Non-tradeables and inclusive growth

OPM Working Paper: Technical Annexes

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Stevan Lee and Enrico Vanino

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Registered in England: 3122495

Level 3, Clarendon House
52 Cornmarket Street
Oxford, OX1 3HJ
United Kingdom

Tel: +44 (0) 1865 207 300
Fax: +44 (0) 1865 207 301
Email: admin@opml.co.uk
Website: www.opml.co.uk
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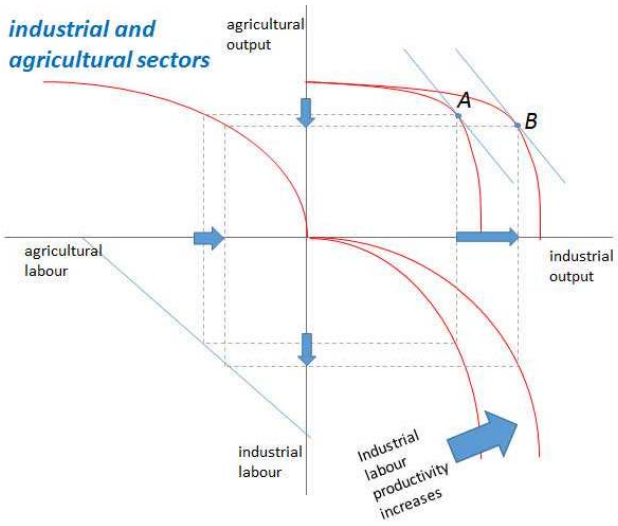
A1 Simple analytical framework for structural change

A simple model of labour allocation illustrates some important points about non-tradeable sector employment.

In this annex everything is illustrated using graphs, not equations; the equations relating to the production functions and levels of production would be standard. A similar model is described in Ismail 2010. Figure A1.1 shows two sectors within the traded sectors of an economy: agriculture and industry. Output is shown as a function of labour inputs, with decreasing returns partial production functions. It is assumed that there is a fixed amount of labour, so increased employment in one sector means reduced employment in the other. A production possibility frontier in the top right quadrant shows the possible combinations of industrial and agricultural output the economy can produce and because of international prices, the economy produces initially at ***A***.

Figure A1.1



The first-round 'shock' is an exogenous increase in industrial labour productivity – like technological progress in manufacturing, for example, or a more profitable trade regime which draws in more capital investment – which shifts out the curve in the bottom right quadrant. For given labour, the industrial sector produces more. Labour productivity has increased in the industrial sector.

This shifts out the production possibility frontier, and because international prices stay the same, production shifts to ***B***: more industrial output, less agricultural output. Note that labour has shifted from agriculture to industry, where productivity has increased – this actually means labour productivity increases in agriculture too, although production decreases. Capital is not modelled, but because labour productivity has increased in both sectors if capital is mobile there will be a net increase in the amount of capital invested.

Figure A1.2

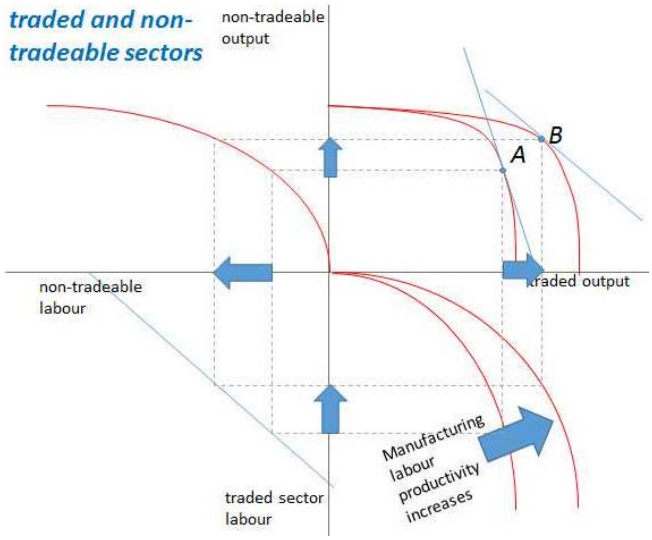


Figure A1.2 looks similar but the two sectors are traded and non-tradeable goods and services. Again, there are decreasing returns to labour inputs in both sectors. The chart describes initial production at ***A***. An improvement in traded sector productivity arises in the manufacturing sector, pushing out the production possibility frontier – this could be the same 'shock' as was modelled in the first diagram. The first-round impact would draw labour and capital towards manufacturing, increase manufacturing output and increase national income. The second-round effect occurs due to an increase in demand, including for non-tradeable services which cannot be imported. As a result, there is inflation of non-tradeable prices and relative prices change – this is often described as 'Dutch disease'. The economy produces at ***B.*** There is an increase in both tradeable and non-tradeable production.

Notice that labour shifts out of the traded sectors into non-tradeables so that increased demand for non-tradeables can be met. Real labour productivity in non-tradeables reduces, but because prices increase production is profitable and nominal output per worker increases. Real and nominal output per worker increases in traded sectors overall.

If we think of the first chart and what might be happening in a traded sector consisting of manufactures and agriculture, the exogenous boost to manufacturing labour productivity would reallocate labour from agriculture to manufacturing within the traded sector. As 'Dutch disease' boosts non-tradeable prices and production, labour is donated by the traded sector to non-traded production – because agriculture's productivity has fallen behind manufacturing it will be agriculture that donates the labour for non-tradeable production.

This seems to reproduce the pattern seen in modern examples of structural transformation. Technological or other boosts to productivity in manufacturing increases income. This increases demand for non-tradeables and labour is drawn from low-productivity agriculture to newly profitable non-tradeable services. Wages increase in all sectors, because labour demand has increased. This is what we might call inclusive growth.

Notice that sectors with lower labour productivity require more labour to sustain a given increase in output. This is why a large increase in manufacturing output might produce relatively few new jobs. A fraction of the earnings from manufacturing boost demand for non-tradeable services but these can easily require several times the amount of labour to produce – this is why modern structural transformation involves shifts of labour from traditional agriculture to services.

The traded sector includes extractive industries, some of which have extremely high average labour productivity – it can take only a few workers to generate massive export earnings from minerals, oil and gas. If this happens, demand for non-tradeables will push up their prices and labour will be drawn from lower productivity traded activities (like traditional agriculture) into services. Wages will be pushed up, which is good for inclusive growth – although it is not so good for the competitiveness of other traded sectors like manufacturing: this is the version of Dutch disease that creates concern.

During structural transformation and LIC to UMIC transitions, very large parts of the workforce transition out of traditional agriculture. But at the same time, more productive types of agriculture might expand total agricultural output – improvements in agricultural productivity will also raise the relative prices of non-tradeables and accelerate a shift of labour to services, just like productivity improvements in manufacturing and natural resources.

It is worth noting that productivity increases are possible in the non-tradeable sectors and they have a special impact on the economy, because non-tradeable demand is so inelastic. An increase in service sector productivity, by itself, might reduce employment in the service sector, releasing labour to traded sectors and reducing wages in the economy overall, even if production increases in traded sectors. In isolation, it seems as though an increase in labour productivity in services could be bad for inclusive growth, but of course in the medium term these productivity increases are also vital for sustained growth. For example in 2010, Bangladesh already had 35% of its workforce engaged in services at GDP/capita of $1,200. At that rate of productivity Bangladesh might require all of its workforce to engage in the service sector before its GDP reaches $3,000. What tends to happen in growing economies is that traded and non-tradeable sectors enjoy simultaneous productivity gains, with traded sector gains staying somewhat ahead of non-tradeable sectors. This is consistent with a slow shift of labour form low-productivity agriculture to higher productivity services and a service sector which keeps up with domestic demand even as GDP doubles and redoubles.

