

Trade Liberalisation and Informality: New stylized facts

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Abstract

The relationship between trade liberalisation and informal activity has not received the attention, whether theoretical or empirical, that it may deserve. The conventional view poses that trade liberalisation would cause a rise in informality. This paper uses three different data sets to assess the sign of the relationship. Empirical results provide a mixed picture. Macro founded data tend to produce results supporting the conventional view. Micro founded data do not. Empirical results also suggest that while informal output increases with deeper trade liberalisation, informal employment falls.

JEL: F13, F16, O17, C23 **Keywords:** Informal Sector, Trade Liberalisation, Cross-sectional Analysis, Time Series Analysis, Panel Analysis

1 Introduction

Informality refers to that share of a country's production of goods and services that does not comply with government regulation. Informal activity is a common feature of most countries, however it is greater in size and more pervasive in developing countries (Schneider and Enste, 2000; Tokman, 2007).

Informality is often linked to trade liberalisation. Under the conventional view, the informal sector represents the inferior segment of a dual labour market, which expands counter-cyclically during downturns when workers are rationed out of the formal labour market. In this setting, trade liberalisation, if perceived as a force of greater competition for domestic producers, is expected to lead to a rise in informality, as firms shed formal workers (inputs) to cut costs. However, this conventional view of informality has been challenged on various grounds.

First, informal activity is not exclusively residual. There is significant evidence that informality, at least in parts, is driven by dynamic, small-scale entrepreneurial activity. This goes back to the seminal work of Hart (1972, 1973) on African labour markets, which has recently been confirmed for Latin America by Maloney (2004) and Perry et al. (2007). La Porta and Shleifer (2008) support the empirical relevance of alternative views on informality using three sets of surveys of both official and unofficial firms conducted recently by the World Bank.¹ The notion of informal entrepreneurship is also noticeable in the ILO's official definition of informality: in 1993, the International Conference of Labour Statisticians (ICLS)² adopted the following international statistical definition of the informal sector: namely, all unregistered (or unincorporated) enterprises below a certain size, including (a) micro-enterprises owned by informal employers who hire one or more

¹ The Enterprise Surveys, the Informal Surveys and the Micro Surveys.

² The primary source is the ILO (1993).

employees on a continuing basis; and (b) own-account operations owned by individuals who may employ contributing family workers and employees on an occasional basis.³

Second, only certain types of shocks and a specific regulatory environment cause a counter-cyclical response of informal activity. Fiess, Fugazza and Maloney (2002, 2008) develop a theoretical model where the sign of the relationship between relative formal/informal earnings and the relative size of labour force depends on the nature of economic shocks and on the tightness of labour regulations. A rise in informality is not necessarily the outcome of a negative economic shock it can also result from a positive shock to the non-tradable sector. The model is tested empirically using time series for Argentina, Brazil, Colombia and Mexico and results confirm the existence of pro-cyclical movements in line with theoretical predictions.

Third, the relationship between trade liberalisation and informality is ambiguous from both a theoretical and an empirical point of view. Moreover, empirical evidence for a large sample of countries is lacking.

This paper provides comprehensive empirical evidence on the relationship between trade liberalisation and informality for a large set of countries. For this purpose we provide evidence from time series, cross-section and panel analyses. As informal activity by its very nature evades official records, measurement becomes a difficult issue. We use three alternative measures of informality, which all have been used in the literature, but never in parallel. The first is a survey-based measure of informal labour market activity from

³ In 2003, the International Conference of Labour Statisticians adopted statistical Guidelines concerning this expanded concept of informal employment to complement the Resolution concerning statistics on the informal sector adopted in 1993. The resulting framework allows countries to adapt the basic operational definition and criteria to their specific circumstances. In particular, flexibility is allowed with respect to the upper limit on the size of employment; the introduction of additional criteria such as non-registration of either the enterprise or its employees; the inclusion or exclusion of professionals or domestic employees; and the inclusion or exclusion of agriculture.

the ILO. The second is Schneider's (2005, 2007) measure of informal activity which is derived from a combination of indirect measures of informal production based on excess currency demand and latent variable methodologies. The third is based on the macro-eclectic approach of Kaufmann and Kaliberda (1996), where the size of the informal economy is measured from the discrepancy between electricity consumption, which is taken as an indicator of overall economic activity, and the official gross domestic product.

Our empirical results offer a mixed picture and no clear-cut conclusion can be drawn. While unconditional cross sectional correlations support the view that trade liberalisation induces a reduction of informality, whether in terms of employment share or in terms of output share, static panel results do not. Results from co-integration analysis suggest that more openness to trade is associated with greater informal employment and output for the majority of countries. Lower trade restrictions, on the contrary, appear to generate lower informal employment and output in most cases. Finally, systems GMM estimation generates contrasting result across datasets. In particular, fewer trade restrictions are associated with more informal *output* but less informal *employment*.

The rest of the paper is organized as follows. The next section reviews major theoretical and empirical contributions on the link between trade liberalisation and informality. Section 3 describes the data and the empirical methodologies and section 4 presents results. The last section discusses possible policy implications and further research orientations.

2 Trade Liberalisation and Informality: Theoretical Insights and Country Experiences

2.1 *Theoretical Insights*

The relationship between trade liberalisation and informality has received little attention, whether from a theoretical or empirical point of view. According to a consensual but not necessarily formal argument trade liberalisation is expected to increase competition for domestic producers. In an effort to lower production costs, domestic producers will seek informally-produced inputs (in the extreme all inputs would be produced informally), which are cheaper since informal producers generally do not comply with labour or fiscal regulations. Greater demand for informally produced inputs is therefore expected to drive the extension of the informal sector following trade liberalisation.

Goldberg and Pacvnic (2003) adopt a model that unambiguously generates such a positive relationship. Their model is based on a dynamic efficiency wage model with three essential assumptions. First, the representative firm faces demand uncertainty. Second, the representative firm can hire workers either from a pool of formal or informal workers. Third, formal employment is subject to labour market legislation and formal workers receive benefits and severance pay on dismissal. Trade liberalisation is modelled as a change in the probability function that governs price shocks. Goldberg and Pacvnic (2003)'s model suggests that the impact of trade liberalisation on informality depends on the degree of labour market liberalisation: the less flexible labour markets, the greater the reallocation from the formal to the informal sector.

Not all theoretical models provide however such clear-cut predictions on the relationship between trade liberalisation and informality. For instance, in the heterogeneous firm model of Aleman-Castilla (2006), trade liberalisation (i.e. lower trade costs) implies that some firms will find it more profitable to enter

the formal sector rather to remain informal. The least productive informal firms will be forced to exit the industry and only the most productive (formal) firms will export to international markets. Here, trade liberalisation reduces the incidence of informality. Moreover, both, the exit of the least productive firms and the rise in output of the most productive (formal) firms lead to an aggregate increase in productivity.

The above models assume that all goods can be traded in principle. Non tradability is endogenously determined and depends only on firms' characteristics, not goods' characteristics. If some goods are allowed to be non-tradable, the impact of trade liberalisation on informality will additionally depend on the reaction of the real exchange rate and/or relative sector productivities. To illustrate, if the informal sector is equated with the non-tradable goods sector, and, if non-tradable goods are only for consumption, then the relationship between trade openness and informality could become negative. In this context, trade liberalisation would lower the price of the non-tradable good in terms of the tradable good (i.e. a real depreciation) and this would decrease the size of the informal sector.⁴ In certain circumstances trade liberalisation could lead to a real appreciation⁵ and hence increase the size of the informal sector.

In a situation where formal firms use non-tradable (informal) goods as inputs, additional arbitrage conditions enter the relationship of trade liberalisation and informality. Trade liberalisation (a fall in trade costs) exposes uncompetitive firms to greater import competition. For these firms the use of cheaper, informally produced inputs may present a survival strategy. However, as formal wages may well rise with greater labour demand from exporting (old and new) firms, informal wages may also increase to eliminate

⁴ See for instance Li (2004) for a theoretical treatment and empirical evidence.

⁵ Calvo and Drazen (1998) for instance show that trade liberalisation of uncertain duration could lead to a real appreciation due to an upward jump in consumption of both tradable and non-tradable goods.

any arbitrage in workers' occupational choice. The sign of the relationship between trade liberalisation and informality will therefore depend on which force dominates. Furthermore, if pre-reform formal wages are determined by labour regulation (e.g. a binding minimum nominal wage), upward pressures on formal wages *post* reform might be slightly undermined; this would increase the chance to observe more informality as a consequence of trade liberalisation.

The fiscal environment can also influence the relationship between trade liberalisation and informality. Existing models generally assume that public expenditures fully adapt to fiscal revenues without specifying how fiscal adjustment is actually achieved. Fiscal consolidation may require higher taxes or new fiscal instruments and both are likely to affect firms' incentives to extend informal inputs and workers' choices to become informal.

Theoretical predictions of how trade liberalisation impacts informality are ambiguous at best; the overall size of the informal sector could rise or fall with trade liberalisation. We next review existing empirical studies on trade liberalisation and informality.

2.2 Country Experiences

Empirical evidence on the relationship between trade liberalisation and informality is limited and generally country specific. Most of the evidence relates to Brazil, Colombia and Mexico for which rich relevant and reliable micro datasets are available.

Pavcnik and Goldberg (2003) use household survey data for Brazil and Colombia collected over the 1980s and the 1990s. They find no evidence of any significant relationship between trade liberalisation and informality in Brazil, whether positive or negative. For Colombia, they present evidence that

informality has increased after trade liberalisation. However, this finding appears directly related to the degree of labour market flexibility. Pavcnik and Goldberg (2003) report that prior to labour market reform, when costs of firing formal workers were high, an industry-specific tariff reduction has been associated with a greater likelihood of becoming informal. After labour market reform, however, industry-specific tariff reductions have been associated with smaller increases in the probability of becoming informal.

