Informality, Tariffs and Wealth

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Informality, tariffs and wealth

Nelson Correa\textsuperscript{a} and Michele Di Maio\textsuperscript{b}\textsuperscript{*}

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This article analyzes the interaction between changes in tariff protection, informality, inequality and aggregate income. First, we describe some new empirical evidence on informality, the formal/informal wage gap and trade openness in Latin American countries. Then we present a simple model characterized by three (empirically based) assumptions: (1) agents consume both formal and informal goods; (2) the government uses tariff revenues to purchase formal goods; (3) informality is a voluntary phenomenon. The model predicts that tariff reduction increases informality and wage inequality and that the maximization of income requires a positive level of tariff protection. The model’s results are shown to be consistent with the empirical evidence concerning Latin American countries.

\textbf{Keywords:} informality; tariffs; trade integration; Ricardian model with a continuum of goods

\textbf{JEL Classifications:} F16; O17

1. Introduction

Informality is a relevant phenomenon in most developing countries.\textsuperscript{1} For this reason, not considering this element when modelling the impact of trade liberalization on the labour market and the economy at large may indeed imply missing an important part of the story (Kar and Marjit 2001; Emran and Stiglitz 2005). Recently the literature has provided a number of possible explanations for the existence of informality and how it is related to trade integration (Goldberg and Pavcnik 2004; Maiti and Marjit 2008; Bacchetta, Ernst, and Bustamante 2009). With respect to previous contributions, the novelty of the model presented in this article consists in the adoption of three novel (empirically based) assumptions. First, agents demand both formal and informal goods. Second, all tariff revenues are used by the government to purchase (only) formal goods. Third, following the empirical

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\begin{thebibliography}{999}
\end{thebibliography}
evidence presented by Maloney (2004) and Bosch, Goni and Maloney (2007), informality is a (partially) voluntary phenomenon. Among the three, the most important and relevant assumption is certainly the last one. The basic idea is that workers enjoy some benefit from being informal. This implies that the labour market is characterized by an equilibrium wage gap between formal and informal wage (Badaoui, Strobl, and Walsh 2007; Bargain and Kwenda 2010). In particular, we formalize allocation decision by workers through the equalization of utility (instead of wage) across job types. Our model explores the theoretical implication of such a view on informality.

Two are the main results of the model. First, the model predicts that reducing tariff protection increases informality and wage inequality. Second, the results show that the presence of informality deeply modifies the standard (positive) effect of trade integration since aggregate income is maximized by a positive level of the tariff. Finally, the model also allows the derivation of some testable relations between preferences for informal goods and the country’s level of specialization. Interestingly our model shows that these results depend on the level of the tariff, the consumption parameters and the level of government efficiency.

To the best of our knowledge, this is the first article that, built in accordance with the view on informality put forward by the influencing paper by Maloney (2004), offers a simple and tractable theoretical framework to determine the effect of reducing tariff protection on a set of important economic variables when the economy is characterized by informality. Moreover we show that the model’s predictions turn out to fit well the empirical evidence concerning developing – in particular Latin American – countries. The article is structured as follows. In the next section, we briefly review the empirical and theoretical literature on informality and trade integration. In Section 3, we present some new empirical evidence concerning trade and informality in Latin American countries. In Section 4, we present the model. In Section 5, the main results of the model are derived and compared with the empirical evidence. Section 6 concludes.

2. Informality and trade: related literature

The term informality may indicate different things. The influential contribution by Maloney (2004) suggests that, given the high heterogeneity which characterizes the informal sector, informality should be identified with its largest component: males who are self-employed or owners of unregistered micro-enterprises with less than five employees. Despite figures may vary depending on the definition used, it is a fact that the informal sector actually accounts for a large share of the labour force in most of the developing countries (Bacchetta, Ernst, and Bustamante 2009). Reducing informality ranks top in the agenda of policy makers because informality is
said to be associated with low quality and poorly paid jobs. However this view is controversial. In particular, Maloney (2004) criticizes the claim that informal jobs are less desirable than formal ones. In fact given the available evidence it cannot be excluded the possibility that some individual may value informal work arrangements superior to formal ones, hence the existence of an informal benefit. Empirical evidence on Latin American countries shows that this may be indeed the case.\(^3\)

The belief that informality is a negative phenomenon has fuelled a number of studies in search for its causes and remedies. In particular a very popular fear is that globalization would increase informality.\(^4\) Nonetheless, up to now, empirical studies examining the relation between trade liberalization and informal employment are few and their results are mixed. Goldberg and Pavicnik (2004), after reviewing a number of country studies, conclude that the informal sector expands following a trade liberalization but that the country’s structural characteristics may play an important role in determining the relations between the two variables.\(^5\) Bacchetta, Ernst and Bustamante (2009) find that more trade seems to be correlated with less informality. However, they also find a positive relation between trade reforms that reduce trade restrictions (in particular tariff rates) and informality rates. The fact that studies deliver opposite results concerning the relation between informality and trade openness suggests that some form of non-linearity may be present. This is one possibility we explore in the next section.

In general, existing results should be interpreted with several caveats because, while the definition of the informal sector used in these studies captures the broad idea of non-compliance with the labour market regulation, the exact source of non-compliance may differ across countries. One should thus be cautious about comparisons of results from cross-country studies when the definition of informality concerns labour market legislation. The definition employed in Maloney (2004) does not suffer from this shortcoming, allowing for cross-country and across time comparison between different country experiences. Using unique data from Latin American countries, it shows that the informal sector is not a residual of the formal one but the result of a (partly) voluntary choice made by workers (see also Gunther and Launov 2006). According to this view, workers trade formal protection off for another dimension of job quality.\(^6\) In fact there are a number of reasons for which a worker may want to become ‘unprotected’ or informal. The most important one is that in developing countries, government provided services to the formal sector are frequently of poor quality. Since workers pay for these implicitly or explicitly, to the degree that perceived benefits fall short of taxes there is an incentive to become informal.

On the theoretical side things are no less complicated. The theoretical literature on informality is highly idiosyncratic both concerning modelling
choices and results obtained (see Gerxhani [2004] for a review). In particular, while most of the theoretical models predict that trade opening increases informality, they widely differ in their predictions about changes in the informal wage and, hence, about welfare implications. For instance, Kar and Marjit (2001) show that a reduction in tariff increases informality and informal wages, but the latter effect may not be sufficient to make trade integration welfare improving. In dual-economy models, the opening of the import-competing formal sector typically pushes workers towards the informal sector. The effect on informal wages depends on capital mobility and production linkages. In general, the more mobile capital is between the formal and informal manufacturing sectors the more likely it is that wages will rise in the urban and rural agricultural informal sectors. Also models which consider the efficiency wage assumption predict an increase in informality but an ambiguous effect on informal wages (Chaudhuri and Mukherjee 2002; Goldberg and Pavcnick 2003). While it is not very common, in some models the informal good is traded. In this case, a reduction in the tariff increases both informality and the informal wage (Chandra and Khan 1993). Other models have considered the presence of vertical linkages between the formal and informal economy. In some cases, the informal sector is assumed to produce intermediate product rather than a final good (Gupta 1993; Beladi and Yabuuchi 2001) while other contributions focus on firms’ decisions to use formal rather than informal labour when the latter is illegal (Marjit, Ghosh, and Biswas 2007) or to subcontract through informal contracts (Maiti and Marjit 2008). In these models the effect of trade integration on informal wages depends on the adjustments made by formal firms to the new situation. Finally, some models emphasize that the structural characteristics of the country (i.e. the international specialization pattern, the number of inter-sectoral linkages, etc.) contribute to determine the effects of trade integration on the informal sector (Cimoli, Pugno, and Primi 2006).