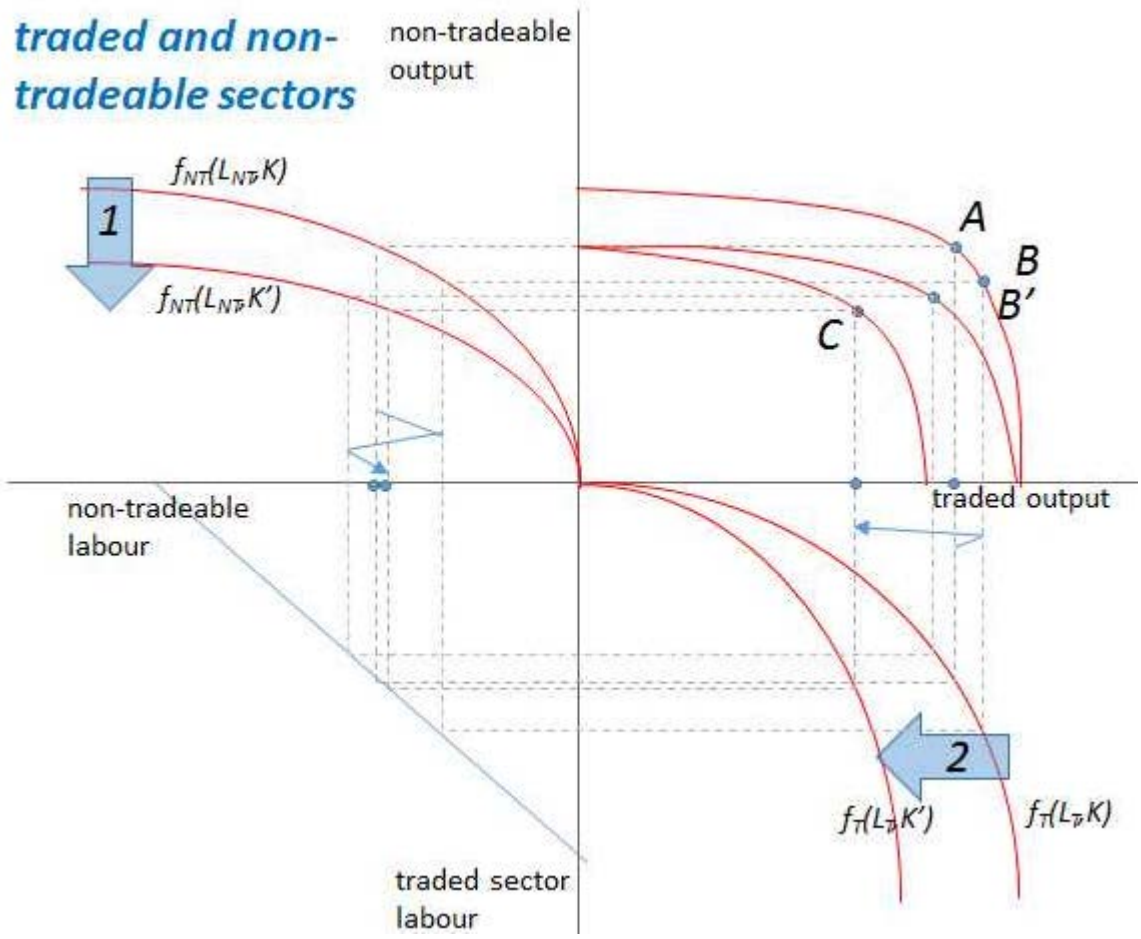
The third diagram shows what might happen if extractive institutions worsen, effectively increasing a ‘tax’ on non-tradeable sectors. The initial ‘shock’ is an increase in the effective tax on non-tradeables from extractive institutions. - a worsening of those institutions. The tax pushes up prices for consumers and demand reduces, pushing production initially from A to B. If this was the end of the story, labour would shift from non-tradeable to traded sectors, with labour productivity, real wages, and output reduced overall.

In this diagram the production functions, which only show the labour input, are for capital in a given set of conditions, so when conditions change, and extraction gets worse, non-tradeables are less profitable and capital is more reluctant to invest. K shifts to K’ and the production function shifts down – as does the production possibility frontier in the top right quadrant. Total output reduces a bit more and so

does demand for non-tradeables, at B'. However, labour productivity has fallen sharply in non-tradeables and in this diagram it is sufficient to draw labour back from the traded sectors.

This is still not the end of the ramifications because part of the extractive institutions 'tax' is passed on to tradeable sectors via the higher input prices. Non-tradeable inflation makes tradeable production less competitive and less profitable so there is a reduction in investment appetite in this sector too: K reduces to K' and the production function shifts in as in the non-tradeable sector. The production possibility frontier shifts again and production finishes at C.

Figure A1.3



The movements in the graph are drawn in a very large form, so the example is visible.

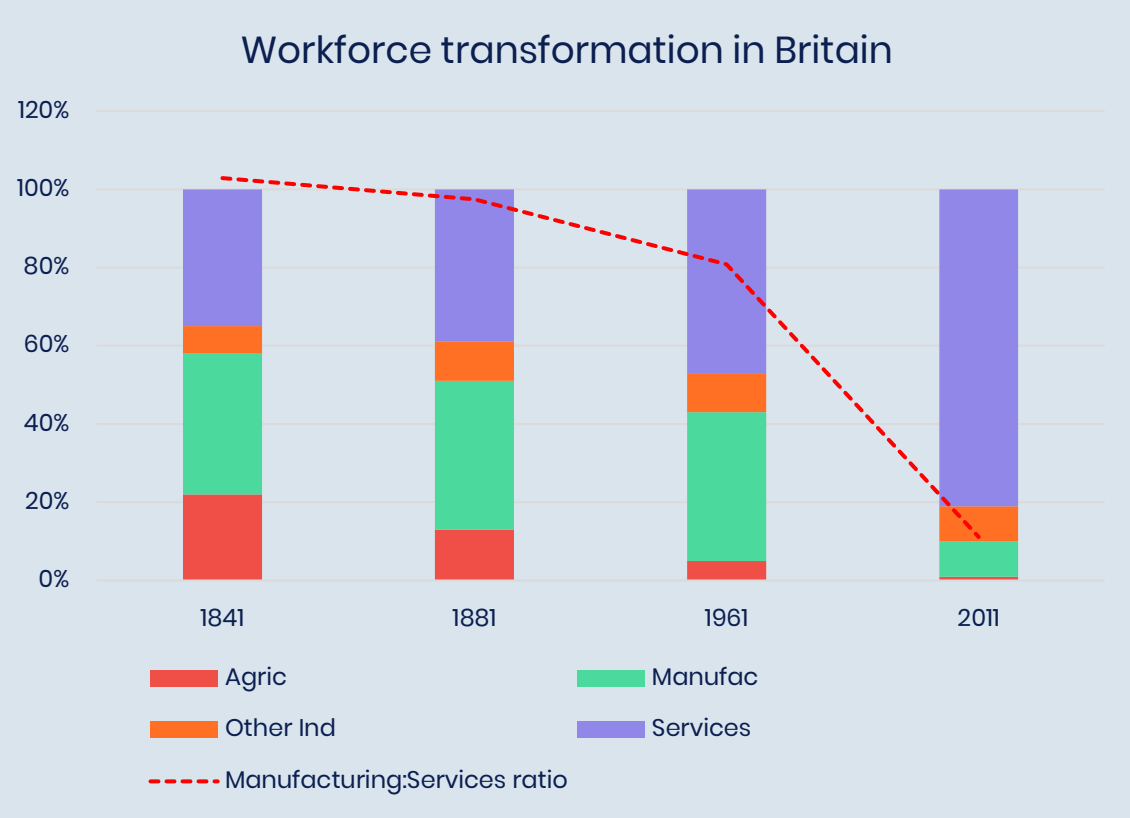
What has happened is that the extractive institutions' tax has pushed up the consumer price of non-tradeables, but has pushed down the producer price and deterred investment. Part of this tax is passed on to the tradeables sector and has deterred investment there too. There is inflation, reduced capital in both sectors, reduced output in both sectors, reduced output per worker, and reduced real incomes. Inflation may mean that nominal wages have increased.

