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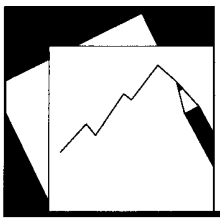

IMF Working Paper

Measuring the Informal Economy in Latin America and the Caribbean

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Abstract

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This paper estimates the size of the informal economy for 32 mainly Latin American and Caribbean countries in the early 2000s. Using a structural equation modeling approach, we find that a stringent tax system and regulatory environment, higher inflation, and dominance of the agriculture sector are key factors in determining the size of the informal economy. The results also confirm that a higher degree of informality reduces labor unionization, the number of contributors to social security schemes, and enrollment rates in education.

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I. INTRODUCTION

The measurement of the size of the informal economy has evoked considerable interest in both academic environments and policy circles, especially given its importance for emerging markets and developing countries. At the same time, measuring the informal economy is not an easy task. The greatest challenge arises from the lack of a clear definition of the informal economy. A wide range of similar terms are used in the literature, such as hidden economy, shadow economy, clandestine economy, parallel economy, subterranean economy, unreported economy, cash economy and black economy. However, as a result of recent comprehensive publications and handbooks, there seems to exist some level of consensus regarding some terms. Following Feige (2005):

- The *illegal economy* consists of the income produced by those economic activities pursued in violation of legal statutes defining the scope of legitimate forms of commerce.

- The *unreported economy* consists of those legal and illegal economic activities that evade fiscal rules as codified in the tax laws.

- The *informal economy* comprises those economic activities that circumvent the costs and are excluded from the benefits and rights incorporated in the laws and administrative rules covering property relationships, commercial licensing, labor contracts, torts, financial credit and social systems. A summary measure of the informal economy is the income generated by economic agents who operate informally. Similarly, Portes et al. (1989) defines the informal economy as "a process of income-generation characterized by one central feature: it is unregulated by the institutions of society, in a legal and social environment in which similar activities are regulated."

Measuring the size of the informal economy is important for many reasons. First, there seems to be strong evidence that suggests a direct and clear link between the size of the informal economy and tax evasion. Table 1 shows, using data for the early 1990s from Schneider and Enste (2000) and Silvani and Brondolo (1993), that there is a clear positive relationship between these two concepts. As extreme cases, countries like Bolivia, which had an informal economy share of approximately 65 percent of GDP, experienced VAT tax evasion of about 45 percent of GDP; while countries like New Zealand, which had a low share of informal activity (around 12 percent), had a much lower level of tax evasion, close to 5 percent of GDP. Second, the informal economy, as a job provider, has an impact on the viability of social security institutions, specifically in terms of the latter's ability to provide protection while receiving enough financial support. For example, in the early 1990s, while 94 percent of the labor force contributed to the social security system in the Netherlands, this percentage was only about 19 for Honduras.[2] Third, inaccurate perceptions about the actual size of an economy could seriously decrease the effectiveness of a wide variety of policies.

[2] Based on information from Forteza and Rama (2001).

This paper estimates the size of the informal economy and the relative contribution of each underlying factor, in 32 mainly Latin American and Caribbean countries in the early 2000s. For this purpose, a structural equation model approach that considers the informal economy as a latent variable with multiple causes and indicators is used. This approach overcomes typical limitations of some commonly-used time series methods because, among other reasons, it does not require information regarding the absolute value of the informal economy for *each* country at some point in time to pin down the evolution of the informal economy over time. On the contrary, this cross-section approach needs this information for *only one country* in the sample. This method also allows the exclusive use of real variables, as opposed to monetary ones, which might underestimate and misrepresent the relevance of the informal economy in countries subject to a high degree of dollarization in circulating currency.

We find that a stringent tax system and regulatory environment, higher inflation, dominance of the agriculture sector, and weakness in governance are the key factors underlying the informal economy. The evidence obtained also confirms that a higher degree of informality reduces labor unionization, the number of contributors to social security schemes, and enrollment rates in intermediate education.

The size of the informal economy in the early 2000s is found to vary considerably—from a low of around 15 percent of measured GDP for The Bahamas to a high of over 70 percent of measured GDP for Paraguay. The relative contribution of each underlying factor to the overall size of the informal economy is also estimated for each country. For some countries like Antigua and Barbuda, Barbados and Trinidad and Tobago, the key element is the tax burden. For other countries, like St. Vincent and the Grenadines, St. Lucia and Belize, the importance of the agriculture sector appears to be decisive, with around 75 percent of exports concentrated in agriculture and food products. For others like Paraguay and the Dominican Republic, labor rigidities are some of the most important factors, with minimum wages representing 170 percent and 90 percent, respectively, of the corresponding GDP per capita.

The paper is organized as follows. The next section reviews the different methods used by the literature to estimate the size of the informal economy. It also carefully explains the "Multiple Indicators, Multiple Causes" (MIMIC) approach, which is the econometric method used in this study. Section III presents the set of countries and variables used in the analysis. The empirical results are discussed in Section IV, and Section V contains some concluding remarks.

II. Methods for Measuring the Size of the Informal Economy

Many alternative methods have been used to measure the size of the informal economy.[3] Some approaches use direct methods based on surveys, but most studies use indirect methods

[3] A thorough review of these approaches is discussed in Schneider and Enste (2000) and the OECD Handbook "Measuring the Non-Observed Economy," released in 2002.

based on: (i) the discrepancy between national expenditure and income statistics; (ii) the discrepancy between the official and actual labor force; (iii) the "electricity consumption" approach of Kauffman and Kaliberda (1996); (iv) the "monetary transaction" approach of Feige (1979); (v) the "currency demand" approach of Cagan (1958) and others; and (vi) the "Multiple Indicators, Multiple Causes" (MIMIC) approach of Frey and Weck-Hanneman (1984). A brief description of each methodology, as well as a detailed explanation of the MIMIC approach, is provided below.

Surveys:[4] These micro approaches use surveys and samples based on voluntary replies, or tax auditing and other compliance methods to measure the informal economy. While providing great detail about the structure of the informal economy, the results are sensitive to the way the questionnaire is formulated and the respondents' willingness to cooperate. Therefore surveys are unlikely to capture all informal activities.

Discrepancy between national expenditure and income statistics:[5] If those working in the informal economy were able to hide their incomes for tax purposes but not their expenditure, then the difference between national income and national expenditure estimates could be used to approximate the size of the informal economy. If all the components of the expenditure side were measured without error and were constructed so that they were statistically independent from income factors, then this approach would indeed yield a good estimate of the size of the informal economy. Unfortunately this gap also reflects other types of omissions and errors and several expenditure estimates are based on income calculations. Accordingly, the reliability of this method is open to question.

Discrepancy between official and actual labor force:[6] If the total labor force participation is assumed to be constant, a decline in official labor force participation can be interpreted as an increase in the importance of the informal economy. Since movements in the participation rate might have many other explanations, such as the position in the business cycle, difficulty in finding a job and education and retirement decisions, these estimates represent weak indicators of the size of the informal economy.