Aleman-Castilla (2006) uses the NAFTA experience to assess the impact of trade liberalisation on informality in Mexico. Using Mexican and US import tariff data and the Mexican National Survey of Urban Labour, Aleman-Castilla (2006) findings suggest that lower import tariffs are related to lower informality in tradable industries. Results also suggest that informality decreases less in industries where import penetration is high and more in industries with greater export orientation.

Pavcnik and Goldberg (2003) and Aleman-Castilla (2006) use a similar two-step estimation approach. In a first step, a linear probability model of informal employment is estimated. Explanatory variables include worker characteristics and industry dummies capturing workers' industry affiliation. Coefficients of the latter are defined as industry-informality differentials. These differentials are then used as the dependent variable in the second-step estimations. They are regressed against import tariffs across years and resulting coefficients are taken as measures of the impact of trade liberalisation on informality.

A related paper, although based on a different empirical approach, is Boni, Gosh and Maloney (2007). Boni et al. (2007) study gross worker flows to explain the rising informality in Brazil's metropolitan labour markets from 1983 to 2002. This period covers two economic cycles, several macro economic stabilization plans, a far-reaching trade liberalisation, and changes in labour

legislation through the Constitutional reform of 1988. Secular movements in the levels and the volatility of gross flows suggest that the rise in informality during that period was largely caused by a reduction in job finding rates in the formal sector. Part of the remainder is linked to the constitutional reform which contributed to rising labour costs and reduced labour market flexibility; only a small fraction of the observed rise in informality is explained by trade liberalisation.

In an earlier study, Currie and Harrison (1997) assess the impact of trade reform on employment in manufacturing firms in Morocco in the 1980s. This paper does not investigate the direct impact of trade reform on informality but offers insights on the role of trade protection on labour market composition. Currie and Harrison (1997) use a survey of manufacturing firms with more than ten employees. Their results suggest that employment in the average firm has been unaffected by the reduction of tariffs and the elimination of quotas. However, exporting firms and industries most affected by the reforms (textiles, beverages and apparel) experienced a significant decline in employment.⁶ Currie and Harrison (1997)'s results further indicate that government-controlled firms behaved quite differently from privately-owned firms. Government-controlled firms actually increased employment in response to tariff reductions, mostly by hiring low-paid temporary workers.

Empirical studies to date suggest that informality can respond to trade liberalisation either positively or negatively, depending on country and industry characteristics.

3 Data and Empirical Strategy

⁶ The 24 point cut in tariff protection caused employment in exporting firms to fall by about 6%. A 21 point cut in tariff protection for textiles, beverages and apparel brought about a 3.5% decline in employment in these sectors.

Our estimates of the size of the informal sector come from three different datasets. The ILO is a micro-founded, survey-based measure which provides a directly observable measure of the share of informal employment. Schneider's (2005, 2007) informality measure and the macro-eclectic approach (Kaufmann and Kaliberda, 1996) are both macro-founded, indirect measures of informal output in total GDP.

3.1 Datasets and dependent variables

The first dataset used in this paper is from ILO. The ILO statistical definition of informality represents an important step towards a better and more consensual measurement of informality around the world. In 1993, the International Conference of Labour Statisticians (ICLS) adopted the following international statistical definition of the informal sector: namely, all unregistered (or unincorporated) enterprises below a certain size, including (a) micro-enterprises owned by informal employers who hire one or more employees on a continuing basis; and (b) own-account operations owned by individuals who may employ contributing family workers and employees on an occasional basis. Data on informal employment from the ILO allow us to construct an unbalanced panel for 32 countries from 1990 to 2004; the corresponding variable is *Info_ILO*.

The second dataset used in this paper takes Schneider's (2005, 2007) estimates of informal activity. Schneider's estimates are derived from a combination of the Currency Demand Approach and the DYMIMIC method of Giles. Schneider's (2005) provides a snapshot of informality for 110 countries in 1990/91, 1994/95, 1999/2000 and Schneider (2007) provides annual observations for the same countries during 2000 and 2004. The corresponding variable is *Info_S*.

Third, we use the macro-eclectic approach proposed by Kaufmann and Kaliberda (1996). According to this method, the size of the informal economy may be measured from any discrepancy between an indicator of the overall economic activity and the official gross domestic product. Given the high correlation between consumption of electricity and economic activity, the growth rate of electricity consumption serves as an indicator of the evolution of the total gross domestic product. Any difference between the growth of electricity consumption and the growth of the official gross domestic product is attributed to changes in the size of the informal economy. We use data on total electricity consumption from World Development Indicators and real GDP from IMF IFS (2006) and seed values for the size of the informal economy for 2000 from Schneider (2007). An advantage of the macro-eclectic approach is that it is the least data intensive. It enables us therefore to construct a balanced panel on informality from 1990 to 2004 for 66 countries. The corresponding variable is *Info_Macro*.⁷

None of our three measure of informality is however without criticism. While surveys-based *Info_ILO* provides a direct measure of the information required to identify the informal sector, surveys commonly suffer from several errors related to design, coverage, non-response, and measurement and processing. Furthermore, differences in national survey design often make comparison across countries and over time difficult.

The macro-eclectic approach has been mainly criticised on the following grounds, and similar criticism extends to Schneider (2005, 2007): (1) a large part of informal activity (e.g. personal services) does not require intensive energy use or could be supplied from alternative energy sources (e.g. coal, wood). (2) technological progress prompted efficiency gains in both demand and supply of energy (e.g. low energy devices) as well as money (e.g. credit

⁷ Country coverage for the macro-eclectic and ILO measures are reported in Appendix 1. We refer the reader to Schneider (2007) for the listing of countries in his sample.

cards, online banking). (3) the elasticity of electricity/GDP or money demand/GDP may not be stable over time or across country.

Despite these issues, there is a reasonable amount of correlation between these different estimates of informal activity. Appendix 2 (Table A3 and Figures A1 and A2) provides the respective correlation coefficients. Correlation is highest in the cross-section. As an example, in 2004, *Info_S* correlates at 0.78 with *Info_ILO*; *Info_Macro* correlates *Info_ILO* measure at 0.68. Correlation is the highest between *Info_S* and *Info_Macro* at 0.97.

To assess co-movement between alternative measures of informality over time, we look at the correlation between changes in *Info_ILO* and *Info_S* during 2000 and 2004 as well as at cointegration between *Info_ILO* and *Info_Macro* between 1990 and 2004 (Appendix 2, Table A4). Even though co-movement between different informality measures over time is lower compared to the correlation in the cross-section, co-movement is nevertheless sizeable. The correlation between first differences in *Info_ILO* and *Info_S* is 0.38 during 2000 and 2004. Cointegration tests between the ILO measure and the macro-eclectic measure of informality indicate that 16 out of 23 series (about 70%) are cointegrated (see Table A5 in Appendix 2).⁸

3.2 Explanatory variables

The selection of our explanatory variables is guided by the empirical literature. They are the following:

lGDPpc refers to the log of GDP per capita in constant 2000 US Dollars and is taken from World Development Indicators (World Bank, 2007). The relationship between informality and GDP per capita has been documented in various studies. For instance, Blau (1987), Maloney (2001), Gollin (2002) and

⁸ The use of first differences on cointegration analysis seems justified given evidence of non-stationarity presented in Section 4.2.

Loayza and Rigolini (2006) assess the relationship between GDP per capita and self employment.

The variable *Lab_Flex* measures labour market flexibility and consists of the Fraser Institute index of labour freedom as published in Gwartney and Lawson (2006). The index is a composite of four equally weighted components, consisting of minimum wages, rigidity of hours, difficulty of firing redundant employees and the cost of firing redundant workers. It varies from zero to ten, where ten represents the highest degree of flexibility. The general burden imposed by stringent regulation, in particular in the labour market, is generally perceived as an important determinant of informality. Various empirical findings (e.g. Goldberg and Pavnic (2003) discussed previously, and Heckman and Pages (2000)) support this view.

The variable *Corruption* measures freedom of corruption. *Corruption* is equivalent to the sub-component Corruption of the ICRG country risk guide. The index varies from one to six, where six represents the lowest levels of corruptions. This variable is usually included in regressions to control for the overall quality and efficiency of institutions in promoting formal economic activities. A more corrupt economy could be associated with poorer institutions and higher costs of production in the formal sector, as expressed for instance in de Soto (1989).

Following Rodríguez and Rodrik (2000) we use different proxies for trade openness to investigate the stability of our results. In the context of the trade-growth literature, Rodríguez and Rodrik (2000) show that the positive impact of trade on growth is less robust than often claimed and subject to difficulties in measuring openness.

The variable *Trade/GDP*, measures total merchandise trade as a percentage of GDP and is taken from World Development Indicators (World Bank, 2007).

The variable *Tariff*, measures a country's effectively applied average external tariff rate.⁹ The measure comes from the UNCTAD-TRAINS database.¹⁰

Dreher (2006) presents an index of globalisation (The KOF Index of Globalization) that comprises three dimensions of globalisation that have been highlighted by Keohane and Nye (2000) and others. Economic globalisation captures economic flows of goods, capital and services. Political globalisation refers to the international diffusion of policy, and social globalisation captures the spread of ideas, information, images, and people around the world. These three indices make up the overall globalisation index and consist by themselves of various sub-components, where the sub-component economic globalisation is of most interest to us. The economic globalisation index consists of two sub-components: actual economic flows (*KOF-Flows*) and trade restrictions (*KOF-Restrictions*). The sub-index on actual economic flows includes data on trade, FDI and portfolio investment. Data on trade (sum of a country's exports and imports) and FDI flows are provided by the World Bank Development Indicators, stocks of FDI are provided by UNCTAD World Investment Report. Portfolio investment is derived from the IMF's International Financial Statistics. The sub-index of restrictions on trade and capital is composed by hidden import barriers, mean tariff rates, taxes on international trade (as a share of current revenue) and an index of capital controls. Data for this index are mainly from Gwartney and Lawson (2006).

