An Estimation of the Underground Economy in Brazil

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1. Introduction

This paper presents an estimation of the size of Brazilian underground economy. The methodology used here differs from the most used in the literature based, which is based on the MIMIC (Multiple Indicators Multiple Causes) method. The paper uses a different method because data available in Brazil allows for a more direct measure than the indirect one based on the MIMIC. Moreover, several authors estimate[1] Brazilian underground economy to reach more than 40% of Brazilian GDP. This paper estimates Brazilian underground economy to represent 15% to 20% of its GDP. This number seems more reasonable than the 40´s percent of Brazilian GDP estimates, given the fact that Brazil has a modern and efficient Receita Federal (Brazil´s Internal revenue Service), a modern economy and a good national accounting system.

This paper estimates the underground economy through the use of two different methods: the monetary approach and the labor market approach. The first one estimates a money demand equation in the way proposed by Tanzi (1980, 1983) and the second one uses Brazilian household data (PNAD) to estimate the size of its informal labor market. We also present an analysis of labor informality in Brazil.

The results show the underground economy represents around 17% of Brazilian GDP. The paper shows that the labor informality has a significant drop in the last years. The level reduction was important for every group but the main important factor explaining the informality reduction is the educational composition effect. It explains up to 60% of the informality reduction. Therefore, in order to reduce labor informality further the government should continue to invest resources to increase high school enrolment and reduce drop outs.

This paper is organized in five sections beginning with this introduction. The second section makes a small review of the literature. Section 3 presents the methodology to estimate the underground economy in Brazil and its results. This section also presents some discussions comparing the Brazilian underground economy measured here and the size measured in other works. The recent informal labor drop decomposition is presented in section 4. The conclusion is presented in section 5.

2 – Literature

The subject of underground economy did not attract attention of economists until the '60s when it became a subject for study. Based on a work by the International Labor Organization (ILO), this subject gained notoriety in the year of 1972 and its study was undertaken.

In fact, Dixon (1999) claims that the underground economy drew little attention until very recently. This fact began to change after the first estimates that indicated how

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large the underground economy could be. Since then, the population in general and the government have become concerned with the phenomenon, mainly due to its tax evasion effect. In addition to reducing tax collection, underground economy reduces credibility of the national accounts, creates difficulties for deciding on public policies (for example, the optimum tax policy is greatly modified by the presence of this sector) and produces unfair competition with firms in the formal sector.

By one hand, theoretical studies have advanced indicating several reasons that lead people to operate within the underground economy. The most frequently indicated factors are the excessive tax burden, high labor costs and strong regulation of the economy. Empirical studies, on the other hand, face a large challenge of trying to measure something which cannot be observed (by its own nature), which results in a complex task.

Despite the multitude of studies, there is a large controversy about the definition, the procedures to prepare estimates and the use of these estimates in formulating policies. Keith Hart (1970, 1973) was the first researcher to use the term Informal Economy to describe the part of the economy which develops beyond the sidelines of the formal labor market. Hart considers informal labor as almost a synonym for self employment. The expression underground economy was also adopted in literature to refer to activities which are characterized by an attempt to evade taxes and avoid governmental regulation.

According to Feige (1989), the term underground economy encompasses a wide range of economic activities that includes production and distribution of illegal goods and services, goods and services marketed and/or produced illegally, which evade taxes or benefit from fraud. As such, underground economy activities encompass activities that are illegal, non-declared, non-controlled by the public authorities or not registered.

An important issue is the relationship between formal and informal. One line of thinking considers underground economy as residual and marginal by nature, and as such, less important. Others consider this sector as dynamic with significant impact potential upon the economy. Therefore, understanding the relationship between formal and informal sectors is important. The effect of formal economy with informal economy can be pro-cyclical or anti-cyclical. Lubell (1991) suggests that both effects are possible: When the economy recesses, individuals migrate to underground economy and when the formal economy is in expansion, the direct and indirect demand for goods and services increases, including in the informal sector. Thus, Greenfield (1993) noted that the development of the sectors occurs in parallel. Similarly, Schneider (1998) documented a strong relationship between the formal and informal sectors of an economy. He reported that, for Germany and Austria, at least two-thirds of the income generated in the underground economy was spent on the formal sector of the economy, generating economic stimulation. The same was reported by Adam and GinsBurgh (1985) for Belgium.