Electricity approach:[7] Kaufmann and Kaliberda (1996) endorse the idea that electricity consumption is the single best physical indicator of overall (official and unofficial) economic activity. Using findings that indicate the electricity-overall GDP elasticity is close to one,[8]

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[4] See for example Isanchen and Strom (1985), Witte (1987), Mogensen et al. (1995), Ivan-Ungureanu and Pop (1996), and Feige (1996).

[5] See for example MacAfee (1980), and Yoo and Hyun (1998).

[6] See for example Contini (1981), Del Boca (1981), and O'Neil (1983).

[7] See for example Del Boca and Forte (1982), Portes (1996) and Johnson et al. (1997).

[8] See Dobozi and Pohl (1995).

these authors suggest using the difference between growth of electricity consumption and growth of official GDP as a proxy for the growth of the informal economy. This method is simple and appealing, but has many drawbacks, including: (i) not all informal economy activities require a considerable amount of electricity (e.g. personal services) or use other energy sources (like coal, gas, etc.), hence only part of the informal economy growth is captured; and (ii) the electricity-overall GDP elasticity might significantly vary across countries and over time.

Transaction approach:[9] Using Fischer's quantity equation, *Money*Velocity = Prices*Transactions*, and assuming that there is a constant relationship between the money flows related to transactions and the total (official and unofficial) value added, i.e. *Prices*Transactions = k (official GDP + informal economy*), it is straightforward to obtain the following equation *Money*Velocity = k (official GDP + informal economy)*. The stock of money and official GDP estimates are known, and money velocity can be estimated. Thus, if the size of the informal economy as a ratio of the official economy is assumed to be known for a benchmark year, then the informal economy can be calculated for the rest of the sample. Although theoretically attractive, this method has several weaknesses, for instance: (i) the assumption of *k* constant over time seems quite arbitrary; and (ii) other factors like the development of checks and credit cards could also affect the desired amount of cash holdings and thus velocity.

Currency demand approach:[10] Assuming that informal transactions take the form of cash payments, in order not to leave an observable trace for the authorities, an increase in the size of the informal economy will, consequently, increase the demand for currency. To isolate this resulting "excess" demand for currency, Tanzi (1980) suggests using a time series approach in which currency demand is a function of conventional factors, such as the evolution of income, payment practices and interest rates, and factors causing people to work in the informal economy, like the direct and indirect tax burden, government regulation and the complexity of the tax system. The size and evolution of the informal economy can be calculated by following two steps. First, the difference between the evolution of currency when government regulations and the direct and indirect tax burden are held at their lowest value and the development of currency with the current (higher) burden of taxation and government regulations is calculated. Second, assuming the same income velocity for currency used in the informal economy as for legal money in the official economy, the size of the informal economy can then be computed and compared to the official GDP. However, there are several problems associated with this method and its assumptions: (i) this procedure may underestimate the size of the informal economy, because not all transactions take place using cash as means of exchange; (ii) increases in currency demand deposits may occur

[9] See for example Feige (1979), Boeschoten and Fase (1984) and Langfeldt (1984).

[10] See for example Cagan (1958), Gutmann (1977), Tanzi (1980, 1983), Scheneider (1997) and Johnson et al. (1998).

because of a slowdown in demand deposits rather than an increase in currency used in informal activities; (iii) it seems arbitrary to assume equal velocity of money in both types of economies; and (iv) the assumption of no informal economy in a base year is open to criticism.

Multiple Indicators, Multiple Causes (MIMIC) approach:[11] All methods described above consider only one indicator or manifestation of the informal economy, e.g., electricity consumption, money or cash demand. However, there often exist several manifestations or symptoms showing up simultaneously. The MIMIC approach explicitly considers several causes, as well as the multiple effects of the informal economy. The methodology makes use of the associations between the observable causes and the observable effects of an unobserved variable, in this case the informal economy, to estimate the unobserved factor itself (Loayza, 1997). The model for one latent variable can be described as follows:

$$y = \lambda\ IE + \varepsilon \tag{1}$$

$$IE = \gamma' x + \upsilon \tag{2}$$

where IE is the unobservable scalar latent variable (the size of the informal economy), $y' = (y_1,...,y_p)$ is a vector of indicators for IE, $x' = (x_1,...,x_q)$ is a vector of causes of IE, λ and γ are the (px1) and (qx1) vectors of the parameters and ε and υ are the (px1) and scalar errors. Equation (1) links the informal economy with its observable, exogenous indicators or symptoms, while equation (2) associates the informal economy with a set of observable, exogenous causes. Assuming that these errors are normally distributed and mutually uncorrelated with $\text{var}(\upsilon) = \sigma_\upsilon^2$ and $\text{cov}(\varepsilon) = \Theta_\varepsilon$, the model can be solved for the reduced form as a function of observable variables by combining equations (1) and (2):

$$y = \pi\ x + \mu \tag{3}$$

where $\pi = \lambda\ \gamma'$, $\mu = \lambda\ \upsilon + \varepsilon$ and $\text{cov}(\mu) = \lambda\ \lambda'\ \sigma_\upsilon^2 + \Theta_\varepsilon$.

Because y and x are observable data vectors, equation (3) can be estimated by maximum likelihood estimation using the restrictions implied in both the coefficient matrix π and the covariance matrix of the error μ. Since the reduced form parameters of equation (3) remain unaltered when λ is multiplied by a scalar and γ and σ_υ^2 are divided by the same scalar, the estimation of equations (1) and (2) requires a normalization of the parameters in equation (1), and a convenient way to achieve this is to constrain one element of λ to some pre-assigned value.

[11] See for example Giles (1999) and Loayza (1997).

Since the estimation of λ and γ is obtained by constraining one element of λ to some arbitrary value, it is useful to standardize the regression coefficients $\hat{\lambda}$ and $\hat{\gamma}$ as follows:

$$\hat{\lambda}^s = \hat{\lambda}\left(\frac{\hat{\sigma}_{IE}}{\hat{\sigma}_y}\right) \qquad \hat{\gamma}^s = \hat{\gamma}\left(\frac{\hat{\sigma}_x}{\hat{\sigma}_{IE}}\right) \quad .$$

The standardized coefficient measures the expected change (in standard-deviation units) of the dependent variable due to a one standard-deviation change of the given explanatory variable, when the other variables are held constant. Using the estimates of the γ^s vector and setting the error term υ to its mean value of zero, the "predicted" *ordinal* values for the informal economy (IE) can be estimated using equation (2). Then, by using information regarding the specific value of informal activity for some country (if it is a cross-country study) or for some point in time (if it is a time-series study), obtained from some other source, the *ordinal* within-sample predictions for IE can be converted into *absolute* series.