We also considered the trade liberalisation index of Wacziarg and Welch (2008), which extends and robustifies the Sachs and Warner (1995) measure of openness. However, as underlined in Wacziarg and Welch (2008) the panel variability of the indicator is extremely limited for the 1990s; we therefore consider it only in our cross-sectional analysis.

⁹ The concept of effectively applied tariff is defined as the lowest available tariff. If a preferential tariff exists, it will be used as the effectively applied tariff. Otherwise, the MFN applied tariff will be used.

¹⁰ The UNCTAD-TRAINS database is available at <http://wits.worldbank.org>.

4 Results

Panel data are by definition two-dimensional: cross-sectional and time. We first exploit the two composing dimensions separately in order to inform and qualify panel results. Cross-sectional analysis indicates how the relationship between informality and trade varies across countries at a given point in time, time series analysis investigates the change in the relationship between informality and trade over time within a given country. Inference from time series analysis is also important to guide the panel approach. For instance, non-stationary introduces severe biases with purely static panel estimation, which makes a dynamic estimation approach more appropriate.

4.1 Cross-sectional evidence

We first explore cross-sectional evidence. Table 1 displays unconditional correlations between the three alternative measures of informality and our explanatory variables. High GDP per capita, low levels of corruption are significantly correlated with low levels of informality, independent of the measure of informality applied. Labour market flexibility is only significantly correlated with *Info_Macro*, however, the correlation is low (-0.13). There is a significant relationship between trade and informality and measures of trade restrictions (*Tariff*, *KOF-Restrictions*), measures of trade volume (*Trade/GDP* and *KOF-Flows*) as well as the Wacziarg and Welch (2008) indicator of trade openness, point into the same direction: trade openness appears to be negatively associated with informality: lower tariffs and greater trade flows are associated with lower levels of informality. The relationship is most apparent between informality and trade restrictions and we find a particularly strong correlation between the *KOF-Restrictions* and *Info_ILO* (0.81).

Appendix 3 (Figures A3 to A5) presents scatter plots between the various measures of informality and trade; the relationship appears not sensitive to excluding developed countries.

There is further significant correlation between our control variables, in particularly corruption and GDP per capita (0.71), as well as between the alternative measures of trade. However, correlations among the trade variables range from 0.12 to 0.69. This suggests that our different trade variables capture different dimensions of trade openness.

Table 1 around here

4.2 Time series evidence

We first pre-test our data for non-stationarity using the Im, Pesaran and Shin (2003), Hadri (2000) and Maddala and Wu (1999) panel unit root tests.

Unit root tests

Im et al. (2003) and Hadri (2000) panel unit root tests both require balanced panels, we therefore also apply the Maddala and Wu (1999) test. This test, which is also referred to as the Fisher test, combines the p-values from N independent unit root tests, it assumes that all series are non-stationary under the null hypothesis against the alternative that at least one series in the panel is stationary. Z_{Fisher} follows a chi-square distributions with $N*2$ degrees of freedom. Due to the pooling of p-values from independent unit root tests, Z_{Fisher} can be applied to unbalanced panels.

Table 2 reports the results of the unit root tests and provides strong evidence in favour of non-stationarity. The Im et al. (2003) Z_{IPS} panel unit root tests only reject the null hypothesis of a unit root for *KOF-Flows*. The Hadri (2000) Z_{μ} panel rejects the null of stationarity for all variables. Results based on the Fisher tests of Maddala and Wu (1999) only fail to reject the null hypothesis of panel unit roots for *Trade/GDP*.

Table 2 around here

Cointegration Analysis

Given strong evidence of non-stationarity, we use the Johansen (1988, 2002) cointegration approach to investigate the relationship between informality and trade liberalisation from a time series perspective. In the presence of cointegration, super-consistency implies that we can concentrate on the relationship between informality and trade liberalisation without fear of omitted variable bias; we therefore abstract from other control variables in this section¹¹.

Given the relatively small sample sizes, we simulate critical values and apply a Bartlett correction to the trace statistics following Johansen (2002).

We find strong evidence of cointegration between both measures of informality and two trade liberalisation indicators (*Trade/GDP* and *KOF-Restrictions*). Results of the individual cointegration tests are displayed in Tables A6 and A7 in Appendix 4. Coefficients are in vector form and normalized on the informality variable (not reported).

There appears to be a fair degree of heterogeneity with respect to the sign of the empirical relationship between trade liberalisation and informality. For *Trade/GDP* and *Info_Macro* we find that in almost 70 percent of cases greater trade openness is associated with higher informality between 1990 and 2004. For *Trade/GDP* and *Info_ILO*, we find a near 50:50 split between countries where informality rises or falls with trade liberalisation. Not all countries in

¹¹ For a discussion of super-consistency see Stock (1987).

Info_Macro are available for *Info_ILO*; for countries that appear in both data sets signs coincide in almost 60% of cases.

Results are similar when considering *KOF-Restrictions* as the measure of trade liberalisation. In 70 percent of cases, lower restrictions on trade have led to an increase of informal output according to *Info_Macro*. For *Info_ILO* set the split remains around 50:50. Where we have country information from both informality data sets, results are coherent in almost 2/3 of observable cases.

Our time series results by country seem to corroborate evidence from cases studies in the literature. We support Pavcnik and Goldberg (2003) findings of a more positive link between trade liberalisation and informality in Colombia (deeper trade liberalisation increases informality). We also support Currie and Harrison (1998) finding of an adverse impact of trade liberalisation on informality in Morocco. *Trade/GDP* and *KOF-Restrictions* provide contradicting evidence on the relationship between trade openness and informality for Brazil and Mexico, and this may explain why Pavcnik and Goldberg (2003) and Aleman-Castilla (2006) fail to identify a clear relationship in these two countries.

Overall, time series analysis indicates that for a given country different measures of informality do not necessarily respond in a similar manner to the same measure of trade liberalisation. Conversely, the same measure of informality does not relate to different measures of trade liberalisation in the same fashion. However, if a dominant pattern had to be identified, results suggest that it should be the one of the conventional view: greater openness to trade leads to higher informality, whether the latter is thought of in terms of employment or in terms of output.

4.3 Panel Evidence

Cross sectional analysis and time series investigation produce contrasting results, suggesting that an approach that merges both dimensions is needed before any possibly robust and clear cut conclusion can be reached.

Time series analysis points to unit roots in most of the variables under consideration. This would make the Pooled Mean Group (PMG) estimator of Pesaran, Shin and Smith (1999) which explicitly accounts for non-stationarity appropriate. To robustify results, we however also report panel estimates based on static fixed effects as well as systems-GMM. The latter approach is able to accommodate possible endogeneity of any of our explanatory variables.

The PMG estimator requires a near-balanced panel and can therefore only be applied to *Info_Macro*. GMM works best for large N and small T , which makes it ideal for *Info_S*, where we have four time series observations on informality for 1990, 1995, 2000 and 2004.

Static approach: Fixed effects

A fixed effects static approach excludes the explicit treatment of both non-stationarity and endogeneity issues. Labour market flexibility and the corruption indices are not found to be significant in any of the fixed effects regressions. Because of their low time variability over the period under scrutiny, both variables effects are likely to be absorbed by the country fixed effects. Thus, we removed them from estimations without loss of either efficiency or power.

Table 3 provides the findings for *Info_Macro* and Table 4 for the *Info_ILO*.¹² Since Pesaran (2004)'s test of cross sectional independence indicates the

¹² Results for *Info_S* are not reported here as they are quite similar to those obtained for *Info_Macro*.

presence of cross-sectional correlation for *Info_Macro*, we include time dummies. Time dummies appear to be sufficient to remove the cross-sectional correlation in the panel.¹³

Both datasets generate comparable results in both sign and magnitude for most indicators of trade liberalisation. The *Info_Macro* panel (Table 3) strongly suggests that more openness and lower tariffs lead to higher informality. The *Info_ILO* panel (Table 4) broadly corroborates this story, although coefficient estimates are sometimes only significant at the 10 percent level.

Table 3 and 4 here

Dynamic Non-stationary Panel: Pooled Mean Group Estimates

To account for non-stationarity in panels, we apply the Pooled Mean Group and the Mean Group estimator. The Mean Group (MG) estimator (see Pesaran and Smith 1995) is based on estimating N time-series regressions and averaging the coefficients, while the PMG estimator relies on a combination of pooling and averaging of coefficients. The MG estimator allows intercepts, slopes and error variances to differ, while the PMG estimator imposes homogeneity on long-run coefficients across groups. If homogeneity cannot be rejected, the PMG estimator is consistent and more efficient than the MG estimator. Hausman tests select the PMG as the efficient estimator and indicate long-run relationship identified between trade openness and informality holds across groups. Results are provided in Table 5. Coefficient estimates are similar in size to results based on static fixed effects, but they are generally more significant; they also suggests that more openness and fewer restrictions on trade lead to higher informal output.

Table 6 about here

¹³ We also included cross-sectional averages of dependent and independent variables as an alternative means to account for cross-sectional dependence and results are similar.

Endogeneity

Fixed effects and PMG estimations do not account for possible endogeneity. Endogeneity could arise if the size of the informal sector influences the degree of trade liberalization in a country. An economy which is largely informal is likely to be poorly industrialized. In that context, economic power is usually highly concentrated and could be expected to be closely related to political power. Any reform would then most likely be guided by vested interests. In the case of trade policy, a strong preference for high protection for domestic productive sectors would most probably be the dominant decision factor in any reform. As a consequence lower tariff cuts would be observed in economies with relatively larger informal sectors.