Despite of the difficult to define and estimate the underground economy several works attempt to do this. Bajada and Schneider (2005) point out that estimating underground activity is a rather difficult task due to the large variety of activities comprised in this classification. One part of this problem concerns defining what is underground economy. A commonly used definition states that underground economy is any economic activity, that despite contributing to the GDP, is not registered. Evidently that is a partial definition since many activities that dodge taxes are considered in the GDP. There are several methodologies (or methods) to measure the underground economy.

The monetary methodology is very popular for evaluating underground economy. It assumes that informal activity seeks to remain hidden from authorities, and consequently, it

requires a greater demand for cash than formal activities which relied more on banking monetary instruments for their transactions.

This method is based on an approach developed by Cagan (1958) to measure currency demand. Gutmann (1977) uses a similar approach to estimate the underground economy in the United States. Tanzi (1980, 1983) expands the Cagan equation for currency demand and uses it as a baseline to calculate informal activities in the United States between 1929 and 1980. Since the underground economy normally performs its transactions by using currency, an increase in informal activity will increase the demand for currency. Several factors that cause the expansion of underground economy, such as the direct and indirect tax burden, are included in this equation which estimates currency demand. Considering that the increase in currency caused by the increasing taxation and other factors was the increase in the informal economy, it is possible to know how much the informal economy increase corresponds to the increase in currency demand. In other words, it is assumed that more taxation increases underground economy, which, in turn, increases currency demand. By measuring these effects, it is possible to evaluate the size of the underground economy.

Despite being widely used, this method suffers several objections: 1) not all transactions in the underground economy are made in cash. As such, the size of the underground economy could be even larger; 2) due to strong innovative banking processes and their impact upon currency demand, it is almost impossible to estimate with the required precision (for a subsequent study of informality) the currency demand; 3) all studies assume the same currency speed in the formal and informal sectors; 4) finally, it is necessary to assume the nonexistence of an underground economy in the reference year, representing once again a sub-evaluation.

Thomas (1999) challenges the form used to estimate the underground economy. The author claims that expanded currency demand as indicative of an underground economy is a weakly supported theory and it could easily be measuring any phenomenon other than underground economy. Consequently, the results, according to the author, are not significantly important and should not be considered as strong guidelines for public policies.

The MIMIC (*multiple indicators multiple causes*) method is another widely used way to measure the underground economy. It considers several causes for the existence and growth of an underground economy throughout a period of time. The empirical method used differs greatly from methods applied in other studies. The method is based in statistical theory for non-observable variables which considered multiple causes and multiple indicators for a phenomenon to be measured and which cannot be observed. A factor analysis is used to measure and estimate underground economy, as a non-observable variable, throughout a given period of time. The method assumes that underground economy – a-non observable variable referred to as latent variable - is caused by a set of factors (observable) and, in turn, induce or cause another set of variables, referred to as indicative variables (which also are observable). Based on the theory that there is a linear relationship between these causal variables and underground economy, and between underground economy and the caused (or indicative) variables, it is possible, based on this relationship, to develop an index of the variable of interest.

However, in order to the index to express the size of underground economy, as a proportion of the GDP, for instance, it is required to have an independent observation of this statistic at a given point in time. This process is called calibration. Thus, in order to

calibrate the index and consequently obtain an estimate of the latent variable, it is required to have an independent observation of this variable in a given moment of time.

The implementation of this method requires choosing the causality of underground economy and its indicative variables. Consequently, there is a certain degree of art in the implementation of this methodology. A poor choice of the two sets of variables will invalidate the exercise. The causes most commonly used are the tax burden and regulation complexity and the willingness of citizens to migrate to underground economy. The most commonly used indicator variables are the increase in the number of monetary aggregates, the increase in the participation of workers in the informal economy (self employed, for example) and the evolution of the product.

Despite the drawbacks[2] presented above, in the MIMIC methodology it is widely used in the literature and the most cited author in the subject, Friederich Schneider uses it in several works. Schneider and Enste (2000) demonstrated that the underground economy has been growing consistently in the last two or three decades.

Bajada & Schneider (2005) demonstrated that not only the size of the underground economy increased between 2000 and 2003 for most countries, but for countries with lower tax burdens and initiatives to monitor informal activities reported a greater expansion in the underground economy, being this result a paradox which will require a deeper assessment by researchers.

ODCE countries reported a reduction of the underground economy in the period between 2000 and 2003 while the other countries observed an expansion of the formal sector. Additionally, even though comparison is difficult due to the different development stages, it is possible to say that countries with solid monitoring institutions have more stable informal sectors (though smaller in size) than those countries in which investigation and the degree of development of these institutions are worse.