3. Informality and trade in Latin America: empirical evidence

The available evidence suggests that both the direction and extent of the effect of trade opening on informal variables are highly dependent on country-specific circumstances (Bacchetta, Ernst, and Bustamante 2009). In this section we discuss some new empirical evidence concerning informality and its relation with some important economic variables in several Latin American countries. Table 1 presents the most recent available UN-ECLAC’s estimates of the evolution of informality during the period 1990–2007 for the largest countries in the region. ECLAC (2008) defines the informality share as the percentage of urban population employed in micro-enterprises (less than five employees) and unskilled self-employed. Two facts emerge from these data. First, informality is a quantitatively important
phenomenon in Latin American countries. Second, informality has significantly varied during the period under consideration, showing also a differentiated dynamics at the country level.

In the last two decades, Latin American countries have undergone deep structural changes. In particular trade liberalization episodes took place in most countries. To explore the possible existence of a relation between increasing trade openness and informality, we run a series of regressions using different specifications. The results are reported in Table 2. Details about data sources and variable definitions are described in Appendix A. We first regress the level of informality on openness. Informality is measured according to the ECLAC (2008) definition and openness is defined as total trade (export plus import) as a percentage of GDP. The result shows that the openness coefficient is not significant (column 1). When we control for country heterogeneity, the coefficient changes sign but remains not significant (column 2). On the contrary, when we include the openness quadratic term both openness and openness squared turn out to be significant controlling or not for heterogeneity (columns 3 and 4) with the former coefficient being positive and the latter negative. Then, following Bacchetta, Ernst and Bustamante (2009), we include as an additional control

Table 1. Informality in Latin America – selected years (percentage of total employed population).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina¹</td>
<td>44.5</td>
<td>42.4ᵃ</td>
<td>41.0ᵇ</td>
</tr>
<tr>
<td>Bolivia</td>
<td>58.5ᵉ</td>
<td>64.2ᵃ</td>
<td>62.5</td>
</tr>
<tr>
<td>Brazil</td>
<td>49.2</td>
<td>47.3ᵃ</td>
<td>41.8</td>
</tr>
<tr>
<td>Chile</td>
<td>39.0</td>
<td>31.8</td>
<td>30.6ᵇ</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>36.9</td>
<td>41.6ᵃ</td>
<td>37.7</td>
</tr>
<tr>
<td>Dominican Rep.</td>
<td>n.a.</td>
<td>45.1</td>
<td>48.9</td>
</tr>
<tr>
<td>Ecuador</td>
<td>54.5</td>
<td>58.9ᵃ</td>
<td>57.8</td>
</tr>
<tr>
<td>El Salvador</td>
<td>n.a.</td>
<td>52.2ᵃ</td>
<td>54.6ᵈ</td>
</tr>
<tr>
<td>Guatemala</td>
<td>n.a.</td>
<td>57.6</td>
<td>58.0</td>
</tr>
<tr>
<td>Honduras</td>
<td>53.3</td>
<td>55.2ᵃ</td>
<td>43.9</td>
</tr>
<tr>
<td>Mexico</td>
<td>n.a.</td>
<td>42.5</td>
<td>43.2ᵇ</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>n.a.</td>
<td>59.8</td>
<td>58.4ᵉ</td>
</tr>
<tr>
<td>Panama</td>
<td>32.3ᶠ</td>
<td>34.2ᵃ</td>
<td>36.4</td>
</tr>
<tr>
<td>Paraguay²</td>
<td>55.2</td>
<td>59.1ᵃ</td>
<td>60.2</td>
</tr>
<tr>
<td>Peru</td>
<td>n.a.</td>
<td>63.3ᵃ</td>
<td>64.6ᵍ</td>
</tr>
<tr>
<td>Uruguay</td>
<td>36.7</td>
<td>41.5ᵃ</td>
<td>43.8</td>
</tr>
<tr>
<td>Venezuela</td>
<td>39.2</td>
<td>53.7ᵃ</td>
<td>50.1</td>
</tr>
</tbody>
</table>

Source: Economic Commission for Latin America and the Caribbean (ECLAC) – Social Panorama 2008. Note: Informality defined as in ECLAC (2008): urban population employed in micro-enterprises (less than five employees) and unskilled self-employed. ¹Greater Buenos Aires; ²Asuncion; ᵃData correspond to 1999; ᵇData correspond to 2006; ᶜData correspond to 1989; ᵈData correspond to 2004; ᵉData correspond to 2005; ᶠData correspond to 1991; ᵍData correspond to 2003.
Table 2. Informality and openness: estimation results.

<table>
<thead>
<tr>
<th>Dependent variable: Informality</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>1.18 (2.48)</td>
<td>1.25 (3.92)</td>
<td>32.52*** (7.01)</td>
<td>22.45* (11.45)</td>
<td>-9.21*** (1.65)</td>
<td>3.12 (4.69)</td>
<td>1.47 (6.41)</td>
<td>44.18*** (14.91)</td>
</tr>
<tr>
<td>Openness²</td>
<td>-21.32*** (4.25)</td>
<td>-12.55** (5.93)</td>
<td>-3.70*** (.27)</td>
<td>-0.83 (.76)</td>
<td>-6.55* (3.70)</td>
<td>-22.10*** (7.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP per capita</td>
<td>3.70*** (.27)</td>
<td>0.83 (.76)</td>
<td>3.55*** (0.30)</td>
<td>2.48*** (0.85)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Country fixed effects | NO | YES | NO | YES | NO | YES | NO | YES
Number of observations | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119
F-test | 0.635 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000
$R^2$ | 0.002 | 0.904 | 0.910 | 0.910 | 0.575 | 0.906 | 0.584 | 0.919

Note: *, **, *** denote significance at 10, 5 and 1%, respectively. All regressions are estimated by OLS. Robust standard errors in parenthesis.
variable GDP per capita as a proxy for economic development. Regressing informality on openness (column 5) controlling for GDP per capita we find that the coefficient becomes significant and negative, but its significance disappears when we control for country heterogeneity (column 6). As previously discussed, the absence of a consensus in the literature on the relation between trade openness and informality and the fact that different studies deliver opposite results suggest that some form of non linearity may be present. We check for this possibility including in the regression also the openness squared term (columns 7 and 8). While in column 7 there seems not to be correlation between trade openness and informality, when we control for heterogeneity (column 8), both the openness variables turn out to be highly significant with the openness coefficient being positive and the coefficient of the squared term negative. The estimated coefficients indicate that the relation between informality and the level of trade integration becomes negative when the trade/GDP ratio is larger than 1. Note that this is a high value since the average trade/GDP ratio is 0.6 for our sample of countries. The GDP per capita coefficient is significant and negative: the estimated magnitude suggest that a 1% increase in per capita GDP is associated with a decrease in informality by 18%. In conclusion, the results indicate the existence of a inverted U-shape relation between informality and openness. The following model will try to account for this empirical evidence.