The empirical evidence linking extractive institutions to non-tradeable sector inflation, and also wage inflation, and linking that inflation to tradeable sector competitiveness is explored elsewhere in the note.

A2 Historical evidence

Industrial Britain had massive employment in manufacturing in the 19th century and 20th century…

Figure A2.1



Britain was the first industrial country and was a dominant supplier of manufactured goods in the global economy through the 19th and 20th centuries. Figure A2.1 shows that manufacturing jobs already accounted for a very high share of total employment by 1841 (about 36%) – by then, a lot of labour had already shifted from agriculture to manufacturing. The share of Britain's workforce employed in manufacturing remained in the 36%–39% range almost throughout the 120-year period from 1841 to 1961 (2011 census analysis, Office for National Statistics (ONS)). For most of this period there were almost as many manufacturing jobs as service jobs – the ratio is illustrated by the dashed red line. There is a gentle shift of labour from agriculture to services before 1960 – after 1960 there is a rapid shift from manufacturing to services.

…this is completely different from the modern pattern…

Why? The likely explanation is that at the dawn of the Industrial Revolution, manufacturing was not all that productive. In the first part of the 19th century food was not traded internationally very much and British agricultural productivity grew faster than manufacturing productivity, so labour transferred from farming to manufacturing

(Crafts 2014). Likewise, manufacturing was not very much more productive than services and so they absorbed similar amounts of labour. In addition, Britain had an extremely large amount of manufacturing jobs compared to contemporary examples.

… but it seems to be a thing of the past.

Figures A2.2 and A2.3 below show corresponding data for China and Bangladesh from 1990 to 2010. China has seen massive growth in manufacturing exports and other rapid shifts in the structure of employment since 1990, with the share of the workforce working in agriculture declining from 60% in 1990 to 28% in 2015. 32% of the workforce was redistributed during this time. Interestingly, about 8% of the workforce shifted from agriculture to industry in the period, compared to 24% shifting from agriculture to services – so whilst the massive output gains and productivity gains were in manufacturing, the dominant labour shift was from agriculture to services. Manufacturing employment in China reached about 15% of the workforce in 2012 – according to the US Bureau of Labour Statistics, this was equal to 100 million jobs (a workforce of approximately 670 million).

Figure A2.2

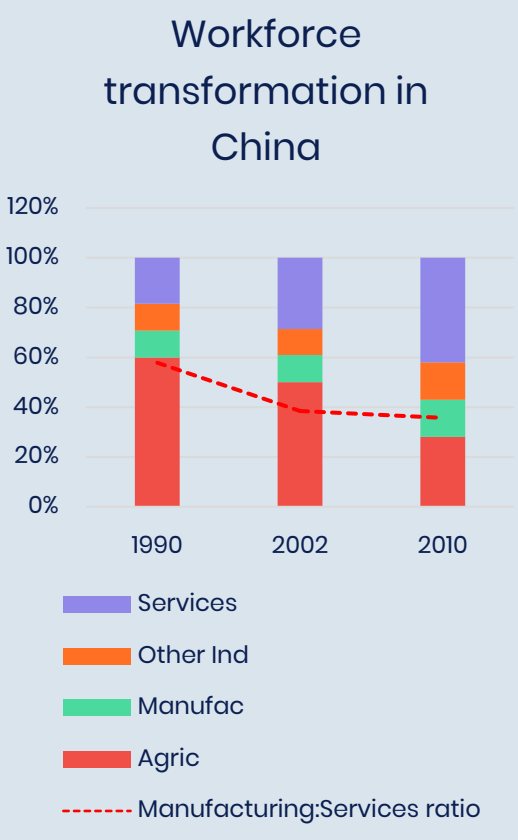
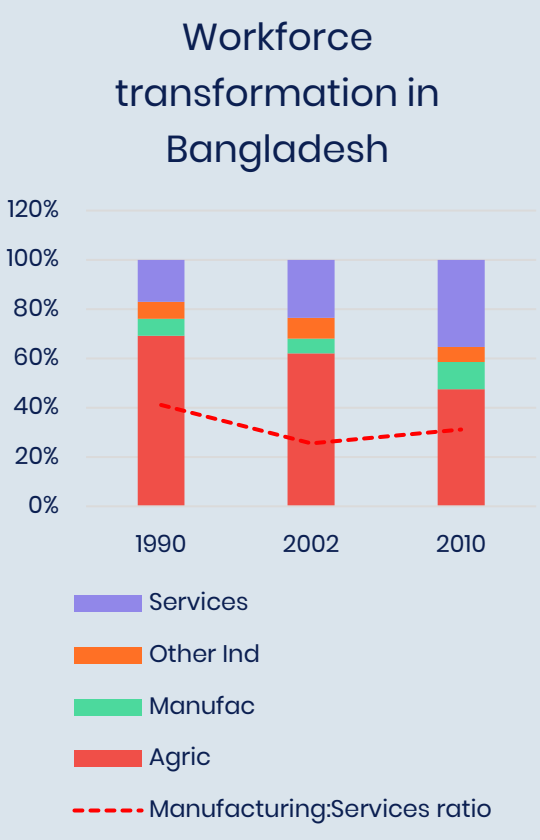


Figure A2.3



GDP per capita in Bangladesh reached $1,211 in 2015, above the LMIC threshold, and up to 23% of the workforce was redistributed from 1990 to 2010, a period that saw the garment industry in Bangladesh enjoy very striking success: this industry now accounts

for over 80% of total exports. Again, the major shift in labour was 24% of the workforce moving from agricultural to the service sector, whilst only 4% of workers transferred to industry. Not all of industrial employment is manufacturing: for example, it includes construction. In 2010 about 8% of the workforce was employed in garments, or 5 million people (a workforce of approximately 63 million). For the time being, Bangladeshi manufacturing is very undiversified beyond garments. The Bangladesh workforce in 2010 was very similar in structure to China's in 2002. In both China and Bangladesh, the ratio of manufacturing jobs to service jobs is much lower than in 19th and 20th century Britain (red dashed line).

In the modern era it appears that only agriculture or services can be the dominant employment sector.

Almost every country now has a service sector employing several times its industrial sector – the exceptions are Bhutan, Brunei and Qatar, unusual economies. There are also only a handful of economies where industry employs over 30% of the workforce. They are all either major oil and gas producers or former Soviet countries or eastern European countries. Perhaps this contradicts the impression that extractive industries do not create industrial jobs but it is probably more complex than that. It is likely that counties with forced or very high savings, such as planned economies, might have more industrial jobs than otherwise because demand is skewed to investment, infrastructure, and construction.

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A3 Extractive institutions and non-tradeable prices

This annex lays out an analysis showing the link between extractive institutions and non-tradeable prices. As reflected in the main body of the text, the driving assumption is that extractive institutions obtain rents from productive sectors by passing costs on to the market – whether these are rents collected as extortion from micro-enterprises and small and medium-sized enterprises or monopoly rents from protected companies. This is only really possibly in non-tradeable sectors or sectors which have been rendered non-traded by regulation: otherwise, international prices prevent the costs of rents being passed on. Therefore, the central hypothesis in this annex is that more extractive institutions (worse institutions) will be associated with higher relative prices for non-tradeables. This is investigated by examining cross-country data on institutional scores and on prices.