Dell'Anno & Schneider (2003) adopted the MIMIC to study the underground economy in Italy and in 21 other ODCE countries. Estimations show that the underground economy in these countries vary from a maximum of 28.3% in Greece, to a minimum of 10.8% in Austria and 8.6% in the United States. Furthermore, an increase in the underground economy was noticed during the first half of the '90s for the ODCE countries. In the second half of that decade it was observed that in most countries the underground economy is stagnated and there are even some cases of reduction.

Regarding Brazil, Schneider and Klinglmair (2004) estimates the Brazilian underground economy to represent 39.8% of GDP in 2000 and Arvate, Lucinda e Schneider (2004) estimates it to reach 39.4% of GDP in 2002. Therefore, the MIMIC method estimates an underground economy for Brazil around 40% of GDP, a very high number.

3 – Methodology

We estimate the underground economy with two different methods: the monetary method and the labor market method. This study uses different data sets: an aggregated data

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[2] Giles & Tedds (2002) claim there is no guarantee that the model will reflect the exact participation of underground economy, since the causes and indicators can reflect other economic phenomenon. A common criticism is that the MIMIC does not reproduce an estimate which can represent underground economy as a percentage of GDP, but solely as an index. Finally, the flexibility provided by the MIMIC approach does not avoid the use of variables which are difficult to measure, and therefore may imply in errors. To more details see Breusch (2005a) and Breusch (2005b).

set is used to estimate a money demand equation while household data is used to estimate the informal labor economy.

3.1- Monetary Method

The monetary method is widely used in the literature to estimate the underground economy. It is based on the idea that informal/underground activities are hidden from authorities and therefore depend on currency to be carried out without the government knowledge. Thus, informal/underground economy use relatively more cash then formal economic activities.

An increase in formal activity according to this method increases money demand. Therefore, variables that affect the informal economy, like direct and indirect tax burden, should be included in the estimated money demand equation. In this paper, we include two variables in addition to gdp per capita (y_t) and interest rates (i_t). Equation (1) includes direct taxes (DT_t) and the share of informal employees in the economy (TSC_t). The informal employee share is given by the ratio between the number of workers with no singed card over the sum of workers with and without signed card. Therefore, the money demand estimated in this paper has the following functional form given by equation (1):

$$\ln m_t = \beta_0 + \beta_1 \ln y_t + \beta_2 \ln i_t + \beta_3 \ln DT_t + \beta_4 \ln TSC_t + \varepsilon_t \tag{1}$$

where m_t is the per capita real quantity of money $\dfrac{M_t}{P_t}$, y_t is the per capita GDP, i_t is the selic interest rate, DT_t is direct taxes and TSC_t is the informal employees share. The estimated equation does not include financial innovations due to data limitations. Therefore, the methodology overestimates the underground economy.

We assume that the higher the direct taxes (DT_t), the higher the underground economy and the Money demand. The same happens when the informal labor share increases in the economy. A higher informal labor share (TSC_t) increases the underground economy and the money demand.

We use data set from March 2002 up to date. We did unit root tests for all variables used in the estimation procedure. All series have a unit root at 10% confidence interval. Therefore equation (1) was estimated using ordinary least square (OLS). The OLS can be used to estimate the money demand in this case because of the existence of super consistence results with regard to estimations containing only variables with unit root. The OLS results are shown in table 1.

Table 1: OLS Money Demand Estimation			
Dependent Variable: Per capita real quantity of Money			
	Coefficient	Standard Deviation	t-statistic
SELIC	-0.19	0.03	-7.23
GDP	0.92	0.03	27.33
TSC	0.11	0.04	2.64
DT	0.09	0.04	2.32
R-squared	0.98		
Adjusted R-squared	0.98		

Source: by Author.

The OLS was used because we have a super consistence estimator when every variable has a unit root. Every variable had the expected sign and were significant. . The selic interest rate (SELIC) reduces money demand(-0,19) while per capita GDP increases Money demand (0,92). The share of informal workers (TSC) increase money demand (0,11) and the direct tax also increase Money demand (0,09).

The OLS results measure the underground economy size using the monetary method. The Brazilian underground economy results are reported in Table 2.

Table 2: Underground Economy Using the Monetary Method	
2003	20.7%
2004	20.2%
2005	19.9%
2006	19.6%
2007	18.9%
2008	18.4%
2009	17.6%
2010	17.2%
2011	16.8%

Source: by author.