3.1. Robustness checks

Table 3 reports a number of robustness checks of our main result. In column 1, we included additional controls to our main specification. Following the literature (see for instance Bacchetta, Ernst and Bustamante 2009), we added the share of the working population and the share of manufacturing in export. The sign and significance of the coefficients of the openness variables remain the same as in our main specification. In column 2, we also included time dummies. The sign of the coefficient of openness and openness squared remains the same as in the main specification but their significance is slightly reduced. In columns 3 and 4, we run our main specification using alternative measures of the level of trade openness: the average country tariff level and the trade/GDP ratio measured in constant prices using data from the Penn World Tables (PWT). In both cases, the sign and significance of these variables confirm the convex relationship between informality and the openness level. Finally, in columns 5 and 6 we consider the issue of endogeneity. We try to address the possibility that endogeneity between informality and trade openness affects our results by estimating two different models. As a first approach, we estimate our model using as explanatory variables the lagged values of openness and openness squared. Results reported in column 5 of Table 3 turn out to be not sensibly different
Table 3. Informality and openness: robustness checks.

<table>
<thead>
<tr>
<th>Dependent variable: Informality</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>35.93***</td>
<td>24.91*</td>
<td></td>
<td></td>
<td>43.93***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(13.56)</td>
<td>(13.09)</td>
<td></td>
<td></td>
<td>(10.50)</td>
<td></td>
</tr>
<tr>
<td>Openness^2</td>
<td>-17.55**</td>
<td>-13.12**</td>
<td></td>
<td></td>
<td>-23.28***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(6.64)</td>
<td>(6.42)</td>
<td></td>
<td></td>
<td>(5.37)</td>
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<tr>
<td>Tariff</td>
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<td>-86.74***</td>
<td>(25.28)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tariff^2</td>
<td></td>
<td></td>
<td>176.03***</td>
<td>(57.36)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Openness (PWT)</td>
<td></td>
<td></td>
<td></td>
<td>34.28***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(12.40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Openness (PWT)^2</td>
<td></td>
<td></td>
<td></td>
<td>-13.72**</td>
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<td></td>
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<td></td>
<td>(5.38)</td>
<td></td>
<td></td>
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<tr>
<td>Openness [t−1]</td>
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<td></td>
<td></td>
<td>23.29**</td>
<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>(9.07)</td>
<td></td>
<td></td>
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<tr>
<td>Openness^2 [t−1]</td>
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<td></td>
<td></td>
<td>-15.3***</td>
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<td></td>
<td>(4.55)</td>
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<td>Working</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>(0.02)</td>
<td></td>
<td></td>
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<tr>
<td>Manufacturing share in export</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP per capita</td>
<td>-2.63***</td>
<td>-2.13**</td>
<td>-2.91***</td>
<td>-2.45***</td>
<td>-1.8**</td>
<td>-2.00**</td>
</tr>
<tr>
<td></td>
<td>(0.86)</td>
<td>(0.85)</td>
<td>(0.77)</td>
<td>(0.89)</td>
<td>(0.63)</td>
<td>(0.77)</td>
</tr>
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<td>(Continued)</td>
<td>Dependent variable: Informality</td>
<td>Country fixed effects</td>
<td>Time dummies</td>
<td>Observations</td>
<td>F-test</td>
<td>( R^2 )</td>
</tr>
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<td>--------------</td>
<td>--------</td>
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</tr>
<tr>
<td>(1)</td>
<td>YES</td>
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<td>119</td>
<td>0.00</td>
<td>0.92</td>
</tr>
<tr>
<td>(2)</td>
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<td>119</td>
<td>0.00</td>
<td>0.93</td>
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<tr>
<td>(3)</td>
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<td>99</td>
<td>0.00</td>
<td>0.95</td>
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<tr>
<td>(4)</td>
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<td>NO</td>
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<td>0.00</td>
<td>0.91</td>
</tr>
<tr>
<td>(5)</td>
<td>YES</td>
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<td>NO</td>
<td>102</td>
<td>0.00</td>
<td>0.95</td>
</tr>
<tr>
<td>(6)</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>119</td>
<td>0.00</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Note: *, **, *** denote significance at 10, 5, and 1%, respectively. Robust standard errors in parenthesis. 
Openness (constant prices) is from the PWT 6.2. \( T_{avg} \) is the average tariff at the country level from Stallings and Peres (2011). \( Working \) is the percentage of working population (16–64). Manufacturing share in export is the share of manufacture in export; both are from the World Bank World Development Indicators 2010.
with respect to the ones in our main regression. Finally in column 6, we estimate our model using the Arellano-Bond GMM estimator which uses the lagged values for all variables as instruments. The results again indicate that our main result is confirmed: there is a convex relationship between informality and trade openness.

We conclude this section presenting in Table 4 correlation coefficients between the main variables we will consider in the following model. Results suggest the existence of a positive association (correlation coefficient 0.25) between openness and the relative formal/informal wage. It also results that informality and the relative formal/informal wage are positively correlated. The positive coefficient (0.42) indicates that in countries where informality is larger wage inequality – as measured by the ratio formal/informal wage – is higher. The table also shows that the dimension of the formal market is negatively correlated with informality while it is positively correlated with the level of openness and wage inequality.

In the following, we present a theoretical model that incorporates as basic features these stylized facts and it is also consistent with the empirical evidence reported in Maloney (2004).

### 4. The model

In this section, we present a variant of the Ricardian model with a continuum of goods elaborated in Xu (2003) in which we introduce informality. There are two countries: North and South. Both countries have a formal sector which produces a continuum of differentiated formal goods and a sector which produces an informal good.

#### 4.1. Production and specialization

#### 4.1.1. The formal sector

As in Dornbusch, Fischer and Samuelson (1977), formal goods are modelled as a continuum over the interval \( z \in [0,1] \). The production of these goods

<table>
<thead>
<tr>
<th>Correlation coefficients, average Latin America</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informality share</td>
</tr>
<tr>
<td>Formal/total market</td>
</tr>
<tr>
<td>Formal/informal wage</td>
</tr>
</tbody>
</table>

Source: Authors’ calculation based on ECLAC (2008). Data for the period 1990–2007. For details on variables’ definition see Appendix A. All correlation coefficients are significant at 5%.
uses workers as only input; one unit of good \( z \) requires \( a(z) \) units of labor in South and \( a^*(z) \) in North, with \( a(z) < 1 \) and \( a(z)^* < 1 \). We assume \( a(z) \neq a^*(z) \) for all \( z \). Define

\[
A(z) = \frac{a^*(z)}{a(z)}
\]

We rank formal goods such that \( A'(z) < 0 \). Thus South has a relative productivity advantage in low-index formal goods and the North in high-index ones.