We then formally test for endogeneity in various cross sections retrieved from our panel data set (not reported). We do find evidence, although not systematic, of endogeneity. This suggests that results obtained in a dynamic GMM panel set up are likely to be the most reliable.

Dynamic approach: GMM

We implement Arellano and Bond (1991) and Blundell and Bond (1998) Dynamic Panel Data Estimator. The approach is based on the Generalised Method of Moments (GMM) and a systems estimator for our instruments (lagged values of the variables themselves).

Table 6, Table 7, and Table 8 report results for the *Info_Macro*, *Info_ILO* and *Info_S*. Contrary to result found with static panel estimations and PMG, the different measures of informality do not generate fully consistent results.

Table 6, 7 and 8 about here

As expected, we find that informality decreases with GDP per capita in all cases. Less corrupted administrations are also associated with less informality.

The labour flexibility variable enters the estimation with the expected sign (not reported): more flexible labour markets reduce the incidence of informality. However, it is never significant at a reasonable level of confidence.

Trade liberalisation measured as the share of total trade in GDP enters insignificantly in all estimations. The composite flow measure from the KOF Index of Globalization (*KOF-Flows*) is significant for the two macro measures of informality. Coefficient estimates are always positive when significant. This indicates that more openness to trade generates higher shares of informal production.

When using tariffs or *KOF-Restrictions* as the indicator of trade liberalisation, we find that coefficient estimates are significant at least at 10% in all regressions but one. We find contrasting evidence across datasets but not across indicators. For the two macro datasets (*Info_Macro* and *Info_S*), less restricted trade is always associated with a larger share of informal output in total GDP. For *Info_ILO* the share of informal employment falls with less restricted trade for both indicators of trade liberalisation.

In all set-ups results are not affected by the number of endogenous variables. It is well known that too many instruments in system GMM can bias the results. Our results are further robust to the inclusion of time dummies. However, we find that coefficient estimates prove robust to treating all variables as endogenous or only trade and informality, which improves the group/ instrument ratio (second column of Tables 6, 7 and 8).

5 Discussion and Concluding Remarks

The paper investigates the empirical relationship between informality and trade liberalisation using three different measures of the informal sector (and four different indicators of trade liberalisation). One measure of informality is

retrieved from household surveys instigated by the ILO and reflects informal employment as a share of total employment. The other two - the macro-eclectic and Schneider (2007) measures - are macro-founded and identify informal output as a share of formal output. Empirical results suggest a mixed picture of the relationship between trade liberalisation and informality. Cross sectional and time series properties of data appear to contrast each other. However, in a dynamic panel estimation set up that account for endogeneity, informal *employment* is found to decrease with deeper trade liberalisation and informal *output* is found to increase with deeper trade liberalisation. No existing theoretical framework is able to replicate these empirical findings. Indeed, the sign of the relationship is the same for any dimension of informality in all models. Both informal output and employment either increase or decrease with deeper trade liberalisation.

Our empirical results may suggest that productivity in the informal sector increases after trade liberalisation. Such an outcome is consistent with a situation where only the most productive informal firms remain active and might even extend production.¹⁴ Let us assume that informal output is only produced by self-employed individuals. Productivity gains in the informal sector with trade liberalisation would then be consistent with a situation where the least productive self-employed relocate to the formal sector where trade liberalisation has generated new and comparatively better employment opportunities. As skills required for informal employment need not necessarily match those for formal sector employment, without loss of generality, formal jobs could be considered as homogeneous in skills requirement. If we additionally introduce the assumption that the productivity of formal firms is heterogeneous, then, from a theoretical point of view, trade liberalisation can lead to greater formal employment. In this theoretical context, the least productive firms would be forced out of

¹⁴ This could be observed even with a rationed access to capital as long as labour hoarding remains possible and returns to capital are not too decreasing.

production, but any loss in production and employment would be more than compensated by the expansion of exporting firms that enjoy lower trade costs (and/or cheaper inputs). Overall, formal employment and output would rise and informal employment would fall; but informal output could rise and the informal share in GDP may also rise.

However, times series analyses and existing empirical evidence at the firm level also suggest that the impact of trade liberalisation is country and industry specific. Policy makers should therefore pay attention to factors that constraint resource reallocation not only across industries within the formal sector, but also from the informal to the formal sector. For instance, workers who are initially informal should be able to take up any job opportunity in the formal sector without any legal penalty. Or, they should be given the opportunity to fully reintegrate into the welfare system.¹⁵ In addition, policy makers would also have to facilitate access to capital (either directly or indirectly) for firms/individuals operating in the informal sector. The latter approach has often been presented as an important step towards the formalisation of informal activities.¹⁶

Our paper contributes to qualify at least empirically the relationship between the informal sector and the degree of trade liberalisation prevailing in an economy. However, further attention, whether theoretical or empirical, should be devoted to it as it also represents a key feature to appreciate the relationship between poverty and trade.

¹⁵ Fugazza and Jacques (2004) show that an improved access to welfare benefits affects positively the willingness for informal workers to search for a job in the formal sector.

¹⁶ See for instance Tokman (2001) and references therein.

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Table 1. Alternative measures of informality: 1990-2004, annual data.

	ILO	Schneider (2007)	electricity cons.	GDP per capita	Corr.	Labor market flexibility	Trade /GDP	Tariff	KOF trade flows	KOF restrictions
GDP per capita	-0.88*	-0.68*	-0.65*	1						
Corruption	-0.72*	-0.62*	-0.57*	0.67*	1					
Labor market flexibility	0.02	0.02	-0.13*	0.11*	0.06	1				
Trade/GDP	-0.16*	-0.19*	-0.17*	0.23*	0.13*	0.21*	1			
Tariff	0.70*	0.37*	0.22*	-0.57*	-0.42*	-0.26*	-0.30*	1		
KOF trade flows	-0.43*	-0.22*	-0.19*	0.51*	0.35*	-0.12*	0.58*	-0.49*	1	
KOF restrictions	-0.81*	-0.52*	-0.53*	0.88*	0.61*	0.05	0.27*	-0.70*	0.61*	1
Wacziarg and Welch (2008)	-0.24*	-0.14	-0.13*	0.26*	0.19*	0.07	0.12*	-0.61*	0.22*	0.36*

Note: * indicates significance at the 1% level of significance.

Table 2: Panel Unit root tests: 1990 -2004

	Z_{IPS}	Z_{μ}	Z_{Fisher}
Macro-eclectic informality	-0.784	52.68*	140.80
ILO informality			48.14
GDP per capita	: -1.555	60.28*	: 84.34
Corruption			: 112.88
Labor market flexibility			122.91
Trade/GDP	-1.458	38.29*	125.5
Tariff			106.2
KOF trade flows	-1.657*	45.85*	147.2

KOF restrictions	1990-2004: -1.069 (N=55, T =15)	1990-2004: 49.68* (N=55, T =15)	1990-2004: 98.8 (N=55, T ^{max} =15)
	1971-2004: -0.882 (N=55, T =34)	1971-2004: 127.4* (N=55, T =34)	1971-2004: 33.1 (N=55, T ^{max} =34)

Notes: For these tests statistics an asterisk (*) denotes rejection of the null hypothesis. Z_{IPS} is the Im et al. (2003) panel unit root test, see equation (6), contains a constant and has a critical value at the 5% significance level of -1.65. The Hadri (2000) Z_{μ} test statistic corresponding to equation (9) has a null hypothesis of stationarity is distributed as standard normal. Z_{Fisher} the Maddala and Wu (1999) panel unit root tests, also referred to as the Fisher test. Z_{Fisher} combines the p-values from N independent unit root tests; it assumes that all series are non-stationary under the null hypothesis against the alternative that at least one series in the panel is stationary. Due to the pooling of p-values from independent unit root tests, Z_{Fisher} can be applied to unbalanced panels.

Table 3: Fixed effects - macro-eclectic measure of informality

	TRADE	TRADEFLOWS	TARIFF	TRD_RESTR
Lgdppc	-0.088*** (0.0142)	-0.0865*** (0.0149)	-0.0771*** (0.0224)	-0.0891*** (0.01494)
Trade Openness				
Trade/GDP	-0.000 (0.001)	-0.000 (0.0002)		
Trade flow KOF				
Tariff			-0.0012*** (0.0002)	
Trade restrictions KOF				0.00066** (0.0003)
Constant	0.9845*** (0.1154)	1.034*** (0.1274)	0.908*** (0.175)	1.021*** (0.1208)
Nobs/ groups	990/ 66	915/61	617/ 53	825/55
Overall R2	0.44	0.45	0.43	0.41

Table 4: Fixed effects - ILO measure of informality

	TRADE	TRADEFLOWS	TARIFF	TRD_RESTR
Lgdppc	-0.0207* (0.0130)	-0.03401** (0.1732)	-0.02616 (0.02205)	-0.0339*** (0.1525)
Trade Openness				
Trade/GDP	0.00021* (0.00013)			
Trade flows KOF		0.00071** (0.00036)		
Tariff			-0.00161* (0.00094)	
Trade restrictions KOF				0.00069*** (0.000259)

Constant	0.4329*** (0.1110)	0.5096*** (0.1380)	0.5224*** (0.1998)	0.5168*** (0.1267)
Nobs/ groups	310/ 30	301/ 29	245/ 28	286/ 28
Overall R2	0.54	0.60	0.68	0.64

