The shadow economy as an equilibrium outcome

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ABSTRACT

We construct a dynamic general equilibrium model of tax evasion where agents choose to report some of their income. Unreported income requires using a payment method that avoids recordkeeping in some markets—cash. Trade using cash to avoid taxes is the 'shadow economy' in our model. We then calibrate our model using money, interest rate and GDP data to back out the size of the shadow economy for a sample of countries and compare our measures to traditional reduced form estimates.

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1. Introduction

There is a vast literature that studies the shadow, or underground, economy (see Schneider and Enste, 2000 for a review). While the definition of the shadow economy is subject to debate, a standard taxonomy attributes most of this activity to being the result of either (1) trade in illegal goods and services or (2) tax evasion.[1]

The key question in this literature is how large is the shadow economy? Answering this question requires measuring the activity in the shadow economy. This is hard to do since the point of trading in this economy is to avoid detection. Therefore researchers have to employ indirect methods to tease out estimates of the size of the shadow economy. These methods include surveys of citizens, discrepancies in national income accounting, money demand estimation and electricity use.

Estimates for the shadow economy in OECD countries range from 5% of official GDP to 27% while developing economies are much higher, ranging from 25% of official GDP to around 70%. While there is considerable uncertainty around these estimates, if they are remotely accurate, then studying the shadow economy would appear to be of first-order importance for economists studying business cycle behavior, optimal fiscal policy and development.

However, a survey of this literature reveals a surprising observation—none of the empirical estimates are obtained using a rigorous theoretical model. This observation has been made before. In his paper "Quantifying the Black Economy:

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  [1] See Feige (1989, 1994) for more on this definition.

'Measurement without Theory' Yet Again?", Thomas (1999) forcefully critiques this literature for not using economic theory to derive estimates of the shadow economy or the implications of those estimates. To quote

> "A large number of economists have sought to estimate the size of the black economy, but often without giving any explicit reasons for why this exercise is worth undertaking. It seems that a large black economy is 'a bad thing', as it may undermine people's willingness to pay taxes and a government's ignorance of the size of the black economy may lead to the imposition of incorrect macroeconomic policies. However, how large is large? What is important, the absolute level of the black economy, its relative size or its rate of change over time? Suppose that a committee of wise and learned economists, after much thought and consultation, informs the government that in their collective judgement the size of the black economy in the United Kingdom in 1998 corresponds to 12.56% of GNP. What should the government do? Should it behave differently if the estimate were 22.56%? *Without a theoretical framework, we have no way to answer these questions.*" (Thomas, p. F381 emphasis added)

A careful inspection of the literature since the publication of Thomas's paper shows that little progress has been made in using theory to guide our measurement of the shadow economy.[2] Why is this? It could be that the size of the shadow economy is a macroeconomic issue yet most of the behavior of the shadow economy involves microeconomic decision-making on tax evasion, illegal activities and the like. It could be that monetary exchange is at the heart of trade in the shadow economy and this requires a dynamic general equilibrium model to understand how aggregate currency demand is driven by individual decisions to evade taxes. While this methodology is standard in macroeconomics, to date, it has not been done in the shadow economy literature.[3] Our objective in this paper is to do just that.

We define the shadow economy as cash transactions done solely to evade taxes. In particular, agents trade in anonymous bilateral markets where cash transactions can be used to avoid paying taxes. Of course, our model also allows for trades in centralized frictionless markets where tax evasion is not possible, even when cash is used as means of payment. Hence, the formal economy in our analysis consists of all reported income. We do not include tax evasion done via accounting mismeasurement nor do we make a distinction between legal and illegal goods—all goods are legal in our economy. Evasion of taxes is the only illegal activity. Clearly, illegal activities are an important component of the shadow economy however we have chosen to ignore it. The reason for doing so is twofold. First, we do not want to get bogged down in a discussion of why some goods or services are illegal. Second, sorting out legal from illegal goods in the international data is a quantitative nightmare. As a result, one should take our estimates as a lower bound on the size of the shadow economy.

To conduct our analysis, we use the Lagos–Wright (2005) search theoretic model of money which from now on we refer as LW. The LW model is convenient for two reasons. The centralized–decentralized trading structure is a natural environment that captures the idea that some trades are easily measured (those in centralized markets) while others are more easily hidden (those in decentralized meetings). Second, the quasi-linear preference structure allows us to control the distribution of money balances over time.

The main difference from LW and most monetary search models is that we assume that there are no information frictions in decentralized markets that make money essential for trade. There is a record-keeping technology, communication of trading histories and enforcement that allow exchange to be conducted through credit. Therefore, absent of any distortion, all trade in decentralized meetings can be conducted with credit. However, if agents use credit then the transaction is recorded and governments can use this record to enforce the payment of income taxes arising from that exchange. On the other hand, monetary transactions are not recorded or reported to the government, which allows agents to evade income taxes.

The questions that we ask in our paper are the following: Will agents use credit and be part of the formal economy or will they participate in the shadow economy by using money to evade taxes? While cash allows agents to evade taxes it is not costless to do so—money can be taxed via inflation. Thus, agents must decide whether to pay the inflation tax or the income tax (or some combination of the two) in decentralized market trades and this in turn determines the size of the shadow economy.

Our key theoretical results are as follows. First, the size of the shadow economy is endogenous and depends on the rate of inflation, the marginal tax rate and how the tax savings from using cash are split between buyers and sellers. Second, *distortionary* taxation is the reason our shadow economy exists. If the government did not have any expenditures or could finance its spending via lump-sum taxes, then credit would be used to facilitate all trade and the shadow economy would disappear.[4] Third, with distortionary taxation, the shadow economy exists as long as the inflation rate is not 'too high' relative to the income tax rate. If inflation is high enough, agents resort to credit, pay the income tax and all trade is in the formal economy. The critical inflation rate is a function of the tax rate, buyer's bargaining power and the extent of trading frictions in the shadow economy.

Our model therefore generates an endogenous shadow economy and we show how to use standard money demand estimates to back out an estimate of the shadow economy. While this sounds similar to existing currency demand

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[2] By structural, we mean a fully specified dynamic, general equilibrium model with optimizing agents—not a structural econometric model.

[3] There are several papers that have used dynamic general equilibrium models to study the shadow economy [see Koreshkova, 2006; Amaral and Quintin, 2006, Aruoba, 2010] but none of them use the models to estimate the size of the shadow economy. In fact, some like Koreshkova (2006), use prevailing estimates of the shadow economy to calibrate the the size of the shadow economy in their models.

[4] This is a critical distinction from Aruoba's (2010) model—if distortionary taxes are eliminated, he still has a shadow economy. Thus, his model is not about tax evasion but rather illegal goods.