4.1.2. The informal sector

In each country there is a sector which produces an informal good.\(^{14}\) Following the empirical evidence (Perez Sainz 1998; ECLAC 2008; Sindzingre 2006), we assume that the informal sector: (1) produces a cheaper good than the formal sector ones; (2) has a lower labour productivity than the formal ones;\(^{15}\) (3) pays a lower wage than the formal ones; (4) is non tradable. Also the production of informal good uses workers as only input with one unit of good \( i \) requiring one unit of labour.

4.1.3. Specialization pattern

Suppose now that South imposes an uniform ad valorem tariff \( t \) on imports from North, and that North imposes a tariff \( t^* \) on imports from South. Denote \( w_f \) and \( w^* \) the formal wages in South and North, respectively. With perfect competition, the price of formal good \( z \) is \( p(z) = a(z)w_f \) if domestically produced and \( p(z) = (1 + t)a(z)^*w^* \) if imported. Thus, South imports good \( z \) if and only if \( p(z) = a(z)w_f > (1 + t)a(z)^*w^* \). The equality defines South’s borderline import good \( z_m \), whose value satisfies

\[
A(z_m) = \frac{w_f}{(1 + t)w^*}
\]

Using the same reasoning, the South exports good \( z \) if and only if \( (1 + t^*)a(z)w_f < a(z)^*w^* = p^*(z) \). The equality defines the South’s borderline export good \( z_x \), whose value satisfies

\[
A(z_x) = (1 + t^*) \frac{w_f}{w^*}
\]

Note that \( z^m = z^x \) iff \( t = t^* = 0 \). If either tariff is positive we always have \( z^m = z^x \). Since South produces goods in the range \([0, z^m]\) and North
produces goods in the range $[z^x,1]$, the goods in the range $[z^x,z^m]$ are tariff-driven non-traded goods. Figure 1 describes the international pattern of specialization.

4.2. Consumption

North and South are populated by $H^*$ and $H$ agents, respectively, each consuming a bundle of formal and informal goods. While the informal good can be only produced domestically, formal ones can be acquired from either domestic or foreign producers. The behavior of consumers is described as the outcome of a two stage utility maximization procedure. In the first stage, the consumer optimally allocates expenditure between formal goods and the informal one. In the second stage, consumption decisions are made over the differentiated formal goods which enter the sub-utility function in a symmetric way. We begin deriving the total demand for the formal goods and the informal one. Then, we will derive the expression for the total demand for each formal good $z$.

4.2.1. First stage

Agents have identical Cobb–Douglas utility functions. Denoting with $p_i$ the price of the informal good and with $p_f$ the price index of formal ones (defined below, equation [5]), we have that individual $h$'s consumption of informal and formal goods, respectively, are given by:

$$c_{ih} = \frac{[1 - \lambda]}{p_i} I_h, \quad c_{fh} = \frac{\lambda I_h}{p_f}$$

with $h = \{i, f\}$, where $h = i$ if the agent is an informal worker and $h = f$ if she is formal. $I_h$ is agent’s income and $\lambda$ is the income share spent on formal goods. Normalizing $H = 1$, aggregate South’s private demand for formal goods is:

$$c_{fi}(1 - L) + c_{ff}L = \frac{\lambda w_i}{p_f} (1 - L) + \frac{\lambda w_f}{p_f} L = \lambda \left[ \frac{w_i(1 - L) + w_f L}{p_f} \right]$$

Figure 1. South’s specialization pattern.
where $L$ and $(1-L)$ are the share of formal and informal workers, respectively and $c_{fi}$ and $c_{ff}$ are individual demand for formal goods by informal and formal workers, respectively. The government uses tariff revenues $G$ to purchase only formal goods.\textsuperscript{17} Thus total expenditure on formal goods is:

$$
\Theta = pf[c_{fi}(1 - L) + c_{ff}L] + G = \lambda[w_i(1 - L) + w_fL] + \alpha t \left[\frac{(1 - z_m)\Theta}{1 + t}\right]
$$

where $G$ is total import tariff revenue. The parameter $0 \leq \alpha \leq 1$ represents the share of tariff revenues that become formal demand. The remaining $(1-\alpha)$ is a pure waste. We interpret $\alpha$ as the efficiency level of the government. The derivation of total expenditure on informal good is identical yielding:

$$
\Delta = (1 - \lambda)[w_i(1 - L) + w_fL]
$$

Finally, total expenditure in South is given by:

$$
E = \Theta + \Delta = w_i(1 - L) + w_fL + \alpha t \left[\frac{(1 - z_m)\Theta}{1 + t}\right]
$$

For the moment, we will assume that there are no government inefficiencies and thus all tariff revenues are spent by the government to purchase formal goods, i.e. $\alpha = 1$. We will discuss the effect of different levels of government inefficiency in Section 5.2.

4.2.2. Second stage

Equation (1) gives total expenditure on formal goods by South agents. The consumption bundle of formal goods of agent $h = \{i_f\}$, $c_{fh}$, is defined as follows:

$$
c_{fh} = \left(\int_0^1 \frac{d}{c_{fhz}^\theta} dz\right)^{-\frac{1}{\theta}}
$$

where $c_{fhz}$ is the quantity of good $z$ demanded by agent $h$, and with $\theta$ that measures the elasticity of substitution between the different goods. The formal goods price index is given by

$$
p_f = \left(\int_0^1 p(z)^{1-\theta} dz\right)^{\frac{1}{1-\theta}}
$$
where \( p(z) \) is the price of good \( z \). International trade implies that:

\[
p(z) = \begin{cases} 
a(z)w_f & \text{if } z < z_m \\
a^*(z)(1 + t)w_f & \text{if } z > z_m 
\end{cases}
\]  
(6)

The agent of type \( h \) in the second stage maximises equation (4) subject to the budget constraint:

\[
\lambda w_h = pzc_fh = \int_0^1 p(z)c_{fh}dz
\]

Since formal goods are a continuum \([0, 1]\), each receives a constant share of the income. This yields the following demand function for good \( z \) by individual \( h \):

\[
c_{fh} = \left( \frac{p(z)}{p_f} \right)^{-\theta} \frac{\lambda w_h}{p_f} \quad h = \{i, f\}
\]

Summing up for all individuals and adding government expenditure we obtain total South demand for each formal good (recall equation [1]):

\[
C_{fz} = \left[ \frac{p(z)}{p_f} \right]^{-\theta} \frac{\lambda w_i}{p_f} (1 - L) + \left[ \frac{p(z)}{p_f} \right]^{-\theta} \frac{\lambda w_h}{p_f} L + \left[ \frac{p(z)}{p_f} \right]^{-\theta} \frac{G}{p_f} + \left[ \frac{p(z)}{p_f} \right]^{-\theta} \frac{\Theta}{p_f}
\]  
(7)

Finally, to simplify the analysis we assume that formal goods enter the sub-utility function in a Cobb–Douglas fashion, \(^{18}\) (i.e. \( \theta \to 1 \)). We have that:

\[
C_{fz} = \frac{\Theta}{p(z)}
\]

where \( C_{fz} \) is total demand for good \( z \).

