

# A Toolkit for Informality Scenario Analysis: A User Guide

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## Aim

The aim of this tool is to allow the user to generate estimates of the size and evolution of informal labor for over 100 countries over the next 20 years.

The tool implements the model described in Loayza (2016), in which the labor force is allocated into three sectors: the formal sector, the modern informal sector, and a rudimentary informal sector. Using historical data and exogenous projections from the ILO and World Bank, as well as estimates of key parameters from the literature, the solutions of the model allow us to generate annual projections for the size of each sector from now until 2040.

## The estimates and projections

As described in section 4 of the paper, the basic parameters used in the projections are: the subjective rate of time preference ( $\rho$ ), the capital depreciation rate ( $\delta$ ), and the Cobb-Douglas output elasticity of labor ( $\alpha$ ). The initial conditions used are estimates of the capital stock, total factor productivity (TFP), the labor force, and the share of formal and informal labor, both rudimentary and modern.

Estimates of informal labor are derived from ILO estimates (ILO, 2018) recently published. The categories of employment are attributed to the two informal sectors described in the model based on their characteristics. First, workers that the ILO classifies as in formal employment are allocated to the formal sector. Next, employers whose production units are considered to be part of the 'informal sector' (ILO, 2018) are allocated to the modern informal sector. Similarly, 'employees and contributing family workers in informal employment in the formal sector' are added to the modern informal sector. This is also the case with 'employees in informal employment in the informal sector' (ILO, 2018). Finally,

all other workers are allocated to the rudimentary sector.<sup>1</sup> For a subset of countries missing new estimates from the ILO, the set of available estimates of rudimentary and modern informal labor are regressed<sup>2</sup> on historical GDP, pension coverage and vulnerable employment to generate estimates.

The exogenous projections needed for the simulations are future population, labor force, and TFP growth rates. The main distortions are the legally mandated labor cost ( $W$ ), the excess capital costs for informal firms ( $\zeta$ ), and the difference in labor productivity between formal and modern informal firms ( $a$ ) as well as between formal and rudimentary informal firms ( $b$ ).

Note that in order to be consistent with the model described in the paper, we use two sets of equations for developing the projections, depending on the presence or absence of migration from a rudimentary economy into the modern economy. When the rudimentary sector reaches a minimum (set to a default value of 5% of the labor force in the projections), the equations in Section 3.2 (*The modern economy in the presence of a rudimentary economy*) are no longer applicable, and those in Section 3.1 are used.<sup>3</sup>

### Using the tool

The tool allows the user to customize the settings for all of the variables used in the projections including time frames over which to average historical data and initial values and annual growth rates for parameters.

A user-friendly “Menu” tab allows the user to choose from a range of key options and scenarios pre-selected by the authors. A chart and table summarizing the projections for a chosen country are automatically generated. A summary of the projections for all of the countries is also available at the bottom of the screen.

The “Initial Conditions and Settings” tab allows users who are comfortable with Excel to further customize the projections. Annual projection data for all countries using informal labor as a share of employment or the labor force can be viewed in the “Projections (% of employment)” or “Projections (% of labor force)” tabs.

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<sup>1</sup> Estimates from the ILO were incomplete for 4 countries: the United States, Iraq, Russian Federation, and the United Kingdom. To fill in the data, values were calculated as residuals and, additional assumptions were made when necessary. For example, for the UK, the number of 'contributing family workers' was assumed to be 0. In addition, for Iraq, average shares across the region were used to estimate the share of 'own-account workers' in the informal sector.

<sup>2</sup> A logit regression with region fixed effects is used.

<sup>3</sup> Users can establish a minimum for the size of the informal modern sector and change the value for the rudimentary sector using the “Initial Conditions and Settings” tab.

## a. Using the Menu tab

### Basic Options

*Country or Region:* choose the country, region, or group for which results will be displayed. A table with results for all countries (excluding outliers and countries with small populations) is available at the bottom of the screen.