The MIMIC approach is chosen as the most appropriate method to calculate the size of the informal economy for the present sample of countries because of the following reasons:

- Tax auditing and other similar survey-based methods are unavailable for most Caribbean countries in the sample.
- The methods based on statistical and labor force discrepancies present, as described before, serious limitations and weaknesses.
- Aside from the above-mentioned critiques, the electricity, transaction, and currency demand approaches share a common crucial limitation. Since the three approaches are based on time series regressions, extra information[12] for *each country* is required in order to pin down the absolute size of the informal economy. Without this extra knowledge, the most that one can learn is the growth pattern of the informal economy. While for some countries like Argentina, Mexico, and Chile this extra information is possible to obtain, for many Caribbean countries there are no such data. On the contrary, the proposed cross-section MIMIC approach only requires extra information regarding the absolute size of the informal economy for one country in the sample.

This paper only focuses on real cause and indicator variables, as opposed to monetary ones, which might underestimate and misrepresent the relevance of the informal economy in countries subject to a high degree of dollarization in circulating currency.[13] This occurs

[12] This extra information could be obtained either by knowing the absolute value of the informal economy for a certain year or by assuming a base year without the informal economy.

[13] There exist the presumption and some concrete evidence based on Feige et al. (2001, 2002) and Feige (2003, 2005) that dollarization in circulating currency is a relevant issue for both low-inflation and non-crisis countries like those of the Caribbean, because of tourism and currency substitution issues, and for typically high-inflation countries like Argentina and Mexico, due to asset substitution issues.

because although monetary data is easily obtained for local currency, data is not available for foreign currency circulating outside the domestic banking system. In this sense, the present study follows closely the study conducted by Loayza (1997) who estimated the size of the informal economy for 14 Latin American countries for the early 1990s using real variables.[14]

III. DATA

This cross-section study considers 32 mainly Latin American and Caribbean countries, for the early 2000s[15]. The countries included are: Antigua and Barbuda, Argentina, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, Cyprus, Dominica, Dominican Republic, Ecuador, El Salvador, Fiji, Grenada, Guatemala, Guyana, Honduras, Jamaica, Malta, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, The Bahamas, Trinidad and Tobago, Uruguay and Venezuela. The cause and indicator variables considered, and their expected relationship with the size of the informal economy, are presented below.[16]

A. Cause Variables

First, the *tax burden* is proxied by the average of corporate and personal marginal income tax rate. The highest rate is used when there is more than one rate. The hypothesis is that an increase of the tax burden boosts the incentive to work in the informal economy.

Second, increases in legal restrictions on the labor market are hypothesized to increase the size of the informal economy. *Labor rigidities* are captured by two alternative indices.[17]

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[14] Loayza uses the used tax burden, labor market restrictions and governance measures as cause variables and tax evasion and the share of the labor force contributing to social security schemes as indicators of the informal economy.

[15] Most of the data is based on 2002 or 2003 information, a time when many Latin American countries were affected by severe economic crises. More details regarding the construction and sources of the data used can be found in the Appendix.

[16] Since 2000, several Latin American and Caribbean countries have introduced market-oriented reforms and tax reforms designed to broaden the tax base and enhance compliance. Accordingly, given that the period of estimation is the early 2000s, the results obtained here may represent an upper bound to the actual size of the informal economy.

[17] Most empirical studies use the labor rigidity index developed by Forteza and Rama (2001). This index is constructed by averaging the normalized values of four labor-related variables, including minimum wage restrictions, mandated benefits, labor unions (measured by the membership of the labor movement as percentage of the labor force) and government employment (measured as the employment in the government as percentage of the labor force). These last two factors are not included in the labor rigidity indices developed in this study for the following reasons: *Labor unionization* seems to be, at least for emerging and developing countries, more of a consequence of the informal economy rather than its cause, since larger informal sectors seem to weaken the bargaining power of workers in the formal sector. For example, countries with well-known important informal sectors, like Peru and Ecuador, have a very low degree of unionization, approximately 5 to 10 percent of the labor force; while countries with traditionally lower informality, like Argentina and Mexico, have unionization close to 35 percent. For this reason, labor unionization is included as an indicator variable, and it is expected to be negatively related with the size of the informal economy. Higher *government employment,* far from increasing labor rigidity and consequently raising the size of the informal economy, could reduce informality, since most public employees contribute to social security systems and are regulated by most

(continued…)

- Labor rigidity index #1 considers minimum wage constraints and is calculated as the ratio of the annual minimum wage to GDP per capita.

- Labor rigidity index #2 equals the average of two normalized components, one of which is the minimum wage ratio as described before, and the other of which captures mandated benefits, as measured by the social security contribution rates as a percentage of wages. Following Loayza (1997), this second rigidity index is divided by GDP per capita in order to account for differences in labor productivity across countries.

Third, the *importance of agriculture* in the economy is included, since many studies endorse the idea that informal work is highly segmented by sector, with clear prevalence for the agricultural and related sectors. One of the most important reasons for this is the minimum enforcement capacity of government prevalent in rural areas. The importance of agriculture is measured as agriculture and food exports as a percentage of total exports to reduce problems of endogeneity.[18] The more prominent the agriculture sector, the larger the expected size of the informal economy.

Fourth, following Giles (1999) the *inflation rate* is included to allow for the upward "creep" of tax brackets, and the associated incentive for taxpayers to engage in informal activities. A more pervasive effect of inflation is that, as it tends to be uneven across sectors, it alters the income distribution, and this may induce disrespect for tax law. The higher inflation, the larger the expected size of the informal economy.

Last, the *strength of enforcement system* is proxied by an average of three indicators developed by International Country Risk Guide (ICRG), specifically quality of bureaucracy, corruption in government, and the rule of law. The stronger the enforcement capability of government, the lower the expected size of the informal economy.

B. Indicator Variables

First, following Loayza (1997) the percentage of the labor force *contributing to the social security system* is included. The larger the informal economy, the lower the expected number of contributors to the social security system.

Second, the *degree of unionization*, measured as the percentage of labor force with membership in some labor union, is considered. The larger the informal economy, the weaker the bargaining power of the workers in the formal sector and, therefore, the lower the degree of unionization.

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institutions of the society. This variable is not included separately as another cause variable because it might be also subject to Wagner's law and consequently subject to some endogeneity problems if the degree of development is related to the size of the informal economy.

[18] The share of agriculture as percentage of GDP was also considered with similar results.

Finally, the *gross enrollment ratio for secondary school* is included as an informal economy indicator. Most countries in the world have signed International Labor Organization Convention 138, which made fourteen the minimum working age; however, one of the most well-recognized consequences of the informal economy is related to child labor and the effect it has on rates of education enrollment.[19] Thus, the larger the informal economy, the lower the expected enrollment rate.