Table 5: Pooled Mean Group estimates - macro-eclectic measure of informality

	TRADE	TRADEFLOWS	TRD_RESTR
Lgdppc	-0.0117 (0.082)	-0.0800*** (0.0033)	-.03390*** (0.0127)
Trade Openness			
Trade/GDP	0.00035* (0.0001)		
Trade flows KOF		0.0006*** (0.0001)	
Tariff			
Trade restrictions KOF			0.0006* (0.0000)
Nobs/ groups	990/ 66	915/61	825/55
Hausman test of efficiency of PMG over MG	$\chi^2(3) = 2.09$ p=0.55 $\chi^2(2) = 0.53$ p=0.77	$\chi^2(3) = 7.85$ p=0.05 $\chi^2(2) = 3.05$ p=0.22	$\chi^2(3) = 1.44$ p=0.69 $\chi^2(2) = 0.58$ p=0.75

Table 6: Results from GMM (macro eclectic informality measure)

	ALL INSTRUMENTED	ONLY TRADE AND INF ENDOG.	ALL INSTRUMENTED	ONLY TRADE AND INF ENDOG.	ALL INSTRUMENTED	ONLY TRADE AND INF ENDOG.	ALL INSTRUMENTED	ONLY TRADE AND INF ENDOG.
	TRD	TRD	TRADE FLOWS	TRADE FLOWS	TARIFF	TARIFF	TRADE RESTR	TRADE RESTR
Lgdppc	-0.0607*** (-4.85)	-0.0485*** (-5.38)	-0.0894*** (-6.40)	-0.0655*** (-6.62)	-0.0899*** (-5.21)	-0.071*** (-5.66)	-0.0877*** (-5.73)	-0.0877*** (-5.73)
Corruption	-0.0368*** (-4.69)	-0.0244*** (-3.07)	-0.0222*** (-2.06)	-0.0257*** (-3.66)	-0.0220*** (-2.05)	-0.0232*** (-2.83)	-0.0247*** (-2.79)	-0.0247*** (-2.79)
Trade Openness								
Trade/GDP	-0.000 (-1.25)	0.000 (0.28)						
Trade flows KOF			0.0249*** (2.66)	0.00272*** (3.53)				
Tariff					-0.005*** (-3.71)	-0.004*** (-4.20)		
Trade restrictions KOF							0.00298*** (4.07)	0.00298*** (4.07)
Constant	0.938*** (8.43)	0.777*** (9.77)	0.9645*** (10.36)	0.7648*** (11.03)	1.17*** (8.92)	1.014*** (8.44)	0.916*** (9.54)	0.916*** (9.54)
Nobs	896	896	840	840	581	581	742	742
No. of groups/No of instruments	64/113	64/59	60/113	60/59	49/13	49/59	53/59	53/59
Hansen test	Chi2(136) = 62.93 p=1.00	Chi2(55) = 56.1 p=0.435	Chi2(109) = 59.10 p=1.00	Chi2() = 59.10 p=1.00	Chi2(109) = 41.21 p=1.00	Chi2(55) = 47.5 p=0.755	Chi2(81) = 51.24 p=0.996	Chi2(55) = 47.5 p=0.753
Arellano-Bond test								

of AR(1) in first differences	z=0.38, p=0.70		z=-0.56, p=0.58	z=-0.56, p=0.58	z=0.90, p=0.37		z=0.47, p=0.64	z=0.43, p=0.66
Arellano-Bond test of AR(2) in first differences	z= -0.22, p=0.83	z= 0.04, p=0.97 z= -0.09, p=0.93	z= -0.15, p=0.88	z= -0.15, p=0.88	z=-0.41, p=0.68	z=0.59, p=0.56 z=-0.50, p=0.62	z=-0.47, p=0.64	z=-0.45, p=0.66

Table 7: Results from GMM (ILO informality measure)

	ALL INSTRUMENTED	ONLY TRADE AND INF ENDOG.	ALL INSTRUMENTED	ONLY TRADE AND INF ENDOG.	ALL INSTRUMENTED	ONLY TRADE AND INF ENDOG.	ALL INSTRUMENTED	ONLY TRADE AND INF ENDOG.
	TRD	TRD	TRADE FLOWS		TARIFF	TARIFF	TRADE RESTR	TRADE RESTR
Lgdppc	-0.100*** (-7.85)	-0.0953*** (-8.71)	-0.103*** (-8.72)	-0.0911*** (-6.86)	-0.0712*** (-4.47)	-0.0645*** (-3.72)	-0.065*** (-2.76)	-0.0654*** (-1.91)
Corruption	-0.0158*** (-1.39)	-0.0225*** (-2.48)	-0.0167*** (-1.94)	-0.0215*** (-2.54)	-0.028*** (-1.88)	-0.0226*** (-1.80)	-0.019*** (-1.86)	-0.0154 (-1.63)
Trade Openness								
Trade/GDP	-0.000 (-1.08)	-0.000 (-1.64)						
Trade flows KOF			-0.000 (-1.57)	-0.0015 (-1.19)				
Tariff					0.0679*** (3.08)	0.0079*** (3.59)		
Trade restrictions KOF							-0.0028** (-1.95)	-0.0030 (-1.29)
Constant	1.24*** (13.11)	1.29*** (14.31)	1.32*** (10.93)	1.28*** (10.68)	0.958*** (8.21)	0.872 (6.38)	1.121*** (11.61)	1.124*** (6.97)
Nobs	335	335	326	326	270	270	311	311
No. of groups/No of instruments	32/110	32/58	31/110)	31/58	30/110	30/58	30/110	30/58
Hansen test	Chi2(106) = 27.08 p=1.00	Chi2(54) = 26.8	Chi2(106) = 25.5 p=1.00	Chi2(54) = 27.1	Chi2(106) = 24.62 p=1.00	Chi2(54) = 22.49	Chi2(106) = 24.6 p=1.00	Chi2(54) = 25.6 p=1.000

Arellano-Bond test of AR(1) in first differences	$z=0.62, p=0.54$	$p=0.99$	$z= 1.02, p=0.31$	$p=0.99$	$z=0.46, p=0.64$	$p=1.00$	$z=0.55, p=0.58$	$z=0.50, p=0.62$
Arellano-Bond test of AR(2) in first differences	$z= 0.79, p=0.43$	$z= 0.81, p=0.42$	$z= 0.88, p=0.38$	$z= 1.14, p=0.26$	$z= 0.02, p=0.98$	$z=0.70, p=0.48$	$z=1.26, p=0.21$	$z=1.40, p=0.16$
		$z= 0.63, p=0.53$		$z= 0.70, p=0.48$		$z= 0.13, p=0.89$		

Table 8: Results from GMM analysis (Schneider (2007) informality measure)

	ALL INSTRUMENTED	ALL INSTRUMENTED	ALL INSTRUMENTED	ALL INSTRUMENTED
	TRD	TRADE FLOWS	TARIFF	TRADE RESTR
Lgdppc	-0.0419 (-1.43)	-0.0816*** (-6.13)	-0.0778*** (-4.39)	-0.0884*** (-4.34)
Labor market flexibility				
Corruption	-0.06638** (-1.96)	-0.0401*** (-3.58)	-0.03358* (-1.74)	-0.0503*** (-2.49)
Trade Openness				
Trade/GDP	-0.0004 (-0.53)			
Trade flows KOF		0.0034*** (4.93)		
Tariff			-0.00216* (-1.70)	
Trade restrictions KOF				0.0028*** (4.48)
Constant	0.8898*** (5.42)	0.8984*** (9.44)	1.063*** (7.20)	1.017*** (7.15)
Nobs	256	240	152	212
No. of groups/No of instruments	64/21	60/37	45/37	53/37
Hansen test	Chi2(17) = 31.85 p=0.10	Chi2(33) = 43.84 p=0.23	Chi2(33) = 39.34 p=0.21	Chi2(33) = 40.91 p=0.162
Arellano-Bond test of AR(1) in first differences	z=-0.88, p=0.38	z= -2.56, p=0.01	z=-0.26, p=0.80	z=-1.89, p=0.06
Arellano-Bond test of AR(2) in first differences	z= -0.71, p=0.48	z= -0.90, p=0.37	z= -0.02, p=0.99	z=-1.88, p=0.06

Appendix 1: Country listings

Table A1: Countries in ILO and Macro-eclectic data sets

ILO	Macro-eclectic approach	
Algeria	Algeria	Senegal
Argentina	Argentina	Singapore
Australia	Australia	South Africa
Austria	Austria	South Korea
Bolivia	Bangladesh	Spain
Brazil	Belgium	Sri Lanka
Canada	Benin	Sweden
Chile	Bolivia	Switzerland
Colombia	Brazil	Syria
Costa Rica	Cameroon	Thailand
Dominican	Canada	United Kingdom
Rep.	Chile	United States
Ecuador	China	Uruguay
Finland	Colombia	Venezuela
Honduras	Costa Rica	Zambia
Hungary	Cote d'Ivoire	Zimbabwe
Indonesia	Denmark	
Israel	Dominican Rep.	
Japan	Ecuador	
Malaysia	Egypt	
Mexico	Finland	
Morocco	France	
New Zealand	Germany	
Norway	Ghana	
Pakistan	Greece	
Panama	Guatemala	
Peru	Honduras	
Philippines	Hong Kong	
Singapore	Hungary	
Sri Lanka	India	
Sweden	Indonesia	
Switzerland	Ireland	
Thailand	Israel	
	Italy	
	Japan	
	Kenya	
	Malaysia	
	Mexico	
	Morocco	
	Nepal	
	Netherlands	
	New Zealand	
	Nicaragua	
	Nigeria	
	Norway	
	Pakistan	
	Panama	

	Peru Philippines Portugal
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Table A2: ILO dataset country-year coverage

