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An evolutionary game theory approach to the dynamics of the labour market: A formal and informal perspective

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ABSTRACT

A stylized fact of the labour market in developing countries is that it is highly segmented in informality. One of the main factors that induce workers and firms into informality is an excessive regulatory system that makes formal economy little attractive. This study aims to analyze the dynamics of workers and firms' entrance and withdrawal of the formal and informal economy, assessing the impact of taxes by using an evolutionary game theory approach in which economic agents decide for one these markets according to the expected pay-off. Moreover, the optimal relation between regulatory and enforcement action by the government is evaluated.

1. Introduction

One of the main characteristics of labour markets in developing countries is a high segmentation in informality. It is acknowledged that the presence of an informal sector can produce undesirable effects over economic performance, yielding a negative impact on productivity levels. In this matter, it is observed that jobs in informal sector reveal to be, in most cases, of lower quality, and therefore, of lower productivity when confronted to those of the formal sector. Moreover, informality can engender a negative externality, affecting directly economic growth through fiscal evasion. The reduction of Government's tax collecting implies a diminution in the supply of public services. According to Loayza (1996), the decrease in the supply of these services accompanied by an increase in the amount of economic activity, end up congestioning public infrastructure, bringing down productivity and consequently affecting negatively countries' growth.

One of the main reasons for the existence of informality is the existence of rigid labour legislation. Independently of their goals, legislations interfere in other areas that are outside of their initial control, having negative effects over the economy, making markets inflexible. These Government instruments end up having effects over resource allocation, production means and income distribution. Of all ways of regulation, those related to workers' welfare are the most restrictive and expensive for developing countries. Regulations made to, theoretically, improve workers' welfare, such as minimum wage, social security, indirect benefits and job protection, have shown to be the main cause of informality, due to the high costs they impose on formal economy.

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Labour legislation can establish negative incentives through two channels. The first, explored by Loayza et al. (2005a), creates a harmful effect over the Schumpeterian dynamic of firms; they, on behalf of the rigidity imposed by regulation, find distorted incentives that interfere on their decisions over resource allocation, capital accumulation, competition and innovation, altering the natural process of creation, growth and disappearance of firms. The second channel is the creation and evolution of informal markets. An over designed regulatory system makes formal economy little attractive to economic agents by imposing high access costs, as well as high costs of remaining in legality. These high costs, combined with an institutionally weak Government, with low monitoring and enforcement power, lead progressively to an increase in informality. However informality is in fact only a second best solution once informal producers are scarcely protected by police and courts in cases of crime against property. Yet, these producers are also left with no access to capital markets in order to insure themselves or obtain credit. Moreover, informal agents have little access to other public services whether it be social security, training programs or facilitated credit.

Based on these evidences, our study aims to focus on the dynamics of workers' entrance and withdrawal of the formal and informal economy, also assessing the impact of taxes and the costs incurred by Government when trying to reduce informality. By starting from the stylized facts of the existence of segmentation in informality in many countries, this paper proposes a model suitable to define the correct lines of intervention for a policy maker in order to control informality. The design of the demand and supply of the formal and informal sectors using the dynamic replicator is adopted in order to delineate a market composed of rational agents who take into account the influence of Government and other agents' choices. The dynamics for wages in the formal and informal sectors is also introduced, which makes wages dependent on demand and supply of labour. The equilibrium analysis of this system results in three possible outcomes: (i) the inexistence of a formal market, (ii) the inexistence of informal market and (iii) the co-existence of both formal and informal markets. The State is considered to be a profit maximizer once it has the duty to offer the maximum possible of public services to attend the population with the maximum welfare, what is only possible through tax collecting. But the central planner faces a trade-off in which it has to choose the optimal taxation in order to maximize receipt without producing extra regulation for the formal sector of the economy. Besides, the proportion of the number of agents in each activity, formal or informal, is sensitive to the government's choice parameters, such as income tax over firms and workers.

Hence, the optimal relation between regulatory and enforcement action by the Government is evaluated considering that the State intends to maximize its income, subject to the foreknown workers' dynamic in the formal and informal sectors of the economy. The paper is presented as follows. In the next section a literature review on informal labour market is shown. The aim of this section is not only to review this literature but also to posit the contribution of the present paper to the current labour economics literature highlighting its connection to the searching/matching models. In the third section the derivation of the dynamic replicator is used to describe the agents in the labour market. In Section 4, an optimization process of the governmental revenues is made, where the State chooses between augmenting its revenues through an increase in tax or through an increase on the amount of contributing agents. In the last section we conclude the study.

2. Literature review

As informality has been an issue in many developing countries, a vast literature can be found on the subject. Many authors argue that informality has as one of the main propellers over designed regulatory systems and high tax structures that lead to uncontrolled effects over productivity and growth. Loayza et al. (2005b), for instance, explore informality by evaluating the effects of regulation over the size of the informal sector relative to the GDP. The authors find that an increase in the rigidity of labour legislation leads to the expansion of informality.

Almeida and Carneiro (2005) found that an increase in informality is the outcome of the firms' search for greater flexibility in the economy. Complementing this study, Maloney (2004) describes economic, social and anthropological evidences for the existence of the informal sector in developing countries. According to this study informal urban micro-firms can be pointed out as agents that, on behalf of the lack of enforcement, may opt for which degree of formal activity they wish to produce. Maloney also observes that, even at lower wages, workers in these economies choose informality due to a level of dignity and autonomy that this type of work might offer.

However, informality also holds its costs for firms. Among these costs, we can detect the diminution of access to public services, as well described in Loayza (1996).[2] In this study, the determining factors and the effects of informality are analyzed by running a model of endogenous growth, where production technology depends on the supply of public services. The model leads to the conclusion that in economies where tax is higher than the optimum, and where the enforcement system is weak, the relative size of the informal sector is negatively correlated to economic growth rate.

Assessing the roll of labour taxation on the determination of formalization levels for the Brazilian labour market, in aggregate and in different qualification levels, Ulyssea and Reis (2005) analyze the labour market by using a two-sector model, the formal and informal sectors, where firms of both segments use qualified and non-qualified workers as production inputs. The results suggest that reductions on taxes charged over wages have significant effects over workers' formalization levels and contribute to an increase on employment and outcome levels.

Following a similar approach, Fernandes et al. (2004) evaluate changes in tax structure over product, employ-

[2] Loayza (1996) makes a review of all costs involved in the entrance and maintenance in the formal and informal sectors of the economy.