Data and methodology

Investigation of the hypothesis requires data on the quality of institutions, data on the relative prices of non-tradeable and tradeable goods, as well as data on other important explanatory variables.

We gathered the required data on the prices of non-tradeable goods and the quality of institutions for different countries by merging several datasets. First, we created time series on the evolution of prices in the non-tradeable sectors using consumer price indexes (CPIs) from two different sources. The first dataset was obtained from the World Bank, providing CPI time series between 1950 and 2016 about almost 110 countries. This database covers the non-tradeable sectors of communication, education, health, housing rents, utilities, culture, transports, restauration, and accommodation. The second source of price indexes was the ILO database, which provides time series between 1970 and 2011 for almost 224 countries, covering the non-tradeable industries of electricity, gas and water supply, housing rents, and other miscellaneous services sectors.

These CPI indexes measure changes in the price level of baskets of non-tradeable goods and services purchased by households, and are weighted in order to reflect their shares in total consumer expenditures. CPIs are indexed to a base year set equal to 100 in order to easily compare the increase in the price of goods and services across different time periods and countries. Given the better coverage of the ILO data in terms of countries included in the sample, we base our empirical analysis mainly on this latter source of data, integrating the World Bank data into our analysis in a second step as a robustness check. The resulting consumer price index for non-tradeable goods using the ILO data is an average of the CPIs for the electricity, gas and water supply industry, the housing sector, and a combination of other services sectors. We then calculate the net non-tradeable price index by taking the difference between the general CPI and the price index for the non-tradeable sectors. In this way, we identify the additional cost of non-tradeables goods and services in respect to the general level of prices, being able

to evaluate the evolution of prices in the non-tradeable sectors net of the general level of inflation in each country.[1]

To measure institutional quality, we rely on two databases provided by the World Bank and summarised in Table 1. The first is the WGIs project, which reports individual governance indicators for over 200 countries over the period 1996–2015. This database includes six different dimensions of governance, such as voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. In addition, we use data from the 'Doing Business' project, which provides measures of business regulations and their enforcement across 190 economies between 2002 and 2015. This database permits us to compare business regulation environments across economies and over time, offering a measure of the overall ease of doing business in a country and providing a relative measure of the economy's regulation performance in respect to the world best practice. In particular, it is possible to compare the evolution of business environments in each country in terms of ease of starting a new business, getting construction permits, electricity access, registering property rights, getting credit, protecting minorities, paying taxes, trading across borders, enforcing contracts, and resolving insolvencies.

Table 1 presents the distribution of the mean value for each of the indicators included in the two datasets across the countries' income categories: LICs, LMICs, UMICs, and HICs. First, we notice little variation within each category of income and set of indicators, suggesting that different indicators might capture the same trends and could be used as proxies for each other. Secondly, we identify a clear trend when comparing the mean values across income categories. For instance, as soon as the income per capita of countries increases above the median the WGI indicators become positive, with the highest scores registered in HICs. In addition, the EDB indexes also follow a similar pattern, registering an improvement in each of the EDB indexes as the income per capita of countries increases, with HICs again registering the best practice in terms of business environment and regulations.

[1] As a robustness check we have performed the same analysis using as a main variable the CPI for non-tradeable sectors, but controlling for the general level of inflation in the econometric model, and the overall results are consistent with those currently presented.

Table 1: Summary statistics for the variables included in the WGI and the EDB databases by countries' income.

	LICs	LMICs	UMICs	HICs
		WGIs		
Corruption control	-0.83696	-0.50253	-0.03361	1.207723
Government eff.	-0.93872	-0.48938	0.049255	1.220714
Political stability	-0.83978	-0.36304	0.149853	0.814664
Regulatory quality	-0.89772	-0.46584	0.061558	1.147828
Rule of law	-0.93808	-0.47226	0.011275	1.155738
Voice and acc.	-0.84034	-0.34366	0.143862	0.861767
		EDB		
Start business	56.07543	71.7038	77.74051	84.58808
Construction permits	53.80234	62.24732	64.41854	72.76206
Get electricity	46.23216	63.78748	69.96493	80.51897
Registration PR	51.11983	57.46214	63.50869	71.58680
Get credit	30.87189	44.14189	52.39833	63.79709
Protection invest.	40.89516	45.43809	53.20552	59.93478
Pay taxes	52.94223	59.9913	66.11398	80.50696
Trading	42.15911	59.94544	68.16056	83.26384
Contract enforc.	47.07675	52.52303	58.31766	65.91151
Resolve insolvencies	20.08461	28.55768	36.86333	66.34612

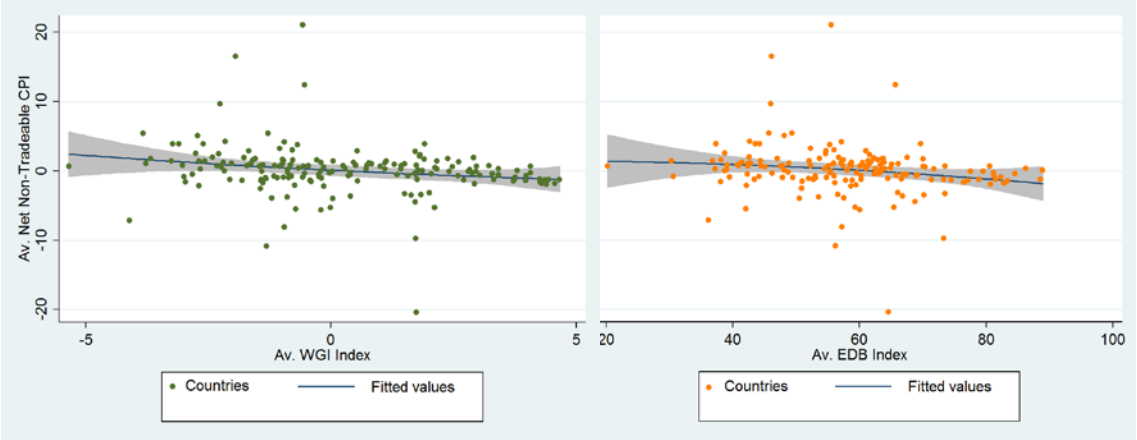
Notes: Mean values of the variables included in the WGI and the EDB databases provided by the World Bank for the period 2002–2011 for LICs, LMICs, UMICs and HICs, as defined by the World Bank (thresholds for year 2011: LICs, less than $1,025; LMICs, between $1,026 and $4,035; UMICs, between $4,036 and $12,475; HICs, above $12,475. Thresholds for all of the different years are available in Table A5 in the appendix).

Given the high correlation between the variables included in the two datasets, we use principal component analysis (PCA) to create two indicators of institutions' quality, one for each database, which are linearly uncorrelated and account for as much of the variability in the two datasets as possible. This results in two new indicators of governance quality and ease of doing business for each country-year, based on the original underlying data, as shown in Table A2 in the appendix. Each index statistically summarises the underlying data contained in the original datasets, weighting each single original indicator according to the additional variability and extra information provided in respect to the other indicators already included.

Once the new indicators of governance quality and ease of doing business are created for each country and year, we can briefly analyse their relationship with the net prices in the non-tradeable sectors by simply plotting in a graph the average level of institutions' quality and the average net CPI index for non-tradeables across our time period in each country part of our sample. Figure 1 presents the two scatter graphs reporting the average net CPI index in non-tradeable sectors using the ILO data on the vertical axis and the averages of the two institutions quality measures on the horizontal axis.