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Algeria												X	X	X	X	4
Argentina							X	X	X	X	X	X	X	X	X	9
Australia	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Austria					X	X	X	X	X	X	X	X	X	X	X	11
Bolivia	X	X	X	X	X	X	X	X	X	X	X					11
Brazil												X	X	X	X	4
Canada	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Chile							X	X	X	X	X	X	X	X	X	9
Colombia			X	X	X	X	X	X	X	X	X	X	X	X	X	13
Costa Rica	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Dominican Republic							X	X	X	X	X	X	X	X	X	9
Ecuador	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Finland	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Honduras							X	X	X	X	X	X	X	X	X	9
Hungary			X	X	X	X	X	X	X	X	X	X	X	X	X	13
Indonesia														X	X	2
Israel						X	X	X	X	X	X	X	X	X	X	10
Japan	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Malaysia						X	X	X	X	X	X	X	X	X		9
Mexico		X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Morocco													X	X	X	3
New Zealand		X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Norway							X	X	X	X	X	X	X	X	X	9
Pakistan						X	X	X	X	X	X	X	X	X	X	10
Panama		X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Peru													X	X	X	3
Philippines												X	X	X	X	4
Singapore		X	X	X	X	X	X	X	X	X	X	X	X	X	X	14

Sri Lanka													X	X	X	3
Sweden	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Switzerland		X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Thailand	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Total	9	14	16	16	17	20	25	25	25	25	25	27	30	31	30	335

Appendix 2: Informality Measures

Table A3: Cross-sectional correlation, levels, selected years

	ILO	Macro-eclectic	Schneider (2007)
ILO	1		
Macro-eclectic	1990: 0.664* (9) 1995: 0.675*** (20) 2000: 0.759*** (25) 2004: 0.682*** (30)	1	
Schneider (2007)	1990 : 0.802*** (9) 1995 : 0.700*** (20) 2000 : 0.759*** (25) 2004 : 0.712*** (30)	1990 : 0.918*** (66) 1995 : 0.951*** (66) 2000 : 0.990*** (66) 2004 : 0.988*** (66)	1

Note: ***, **, * significant at the 1%, 5% and 10% level. Number of observations used to calculate the correlation coefficients in brackets.

Table A4: Cross-sectional correlation, 1st differences, selected years

	Info_ILO	Info_Macro	Info_S
Info_ILO	1		
Info_Macro	1990-1995: 0.615* (8) 1995-2000: -0.186 (19) 2000-2004: 0.036 (22) 1990-2004 : -0.05 (7)	1	
Info_S	1990-1995: 0.684* (8) 1995-2000: 0.466** (19) 2000-2004: 0.386* (22) 1990-2004 : 0.470 (7)	1990-1995: 0.134 (66) 1995-2000: 0.324*** (66) 2000-2004: 0.215* (66) 1990-2004 : 0.557*** (66)	1

Note: ***, **, * significant at the 1%, 5% and 10% level. Number of observations used to calculate the correlation coefficients in brackets.

Figure A1: Info_ILO versus Info_Macro (all years)

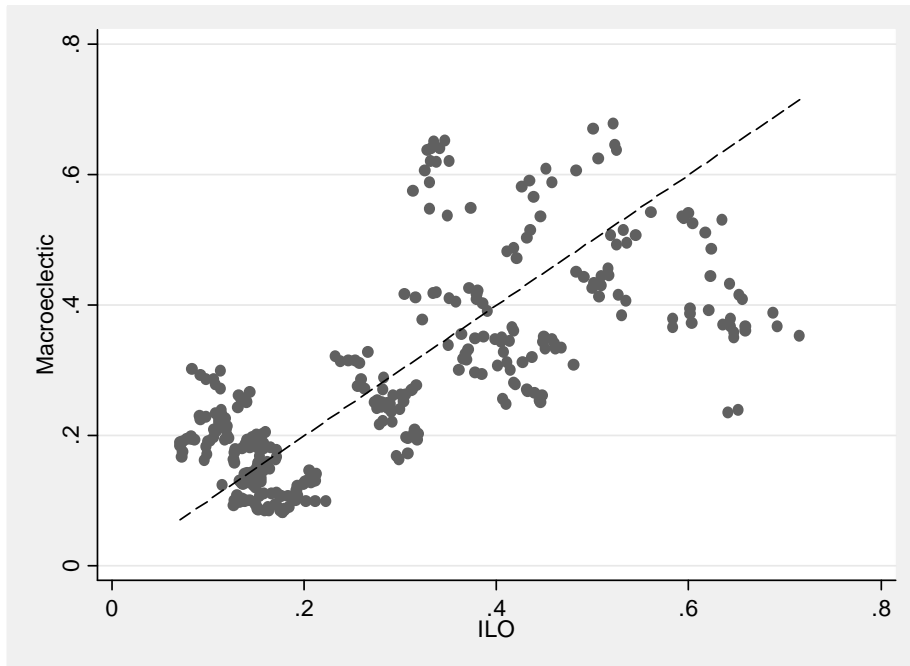


Figure A2: Info_ILO versus Info_Macro (mean)

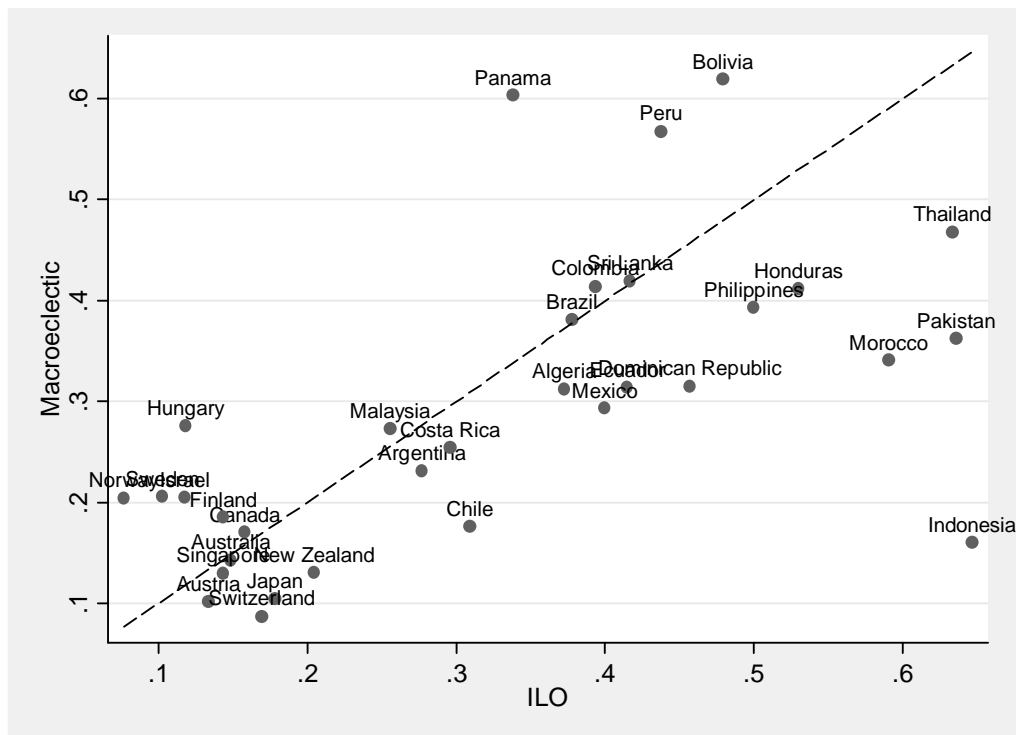


Table A5: Cointegration analysis between Info_ILO and Info_Macro

	cointegration rank	trace- test	simulated c.v.	
Argentina	r = 0	5.22*	15.93	
	r = 1	0.49	7.36	
Bangladesh	r = 0	16.04	15.93	coint.
	r = 1	1.52*	7.36	
Chile	r = 0	17.11	15.93	coint.
	r = 1	0.66*	7.36	
Colombia	r = 0	16.19	15.93	coint.
	r = 1	0.31*	7.36	
Costa Rica	r = 0	16.35	15.93	coint.
	r = 1	0.26*	7.36	
DR	r = 0	7.19*	15.93	
	r = 1	0.02	7.36	
Ecuador	r = 0	17.80	15.93	coint.
	r = 1	3.85*	7.36	
Honduras	r = 0	16.14	15.93	coint.
	r = 1	2.49*	7.36	
Pakistan	r = 0	7.30*	15.93	
	r = 1	0.53	7.36	
Panama	r = 0	23.33	15.93	coint.
	r = 1	4.43*	7.36	
Thailand	r = 0	11.33*	15.93	
	r = 1	2.11	7.36	
Austria	r = 0	2.98*	15.93	
	r = 1	0.42	7.36	
Finland	r = 0	16.47	15.93	coint.
	r = 1	0.00*	7.36	
Hungary	r = 0	8.50*	15.93	
	r = 1	1.36	7.36	
Norway	r = 0	17.85	15.93	coint.
	r = 1	2.74*	7.36	
Sweden	r = 0	17.35	15.93	coint.
	r = 1	0.01*	7.36	
Switzerland	r = 0	18.58	15.93	coint.
	r = 1	3.46*	7.36	
Australia	r = 0	18.97	15.93	coint.
	r = 1	2.84*	7.36	
Canada	r = 0	19.64	15.93	coint.
	r = 1	4.75*	7.36	
Israel	r = 0	11.95*	15.93	
	r = 1	0.00	7.36	
Japan	r = 0	20.72	15.93	coint.
	r = 1	2.37*	7.36	
New Zealand	r = 0	16.14	15.93	coint.
	r = 1	0.67*	7.36	
Singapore	r = 0	25.02	15.93	coint.
	r = 1	1.37*	7.36	

Notes: Johansen (1988) Trace test examines whether there is cointegration between the ILO measure of informality and the informality measure derived from the macro-eclectic approach. The null of cointegrating vectors is given by r . Model selected on the basis of a model reduction

procedure and residuals are reasonably well specified. To account for potential small sample bias, critical values are simulated for $N=14$ and a Bartlett correction from Johansen (2002) is applied. Star (*) indicates that we reject the null of cointegration.