IV. Empirical Results

A. Preliminary Evidence

Table 2 shows the correlation between each cause and indicator variable. If both the conjectured relation between the cause variables and the informal economy and the hypothesized association between the informal economy and its indicators are present, there should be a specific pattern in the correlations between the cause and indicator variables. For example, if stronger labor rigidities are expected to increase the size of the informal economy and the latter effect is supposed to decrease the percentage of contributors to social security, then there should exist a negative relationship between labor rigidity and percentage of contributors to social security. It is clear from Table 2 that, aside for the relationship between tax burden and degree of unionization (top-right cell), all remaining observed correlations matches their expected signs. Therefore, there seems to be strong preliminary support for our hypotheses.

B. MIMIC Estimation Results

The benchmark MIMIC specification, Model 1, is represented in Figure 1. The labor rigidity index #1, tax burden, importance of agriculture, and inflation are the *cause* variables of the informal economy; while the number of contributors to the social security system, the degree of unionization, and the gross enrollment ratio for secondary school are the *indicator* variables.[20] Before analyzing the estimation results, it is important to remark that several goodness-of-fit statistics support the underlying model (see box in Figure 1). These goodness-of-fit measures are based on fitting the model to sample moments, which means to compare the observed covariance matrix to the one estimated on the assumption that the model being tested is true. The Discrepancy function (CMIN) is one of the most common fit tests, and is the minimum value of the discrepancy function between the sample covariance matrix and the estimated covariance matrix. The chi-square value should not be significant if there is a good model fit, while a significant chi-square indicates lack of satisfactory model

[19] The primary net enrollment rate may be the best proxy to capture this phenomenon; however, due to data unavailability for many Caribbean countries and the fact that countries with such information have a high correlation with the secondary gross enrollment rate, the latter measure is used.

[20] Although most variables are subject to endogeneity, strength of enforcement system is one variable that has the potential to be most severely affected. For this reason it is not included in the benchmark specification (Model 1).

fit. The goodness-of-fit index (GFI) and the adjusted goodness-of-fit index (AGFI) tests are also measures of discrepancy between the predicted and observed covariances. The GFI can be interpreted as the percent of observed covariances explained by the covariances implied by the model. The AGFI is a variant of the GFI which adjusts GFI for degrees of freedom. By convention, both GFI and AGFI should by equal to or greater than 0.90 to accept the model. The root mean square error of approximation (RMSEA) is also a fit test that some authors argue is less sensitive to sample size than the above mentioned tests (see for example Fan et al. (1999)). By convention, there is good model fit if the RMSEA is less than or equal to 0.05.

The coefficients on the causal and indicator variables have the expected signs, and are statistically significant (mostly at the 1 or 5 percent level). Specifically, a one standard deviation increase in the tax burden, labor rigidities, importance of agriculture and inflation increase the size of the informal economy by 0.27, 0.52, 0.40 and 0.47 standard deviations, respectively. Importantly, the joint influence of these four causal variables explains approximately 79 percent of the variance of the informal economy (Figure 1).

We find that increases in the informal economy reduce the number of workers contributing to the social security system, the degree of unionization, and the secondary enrollment ratio, and explains 76, 35, and 57 percent of their respective variances.

Alternative MIMIC specifications are considered for robustness purposes. Models 2 and 3, respectively displayed in Figures 2 and 3, include an alternative measure of labor rigidity and strength of enforcement system. They both confirm the results obtained in the benchmark model, and Model 3 also presents evidence suggesting that the strength of enforcement appears to be an important determinant of the size of informal economy.

C. Estimation of the Size of the Informal Economy

Using the estimates of the benchmark model, Table 3 and Figure 4 show the standardized *ordinal* values of the size of the informal economy for the countries in the sample. Since these ordinal values only identify the relative position of the countries, we set the informal economy of Jamaica to be equal to 35 percent of total GDP in order to estimate the *absolute* values of the informal economy as percentage of total GDP.[21] The Bahamas, Cyprus, Grenada, St. Kitts and Nevis, Trinidad and Tobago and Barbados are among the countries with the smallest informal economies, with values ranging from 15 to 25 percent of GDP. These values are among the lowest not only for the Caribbean region, but also in relation to most Latin American countries. On the other hand, St. Vincent and the Grenadines, Belize and Dominican Republic are among the countries with the largest informal economies in the Caribbean, with sizes varying between 45 and 51 percent. Notwithstanding that, these

[21] According to a study conducted by De La Roca et al. (2002), the informal economy in Jamaica accounted for about 35 percent of the total GDP in 2000–01.

estimates are smaller than those for the countries with the highest levels of informal activity in Latin America, such as Paraguay and Nicaragua, with values around 65-70 percent of GDP.

As detailed above, the *absolute* values of the informal economy, unlike the *ordinal* measures, rely on extra information pinning down the absolute value of the informal economy for one country, in this case Jamaica. The information for Jamaica is based on a comprehensive study by De La Roca et al. (2002) that used different methodologies and data collected as part of the 2001 Jamaica Survey of Living Conditions, and is therefore an attractive data source to pin down the absolute series of the informal economy.[22] Since the *order* of countries according to the size of the informal economy is independent of this extra information but the *absolute* values of the informal economy do depend on this data, caution is advised regarding use of the latter values as accurate measures of the degree of informality.

Table 4 shows the absolute values of the informal economy for Caribbean countries, using the different specifications employed in Models 1, 2, and 3. It can be inferred that the estimated absolute sizes of the informal economy are similar across models. The Spearman rank correlation coefficient is 0.89 between Models 1 and 2, 0.98 between Models 1 and 3, and 0.85 between Models 2 and 3. The null hypothesis that the estimated absolute sizes of the informal economy are independent across models is rejected at the 1 percent level of significance for all comparisons.

The estimates reported here of the size of informal economies are similar to those reported in Schneider (2002) for the late 1990s. For 15 common countries, there is a positive correlation of 0.37 between the absolute sizes of the informal economy, and the Spearman rank correlation test has a value of 0.44, which rejects at the 10 percent level of significance the null that these rankings have zero correlation.

D. Relative Contribution of Each Cause Variable to the Size of the Informal Economy

Table 5 shows the relative contribution of each cause variable to the size of the informal economy for all countries studied, and Figure 5 displays these values for the Caribbean economies. On average the tax burden, labor rigidity, importance of agriculture, and inflation contribute around 35, 26, 31 and 8 percent to the overall size of the informal economy, respectively. However, this profile differs greatly across countries. Key features are:

[22] De La Roca et al. (2002) studies the informal economy for Jamaica in the early 2000s, to evaluate the impact of the structural reforms of the 1990s. They found similar informal economy estimates using macroeconomic approaches like monetary and electricity consumption approach and microeconomic approaches based on the addition of the total amount of wages of the informal workers, the unreported income of the formal workers in the economy, and the value added generated by households' independent activities whether agricultural or non-agricultural.

- For countries like Antigua and Barbuda, Barbados and Trinidad and Tobago, the main component influencing the informal economy is the tax burden. For example, in the late 1990s, Antigua and Barbuda had among the highest marginal statutory corporate tax rate (of 40 percent) in the Caribbean.