### 4.3. Labour market equilibrium

As we have seen, agents in South spend \( \Theta \) on the continuum of formal goods \([0, 1]\). Since all formal goods receive an equal share in expenditure and the price of domestically produced ones is \( p(z) = a(z)w_f \), agents demand \( \frac{\Theta}{p(z)} = \frac{\Theta}{a(z)w_f} \) units of each formal good domestically produced. Given that the unit labour requirement is \( a(z) \), it follows that the labour demand for each formal good in South is given by \( \frac{\Theta}{a(z)w_f} \). Since the range of formal good produced in South and consumed by South agents is \([0, z_m]\), domestic
consumption generates a total demand for formal labour in South equal to $z_m \Phi$.

Let $E^*$ denote total North nominal expenditure. Agents in North spend $E^*$ on goods $z$ exported by South at the price $(1 + t^*)p(z)$, which implies a formal demand equal to $\frac{E^*}{(1 + t^*)w_f}$. Since the range of Southern goods exported to North is $[0, z_x]$, North’s consumption generates a total demand for South formal labour equal to $\frac{z_x E^*}{(1 + t^*)w_f}$. Adding the domestic and foreign components of formal labour demand, we obtain

$$L = \frac{1}{w_f} \left[ z_m \Theta + \frac{z_x E^*}{(1 + t^*)} \right]$$

(8)

where $L$ is the demand for formal workers in South.

The demand for informal labour is generated only by Southern agents consumption decisions. Denote $w_i$ the South informal wage and $p_i$ the price of the informal good. Southern agents spend $\Delta$ buying the informal good. Employment in the informal sector is determined by the equality between the number of demanded and supplied goods. Normalizing labour supply in South to 1, we can write:

$$\frac{\Delta}{p_i} = \frac{(1 - L)}{a_i}$$

This implies a demand for informal labour equal to

$$(1 - L) = \frac{\Delta}{w_i}$$

(9)

Total employment in South is obtained summing up equations (8) and (9) yielding

$$H = \frac{1}{w_f} \left[ z_m \Theta + \frac{z_x E^*}{(1 + t^*)} \right] + \frac{1}{w_i} \Delta = 1$$

Following the same procedure, we obtain North’s full employment condition. Southern agents demand $\frac{\Theta}{\alpha(z)w^*}$ units of the foreign produced formal goods. This implies a labour demand for formal workers in North equal to $\frac{\Theta}{(1 + t)w^*}$. The full employment condition in North reads:

$$H^* w^* = \frac{(1 - z_m) \Theta}{(1 + t)} + (1 - z_x) E^*$$

Each workers inelastically supply one unit of work. The equilibrium allocation in the labour market is then determined in accordance with the
empirical evidence reported in Maloney (2004). His empirical analysis suggests that workers attach some positive value to the fact of being informal. Thus, some worker may prefer working in the lower-wage informal sector instead of working in the higher-wage formal one because she values positively the fact of being informal. In this sense, informality is interpreted as a voluntary choice.

We formalize this empirical evidence in the following way. Since the formal wage is larger than the informal one, we write:

$$w_f > w_i = w_f - g$$

where $g > 0$. Define $b$ the benefit workers attach to the fact of being informal, i.e. the informality benefit. It follows that the equilibrium condition in the labour market is given by

$$U(w_f) = U(w_i + b)$$

In equilibrium must obviously hold that $g = b$, i.e. the wage difference $g$ is equal to the benefit $b$ the workers attach to the fact of being informal. This is the necessary condition for the workers to be indifferent as where to be employed.

4.4. Trade balance

World commodity market equilibrium implies balanced trade. Measured at world prices, South imports manufactures of value $\frac{(1-z_m)\Theta}{1+t}Y$. North imports manufactures of value $z_\chi E^*/(1+t)$. Trade balance thus reads:

$$\frac{(1-z_m)\Theta}{(1+t)} = \frac{z_\chi E^*}{1+t}$$

5. Results

We now present the model’s results. We begin studying the impact of increasing trade integration on wage inequality, the level of informality and aggregate income. Then we describe the results of a number of static comparative exercises concerning agents’ preference for buying formal goods, the level of government efficiency and the value workers attach to being informal. To focus on the effects of increasing trade integration on South, we assume that North has no tariff protection, i.e. $t^* = 0$. We begin deriving the model’s results assuming that there are no inefficiency associated to government spending, i.e. $\alpha = 1$; we postpone the analysis of changes in this parameter to section 5.2.
5.1. Trade integration

We describe the process of increasing trade integration as a decrease in the tariff level $t$. We begin our analysis considering the effect of tariff reduction on wage inequality. While the complexity of the model does not allow us to analytically derive the result, the numerical solution indicates that:

**Proposition 1** Reducing tariff protection increases the relative formal/informal wage

This result is shown in Figure 2: under the assumptions made, reducing the tariff always increases the formal/informal wage ratio. The intuition for this result is as follows. As the tariff decreases, specialization increases and the range of domestically produced goods shrinks. This implies that both the average unit of labour requirement and, through the decrease in the demand for formal workers, the formal wage decreases. Given equation (10), the equilibrium condition in the labour market requires the informal wage to decrease as much as the formal one. But this implies that the informal wage decreases in relative terms more than the formal one and thus the formal/informal wage ratio increases.

Interestingly, the model’s prediction is in accordance with the evidence reported in Table 4 that there is a positive correlation between the level of openness and the formal/informal wage ratio.

![Figure 2. Tariff level ($t$) and informality ($1-L$).](image-url)
The change in the tariff level also affects the distribution of workers between the informal and the formal sectors. There are different mechanisms simultaneously at work. First, the reduction in the tariff tends to reduce informality because of the increase in the foreign demand for the (formal) domestic production. At the same time, tariff reduction increases informality since the domestic relative price of the informal good decreases with the tariff.24 Finally, tariff reduction affects domestic formal demand also through government spending. The latter is given by the tariff revenues, which are a concave function of the tariff.25 Numerical results reported in Figure 3 show that:

**Proposition 2** Reducing tariff protection increases informality.

This means that, under the assumptions made, the relative increase in informal demand due to changes in relative prices and in the reduction in the level of government spending is always larger than the increase in formal demand from North consumers. In the next section, we show how this result changes depending on the degree of government efficiency.26

Our model is also suitable to analyze the impact of increasing trade integration on aggregate income. The relation between the level of tariff protection and aggregate income is shown in Figure 4 and it indicates that:

![Figure 3. Tariff level (t) and formal/informal wage.](image-url)
**Proposition 3** The level of the tariff that maximizes aggregate income is positive.

This result is important because it shows that decreasing tariff protection in the presence of informality, even when the latter is a voluntary phenomenon, may not be always welfare increasing.

In our model, the effect of tariff reduction on aggregate income depends on the trade-induced changes in three variables: informality, export and tariff revenues. While the first two have a monotonic relation with the level of tariff protection, the latter has not. As we have seen (Proposition 2), reducing tariff protection increases informality and thus reduces the average wage and the aggregate income. At the same time, a lower tariff increases export, and thus formal demand and income. Tariff revenues are instead a concave function of the level of tariff protection. The numerical results show that starting from a high level of tariff protection the net effect of tariff reduction is positive since the negative effect on aggregate income due to the trade-induced increase in informality is smaller than the positive one through the increase in export and tariff revenues. Yet, given the concavity of the revenue function, when the level of tariff becomes lower than its optimal level \( \tilde{t} \), also tariff revenues start to decrease as tariff becomes lower. Thus, as shown in the graph, for tariff values lower than \( \tilde{t} \) the relation between trade integration and aggregate income becomes negative.