The monetary method gives and underground economy that is reducing its size over time. It was as big as 20.7% of the GDP in 2003 and reduced its size to 16.8% in 2011.

3.2 – Labor Market

We also estimated the underground economy based on a household survey (PNAD) that allows a sharp measure of informal labor in Brazil. We estimated the percentage (share) of informal workers (SUB_{PIW}) and the share of informal labor income (SUB_{ILI}).

1. The percentage of informal workers (SUB_{PIW}) is defined as follows:

$$SUB_{PIW} = \frac{\sum_{i=1}^{N} p_i SC_i}{\sum_{i=1}^{N} \left[p_i SC_i + p_i (1 - SC_i) \right]} \quad (2)$$

where p_i is the weight of employee i in the PNAD sample and SC_i is a *dummy* variable with value 1 if the worker has no signed card and value zero if the worker has a signed card.

Equation (2) calculates the percentage of no signed card employees over the total of employees.

2. An informal labor income (SUB_{ILI}) is computed using equation (3), below:

$$SUB_{ILI} = \frac{\sum_{i=1}^{N} w_i p_i SC_i}{\sum_{i=1}^{N} \left[w_i p_i SC_i + w_i p_i (1 - SC_i) \right]} \tag{3}$$

where w_i is the wage paid to employee i, p_i is employee´s i sample weight and SC_i is a *dummy* variable with value 1 if the worker has no signed card and value zero if the worker has a signed card.

The labor income represents around 60% of total income in the Brazilian economy. Therefore, we weight the two informal labor measures presented above by 0.6 to generate the underground economy in Brazil.

Therefore, the underground/informal economy measured in the labor market methodology $SUB_{LM,t}$ is the average weight of the percentage of informal workers (SUB_{PIW}) and the informal labor income (SUB_{ILI}) weighted by 0.6:

$$SUB_{LM} = 0{,}6 \times \frac{SUB_{PIW} + SUB_{ILI}}{2} \tag{4}$$

The underground economy results calculated using the labor method is reported in Table 3:

<div align="center">Table 3:Labor Market Underground Economy</div>

	Informal labor income weighted by 60%	Percentage of Informal Workers weighted by 60%	Average
2003	16.9%	25.8%	21.4%
2004	17.3%	25.9%	21.6%
2005	16.6%	25.4%	21.0%
2006	16.8%	24.9%	20.8%
2007	16.2%	23.9%	20.1%
2008	15.1%	22.9%	19.0%
2009	15.8%	22.9%	19.4%
2010	-	-	18.2%*
2011	-	-	16.8%*

Source: by author. * Updated with the Monthly Employment Survey (PME)[3].

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[3] The update was made using the monthly employment survey because in 2010 we did not have the PNAD and the 2011 data will be available only on September 2012.

Table 3 shows a slow and steady reduction of underground economy in Brazil measured using the labor market method. It represented more than 20% of Brazilian GDO in 2003 and declined to less than 17% in 2011.

3.3 – Underground Economy

The underground economy size is given by the average of the monetary method and the labor income method in September[4], as shown in equation (5):

$$SUB_{3/t} = \frac{SUB_{MM,t} + SUB_{LM,t}}{2} \qquad (5)$$

Table 4 shows the underground economy estimation. The underground economy size has been reduced over the last nine years. The underground economy drop has been slowly but consistent. Table 4 shows that its size dropped from 21% of GDP in 2003 to 16.8% in 2011.

Table 4: Underground Economy Estimate (%GDP)	
2003	21.0%
2004	20.9%
2005	20.4%
2006	20.2%
2007	19.5%
2008	18.7%
2009	18.5%
2010	17.7%
2011	16.8%

Source: by author.

Table 5 shows the underground economy as a percentage of the GDP and in Real values. As can be seen the underground economy as a share do the GDP reduced its size every year but in monetary (nominal and real) values it continues to increase in some years, but in a slower growth rate than the formal economy. Therefore, one should not expect the underground economy to disappear in Brazil because despite its reduction as a percentage of GDP it was 11.2% bigger in 2011 comparing with 2003.

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[4] PNAD data set is collected in September.