From the two graphs it is possible to identify two similar trends across countries. First, note a negative relationship between the average WGI index of governance quality and the average net CPI of non-tradeable goods in a country, suggesting that countries experiencing, on average, a higher increase in the net level of non-tradeable prices are also characterised by a lower quality of governance and institutions. In particular, countries on the right-hand side of the distribution, which show on average the highest scores for institution quality, registered on average a negative net CPI for non-tradeable goods, suggesting that the price growth of non-tradeable goods in these countries has been lower than the general level of inflation.

Figure 1: Correlation and predicted values of the relationship between the average net non-tradeable CPI index (ILO), and the average WGI and EDB indexes for each country during the period 2002–2011.



Notes: Scatters of the average mean values for the period 2002–2011 of the WGI and the EDB indexes estimated using PCA, and of the net non-tradeable CPI measured averaging the CPIs for the electricity, gas, and water supply industry, the housing sector, and miscellaneous other services sectors provided by the ILO, and then taking the difference between the general CPI and the average price index for the non-tradeable sectors.

The relationship between the average EDB index and the average net CPI of non-tradeable goods across countries shows a similar trend, even though it is less clear than the previous one. In fact, it is possible to notice an overall negative relationship, indicating that the closer to the best practice a country is in terms of ease of doing business the lower is the net inflation for non-tradeable goods, especially on the right-hand side of the distribution. However, the trend is blurred and not clearly identifiable at the mean of the distribution, where countries with an average score in terms of business environment registered a very large variation in terms of average net non-tradeables CPI. This evidence also suggests that the WGI index might better represent the variation of institution quality across countries, given its evenly distributed

dispersion. By contrast, the average EDB index seems to be mostly concentrated around the mean value, with countries with very different institutional structures and quality registering quite similar scores in terms of business environments.

To identify the relationship between the quality of institutions in a country and the net cost of non-tradeable goods while controlling for time-variant and country-specific idiosyncratic effects, we decide to estimate an econometric model using a simple ordinary least square (OLS) technique. Our final aim is to precisely identify the effect of a change in institutions' quality on the rent generation resulting from increases in the price of non-tradeable goods. In particular, we want to estimate how an improvement in institutions, governance and business regulations quality affects the growth of prices in non-tradeable sectors, net of the overall rate of inflation. Thanks to our data, it is possible to measure the dynamic evolution of institutions' quality in each country using the WGI and EDB indexes, and to identify their impact on the additional growth of non-tradeables prices in respect to the overall level of inflation rate using the net CPI for non-tradeables.

To do this, we implement the following first-difference country-fixed-effect OLS model to estimate the impact of a change in the quality of institutions on the net growth of non-tradeable goods and services prices:

$$\Delta CPI\_NT_{ct} = \beta_0 + \beta_1 \Delta WGI_{ct} + \beta_2 \Delta EDB_{ct} + \beta_3 \Delta PERF_{ct} + j_c + j_t + \varepsilon_{ct}$$

In our model, ΔCPI_NT_{ct} represents the additional growth of the CPI of non-tradeable goods and services, net of the overall rate of inflation, registered at time *t* in country *c*. The key explanatory variables ΔWGI_{ct} and ΔEDB_{ct} are the two growth rates of the measures of institutions quality built with the principle component analysis, describing the evolution of the WGI index and the EDB index for each country across our time period (2002–2011).

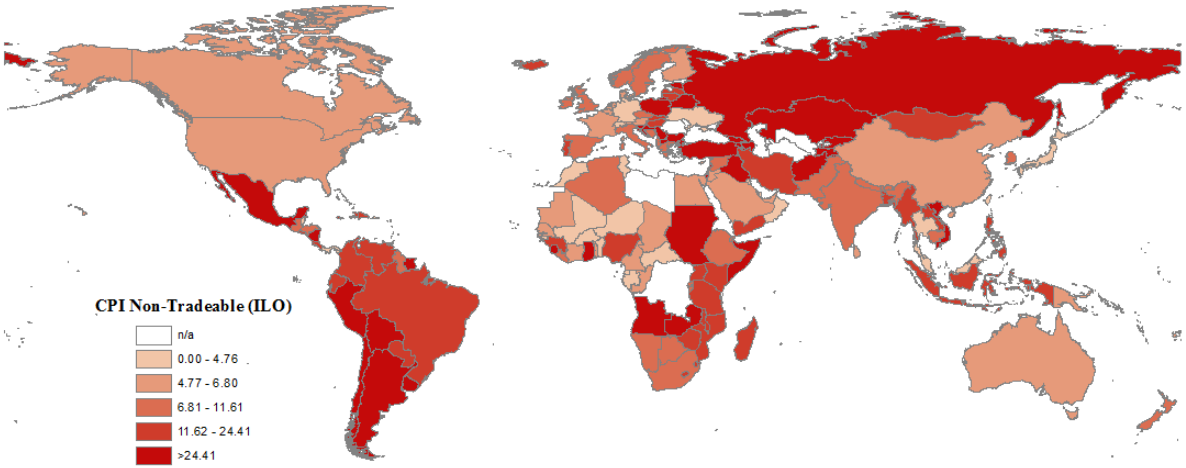
Table 2: Summary statistics of the main variables considered in the empirical analysis by countries' income category.

	LIC				LMIC			
	Mean	*S.D.*	*Min*	*Max*	*Mean*	*S.D.*	*Min*	*Max*
Net CPI NT (ILO)	3.409	63.933	-831.69	870.35	13.203	332.670	-2160.86	9127.75
Net CPI NT (All)	1.217	63.196	-831.69	870.35	11.710	364.534	-2470.85	9127.75
WGI index	-2.100	1.233	-5.99	0.54	-1.041	1.188	-4.59	2.08
EDB index	43.020	9.937	6.10	69.86	53.638	8.747	28.59	82.16
Unemployment	7.41	6.10	0.10	39.30	10.80	6.95	0.90	37.30
Ser. imports	1,240	3,080	0.20	40,400	5,210	14,300	6.80	159,000
GDP capita (purchasing power parity (PPP))	1,637	1,214	239.74	21,099	5,227	2,482	1,038	15,799
	UMIC				**HIC**			
	Mean	*S.D.*	*Min*	*Max*	*Mean*	*S.D.*	*Min*	*Max*
Net CPI NT (ILO)	4.541	115.386	-608.81	2760.42	0.549	3.627	-12.96	18.89
Net CPI NT (All)	13.107	320.661	-2576.40	2760.42	-6.748	34.747	-222.95	106.71
WGI index	0.183	1.511	-4.36	3.21	2.686	1.410	-3.43	4.93
EDB index	60.350	9.291	25.20	81.75	72.722	9.689	36.33	93.02
Unemployment	10.91	6.31	0.70	37.60	6.75	4.02	0.20	27.20