Appendix 3: Cross-sectional Analysis

Figure A3: Info_ILO and alternative Trade Openness Measures

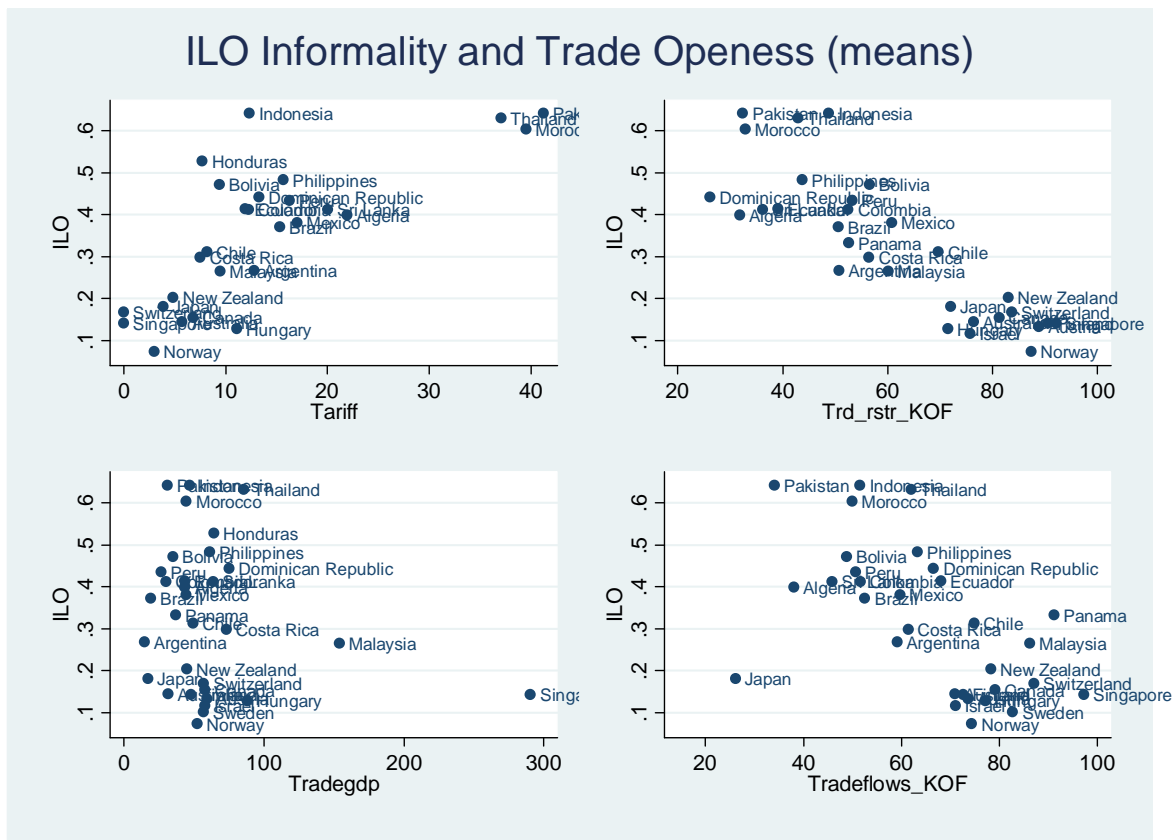


Figure A4: Info_Macro and alternative Trade Openness Measures

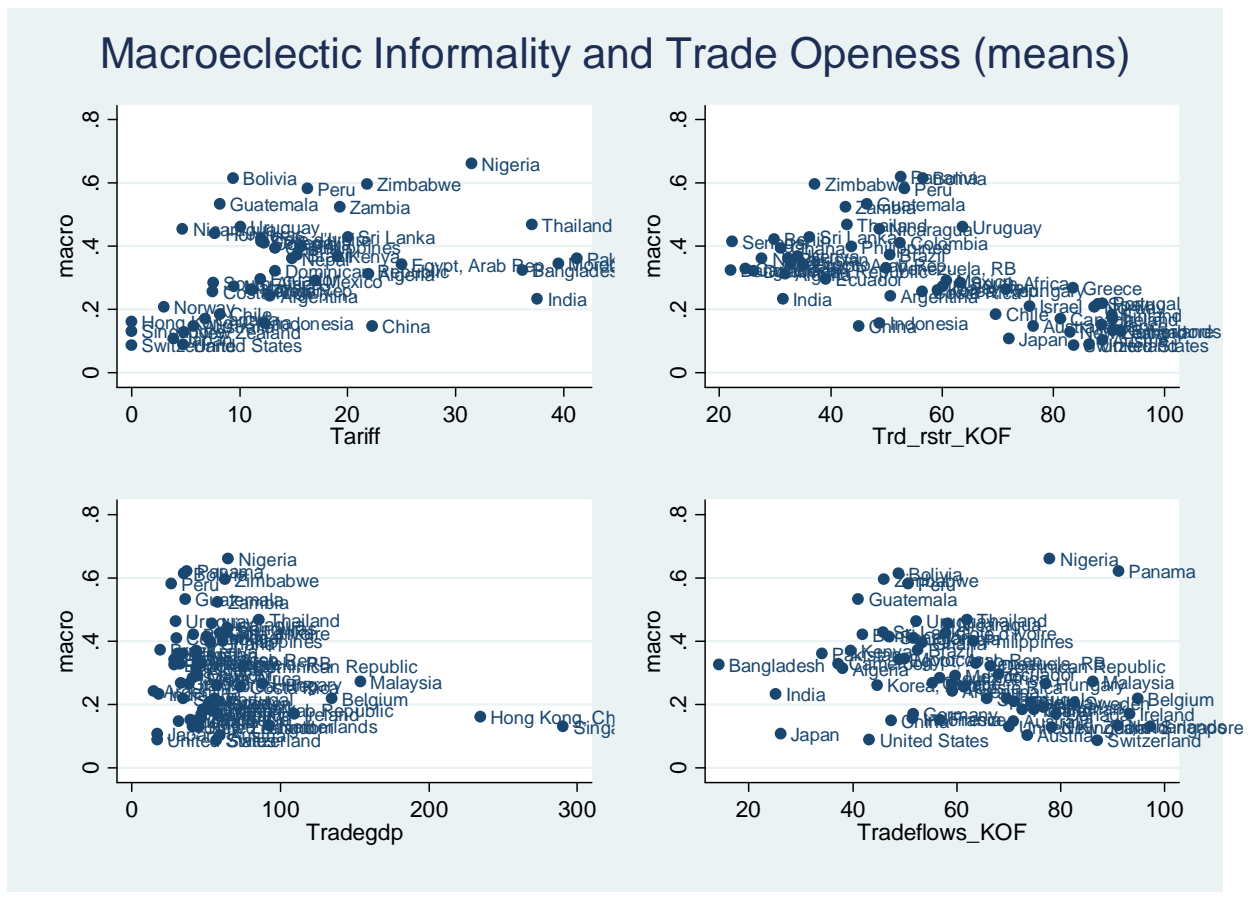
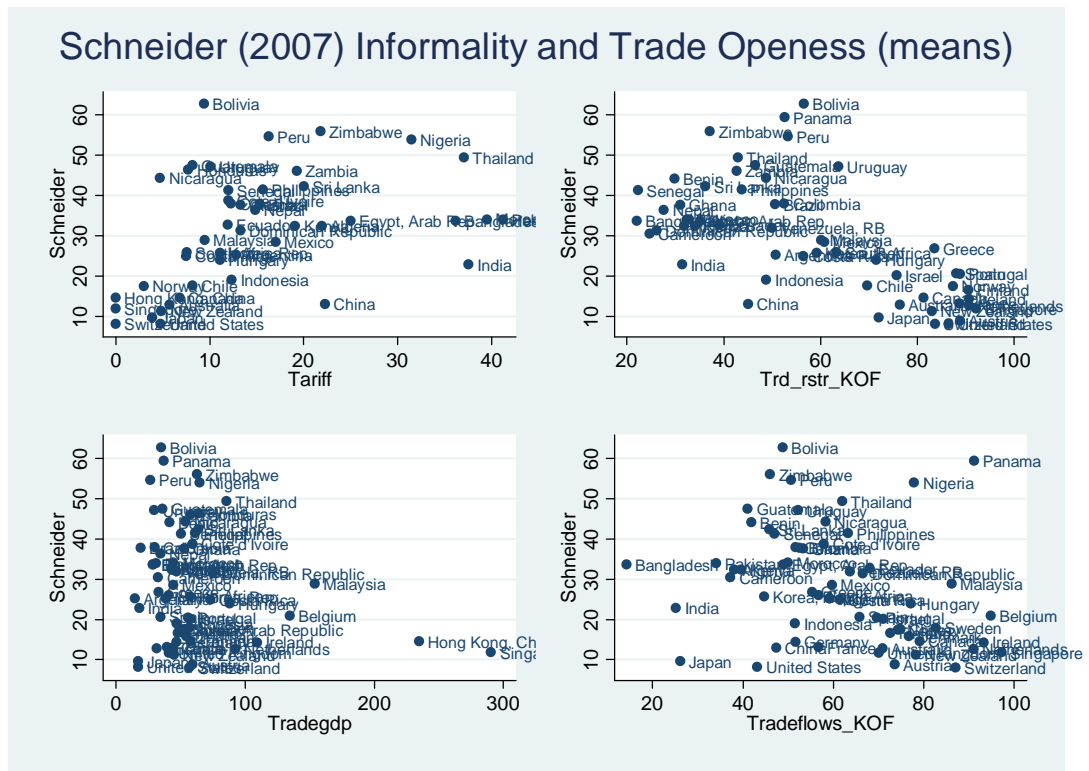