Table 5: Underground Economy in Brazil			
	%	(1,000,000 reais)	
	GDP	Reais Correntes	2011 Reais
2003	21.0%	357,388.7	625,365.9
2004	20.9%	405,317.3	656,466.7
2005	20.4%	438,417.5	662,326.2
2006	20.2%	478,455.2	680,935.3
2007	19.5%	518,520.1	697,048.7
2008	18.7%	566,687.5	703,205.7
2009	18.5%	599,740.0	694,321.4
2010	17.7%	668,604.5	715,196.5
2011	16.8%	695,760.5	695,760.5

Source: by author.

3.4 - Discussion

This result is totally different from the underground economy size around 40% estimated by , Schneider and Klinglmair (2004), Arvate, Lucinda e Schneider (2004) and Schneider (2009). The results may differ due to different Money demand specification. We used real money demand $\left(m_t = \dfrac{M_t}{P_t} \right)$ instead of money demand (M_t).

The 40% underground economy estimates seem exaggerated. Small consistence tests can be made in order to dismiss such sizeable estimates. Brazilian people would be 40% richer, the debt to GDP ratio would fall to 28.7% instead of the 40.2% in 2010. The tax burden would be only 26% instead of 36%.

Using the unemployment monthly survey (PME) we observe that the percentage of informal workers in the Brazilian economy represented 22.8% in March 2012. Informal labor income is at least 20%[5] below the formal labor income. Moreover, with a lower income most of the informal workers would not pay income tax. Therefore, the revenue losses must be even smaller.

It is possible that an important part of the difference between others estimate and ours is due to the inclusion of self employed people. The inclusion of self employed workers in the informal labor market calculation would increase its number to 38.7%, a number close to other countries estimates. As labor income represents only 60% of total income this would imply an underground economy around 23% assuming that informal workers and self employed labor income is equal to formal labor income, what is not true!!!

Moreover, Brazilian law allows for a self employed worker to own a "small firm" that is totally legal. Tax reforms allowed the creation of the simples and super-simples that lower taxes for small business and reduce bureaucracy. Finally, we create the MEI (*Micro Empreendedor Individual* – small firm individual agent) that formalizes a self employed

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[5] The signed card impact can be estimated using the mincerian approach. An OLS estimation gives an implied 20% wage increase for signed car individuals.

business with a monthly payment lower than R$100. Thus, we claim that the self employed worker should not be considered an informal worker or a part of the underground Brazilian economy. It seems that the ILO definition of informal worker should not apply to Brazilian labor market because we have an informal labor category.

Therefore, there is plenty of evidence to disregard any Brazilian underground estimate around 40% of its GDP.

4 – Informal Labor Reduction Decomposition

This section shows an informal labor reduction decomposition presented in Barbosa Filho and Moura (2012). The authors propose an informal variation decomposition that allows you separate the variation in two different components: an informality level effect and a composition effect.

The informality rate is defined as the share of no sign card employees among employees in the economy as reported in equation (2). Defining labor informality as I_t, we have the following:

$$I_t = \frac{NoSignedcard_t}{Employee_t} = \frac{NoSignedcard_t}{NoSignedcard_t + Signedcard_t} = \frac{I_t}{E_t} \tag{6}$$

The informality rate can be rewritten in order to allow the employee separation among different social demographic groups. Those social demographic groups can be grouped by gende, race, schooling, age, experience, and human capital, for example. Therefore, we can rewrite (6) in two terms, the employee's participation and the informal level in the following way:

$$I_t = \frac{I_t}{E_t} = \frac{\sum_i I_{i,t}}{\sum_i E_{i,t}} = \frac{\sum_i E_{i,t} \times \frac{I_{i,t}}{E_{i,t}}}{\sum_i E_{i,t}} \tag{7}$$

$$I_t = \sum_i \frac{E_{i,t}}{\sum_i E_{i,t}} \frac{i_{i,t}}{E_{i,t}} = \sum_i \varphi_{i,t} I_{i,t} \tag{8}$$

where each group i participation is given by $\varphi_{i,t} = \dfrac{E_{i,t}}{\sum_i E_{i,t}}$ and the informal rate in each

group i defined as $I_{i,t}$.