![Figure 4. Tariff level (t) and aggregate income (E).](image-url)
5.2. Comparative statics

5.2.1. Consumers’ preferences

One of the assumptions of our model is that South workers demand (in fixed shares) both formal and informal goods. We now describe the relation between agents’ preferences for the informal good ($\lambda$) and wage inequality, i.e. the formal/informal wage ratio. This is stated in the following:

**Proposition 4** For any given level of tariff protection, the higher the income share spent in buying formal goods the higher wage inequality.

**Proof.** See Appendix B.

The model thus predicts that in countries where the informal market is larger the informality wage gap should be smaller. Interestingly, this result is in accordance with the empirical evidence reported in Table 4, which reports a positive correlation between the formal/total demand ratio and the formal/informal wage ratio. The relation between the preference for formal goods and aggregate income is instead stated in the following:

**Proposition 5** Ceteris paribus, the higher the income share spent in buying formal goods the higher aggregate income.

**Proof.** See Appendix B.

Finally, different levels of $\lambda$ also have an effect on the pattern of specialization. Figures 5 and 6 show that, for each level of tariff protection, a higher $\lambda$ is associate with a larger export range and a smaller import range.

The reason is that for any given specialization pattern, the higher $\lambda$ the higher aggregate income (see Proposition 5). Ceteris paribus, the higher the aggregate income the higher the total amount of import and the higher the trade deficit. The trade balance equilibrium can re-established only through an increase in the export range $[0,z_x]$ and a reduction in the import range $[z_m,1]$.

5.2.2. Government efficiency

The government plays a crucial role in our model. As we said, the $\alpha$ parameter measures the government’s efficiency in collecting tariffs (or in using them) to buy formal goods (see equation [1]). When $0 \leq \alpha < 1$, a share $(1-\alpha)$ of the tariff revenues does not accrue to the government and they are assumed to become a pure waste. Since by assumption government demands only formal goods, it follows that, for any given level of the tariff, the lower
the lower tariff revenues, formal (aggregate) demand and aggregate income. The effect of the level of government’s efficiency on the relation between tariff protection and aggregate income is shown in Figure 7.

Figure 7 confirms that, independently from the efficiency of the government, Proposition 3 remains valid: in the presence of informality, increasing trade integration always reduces aggregate income if the tariff falls below its optimal value, with the latter depending on government efficiency. Yet the negative (positive) effect of reducing tariff protection when $t < i(\alpha)$ ($t > i(\alpha)$), is smaller (larger) the larger (smaller) the level of government inefficiency. Thus if the government is highly inefficient, then the benefit from starting a process of trade liberalization may be enhanced by simultaneously improving government efficiency.

The level of government efficiency has also an effect on the relation between trade integration and the level of informality. As shown in Figure 8, the lower $\alpha$ the higher informality for any given level of tariff protection.

To explain the concave form of the relation between informality and the tariff level when $\alpha < 1$ consider equation (2). Rearranging and taking the derivative with respect to the tariff, we have:

$$\frac{\partial(1 - L)}{\partial t} = \frac{1}{w_i^2} \left( w_i \frac{\partial k(\cdot)}{\partial t} - k(\cdot) \frac{\partial w_i}{\partial t} \right)$$

where $k(\cdot) = E - w_i L - \alpha t \frac{(1 - z_m) \theta}{1 + t}$ is informal workers’s total expenditure. 

*Ceteris paribus*, a lower $\alpha$ implies that the government demand for formal
goods is lower and $k$ is higher. Since $k$ is a concave function of the tariff it follows that also the relation between informality and the tariff level becomes concave.\textsuperscript{28} Thus when $\alpha < 1$ the model’s prediction is in line with the empirical evidence presented in Table 2. As the tariff decreases, first informality increases then, for lower levels of the tariffs, it begins to decrease. Note that as long as tariff revenues are increasing, informality decreases with government efficiency. In particular, given the concave form of the tariff revenues function, the reduction in the informality is not monotonic and it is larger for intermediate levels of the tariff. This result is interesting since it makes explicit how the characteristics and the behavior of the government may have an important effect on the way increasing trade integration modifies the level of informality in the economy.

Regression results (not reported) confirm the theoretical results depicted in Figures 7 and 8, i.e. that both the relationships between aggregate income and openness and the one between informality and openness depend on the level of government efficiency.\textsuperscript{29} Using the Rule of Law variable from Kaufmann, Kraay and Mastruzzi (2009) as proxy for government efficiency,\textsuperscript{30} we find that, controlling for openness, government efficiency is positively correlated with aggregate income and that its interactions with openness and openness squared indicate that its effect is non-linear in the tariff level (see Figure 7). In addition, regression results indicate that the non-linear relationship between informality and openness is robust to the level of government efficiency and that – in accordance with Figure 8 – the latter interact with the tariff level in determining how changes in the openness level impacts on informality.

Figure 6. Tariff, import range ($[zm; 1]$) and preference for formal goods ($\lambda$).
Figure 7. Aggregate income ($E$) and tariff ($t$) for different levels of government efficiency ($\alpha$).

Figure 8. Informality ($1-L$) and tariff level ($t$) for different levels of government efficiency ($\alpha$).
To complete our analysis, we show that Propositions 1, 4 and 5 hold up to government inefficiency. Numerical results show that for any value of $\lambda$ reducing tariff protection increases the relative formal/informal wage (Proposition 1), with the effect being larger when $\lambda$ is larger (Proposition 4). They also indicate that for any level of $\alpha$ and for any level of the tariff, the higher the income share spent in buying formal goods ($\lambda$) the higher aggregate income (Proposition 5). Together these results indicate that all the Propositions are robust to the level of government efficiency $\alpha$.

Finally, we considered how the parameter $\alpha$ affects the volume of trade. The lower $\alpha$, the lower the tariff revenues collected, and hence, the lower domestic demand for formal goods (see equation [1]). Thus, the higher government inefficiency the lower imports and, through the balance of payment equilibrium condition, exports. This implies that in our model government efficiency is negatively correlated with trade.

5.2.3. Informality benefit

As a last exercise, we consider how the model’s results change with the informality benefit, i.e. the value workers attach to being informal. The model’s results show that, ceteris paribus, the more the workers value the benefit of being informal the higher the ratio between formal and informal wage (wage inequality). This is stated in the following:

**Proposition 6** Wage inequality is increasing in the value workers attach to being informal.

**Proof.** See Appendix B.

The intuition behind this result is as follows. When the benefit of being informal increases, in order to maintain the equalization of workers’ utility, informal workers will accept a lower wage for staying in the informal sector or, equivalently, they will demand a higher wage for becoming formal. In both cases the results is an increase in the formal/informal wage ratio. The increase of $b$ has three additional effects, summarized in the following:

**Proposition 7** An increase in workers’ preference for being informal increases informality and reduces both the range of exported goods and aggregate income.