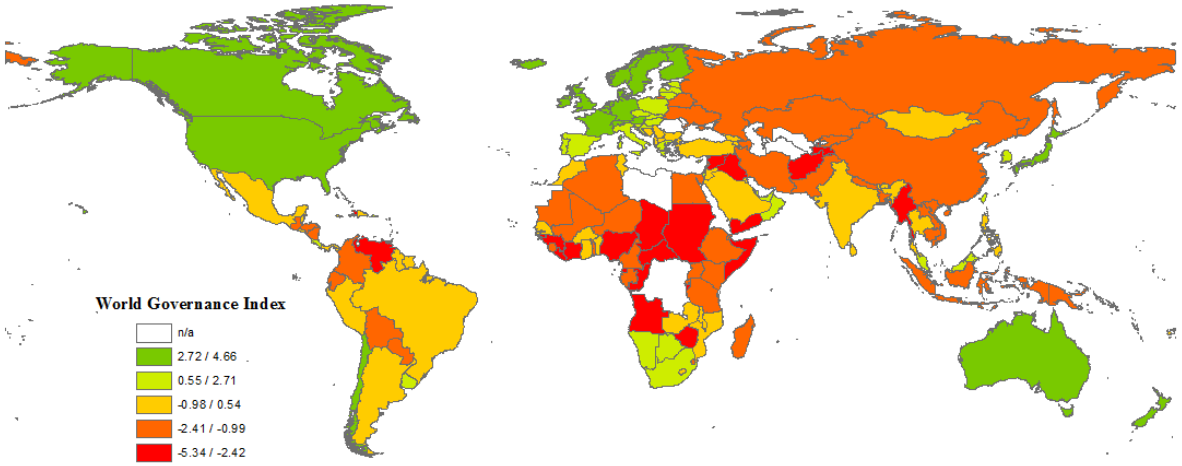
Ser. imports	10,300	29,000	37.40	383,000	48,300	74,900	96.90	470,000
GDP capita (PPP)	13,596	5,784	3,488	40,719	36,416	20,147	11,446	141,947

Notes: Summary statistics (mean value, standard deviation, minimum and maximum values) for the net non-tradeable CPI (ILO and World Bank) measured as the difference between the general CPI and the average CPI for the non-tradeable sectors, the WGI and the EDB indexes estimated using PCA, unemployment rate (World Bank), total imports of services (millions of USD, COMTRADE) and GDP per capita (PPP, World Bank). Example of income thresholds for year 2011: LICs, income per capita below $1,025; LMICs, income per capita between $1,026 and $4,035; UMICs, income per capita between $4,036 and $12,475; HICs, income per capita above $12,475. Complete list of thresholds for the different years available in Table A6 in the appendix.

Changes in the relative prices of non-tradeable goods



Levels in the composite WGI



Because these are dynamic data from a cross-country panel we are controlling for all time-invariant effects.

In addition to the quality of institutions, the main explanatory variable of interest, we control for three other time-variant and country-specific characteristics, including measures of country economic performance and factors which could affect the additional growth of the price of non-tradeables in respect to the overall rate of inflation in each country:

a) unemployment;

b) the amount of service imports; and

c) GDP per capita at PPP.

We consider the unemployment rate obtained from the ILO database. High/increasing levels of unemployment are taken to represent labour supply restrictions – perhaps related to human capital, perhaps to labour market restrictions, like trade union power. They push up labour costs and therefore the relative price of non-tradeable goods. Of course, low unemployment could indicate exceptionally buoyant domestic demand, which might be expected to push up the prices of non-tradeables, but this effect is probably proxied by the GDP per capita growth variable below.

We include in our model the growth of imports of services from abroad obtained from the COMTRADE database to control for the level of foreign competition in the 'non-tradeable' sectors and the potential impact on prices in these industries.

Thirdly, we take into consideration GDP per capita (growth) at PPP from the World Bank database. This is taken to represent the buoyancy of domestic demand such that high growth is likely to push up the relative demand for non-tradeable goods and services.

In this way we will be able to precisely identify the relationship between institutions' quality and rent generation, reflected in the growth of relative prices in non-tradeable goods and services, which will allow us to estimate the impact of a change in the quality of institutions on the growth of non-tradeable goods and services prices. In addition, we will also be able to estimate this dynamic effect for the time-varying control variables, allowing us to identify the impact of income unemployment growth, a higher import penetration of services from abroad, and GDP growth on the relative price of non-tradeables. Moreover, we include year and country fixed-effects j_c and j_t in order to account for any specific source of unobserved heterogeneity and to capture possible time dynamics and country-specific idiosyncratic characteristics which we are not able to measure. The first-difference model allows us to measure the effect of a standard deviation increase in the quality of institutions in each country on the additional growth of prices in non-tradeable sectors in respect to the general level of inflation. In addition, the economic performance control variables, together with the country-year fixed-effects, will make our estimation more precise by taking into account the unobserved heterogeneity in terms of economic performance, level of development, dynamic trends, and other country-specific characteristics.

Results and discussion

We base our main empirical analysis on the CPI data provided for non-tradeable sectors by the ILO, given its more comprehensive coverage of countries compared to the World Bank data. As a robustness check in Tables A4 and A5, the appendix, we provide the same analysis including the CPI World Bank data for the countries for which the ILO data are not available. Table 3 illustrates the complete results of our analysis, with the estimation for each different econometric specification.[2]

From column 1 to column 3 we increase the efficiency of our estimation by incrementally including year dummies and year-country fixed-effects in order to estimate the casual effect between changes in institutions' quality and the growth of the net non-tradeables CPI. First, note the overall robustness of our main results, which do not flip or variates while increasing the precision and rigorousness of the econometric technique.

Focusing in particular on column 3, the most conservative and strict specification, including both first-difference and country-year fixed-effects, the results show that an improvement in the quality of governance (a reduction in the extent of extractive institutions) is associated with a reduction in non-tradeable price inflation, net of general inflation. Our interpretation is that this negative and significant impact of an increase of the WGI index on the net CPI for non-tradeable sectors indicates that an improvement in the quality of governance leads to a decrease in the prices of the services sectors, which are usually less exposed to foreign competition and more prone to the generation of rents. The magnitude is large. By calculating the marginal effect for this specification we find that an increase of 1% in the quality of institutions measured by the WGI index would result in a decrease by almost 12% of the additional price of non-tradeable goods on top of the inflation rate.

However, an improvement of business regulations does not seem to affect the net rate of CPI in non-tradeable sectors, as previously anticipated.

An increase in the level of unemployment in a country pushes up prices of non-tradeable goods and services. This prediction seems to contradict the standard trade-off between low inflation and unemployment, but our interpretation is that it reflects labour supply constraints: a lack of skilled workers or labour market distortions cause structural unemployment, not short-run demand effects which are captured in the growth term below. These supply-side restrictions increase wages and have a consequent positive impact on the relative prices of non-tradeable services (Galbraith 1997; Danninger and Mincer 2000; Riley and Young 2007; Salami 2011; Bartlett 2012).

As expected, we find a negative and significant impact of service imports growth on the net growth of CPI of non-tradeable sectors. More precisely, we demonstrate that an increase in the penetration of services provided by foreign companies creates a more competitive environment, with a positive, even if small, effect on the decrease of

[2] As an additional robustness check we have estimated our main model by including separately the WGI and the EDB indexes, to control for the possible problem of collinearity between these two variables. The results of these alternative specifications are consistent with those currently presented, excluding collinearity issues.

inflation in the non-tradeable sectors – typically more closed to international trade – in respect to the overall level of inflation in the country.

Thirdly, the GDP (PPP) per capita growth rate is positively associated with non-tradeable price inflation. Our interpretation is that buoyant demand pushes up the relative price of non-tradeables, as in 'Dutch disease'.

Table 3: Results of the OLS estimation of the impact of institutions quality changes on the relative growth of prices in non-tradeable sectors (ILO).