Figure A5: Info_S and alternative Trade Openness Measures



Appendix 4: Cointegration Analysis

Table A6: Cointegration Analysis of Informality and Trade openness

region	country	Info_Macro, Trade/GDP	standard errors	p- value	Info_ILO, Trade/GDP	standard errors	p- value
Africa							
	Benin	0.0179	0.0037	0.00			
	Cameroon	-0.0067	0.0022	0.00			
	Ct. d'Ivoire	-0.0040	0.0007	0.00			
	Ghana	0.0036	0.0018	0.05			
	Kenya	0.0067	0.0027	0.01			
	Nigeria	0.0254	0.0128	0.05			
	Senegal	-0.0112	0.0040	0.01			
	S. Africa	-0.0027	0.0008	0.00			
	Zambia						
	Zimbabwe	-0.0183	0.0070	0.01			
East Asia & Pacific							
	China	-0.0013	0.0007	0.06			
	Indonesia	0.0287	0.0034	0.00			
	Malaysia	-0.0525	0.0102	0.00	-0.3992	0.1111	0.00
	Philippines	-0.0113	0.0017	0.00	-0.0647	0.0026	0.00
	Thailand	-0.0102	0.0023	0.00	0.0044	0.0015	0.00
Latin America							
	Argentina	-0.0045	0.0011	0.00	0.0020	0.0002	0.00
	Bolivia	0.0194	0.0060	0.00	0.0375	0.0074	0.00
	Brazil	-0.0017	0.0004	0.00			
	Chile	-0.0033	0.0002	0.00	-0.0012	0.0002	0.00
	Colombia	0.0007	0.0004	0.09	-0.0080	0.0016	0.00
	Costa Rica	-0.0017	0.0007	0.02	-0.0019	0.0008	0.02
	DR	-0.0046	0.0014	0.00			
	Ecuador	-0.0039	0.0005	0.00	0.0009	0.0003	0.00
	Guatemala	-0.0446	0.0224	0.05			
	Honduras						
	Mexico	-0.0031	0.0003	0.00	0.0059	0.0017	0.00
	Nicaragua	-0.0021	0.0005	0.00			
	Panama	-0.0455	0.0131	0.00	0.0021	0.0012	0.07
	Peru	-0.0053	0.0029	0.06			
	Uruguay	-0.0037	0.0013	0.01			
	Venezuela	-0.0243	0.0039	0.00			

region	country	ILO_Macro, Trade/GDP	standard errors	p	Info_ILO, Trade/GDP	standard errors	p- value
Middle East and Northern Africa							
	Algeria	-0.0066	0.0006	0.00			
	Egypt	-0.0633	0.0206	0.00			
	Morocco	-0.0077	0.0045	0.09			
	Syria						
South Asia							
	Bangladesh	-0.0086	0.0024	0.00			
	India	0.0027	0.0007	0.00			
	Nepal						
	Pakistan	-0.0752	0.0195	0.00	-0.0068	0.0035	0.05
	Sri Lanka	-0.0416	0.0119	0.00			
High Income							
	Austria	-0.0001	0.0001	0.11	0.0006	0.0000	0.00
	Belgium	0.0026	0.0012	0.03			
	Denmark	0.0009	0.0006	0.15			
	Finland	0.0015	0.0004	0.00	0.0017	0.0004	0.00
	France	-0.0007	0.0002	0.01			
	Germany	0.0002	0.0001	0.05			
	Greece	-0.0017	0.0012	0.14			
	Ireland	0.0096	0.0012	0.00			
	Italy	-0.0017	0.0003	0.00			
	Netherlands	-0.0004	0.0003	0.14			
	Norway	-0.0102	0.0016	0.00	-0.0054	0.0015	0.00
	Portugal	-0.0019	0.0005	0.00			
	Spain	-0.0018	0.0002	0.00			
	Sweden	0.0028	0.0005	0.00	0.0074	0.0014	0.00
	Switzerland	-0.0002	0.0001	0.10	-0.0019	0.0003	0.00
	UK	0.0033	0.0010	0.00			
	US	0.0012	0.0003	0.00			
	Australia	0.0011	0.0003	0.00	0.0036	0.0007	0.00
	Canada	0.0102	0.0022	0.00	-0.0016	0.0003	0.00
	Japan	0.0012	0.0003	0.00	0.0062	0.0016	0.00
	N. Zealand	0.0084	0.0013	0.00	-0.0240	0.0086	0.01
High Income, other							
	Korea, Rep.	-0.0034	0.0008	0.00			
	Israel	-0.0025	0.0004	0.00	0.0003	0.0000	0.00
	Singapore	-0.0034	0.0015	0.03	-0.0090	0.0028	0.00

Note: coefficient estimates of Johansen cointegration regression of data vector consisting of informality and trade openness. Coefficients are in vector form and normalized on informality variable (not reported). A positive coefficient implies that greater trade openness lead to higher informality, a negative coefficient indicates that trade liberalisation leads to a reduction in informality.

Table A7: Cointegration analysis between Informality and Trade Restrictions

region	country	Info_Macro, trade restrictions	standard errors	p	Info_ILO, trade restrictions	standard errors	p- value
Africa							
	Benin	-0.0220	0.0027	0.00			
	Cameroon	-0.01586	0.00943	0.09			
	Cote d'Ivoire						
	Ghana	0.0108	0.0020	0.00			
	Kenya	-0.0023	0.0009	0.01			
	Nigeria						
	Senegal	-0.0091	0.0018	0.00			
	S. Africa	-0.00368	0.00148	0.01			
	Zambia	0.0016	0.0009	0.08			
	Zimbabwe	0.0218	0.0057	0.00			
East Asia & Pacific							
	China	0.0076	0.0024	0.00			
	Indonesia	-0.0035	0.0005	0.00			
	Malaysia	-0.0109	0.0015	0.00	0.0044	0.0003	0.00
	Philippines	-0.0073	0.0012	0.00			
	Thailand	-0.0108	0.0007	0.00	0.0058	0.0011	0.00
Europe and Central Asia							
	Hungary	0.0044	0.0011	0.00	-0.0044	0.0007	0.00
Latin America and Caribbean							
	Argentina	0.0032	0.0010	0.00	-0.0007	0.0003	0.03
	Bolivia	-0.0118	0.0010	0.00	-0.0361	0.0063	0.00
	Brazil	0.0017	0.0006	0.01			
	Chile	-0.0034	0.0006	0.00	-0.0011	0.0003	0.00
	Colombia	-0.0405	0.0025	0.02	-0.0530	0.0201	0.01
	Costa Rica	-0.0003	0.0002	0.08	-0.0010	0.0004	0.01
	DR	-0.0050	0.0011	0.00			
	Ecuador	-0.0016	0.0008	0.03	0.0394	0.0079	0.00
	Guatemala	-0.0158	0.0035	0.00			
	Honduras						
	Mexico	0.0131	0.0053	0.02	-0.0223	0.0069	0.00
	Nicaragua	-0.0006	0.0002	0.01			
	Panama	-0.0057	0.0008	0.00	-0.0012	0.0005	0.01
	Peru	0.0300	0.0108	0.01			
	Uruguay	-0.0049	0.0023	0.03			
	Venezuela	-0.0057	0.0028	0.04			

region	country	Info_Macro, trade restrictions	standard errors	p- value	Info_ILO, trade restrictions	standard errors	p- value
Middle East & North Africa							
	Algeria	-0.0076	0.0013	0.00	0.0041	0.0022	0.07
	Egypt	0.0142	0.0045	0.00			
	Morocco	-0.0558	0.0246	0.02			
	Syrian Arab Republic						
South Asia							
	Bangladesh	-0.0047	0.0012	0.00			
	India	0.0036	0.0010	0.00			
	Nepal	-0.0166	0.0067	0.01			
	Pakistan	-0.0019	0.0006	0.00	0.0020	0.0002	0.00
	Sri Lanka	-0.0032	0.0003	0.00			
High Income							
	Austria	-0.0002	0.0001	0.05	-0.0056	0.0015	0.00
	Belgium						
	Denmark						
	Finland	0.0153	0.0034	0.00	0.003793	0.000783	0
	France	-0.00108	0.00034	0.01			
	Germany						
	Greece	-0.0020	0.0004	0.00			
	Ireland	0.0104	0.0026	0.00			
	Italy						
	Netherlands	-0.0009	0.0004	0.02			
	Norway	-0.0083	0.0029	0.00	-0.0028	0.0003	0.00
	Portugal	-0.0168	0.0051	0.00			
	Spain	-0.0097	0.0014	0.00			
	Sweden						
	Switzerland	-0.0006	0.0003	0.05	-0.0087	0.0027	0.00
	United Kingdom						
	USA	0.0065	0.0006	0.00			
	Australia	0.0010	0.0001	0.00	0.0044	0.0006	0.00
	Canada	0.0031	0.0003	0.00	0.0011	0.0005	0.04
	Japan	-0.0009	0.0003	0.00	0.0022	0.0005	0.00
	N. Zealand	0.0023	0.0005	0.00	0.0036	0.0011	0.00
High Income, other							
	Korea, Rep.	-0.0125	0.0013	0.00			
	Israel	-0.0022	0.0001	0.00	0.0004	0.0001	0.00
	Singapore	0.0036	0.0014	0.01	0.0089	0.0045	0.05

Note: coefficient estimates of Johansen cointegration regression of data vector consisting of informality and trade restrictions. Coefficients are in vector form and normalized on informality variable (not reported). A positive coefficient implies that lower restrictions on trade (e.g lower import tariffs) lead to a reduction in informality; a negative coefficient indicates that trade liberalisation leads to higher informality.