formal and informal sector of the economy. However, these concentrate almost entirely on the real sector by looking at positive and negative effects of the informal sector on aspects of the economy which include: competitiveness, income, inequality, corruption, public revenues and policy effectiveness (for reviews see La Porta & Shleifer, 2008; Schneider, 2005).

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[1] See, for example, "*Such (tax) evasion has played a significant role in Greece's debt crisis, and as the country struggles to get its financial house in order, it is going after tax cheats as never before*" (Greek Wealth Is Everywhere but Tax Forms, *New York Times*, Suzanne Daley, May 1, 2010). The informal sector in Greece and Portugal is estimated in 2007 at 26.5 percent and 23.5 percent, respectively, against an average of 18.24 percent in the euro zone (estimates by Schneider et al., 2010).

[2] For, example, Moody's downgraded Greece's debt to "highly speculative", from Ba1 to B1, in March 2011 citing "endemic tax evasion" as one of the main reasons for its decision.

[3] See, for example, "*Tax evasion. Dues and don'ts. Southern Europe will have trouble increasing its tax take*", *Economist*, August 12, 2010.

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In the present paper we explicitly examine for the first time the links between the informal sector and sovereign debt markets. Our main hypothesis is that countries which have larger informal sectors face worse sovereign credit ratings and higher lending costs. This stems from the theoretical and empirical literature which shows the harmful economic effects of the informal sector with respect to, for example, tax revenues, public goods and services, competitiveness, productivity, efficiency and growth. Motivated by Schneider (2005), we also test if the informal sector has an asymmetric impact on sovereign debt markets which depends on the stage of economic development of a country.

As suggested by the current literature on modeling of credit risk (see, for example, Bennell, Crabbe, Thomas, & ap Gwilym, 2006; Christodoulakis, 2014; Elgin & Uras, 2013; Sawik, 2012; Terradez, Kizys, Juan, Debon, & Sawik, 2015), our analysis uses both parametric and nonparametric methods along with data mining techniques. In particular, we use order probit regression, MLP and RBF neural networks, and, decision trees. Overall, our empirical results indicate that the informal sector is an important predictor of credit risk in all the approaches considered. Specifically, it has damaging effects for both industrialized and developing countries on credit ratings issued by S&P, Moody's and Fitch and on lending costs, respectively.

Our analysis provides an important extension to the existing literature. First, it provides modellers, researchers and analysts with a new variable that can be used to improve credit risk predictions and decisions. Second, it shows that MLP neural networks allow the most efficient exploitation of the information in the dataset considered. Standard parametric models cannot deal as successfully with the complexities and behavior of the data. Moreover, our approach in employing neural network models in assessing the significance of the informal economy is innovative. In particular, we partially overcome the black-box nature of the neural network models by using for the first time variable importance analysis via simulation. Third, investigating the link between the informal and financial sector helps us to better understand the impact of the informal sector on economic development and growth. Sovereign debt markets are fundamental dimensions of financial health; they can significantly amplify or inhibit economic activity and constitute a critical element of the financial sector. It has become clear today that understanding the role of the financial sector, in which sovereign debt plays a key role, is crucial in modeling the economy as a whole (see Brunnermeier & Sannikovy, 2014, inter alia). Moreover, the effectiveness or appropriateness of economic policies can depend significantly on financial market-determined variables such as interest rates and investment risk premia (see Akitoby & Stratmann, 2008). Fourth, a variety of stakeholders in the financial sector, both inside and outside a country, which includes financial intermediaries, regulators, policy makers, information brokers, lenders, corporations, risk managers and investors, are interested on the potential effects that the informal sector may have on their decisions and goals which involve sovereign debt (see Ferreira & Gamab, 2007). Fifth, our paper contributes to the important discussion pertaining the widespread evidence concerning the links between corruption, credit ratings and lending costs (see among others, Caulkins et al., 2013). In particular, since the informal sector is associated with corruption, it is important to see if and how it also affects debt markets. Finally, given the ongoing sovereign debt crisis in Europe, any new findings about the drivers of country ratings and costs of debt are particularly valuable. It is crucial to understand the function of the informal sector since it may provide a useful policy lever, metric or window of information.

2. Literature review

2.1. Causes and effects of the informal economy

The explanations for the emergence of the informal sector are based mainly on the advantages enjoyed by agents operating outside the formal sector. The earliest and most popular of these explanations concentrates on the avoidance of taxes (see, for instance, Eilat & Zinnes, 2002). Latter research considers the importance of the weak rule of law which amplifies corruption in the formal economy (e.g., Friedman, Johnson, Kaufmann & Zoido-Lobaton, 2000; Johnson, Kaufmann & Zoido-Lobaton, 1998). Other researchers suggest that the informal economy is fuelled by restrictions related to, for example, bureaucracy, labour or trade regulations (e.g., Choi & Thum, 2005; Friedman et al., 2000), or, by attempts to retain social benefits (Schneider & Enste, 2000). The literature also highlights the fact that agents operating in the informal sector have certain disadvantages in terms of, for example, losing access to certain public services (e.g., legal, security, health, pensions) and private services (e.g., banking, insurance).

The theoretical and empirical literature shows that the informal sector has both negative and positive effects on the economy as a whole (see, among others, Asea, 1996; Eilat & Zinnes, 2002; Schneider & Enste, 2000). As discussed below, it remains undecided if the informal economy has an overall positive or negative influence on economic activity and growth (see Eilat & Zinnes, 2002; Schneider & Enste, 2000).

On the one hand, the expansion of the informal sector shrinks the tax base and revenues. Raising tax rates in order to compensate for the loss in revenues strengthens the incentives to leave the formal sector and may trap economies into a vicious circle. Printing money as a substitute for lost tax revenues is obviously not a long-term solution since it just covers up the problem and eventually leads to inflation and destabilization in the economy. The informal sector becomes a nightmare to macroeconomic policy makers since it increases both model and estimation risk (e.g., Tanzi, 1999), i.e., the uncertainty concerning the correct macroeconomic model and parameter values, respectively. Since informal sector firms operate largely outside the banking system, monetary policy in particular becomes far less effective. Asset allocation and capitalization is also distorted since certain sectors which are better suited for informal sector operation (e.g., commerce, services) become inflated and firms tend to concentrate on shorter-term ventures which have smaller risk and capital expenditures (Kaufmann & Kaliberda, 1996). At the same time, there is unfair competition between firms operating in the informal and formal sector, respectively. The cost of production in the informal sector can be significantly higher since it must include time and money spent on bribes along with the relatively higher costs of informal financing and personal equity. Finally, an important negative social effect of the informal economy is that selective free-riding on public services and unfair competition builds up a socially acceptable distrust against government, official institutions and rule of law (Schneider & Enste, 2000).

On the other hand, possible positive effects of the informal sector have also been discussed in the literature. The main argument here is that it allows economic activity and entrepreneurship when operation in the official sector is not possible or viable due to say excess taxes and regulation or corruption and bureaucracy. Informal sector revenues eventually feed into the formal sector via consumption or savings and therefore ultimately have some positive effect. Finally, under certain conditions it can lead to the creation of markets and the expansion of financial resources. From a neoclassical perspective, the informal sector responds to demand for