	(1)	(2)	(3)	(4)	(5)	(6)
		ALL COUNTRIES			LICs and LMICs	
WGI index	-0.111***	-0.113***	-0.121***	-0.146***	-0.144***	-0.206***
	(0.0287)	(0.028)	(0.0338)	(0.0504)	(0.0513)	(0.0641)
EDB index	0.0005	0.0007	0.0007	0.001	0.001	0.0008
	(0.0008)	(0.0008)	(0.001)	(0.001)	(0.001)	(0.001)
Unempl.	0.015***	0.014***	0.017***	0.031***	0.031***	0.039***
	(0.004)	(0.004)	(0.004)	(0.009)	(0.009)	(0.011)
Services imports	-0.0005***	-0.0004***	-0.0004***	-0.0004**	-0.0004**	-0.0004**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
GDP capita (PPP)	0.007***	0.008***	0.015***			
	(0.001)	(0.001)	(0.001)			
Constant	-0.0003***	-0.0003**	-0.0006***	0.00001	-0.0001	-0.00005
	(0.00008)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0003)
Observations	876	876	876	429	429	429
No. countries	140	140	140	82	82	82
Year dum.	No	Yes	Yes	No	Yes	Yes

Year-country FE	No	No	Yes	No	No	Yes

Notes: Estimation based on ILO, World Bank and COMTRADE data for the period 2002–2011. The estimator used is a first-difference panel OLS with country and year fixed-effects. Robust standard errors reported in parentheses. Statistical significance levels: *** p<0.01, **<0.05, * p<0.1. The dependent variable is the growth of non-tradeables CPI (ILO), net of the general CPI in the economy. The main regressors are the growth rates of the WGI and the EDB indexes estimated using PCA. As control variables we include the growth of unemployment rate (World Bank), the increase of total imports of services (COMTRADE), and the growth of the GDP per capita in PPP (World Bank). Columns 1, 2 and 3 include all countries in our sample (complete list available in Table A1 in the appendix); columns 4, 5 and 6 report the results of the estimation for LICs and LMICs (i.e. for year 2011 are included all the countries with an income per capita below $4,035. Thresholds for the different years are available in Table A6 in the appendix).

We might expect that changes in institutional quality and the implementation of transparent and improved regulations could have a larger effect on the price of non-tradeable sectors in those least developed countries which are further away from the best practice frontier of more developed economies. For this reason, columns 4 to 6 in Table 3 present the results of our model applied only to LICs and LMICs, as defined by the World Bank.[3]

The results for the LMIC sample are consistent with the general sample, confirming the previously discussed findings. However, it is possible to notice a larger marginal effect of an improvement of governance quality on the growth of the net CPI for the non-tradeable sectors in these poorer countries. Here, a 1% increase in the quality of institutions measured by the WGI index produces a decrease in relative price inflation for non-tradeable goods of 20%, compared to the 12% measured for the general sample. This may mean that that the prices of non-tradeables are more sensitive to governance quality in countries which are farther from the frontier of quality institutions, or, given that we are using the WGI index as a proxy for the extent of rent-extracting institutions, it may be that the WGI is more associated with a different degree of intensity of rent-extracting institutions in the ranges experienced in LICs and LMICs, compared with low and truncated levels of rent-extracting institutions in richer countries with higher WGI scores. The latter is more consistent with our hypothesis. Either way, the implication is that it might be particularly beneficial for poorer countries to improve governance in order to fight rent extraction. The first-round effect seems to be to moderate the inflation of prices in non-tradeable sectors for final consumers and intermediate customers.

3 At the beginning of our sample period in 2002 the World Bank defined as LICs and LMICs all countries with an income per capita below $2,395. In 2011 the threshold for LMICs increased to $4,035.

Table 4: Impact of institutions' quality changes on the relative growth of prices in non-tradeable sectors (ILO) across countries' income distribution.

	(1)	(2)	(3)	(4)
Income category	*LICs*	*LMICs*	*UMICs*	*HICs*
WGI index	0.0184	-0.228**	0.0115	0.003
	(0.0323)	(0.109)	(0.0359)	(0.0241)
EDB index	-0.0025*	0.002	-0.0001	0.0007
	(0.0014)	(0.002)	(0.0008)	(0.0009)
Unemployment	-0.003	0.0267*	-0.003	-0.002
	(0.0116)	(0.0149)	(0.002)	(0.004)
Services imports	-0.00001	-0.009***	-0.0005*	0.0003
	(0.00007)	(0.001)	(0.0002)	(0.0003)
Constant	0.0001	0.0009*	0.0003**	0.0002*
	(0.0001)	(0.0005)	(0.0001)	(0.0001)
Observations	191	238	166	284
No. countries	38	55	44	44
Diff.	Yes	Yes	Yes	Yes
Year-country FE	Yes	Yes	Yes	Yes

Notes: Estimation based on ILO, World Bank and COMTRADE data for the period 2002–2011. The estimator used is a first-difference panel OLS with country and year fixed-effects. Robust standard errors reported in parentheses. Statistical significance levels: *** p<0.01, **<0.05, * p<0.1. The dependent variable is the growth of non-tradeables CPI (ILO), net of the general CPI in the economy. The main regressors are the growth rates of the WGI and the EDB indexes, estimated using PCA. As control variables, we include the growth of the unemployment rate (World Bank), the increase of total imports of services (COMTRADE), and the growth of the GDP per capita in PPP (World Bank). Column 1 includes all LICs (i.e. income per capita below $1,025 in year 2011), column 2 reports the results for LMICs (i.e. income per capita between $1,026 and $4,035 in year 2011), column 3 for UMICs (i.e. income per capita between $4,036 and $12,475 in year 2011) and column 4 for all HICs in our sample (i.e. income per capita above $12,475 in year 2011). Complete list available in Table A1 in the appendix; thresholds for the different years available in Table A6 in the appendix.

This heterogeneous impact of institutions' quality on the growth of net CPI of non-tradeables in countries with different levels of economic development can be further examined by looking at the different effect across the distribution of countries' income per capita, in Table 4. Breaking down our analysis by income distribution, we find that the overall result of a negative and significant impact of an improvement of governance quality on the net price growth of non-tradeables is mainly driven by LMICs in the second column, with an income per capita between $1,000 and $4,000 in 2011. In this case, the effect of a catch-up has a significantly larger impact on prices of non-tradeables than for countries which are closer to the frontier of institutional best

practices, and even in respect to poorer countries. In particular, for LMICs an increase by 1% of the WGI index would lead to a 23% decrease in the net price of non-tradeable goods and services in respect to the overall level of inflation.

In the LIC group we find that the doing business index (EDB) seems to overtake the WGI index as the best proxy for extractive institutions. Table 2 shows that EDB varies more across country income groups, with some LICs exhibiting very low scores. As both EDB and WGI are both proxies for rent-extracting institutions, it is quite possible that EDB improvements at the low end of the range reflect reductions in rent-seeking institutions better than in the mid and upper ranges, whereas WGI reflects rent-seeking better in the lower-mid range.

Appendix

Table A1: List of countries included in our study and income classification in 2002 and 2011

Country	2002	2011	Country	2002	2011	Country	2002	2011	Country	2002	2011
Albania	LM	LM	Germany	H	H	Jordan	LM	UM	Pakistan	L	LM
United Arab Emirates	H	H	Denmark	H	H	Japan	H	H	Panama	UM	UM
Argentina	UM	UM	Dominican Rep	LM	UM	Kazakhstan	LM	UM	Peru	LM	UM
Armenia	LM	LM	Algeria	LM	UM	Kenya	L	L	Philippines	LM	LM
Australia	H	H	Ecuador	LM	UM	Kyrgyz Republic	L	L	Papua New Guinea	L	LM
Austria	H	H	Egypt	LM	LM	Cambodia	L	L	Poland	UM	H
Azerbaijan	L	UM	Spain	H	H	Korea, Rep.	H	H	Portugal	H	H
Burundi	L	L	Estonia	UM	H	Kuwait	H	H	Paraguay	LM	LM
Belgium	H	H	Finland	H	H	Lao PDR	L	LM	Qatar	H	H
Benin	L	L	Fiji	LM	LM	Sri Lanka	LM	LM	Russia	LM	UM
Burkina Faso	L	L	France	H	H	Lesotho	L	LM	Rwanda	L	L
Bangladesh	L	L	Gabon	UM	UM	Lithuania	UM	UM	Saudi Arabia	UM	H