- For other countries like St. Vincent and the Grenadines, St. Lucia, and Belize, the importance of the agricultural sector seems to be one of the most relevant factors driving the informal economy, with approximately 75 percent of exports concentrated in agriculture and food products.

- For countries like Paraguay and Dominican Republic, the significance of labor rigidities appears to be decisive, with minimum wages representing 170 percent and 90 percent of the corresponding GDP per capita, respectively.

- For most economies, inflation does not seem to be an important factor determining the size of the informal economy, most likely due to the relative price stability observed in these countries in the second half of the 1990s.

V. CONCLUDING REMARKS

This paper estimates the size of the informal economy and the relative contribution of each underlying factor in 32 (mainly) Latin American and Caribbean countries in the early 2000s. This is the first study to address this issue for many Caribbean countries.

Using a structural equation model approach that considers the informal economy as a latent variable with several causes and effects, we find that a burdensome tax system, rigid labor markets, higher inflation, and dominance of the agriculture sector are the key factors in determining the informal economy, representing altogether around 79 percent of the informal economy variance. The results also confirm that a higher degree of informality reduces labor unionization, the number of contributors to social security schemes, and enrollment rates in education.

The size of the informal economy differs considerably across countries. While in countries like Paraguay and Nicaragua the informal sector reaches values around 70 percent of total GDP, in economies like The Bahamas, Cyprus, Grenada, St. Kitts and Nevis, Trinidad and Tobago, and Barbados, the informal share is below 25 percent of GDP.

We also find that the relative contribution of each cause variable to the informal economy varies significantly across countries. For countries like Antigua and Barbuda and Trinidad and Tobago, the most important factor influencing the size of the informal economy is the tax burden. For other countries like St. Vincent and the Grenadines, St. Lucia, and Belize, the importance of the hard-to-regulate agricultural sector appears to be one of the most important elements; while for economies like Paraguay and Dominican Republic, the significance of labor rigidities appears to be crucial.

The above analysis has important policy implications for authorities striving to reduce the degree of informality. For instance, in countries where the informal economy is related to a high tax burden, policy options include lowering and homogenizing effective tax rates across all sectors in the economy. In economies where labor market rigidities generate the informal economy, steps need to be taken to accelerate labor market reforms and enhance flexibility. In countries where inflation is the key factor, priority should be given to tightening monetary policy and stabilizing prices. In addition, given the high debt burden borne by many Latin American and Caribbean countries, a reduction in the size of the informal economy should assist in bolstering fiscal and debt sustainability.

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APPENDIX. DATA CONSTRUCTION AND SOURCES

Causal Variables

1. *Tax burden*: The proxy for tax pressure is the average of corporate and personal marginal income tax rates. The highest rate is used when there is more than one rate. This proxy measure is normalized between zero and 100. The data correspond mostly for 2003 and is obtained from *World Development Indicators* 2006, and Bain and dos Santos (2004).

2. *Labor rigidity indices*: Two alternative measures of labor rigidity are constructed.

- Labor rigidity index #1 is represented by the ratio of minimum wage and GDP per capita normalized between zero and 100. The minimum wage corresponds to the most general minimum wage regime. When minimum wages vary across sectors, the one for manufacturing (or for commerce, if manufacturing is not available) is reported. When minimum wages vary across regions, the value reported is either a simple average across regions or the minimum wage applicable in the main urban centers. A zero indicates that the country has no government set minimum wage, although minimum wages negotiated at the sectoral level may exist.

- Labor rigidity index #2 is the normalized average of two components divided by real GDP per capita. The first component captures minimum wage restrictions and corresponds to labor rigidity index #1, while the second element represents mandated benefits and is measured by the contribution rates (as percentage of salaries) for all social security programs for both the employee and employer. Only for Belize, where the contributions are flat-rate according to earning classes, the normalized legal number of days of maternity leave with full pay without complications is used. Following Loayza (1997) the normalized average of these components is divided by real GDP per capita in order to account for differences in labor productivity across countries.

The data for minimum wages correspond to 2002 and are mainly obtained from the "Country Reports on Human Rights Practices" (2002). The Country Reports on Human Rights Practices are submitted annually by the U.S. Department of State to the U.S. Congress. The reports cover internationally-recognized individual, civil, political, and workers' rights, as set forth by the Universal Declaration of Human Rights. For Costa Rica and Mexico information from the respective ministries of labor is used. The social security contribution data correspond mostly to year 2003 and is obtained from "Social Security Programs Throughout the World". Maternity leave information correspond to the average of the period 1999–2002, and is obtained from several online publications from The Clearinghouse on International Developments in Child, Youth and Family Policies, Columbia University.

3. *Importance of agriculture*: It is measured by the agricultural raw material and food exports (as percentage of total exports) using *World Development Indicators* 2006 and correspond mainly for 2000. For Dominican Republic, and for Fiji, 2001 and 2002 information is used, respectively.

4. *Inflation*: Annual average consumer prices inflation for the period 1995–99. Aside from Antigua and Barbuda, in which IMF data is used, the rest of the information is obtained from *World Development Indicators* 2006.

5. *Strength of enforcement system*: Following Loayza (1997), the strength of enforcement system is proxied by an average of three subjective indicators reported in the International Country Risk Guide (ICRG) for 2002. The three variables considered are quality of bureaucracy, corruption in government, and the rule of law. Quality of bureaucracy scores high under "autonomy from political pressure" and "strength and expertise to govern without drastic changes in policy or interruption in government services". Low scores in corruption in government indicate "high government officials are likely to demand special payments" and "illegal payments are generally expected throughout lower levels of government". The variable rule of law "reflects the degree to which the citizens of a country are willing to accept the established institutions to make and implement laws and adjudicate disputes". Higher values are associated with "sound political institutions, a strong court system, and provisions for an orderly succession of power." ICRG is a publication of Political Risk Services of Syracuse, NY.