**Proof.** See Appendix B.

These results highlight the central role played by worker’s evaluation of the benefit of being informal as a determinant of the effects the reduction of tariff protection may have on the economy. These results should thus not be
overlooked when design policies aiming at reducing informality and its negative effects.

6. Concluding remarks

Informality is an important feature of the labour market in developing countries. In this article we presented a model to analyze the link between increasing trade integration and informality where the latter is treated as a voluntary phenomenon. The main novelty of the model is the fact that the labour market is characterized, in accordance with recent empirical evidence, by an informality benefit. This implies an equilibrium wage gap even if the labour market is not segmented. The objective of this article was to explore the theoretical implication of this view of informality in developing countries.

Two are the main results of the model. First, reducing tariff protection increases both informality and wage inequality. Second, aggregate income is maximized for a positive level of the tariff. The model is able to account for a number of stylized facts related to Latin America countries.

While able to produce a number of predictions which are in accordance with the empirical evidence, the present model is obviously not exempted from shortcomings. An important one is how we have modeled the way competition takes place in the domestic market: the next step should be to consider the possibility that the informal sector competes with both domestic and foreign production.

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Notes

1. There are different definitions of informality. Following ECLAC (2008), we define informality as the percentage of urban population employed in micro-enterprises (less than five employees) or low-skilled self employed. The concept of informality and its different definitions are discussed in section 2.

2. In its original meaning, informality included ‘illicit or illegal activities by individuals operating outside the formal sphere for the purpose of evading taxation or regulatory burden’ (ILO 1972). In more recent analysis, the informal sector is usually defined as the sector of the economy that does not comply with labour market regulation such as minimum wage laws, hiring/firing regulations, or minimum age laws. In other cases, it is defined as the group of ‘very small enterprises that use low-technology models and do not refer to legal status’ (Webster and Fidler 1996; ECLAC 2008). A broader definition of the informal sector may also include temporary workers in formal
establishments. For a discussion of the different interpretations of the concept of informality see Portes and Schauffler (1993).

3. Boch et al. (2007) draw a similar conclusion considering the Brazilian case. Opposite evidence on this point based on Colombian data is instead reported in Goldberg and Pavcnik (2003).

4. There are, obviously, other important factors that influence the level of informality in a country (see for instance Loyaza, 1996). In particular, early empirical studies focused on the relation between the tax rate (and the level of government intervention in the economy) and informality founding a positive correlation between the two. More recent and detailed studies show that this relation is far from robust (Goldberg and Pavcnik 2004).

5. For instance, Ghosh and Paul (2008) find robust empirical evidence trade liberalization or openness significantly increases the informal share of GDP in 18 Central Eastern European and Former Soviet Union countries. As Maloney (2004) remarks: ‘Arguing that workers are voluntarily informal does not, of course, imply that they are not living in poverty, only that they would not obviously be better off in the formal jobs for which they are qualified.’

6. Marjit and Acharyya (2003) show that with immobile capital the opening of the formal sector induces workers move to the informal sector and the informal wage decreases. Marjit (2003) considers a situation in which even with immobile capital between sectors, trade opening increases the informal wage and informality since the trade-induced contraction in the formal sector causes a capital flows to the labour-intensive sub-segment of the informal sector.

7. Note that restricting our analysis only to Latin American countries somehow minimizes the problems which affect the cross-country analysis of informality as discussed in the previous section.

8. The ECLAC’s definition of informality is an extended version of Maloney’s (2004) one since also domestic services are included into the informal sector. Since this definition of informality is not subjected to the discrepancies caused by the regulatory frameworks of each country, it can be safely used for comparison across countries.

9. There are four countries in our sample for which the trade/GDP ratio is larger than 1 for at least one year in the period considered. These countries are: Costa Rica, Honduras, Panama and Paraguay.

10. We use three year time dummies to allow for a sufficiently large number of observations in each group.

11. Bacchetta et al. (2009) argue that the size of the informal sector may be a factor determining the country’s success in international trade. This reverse effect would bias estimated coefficients.

12. As emphasized by Bacchetta et al. (2009), the size of the informal sector is a possible factor determining the level of trade integration of a country. The reverse effect running from informality to the level of trade integration may bias the estimated of the coefficient in our main regression.

13. While it would also be possible to model a continuum of informal sectors, the simplified framework here adopted is able to highlight the basic idea of the model and the mechanism behind our results.

14. ECLAC estimates show that the relative informal/formal productivity ranges between 10% and 40% (Cimoli et al. 2006).

15. This implies that the informal good is assumed to be necessary in consumption. There are different ways to motivate this assumption. One is to argue, as in Marcouiller and Young (1995), that the formal and the informal sectors
produce different goods. Another is to think about the informal sector as something like agriculture, which would be simply too costly for the government to regulate so that the informal good will never become formal. We thank an anonymous Referee for suggesting us this additional interpretation. Finally, note that modeling the informal sector as a non-traded one necessary for consumption (possibly agriculture) and the fact that the demand for the formal good is independent of the informal one under Cobb–Douglas preferences imply that in analyzing the impact of trade integration on South we would not need to consider the informal sector in North.

16. Government spending is assumed to be financed only through tariff revenues. The presence of a taxation scheme would not modify our results as long as the (net) formal wage is superior to the informal one, condition which is consistent with the evidence discussed in Section 2.

17. A more general formulation of the model would take into consideration that the elasticity of substitution determines how reactive is the formal price index to changes in the tariff level. *Ceteris paribus*, the higher the lower the formal price index for any reduction in the tariff level.

18. If this were not the case, since formal wage is higher than the informal one, all workers would prefer staying in the formal sector. Note that if there were no benefits attached to being informal, the only possible explanation for the existence of an informal sector with a lower wage than the formal one is a segmented labour market due for instance to the existence of efficiency wages (Cimoli et al. 2006) or to the presence of institutional rigidities that do not allow the labour market to clear (Loyaza 1996).

19. According to Maloney (2004): ‘If much of the sector is voluntary, in the sense of workers preferring their present job to one in the formal sector, then the informal job must be at least of equal quality measured along a broader set of relevant job characteristics.’

20. An alternative justification for the workers’ preference for not being formal can be given in terms of reallocation costs. For instance, as long as rural agriculture is informal, one may interpret the benefit of informality as the value the individual attaches to her preference for staying in her village instead than moving to the urban area to become a formal worker. In equilibrium, the formal wage net of these costs and the informal wage would be equal. We thank an anonymous Referee for suggesting us this additional interpretation.

21. The system has 9 variables and 9 non-linear equations. We numerically solved the model using an *ad-hoc* FORTRAN77 program. We have extensively checked the qualitative robustness of the results to all the admissible ranges of the parameters of the model and we only discuss this issue when results are sensitive to the parameter specification. If not otherwise stated, Figures are drawn using the following parameters: $g = 0.5$, $A(z) = 1 - 0.5z$, $\lambda = 0.8$, $\alpha = 1$. The program codes are available upon request from the Authors.

22. Note that this effect depends on the relative change in the import and export quantities and thus on the shape of the $A(z)$ function.

23. This follows from Proposition 1: since labour is the only factor of production, relative goods prices mimic relative factor prices.