*Range for Background Data:* choose the minimum and maximum year over which to average historical data for all initial conditions except the growth rates of the labor force, capital and TFP and the labor force (2000-2016),

*Absolute % difference in growth rates of labor costs and labor productivity under Populist or Reformist scenario:* i.e. for the Populist scenario choose how much slower labor productivity grows than labor costs, and vice-versa for the Reformist scenario. The default is 0.5%

*Project informal labor as a % of Employment or Labor Force:* choose estimates of employment as a share of total employment or as a share of the labor force. Labor force estimates are derived from estimates as a share of employment, allocating a portion of unemployment to the formal sector (corresponding to the natural rate of employment) and the rest to the two informal sectors, proportionately. This reflects the fact that informality is often driven by the same factors as unemployment. Estimates are similar though can vary significantly for countries with high rates of unemployment.

*Natural rate of unemployment:* choose a rate of natural unemployment. When changing this parameter, this value will be applied to all countries in the projections.

*Growth rate of A:* choose the growth rate of A (productivity of the formal sector in the model, approximately TFP). The default setting is for each country to use the historical average of TFP growth in that country from 2000-2016. When changing this parameter, this value will be applied to all countries in the projections.

### Other Parameter Growth Settings<sup>4</sup>

In this section, the user may define annual growth rates for each parameter to generate scenarios where informality is more or less persistent (e.g. see the “Persistent Informality” scenario described in section 4.2. Projections in Loayza (2016). When the growth rates are set to 0 or blank,  $\mu$ ,  $\zeta$ ,  $a$  and  $b$  are projected to be constant over time.

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<sup>4</sup> The initial values of  $\mu$ ,  $\zeta$ ,  $a$  and  $b$  may be changed in the “Initial Conditions and Settings” tab.

The authors propose two sets of default growth rates which may be appropriate for developing or developed countries.

*Use default settings for persistent informality in developing countries:* use 1% growth rate for  $\mu$ , 0.25% growth rate for  $a$ , 0.25% growth rate for  $b$ , and -0.25% growth rate for  $\zeta$ . This leads to more persistent informality in developing countries under the baseline scenario.

*Use default settings for persistent formality in developed countries:* use 0.5% growth rate for  $\mu$ , 0 % growth rate for  $a$ , 0% growth rate for  $b$ , and 0 % growth rate for  $\zeta$ . This leads to more persistent formality in developed countries under the baseline scenario.

While users can also change the growth rate of each parameter manually, this option should be used with caution.

*Changing cost of living in the modern economy ( $\mu$ ):* set growth rate for the difference in cost of living between the modern economy and the rudimentary informal sector. The initial value is set to 1.81, and a positive growth rate will mean a growing gap in the cost of living in the two sectors.

*Changing relative productivity of the modern informal economy ( $a$ ):* set growth rate for the ratio between the productivity of the formal and the informal modern sector. The initial value is set to 0.71, and a positive growth rate will mean a decreasing gap in the productivities of the two sectors.

*Changing relative productivity of the rudimentary informal economy ( $b$ ):* set growth rate for the ratio between the productivity of the formal sector and the rudimentary informal sector. The initial value is derived from the solutions of the model and is country-specific. A positive growth rate will mean a decreasing gap in the productivities of the two sectors.

*Changing relative cost of capital in the modern informal sector ( $\zeta$ ):* set growth rate for the ratio between the cost of capital faced by informal modern and formal firms. The initial value is set to 1.3, and a negative growth rate will mean a decreasing gap in the cost of capital in both sectors.

### Snapshot of projections for all countries

*Choose Scenario:* choose between Populist, Baseline or Reformist scenario where, in the formal sector:

- Populist: Labor productivity grows slower than labor costs ( $W$ )
- Baseline: Labor productivity grows at the same rate as labor costs ( $W$ )
- Reformist: Labor productivity grows faster than labor costs ( $W$ )

### b. Using the Initial Conditions and Settings tab

*Time frame for Initial Condition estimates based on historical data:* Choose individual time frames for the historical data averages of the labor force, growth rate of the labor force, employment, capital, growth rate of capital, GDP, growth rate of TFP, and growth rate of the labor force.

### Initial Parameter Values and Settings for Projections

*Initial year for the projections:* currently set to 2016. Based on the availability of historical data, use a year from 1990 to 2016.