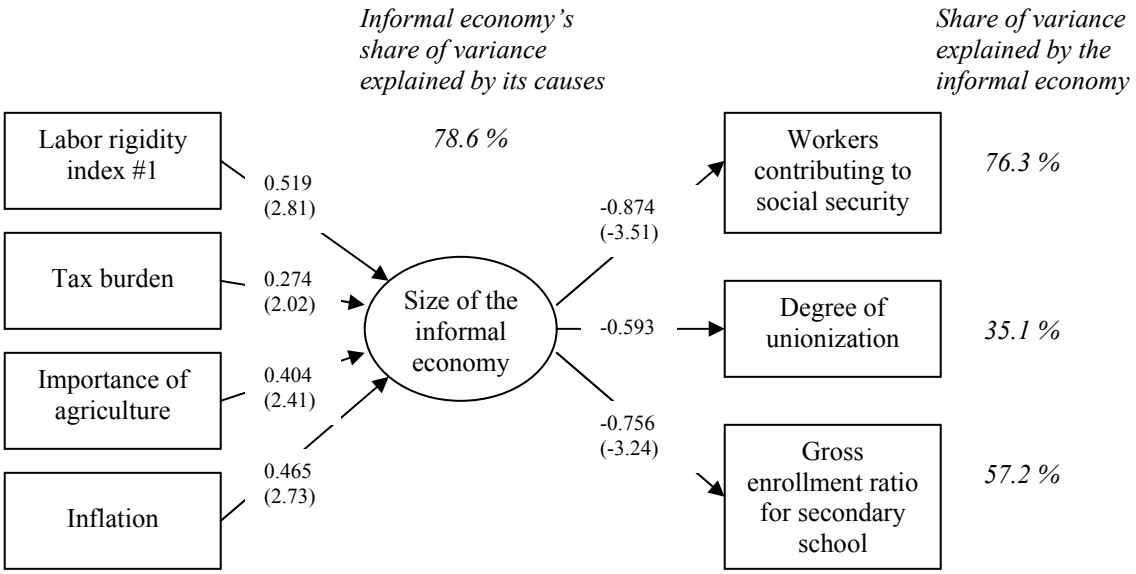
Indicator Variables

1. *Workers contributing to social security*: Active contributors to old-age pension schemes, in percent of the labor force. It is based on social security agencies, household surveys, and IMF country desk information, predominantly for 2002.

2. *Degree of unionization*: Total union membership considering both public and private sectors, in percent of the labor force. The data is mainly from "Country Reports on Human Rights Practices" (2002), complemented by information from national authorities.

3. *Gross enrollment ratio for secondary school*: Total secondary enrollment as a percentage of the corresponding official school-age population, mostly for 2001. The sources of information are *Human Development Report* (2005) and World Bank (2005).

Figure 1. MIMIC Estimation Results. Model 1



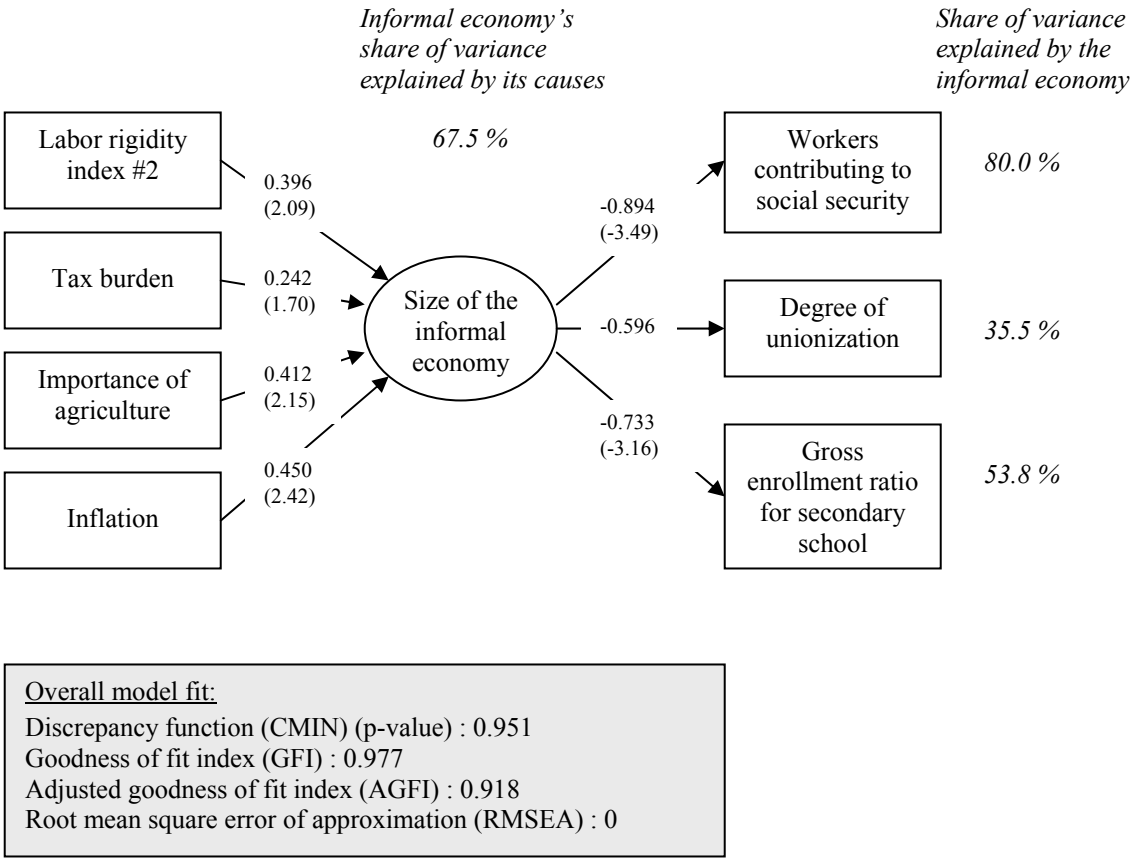
Overall model fit:
Discrepancy function (CMIN) (p-value) : 0.932
Goodness of fit index (GFI) : 0.973
Adjusted goodness of fit index (AGFI) : 0.907
Root mean square error of approximation (RMSEA) : 0

Note: The standardized regression coefficients and their respective *t*-values, indicated in parentheses, are displayed by the arrow pointing in the direction of influence.

In order to remove the structural indeterminacy of the coefficients, the non-standardized coefficient associated with *Degree of unionization* was set to -1. For this reason a *t*-test cannot be performed on this coefficient. The same standardized coefficients are obtained by setting the coefficient of another indicator equal to -1.

Source: Author's calculations.