24. See the Appendix for the Proof.

25. To anticipate the result, in the presence of government inefficiencies, the relation between the tariff level and informality becomes convex, in accordance with the estimation results reported in Table 2.

26. Emran and Stiglitz (2005) show that, in the presence of an informal sector, price-neutral reforms (i.e. reducing trade taxes and increasing consumption tax
like VAT) do not necessarily enhance welfare. Other recent contributions comparing tariffs and VAT in the presence of informality are Boadway and Sato (2009), Davies and Paz (2010) and Keen (2008).

27. This results implies that, if the government is inefficient, there is a level of the tariff below which a reduction in the tariff decreases informality. The reason is the following. Starting from the tariff revenue maximizing tariff, reducing the tariff reduces tariff revenues and thus aggregate income. This implies that both formal and informal demand decrease. But since the informal market is only domestic, income reduction mostly affects the demand for the informal good. Instead, the formal market (relatively) increases as an effect of the reduction in the tariff which has enlarged the opportunity for international trade.

28. Detailed regression results are available upon request from the authors.

29. The same proxy is also used in Bacchetta et al. (2009).

30. Detailed results are available from the Authors.

References


Appendix A. Data

In this section, we describe how each variable used in section 3 is calculated. GDP per capita and Informality are taken from ECLAC – Social Panorama of Latin America (2008) on the basis of special tabulations of data from household surveys. The other variables are calculated using the data in ECLAC (2008) in the following way. Openness: Exports plus Imports divided by GDP – Millions of dollars at constant 2000 prices. Informal wage: weighted average of: (1) average income in establishments employing up to five persons; (2) average income in domestic employment and average income for non-professional; (3) non-technical self-employed. Formal wage: is calculated from total income assuming that the total average income is a weighted average of the informal wage and formal wage. Formal workers is one minus the (proportion of) informal workers. Formal market is calculated as the number of formal workers multiplied by their wage. Informal market is calculated as number of informal workers multiplied by their wage. Total market is the sum of informal and formal markets. Formal propensity is the ratio formal/total market. Informality benefit: the difference between the formal and the informal wage.

Appendix B. Concavity of the tariff revenue function

We show that the tariff revenues are a concave function of the tariff level. From equation (1), under the assumption $z = 1$, we have that

$$TR = t\left(\frac{(1 - z_m)\Theta}{1 + t}\right)$$

which can be rewritten as

$$TR = tz_x$$

Differentiating equation (13) we have that,

$$\frac{\partial TR}{\partial t} = z_x + t\frac{\partial z_x}{\partial t}$$

where $\frac{\partial z_x}{\partial t} < 0$. When $t = 0$, equation (14) is positive because $z_x$ is positive. Since equation (13) is a continuous function, as $t$ increases its derivative has to remain positive for an interval. Thus, starting from a low level of tariff protection, equation (14) is positive, i.e. tariff revenues grow as $t$ increases. Equation (13) is maximized for

$$\tilde{t} = -z_x\left(\frac{\partial z_x}{\partial t}\right)^{-1} > 0$$

which is positive. For $t \to \infty$ the second term on the right-hand side goes to $-\infty$. This means that starting from high levels of protection, a reduction in $t$ increases tariff revenues. For a high level of $t$, the economy is relatively closed and the tariff revenues are low because the range of imported goods $[1 - z_m]$ is small. In this situation, a tariff reduction has a strong impact on the specialization pattern; reducing the tariff quickly increase the import range. In this case, the increase in the tariff revenues induced by tariff reduction is larger than the loss due to the lower tariff and tariff revenues increase with trade integration. But there is a level of the tariff, for which a further decrease in the tariff reduces tariff revenues. In this case
the increase of the import range cannot compensate for the decrease in the tariff level: tariff revenues decrease with trade integration.

**Proof of Proposition 4**

If the (fixed) share of expenditure on formal goods increases, the ratio formal/informal wage increases for any level of protection. Using equation (10) we have:

\[
\frac{\partial (w_f/w_i)}{\partial \lambda} = -\frac{g}{w_i^2} \frac{\partial w_i}{\partial \lambda} > 0
\]

since \( \frac{\partial w_i}{\partial \lambda} < 0 \). Note that the relation between \( \lambda \) and the informal wage is always negative because, ceteris paribus, the change in the preference for formal goods decreases the demand for the informal one and reduces the informal wage (see equation [9]).

**Proof of Proposition 5**

The proof that a higher \( \lambda \) implies a higher aggregate income immediately follows from the observation that a higher preference for formal goods implies a larger share of workers employed in the formal sector and thus a higher average wage.

**Proof of Proposition 6**

In equilibrium:

\[
w_f = w_i + b = w_f - g + b \Leftrightarrow b = g
\]

where \( g \) is the wage gap and \( b \) is the *informality benefit*, i.e. the utility gain of being informal. Thus we have

\[
w_f = w_i + b
\]

\[
\frac{w_f}{w_i} = 1 + \frac{b}{w_i}
\]

Differentiating:

\[
\frac{\partial (w_f/w_i)}{\partial b} = \frac{1}{w_i} + b \frac{\partial (1/w_i)}{\partial b} > 0
\]

where

\[
\frac{\partial (1/w_i)}{\partial b} = \frac{\partial \left( \frac{1}{w_f - g} \right)}{\partial b} = (-1)(-1) \left( \frac{1}{w_f - g} \right)^2 > 0 \quad (15)
\]

**Proof of Proposition 7**

Since there is a positive relation between \( b \) and \( g \) (see Proof of Proposition 6), let consider the effect of changes of \( g \) on the level of informality. As \( g \) increases, the informal good becomes relatively less expensive. This makes the relative demand for formal goods to decrease inducing an increase in the informal/formal employment
ratio $\Gamma$. This can be easily shown rearranging equations (2) and (9) yielding $\Gamma = \frac{1 - \lambda}{\lambda} \frac{w_i}{w_o}$. Differentiating it with respect to $g$:

$$\frac{\partial \Gamma}{\partial g} = \frac{1 - \lambda}{\lambda} \left[ \frac{1}{w_i} + g \frac{\partial (1/w_i)}{\partial g} \right] > 0$$

(16)

We now consider the effect of different levels of $g$ on aggregate income. Using equations (1) and (2) we obtain

$$E = \frac{\Delta}{1 - \lambda} + tz_x$$

Differentiating with respect to $g$ we obtain

$$\frac{\partial E}{\partial g} = \frac{1}{1 - \lambda} \frac{\partial \Delta}{\partial g} + t \frac{\partial z_x}{\partial g} < 0$$

where

$$\frac{\partial \Delta}{\partial g} < 0$$

and

$$\frac{\partial z_x}{\partial g} < 0$$

The sign of the first derivative immediately follows from equation (9), i.e. equilibrium condition in the informal sector: $\Delta$ must decreases because if $g$ increases $w_i$ decreases (see equation [15]). The second derivative describes the effect of the informality benefit on the range of exported goods. As we have seen, a reduction in the informal wage makes aggregate income to decrease. This implies a reduction in the import and, through the balance of payment condition, a reduction in the range of exported goods.