*Minimum size of the rudimentary economy:* choose a lower limit on the percentage of the labor force that is employed in the rudimentary economy. Currently set to 5%.

*Minimum size of the informal modern sector:* choose a lower limit on the percentage of the labor force that is employed in the modern informal sector. Currently set to 0%.

*Constant capital share ( $\alpha$ ):* choose an alternative value for the constant capital share of output for the modern economy. Currently set to 0.5.

*Cost of living adjustment from rudimentary economy ( $\mu$ ):* choose an alternative value for the difference in cost of living between the modern economy and the rudimentary informal sector. Currently set to 1.81.

*Ratio between productivities of the modern informal and formal sectors ( $a$ ):* choose an alternative value for the ratio between the productivity of the formal and the informal modern economy. Currently set to 0.71.

*Ratio between capital rental rate for modern informal and formal firms ( $\zeta$ ):* choose an alternative value for the ratio between the cost of capital faced by informal modern and formal firms. Currently set to 1.3.

*Ratio between wages in the modern informal and formal sectors using constant alpha ( $\pi$ ):* choose an alternative value for the ratio between the informal wage rate and the formal wage rate,  $W$ . Note that it is currently a function of the capital share ( $\alpha$ ) and the ratio between the capital rental rates and productivities in each sector ( $\zeta$  and  $a$ ), equal to 0.39.

*Difference in growth rate of labor costs and growth rate of labor productivity:* choose a growth rate. A positive growth rate tends to decrease formality and vice versa.

*Growth rate of  $a$ :* choose a growth rate for the ratio between the productivity of the formal and the informal modern sector

*Growth rate of  $b$ :* choose a growth rate for the ratio between the productivity of the formal and the rudimentary informal sector

*Growth rate of  $\mu$* : choose a growth rate for the difference in cost of living between the modern economy and the rudimentary informal sector

*Growth rate of  $\zeta$* : choose a growth rate for the ratio between the cost of capital faced by informal modern and formal firms

*Growth rate of TFP*: projections currently use an average of the TFP growth rate from 2000-2016 for each country, as the future growth rates for A. The user may choose an alternative growth rate here.

*Natural rate of unemployment*: choose the percentage of unemployment allocated to the formal sector. Currently 5% of unemployment is allocated to the formal sector.

#### Initial Conditions Based on Historical Data, Based on the Model and Settings for Projections

Table 1 shows the country-specific variables used in the projections. The variables in the first section show averages for the variables based on the historical data in the “Historical Data” tab, for the years defined above. The equations for the allocation of labor into the three sectors are also available.

The second section shows the initial conditions based on the equations of the model. For those variables that depend on the capital share, values are displayed using both the constant capital share and a country specific share.

The next section consists of dummy variables identifying outlier countries with respect to various variables and also specific sub-groups (small population, OECD).

Finally, the historical growth rates of TFP and growth rates of the labor force, as well as the estimates of the subjective rate of time preference plus the depreciation rate are calculated.

## Description of Variables and Data Sources

Variable	Description	Data Source/ Method
Capital share ( $\alpha$ )	In the production function of the modern economy, the capital share measures the share of national income that accrues to owners of capital.	We use a constant estimate of 0.5. This corresponds roughly to the median value of country-specific estimates we derived from labor shares presented in the Penn World Tables (averaged from 1990-2016).
Subjective rate of time preference ( $\rho$ )	The marginal rate of substitution between present and future consumption.	Using the equation that determines the rate of capital growth in the modern economy and the average growth rate of capital from 2000-2016, we obtain the implicit depreciation rate and the subjective rate of time preference. We set a minimum value of 1 percent.
Capital depreciation rate ( $\delta$ )	The rate at which the economic value of the capital stock decreases over time.	
Capital stock (K)	Goods or assets used for production in the modern economy.	We develop historical estimates using Gross Capital Formation in 2010 US dollars from WDI (1960-present), extrapolating using Investment from Penn World Tables (1950-2014) for past years in which it is not available. For the initial conditions, we use an average from 2012-2016 and update future years using the growth rate derived from solutions of the model.
Total factor productivity of the formal sector (A)	The total factor productivity of firms operating in the formal sector, using capital and labor.	We develop country-specific estimates using the production function of the modern economy and our estimates of capital and labor in the modern economy. For the initial conditions of the underlying data, we use an average from 2012-2016.
Growth of Total factor productivity of the formal sector (A)	Growth of total factor productivity of firms operating in the formal sector, using capital and labor.	We calculate an annual log growth rate of the historical estimates of TFP and take an average from 2000-2016. TFP is calculated using capital estimates, total employment and GDP. We set a minimum value of 0.
Growth of the Labor force (growth of $L_F + L_I + L_R$ )	Growth of the total labor force (i.e. in the modern and rudimentary economy) by country.	We use estimates and projections of the size of the labor force by country from the ILO (available until 2040) to find an annual growth rate. For the initial year, we use an average of estimates of the size of the labor force from 2012-2016 from WDI and update this using the projected growth rate.