Figure 2. MIMIC Estimation Results. Model 2

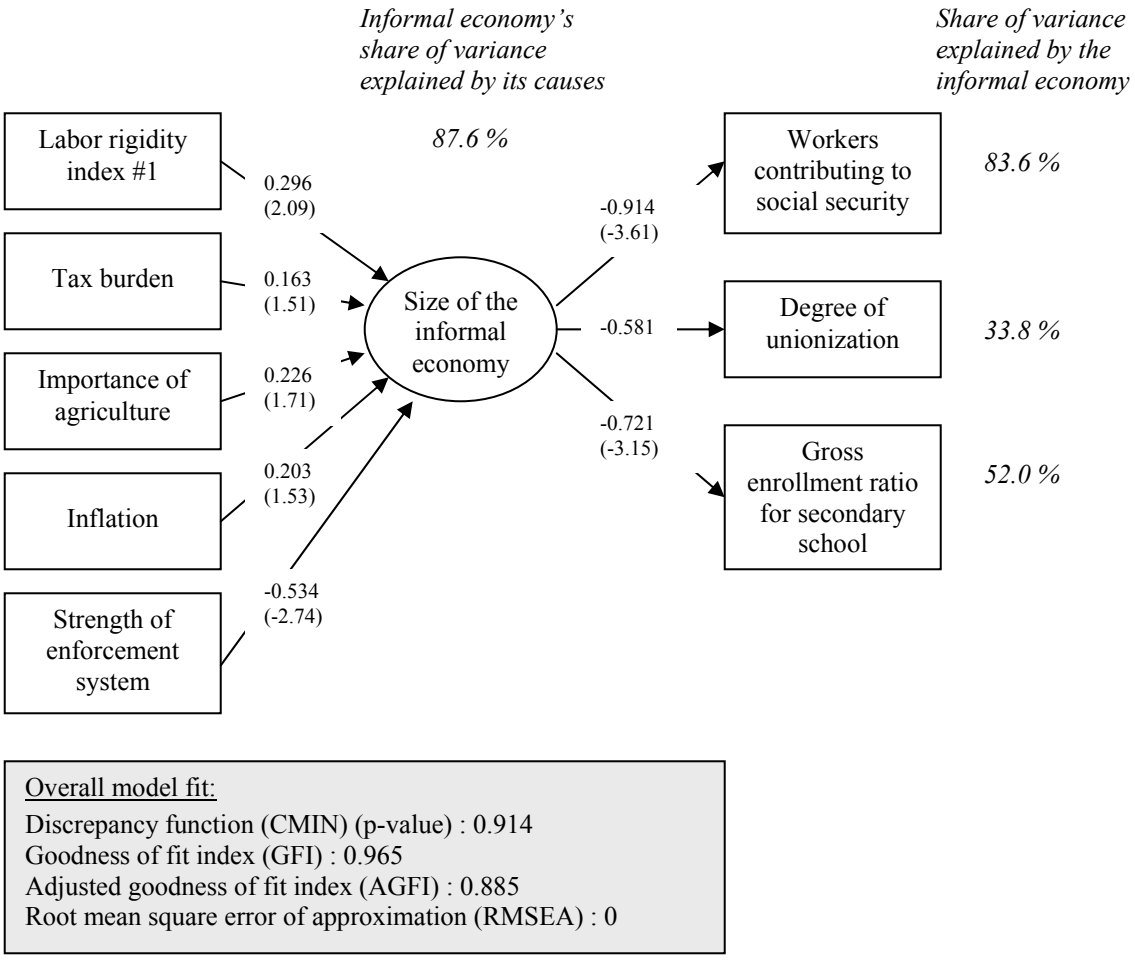


Note: The standardized regression coefficients and their respective *t*-values, indicated in parentheses, are displayed by the arrow pointing in the direction of influence.

In order to remove the structural indeterminacy of the coefficients, the non-standardized coefficient associated with *Degree of unionization* was set to -1. For this reason a *t*-test cannot be performed on this coefficient. The same standardized coefficients are obtained by setting the coefficient of another indicator equal to -1.

Source: Author's calculations.

Figure 3. MIMIC Estimation Results. Model 3

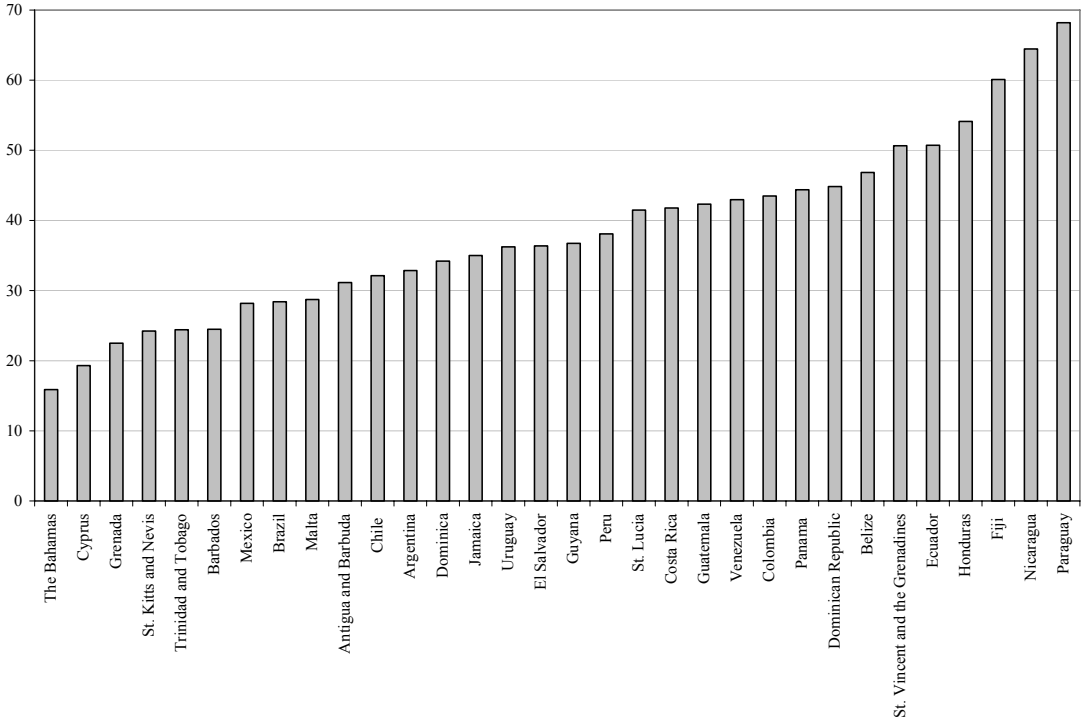


Note: The standardized regression coefficients and their respective *t*-values, indicated in parentheses, are displayed by the arrow pointing in the direction of influence.

In order to remove the structural indeterminacy of the coefficients, the non-standardized coefficient associated with *Degree of unionization* was set to -1. For this reason a *t*-test cannot be performed on this coefficient. The same standardized coefficients are obtained by setting the coefficient of another indicator equal to -1.