4.1 – Informal Rate Decomposition

Given equation (8) is possible to decompose the informal rate variation in two different components: the composition effect and the level effect.

$$I_t - I_{t-1} = \sum_i \varphi_{i,t} I_{i,t} - \sum_i \varphi_{i,t-1} I_{i,t-1} = \sum_i \left(\varphi_{i,t} I_{i,t} - \varphi_{i,t-1} I_{i,t-1} \right) \tag{9}$$

$$I_t - I_{t-1} = \frac{1}{2} \sum_i \left(\varphi_{i,t} I_{i,t} - \varphi_{i,t-1} I_{i,t-1} \right) + \frac{1}{2} \sum_i \left(\varphi_{i,t} I_{i,t} - \varphi_{i,t-1} I_{i,t-1} \right) \tag{10}$$

Adding and subtracting the term $I_{i,t-1} \varphi_{i,t}$ on the first term of the right hand side of (10) and adding and subtracting $I_{i,t} \varphi_{i,t-1}$ in the second term, we obtain:

$$= \frac{1}{2} \sum_i \left[\varphi_{i,t} \left(I_{i,t} - I_{i,t-1} \right) + I_{i,t-1} \left(\varphi_{i,t} - \varphi_{i,t-1} \right) \right] + \frac{1}{2} \sum_i \left[\varphi_{i,t-1} \left(I_{i,t} - I_{i,t-1} \right) + I_{i,t} \left(\varphi_{i,t} - \varphi_{i,t-1} \right) \right]$$

$$= \sum_i \frac{\varphi_{i,t} + \varphi_{i,t-1}}{2} \left(I_{i,t} - I_{i,t-1} \right) + \sum_i \frac{I_{i,t} + I_{i,t-1}}{2} \left(\varphi_{i,t} - \varphi_{i,t-1} \right) \tag{11}$$

$$I_t - I_{t-1} = \sum_i \Delta I_{i,t}^L + \sum_i \Delta I_{i,t}^C = \Delta I_t^L + \Delta I_t^C \tag{12}$$

Thus, we are able to decompose the labor informality rate in two components: one related to changes in the informality rate that we call level effect $\left(\Delta I_t^L \right)$ and other related to changes in different groups participation among employees, the composition effect $\left(\Delta I_t^C \right)$. The first one indicates the informal rate variation among each group "i" given each group participation among employees. The second one computes the variation in the labor informality rate given by changes in each group "i" composition among employees keeping each group informality rate constant.

4.2 – Results

Barbosa Filho and Moura (2012) use this decomposition to analyze the labor informal rate drop using the national household survey (PNAD) in the 2002-2009 period. Table 8 reports some of the results reported in Table 6 of Barbosa Filho and Moura (2012).

The results show an important result: up to 60% of the drop can be explained by the educational composition effect. The increase in education attainment in the period, measured by average schooling, in the period reduces labor informality rate.

Table 6: Informality Rate Variation Decomposition			
Schooling			
Period – Sample	Level Effect	Composition Effect	Total Effect
2009-2002	-2.4%	-3.8%	-6.2%
2008-2002	-2.3%	-3.2%	-5.5%

Source: Barbosa Filho e Moura (2012).

As the average of schooling years is still very low in Brazil, educational investments must be seen as a way to improve Brazil´s competitiveness and to reduce its labor market informality.

5 – Conclusion

This paper presented a Brazilian underground economy estimate based on two different approaches: the monetary method and the labor market one. The results showed that Brazilian underground economy has a size between 15% and 20% of its GDP, a figure smaller than the estimates around 40% of GDP presented in the literature.

We discuss our results and make some consistency tests in order to show that the underground economy literature has overestimated the Brazilian underground economy size. We showed that in order to have a Brazilian underground economy around 40%, the country would have to have a quite small sovereign debt (only 28% of GDP) and a smaller tax burden. The small tax burden would go in the opposite direction of an efficient Receita Federal (Brazilian IRS).

Moreover, if we assume that the sum of informal workers (with no signed card) and self employed workers represent the underground economy and assuming that their labor income is equal to formal workers income, the Brazilian underground economy would reach only 24% of GDP considering a labor income share of 60% of GDP. Therefore, we claim that the Brazilian underground economy estimated in this paper (around 16% of GDP) is more reliable than the one usually resented in the literature (40% of GDP).

Finally, we also show the importance of increasing education attainment in the Brazilian economy to explain the drop in informal workers in Brazil. The paper shows that the increase is higher educated groups participation rate explains up to 60% of informality drop between 2002 and 2009.

A replacement of the monetary method due to its drawbacks[6] is a topic of future research. In this case, the main goal is to create an informal capital market measure of the underground economy similar to the informal labor market methodology used in this paper. The inclusion of informality in the capital market would probably provide a better measure of the Brazilian underground economy.

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[6] For more details see paragraph 2 in Page 3.

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