Variable	Description	Data Source/ Method
Excess capital costs for informal firms ( $\zeta$ )	Informal firms pay a capital rental rate which is a multiple, $R$ , of the market determined net capital rental rate paid by formal firms.	Based on an estimate by Scheinkman and de Paula of the additional cost of capital for informal firms in Brazil, we assume a constant value of 1.3 for all countries. For the persistent informality parameter options, we set $\zeta$ to decrease 0.25% percent annually.
Cost of Living Adjustment ( $\mu$ )	The wage adjustment between the rudimentary and modern economies, which accounts for differences in the cost of living or in the cost of labor participation between the two economies.	We find the ratio between the average monthly wage of all employees and of employees in elementary occupations, available for a subset of countries from the ILO. We use the mean, after excluding outliers, 1.81. For the persistent informality parameter options, we set the growth rate of $\mu$ to be 1 percent annually.
Ratio of formal to modern informal productivity ( $a$ )	Total factor productivity in the informal sector is a fraction, $a$ , of productivity in the formal sector ( $A$ ).	We use an estimate from Perry (2007) that, controlling for firm characteristics, informal firms are 71% as productive as formal firms. For the persistent informality parameter options, we set the growth rate of $a$ to be 0.25% percent annually.
Ratio of formal to rudimentary informal productivity ( $b$ )	Labor productivity in the rudimentary economy is a fraction, $b$ , of total factor productivity in the formal sector.	Country-specific estimates are obtained through calibration of the model. For the persistent informality parameter options, we set the growth rate of $b$ to be 0.25% percent annually.
Formal Labor ( $L_F$ )  <i>As a share of labor force or employment</i>	The total share of workers employed in formal jobs.	We use estimates of informal labor from the ILO (ILO, 2018) to identify formal labor. For the estimates as a share of the labor force, we allocate an additional share of the labor force to be formal (default is 5%). For a subset of countries, a logit regression of informality and historical estimates of GDP (WDI), contribution to pensions (ILO and World Bank) and vulnerable employment (ILO) (averages from 2012-2016) are used to fill in missing data.
Informal Rudimentary Labor ( $L_R$ )	The total number of workers in the rudimentary economy, using primary production technologies with little capital and low productivity	We use ILO estimates of informal employment by sector and status in employment to allocate a portion to the rudimentary sector and the rest to the modern informal sector. For a subset of countries, a logit regression of informality and historical estimates of GDP (WDI), contribution to pensions (ILO and World Bank) and vulnerable employment (ILO) (averages from 2012-2016) are

Variable	Description	Data Source/ Method
		used to fill in missing data.
Informal Modern Labor (L <sub>i</sub> )	The total number of workers employed in informal firms operating in the modern economy.	We use ILO estimates of informal employment by sector and status in employment to allocate a portion to the rudimentary sector and the rest to the modern informal sector. For a subset of countries, a logit regression of informality and historical estimates of GDP (WDI), contribution to pensions (ILO and World Bank) and vulnerable employment (ILO) (averages from 2012-2016) are used to fill in missing data.
Legally mandated labor cost, i.e. minimum wage (W)	The legally mandated cost of labor paid by firms in the formal sector.	We use the equation for the aggregate capital-labor ratio in the modern economy to derive an estimate.

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