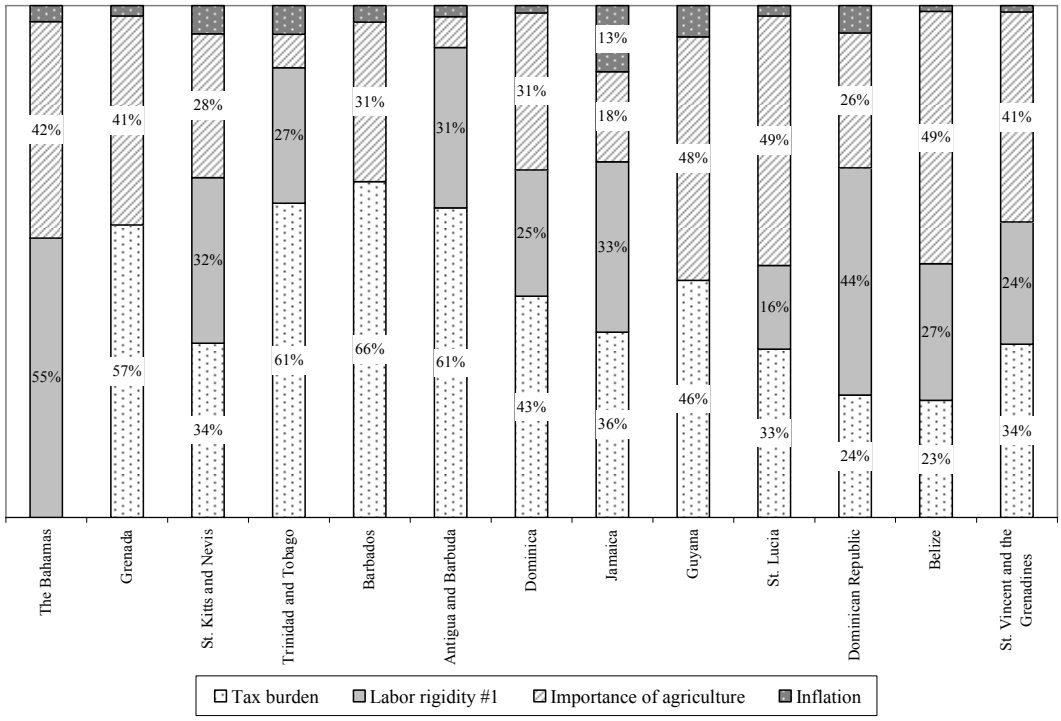
Source: Author's calculations.

Figure 4. Estimated Size of the Informal Economy, early 2000s



Source: Author's calculations based on Model 1 MIMIC results.

Figure 5. Caribbean: Contribution of Each Cause Variable to the Size of the Informal Economy



Note: Only contributions higher than 7 percent display the associated number.
Source: Author's calculations based on Model 1 MIMIC results.

Table 1. Size of the Informal Economy and VAT Tax Evasion

(In percent of GDP)

	Informal economy (early 1990s)	VAT tax evasion (early 1990s)
New Zealand	12%	5%
Sweden	16%	6%
Argentina	21%	30%
Honduras	47%	35%
Bolivia	66%	44%

Sources: Schneider and Enste (2000), and Silvani and Brondolo (1993).

Table 2. Correlations Between Cause and Indicator Variables

	Workers contributing to social security	Gross enrollment ratio for secondary school	Degree of unionization
Tax burden	-0.14	-0.12	0.07
Labor rigidity index #1	-0.59	-0.60	-0.39
Labor rigidity index #2	-0.59	-0.53	-0.36
Importance of agriculture	-0.39	-0.32	-0.31
Inflation	-0.40	-0.29	-0.30
Strength of enforcement system	0.82	0.58	0.49

Source: Author's calculations.

Table 3. Estimated Size of the Informal Economy: Standardized and Absolute Values, early 2000s

Country	Standardized value	Absolute value (% of GDP)
The Bahamas	-1.766	15.9
Cyprus	-1.496	19.3
Grenada	-1.244	22.5
St. Kitts and Nevis	-1.108	24.2
Trinidad and Tobago	-1.092	24.4
Barbados	-1.087	24.5
Mexico	-0.797	28.2
Brazil	-0.779	28.4
Malta	-0.752	28.7
Antigua and Barbuda	-0.562	31.2
Chile	-0.486	32.1
Argentina	-0.428	32.9
Dominica	-0.322	34.2
Jamaica	-0.259	35.0
Uruguay	-0.161	36.2
El Salvador	-0.150	36.4
Guyana	-0.122	36.7
Peru	-0.017	38.1
St. Lucia	0.251	41.5
Costa Rica	0.274	41.8
Guatemala	0.318	42.3
Venezuela	0.369	43.0
Colombia	0.410	43.5
Panama	0.480	44.4
Dominican Republic	0.515	44.8
Belize	0.673	46.8
St. Vincent and the Grenadines	0.974	50.6
Ecuador	0.980	50.7
Honduras	1.247	54.1
Fiji	1.719	60.1
Nicaragua	2.061	64.4
Paraguay	2.357	68.2
Mean	0.000	38.3
Standard deviation	1.000	12.7

Source: Author's calculations based on Model 1 MIMIC results.

Table 4. Caribbean: Estimated Absolute Size of the Informal Economy Under Alternative Model Specifications, early 2000s

(In percent of GDP)

Country	MIMIC Model 1	MIMIC Model 2	MIMIC Model 3
The Bahamas	15.9	11.5	15.1
Grenada	22.5	31.8	22.9
St. Kitts and Nevis	24.2	24.6	24.4
Trinidad and Tobago	24.4	25.2	24.8
Barbados	24.5	36.6	24.3
Antigua and Barbuda	31.2	29.7	31.7
Dominica	34.2	38.8	35.0
Jamaica	35.0	35.0	35.0
Guyana	36.7	57.3	37.3
St. Lucia	41.5	52.0	41.8
Dominican Republic	44.8	46.1	45.3
Belize	46.8	56.5	47.4
St. Vincent and the Grenadines	50.6	58.4	51.4

Source: Author's calculations.

Table 5. Relative Contribution of Each Causal Variable to the Size of the Informal Economy

Country	Tax burden	Labor rigidity index #1	Importance of agriculture	Inflation
The Bahamas	0.0	54.6	42.3	3.1
Cyprus	32.2	0.0	63.5	4.3
Grenada	57.1	0.0	40.9	2.0
St. Kitts and Nevis	34.0	32.4	28.1	5.5
Trinidad and Tobago	61.4	26.5	6.5	5.6
Barbados	65.6	0.0	31.2	3.2
Mexico	52.4	14.4	5.4	27.8
Brazil	31.1	19.6	27.5	21.8
Malta	52.2	42.1	2.6	3.1
Antigua and Barbuda	60.5	31.3	6.1	2.1
Chile	36.1	27.6	30.2	6.0
Argentina	45.6	15.3	38.3	0.7
Dominica	43.2	24.7	30.7	1.4
Jamaica	36.2	33.3	17.6	12.9
Uruguay	22.8	15.4	43.0	18.9
El Salvador	32.1	30.3	32.8	4.8
Guyana	46.3	0.0	47.6	6.1
Peru	31.9	36.7	24.4	7.0
St. Lucia	32.9	16.4	48.7	2.0
Costa Rica	30.8	35.6	22.0	11.6
Guatemala	31.4	23.0	39.5	6.1
Venezuela	33.9	24.9	1.1	40.1
Colombia	36.4	35.3	15.2	13.1
Panama	29.0	23.1	47.1	0.8
Dominican Republic	23.9	44.4	26.3	5.4
Belize	22.9	26.7	49.3	1.1
St. Vincent and the Grenadines	33.8	23.9	41.0	1.2
Ecuador	21.1	35.7	22.2	21.0
Honduras	19.8	31.2	37.4	11.7
Fiji	22.8	29.6	45.8	1.7
Nicaragua	18.5	37.1	38.9	5.6
Paraguay	10.4	52.4	32.7	4.5
Mean	34.6	26.4	30.8	8.2

Source: Author's calculations based on Model 1 MIMIC results.