Bulgaria	LM	UM	United Kingdom	H	H	Luxembourg	H	H	Senegal	L	LM
Bahrain	H	H	Georgia	L	LM	Latvia	UM	UM	Singapore	H	H
Bahamas	H	H	Ghana	L	LM	Morocco	LM	LM	Solomon Islands	L	LM
Bosnia Herzegovina	LM	UM	Guinea	L	L	Madagascar	L	L	El Salvador	LM	LM
Belarus	LM	UM	Gambia, The	L	L	Maldives	LM	UM	Serbia	..	UM
Belize	UM	LM	Guinea-Bissau	L	L	Mexico	UM	UM	Slovak Republic	UM	H
Bolivia	LM	LM	Greece	H	H	Macedonia	LM	UM	Slovenia	H	H
Brazil	LM	UM	Guatemala	LM	LM	Mali	L	L	Sweden	H	H
Brunei Darussalam	H	H	Guyana	LM	LM	Mongolia	L	LM	Swaziland	LM	LM
Botswana	UM	UM	Hong Kong	H	H	Mozambique	L	L	Chad	L	L
Central African Rep	L	L	Honduras	LM	LM	Mauritania	L	L	Togo	L	L
Canada	H	H	Croatia	UM	H	Mauritius	UM	UM	Thailand	LM	UM
Switzerland	H	H	Haiti	L	L	Malawi	L	L	Trinidad & Tobago	UM	H
Chile	UM	UM	Hungary	UM	H	Malaysia	UM	UM	Tunisia	LM	UM
China	LM	UM	Indonesia	L	LM	Namibia	LM	UM	Turkey	LM	UM
Côte d'Ivoire	L	LM	India	L	LM	Niger	L	L	Uganda	L	L

Cameroon	L	LM	Ireland	H	H	Nigeria	L	LM	Uruguay	UM	UM
Congo, Rep.	L	LM	Iran	LM	UM	Nicaragua	L	LM	United States	H	H
Colombia	LM	UM	Iraq	LM	LM	Netherlands	H	H	Venezuela	UM	UM
Cabo Verde	LM	LM	Iceland	H	H	Norway	H	H	Yemen	L	LM
Costa Rica	UM	UM	Israel	H	H	Nepal	L	L	South Africa	LM	UM
Cyprus	H	H	Italy	H	H	New Zealand	H	H	Zambia	L	LM
Czech Republic	UM	H	Jamaica	LM	UM	Oman	UM	H	Zimbabwe	L	L

Notes: Thresholds for 2002: low-income country (L), below $735; low-middle income country (LM), between $736 and $2,935; upper middle-income country (UM), between $2,936 and $9,075; high-income country (H), above $9,075. Thresholds for 2011: low-income country (L), below $1,025 USD; low middle-income country (LM), between $1,026 and $4,035; upper middle-income country (UM), between $4,036 and $12,475; high-income country (H), above $12,475. Thresholds for the different years available in Table A6 in the appendix.

Table A2: PCA for WGI index and the EDB index

WGI index		EDB index	
Eigenvalue	5.0845	*Eigenvalue*	4.6623
Difference	4.6643	*Difference*	3.6014
Proportion	0.8474	*Proportion*	0.4662
Cumulative	0.8474	*Cumulative*	0.4662
Corruption control	0.4230	*Start business*	0.3405
Government eff.	0.4247	*Construction permits*	0.2435
Political stability	0.3623	*Get electricity*	0.3078
Regulatory quality	0.4137	*Registration PR*	0.2990
Rule of law	0.4323	*Get credit*	0.3232
Voce and acc.	0.3891	*Protection invest.*	0.3331
		Pay taxes	0.3083
		Trading	0.3355
		Contract enforc.	0.3105
		Resolve insolvencies	0.3481

Notes: Estimation of the WGI and the EDB indexes, applying a PCA to the World Bank data for the period 2002–2011.

Table A3: Correlation matrix for the main variables used in the study

	Net NT CPI (ILO)	Net NT CPI (ALL)	WGI index	EDB index	Unempl.	Service imports	GDP cap. (PPP)
Net NT CPI-ILO	1						
Net NT CPI-ALL	0.5631	1					
WGI index	-0.0333	-0.0052	1				
EDB index	-0.0107	0.0450	0.7724	1			
Unemployment	0.0539	0.0209	-0.1290	-0.0664	1		
Service imports	0.0105	-0.0746	0.6214	0.6093	-0.2120	1	
GDP capita-PPP	0.0347	-0.0176	0.7673	0.7761	-0.0877	0.7380	1

Table A4: Results of the OLS estimation of the impact of institutions quality changes on the net growth of prices in non-tradeable sectors (ILO+World Bank)

	(1)	(2)	(3)	(4)	(5)	(6)
		ALL COUNTRIES			LMICs	
WGI index	-0.0948***	-0.0918***	-0.0987***	-0.184***	-0.186***	-0.201***
	(0.0310)	(0.0311)	(0.0316)	(0.0519)	(0.0533)	(0.0541)
EDB index	-0.00094	-0.00079	-0.0004	-0.0005	-0.0005	0.00002
	(0.00097)	(0.001)	(0.0012)	(0.00148)	(0.00157)	(0.00160)
Unempl.	0.0167***	0.0146***	0.0149***	0.0260**	0.0259**	0.0303***
	(0.00473)	(0.00479)	(0.00484)	(0.0105)	(0.0107)	(0.0108)
Services imports	-0.0005***	-0.0005***	-0.0005***	-0.0004**	-0.0004**	-0.0004**
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
GDP capita (PPP)	0.008***	0.011***	0.011***			
	(0.001)	(0.001)	(0.001)			
Constant	-0.0005***	-0.0007***	-0.0005***	-0.0002	-0.0004	-0.0001
	(0.0001)	(0.0002)	(0.0001)	(0.0003)	(0.0004)	(0.0003)
Observations	1,228	1,228	1,228	548	548	548
No. countries	146	146	146	87	87	87
Year dum.	No	Yes	Yes	No	Yes	Yes

Year-country FE	No	No	Yes	No	No	Yes

Notes: Estimation based on ILO, World Bank and COMTRADE data for the period 2002–2011. The estimator used is a first-difference panel OLS with country and year fixed-effects. Robust standard errors reported in parentheses. Statistical significance levels: *** p<0.01, **<0.05, * p<0.1. The dependent variable is the growth of non-tradeables CPI (ILO+World Bank), net of the general CPI in the economy. The main regressors are the growth rates of the WGI and the EDB indexes, estimated using PCA. As control variables we include the growth of the unemployment rate (World Bank), the increase of total imports of services (COMTRADE), and the growth of the GDP per capita in PPP (World Bank). Columns 1, 2 and 3 include all countries in our sample (complete list available in Table A1 in the appendix); columns 4, 5 and 6 report the results of the estimation for LICs and LMICs (i.e. for year 2011 are included all the countries with an income per capita below $4,035. Thresholds for the different years available in Table A6 in the appendix).

Table A5: Impact of institutions' quality changes on the net growth of prices in non-tradeable sectors (ILO+World Bank) across countries' income distribution

	(1)	(2)	(3)	(4)
Income category	*LICs*	*LMICs*	*UMICs*	*HICs*
WGI index	-0.0470	-0.213**	0.142	-0.0021
	(0.0382)	(0.102)	(0.0845)	(0.0287)
EDB index	0.002*	0.001	-0.004	0.001
	(0.001)	(0.002)	(0.003)	(0.001)
Unemployment	-0.0050	0.0226	-0.002	0.003
	(0.0154)	(0.0141)	(0.008)	(0.004)
Services imports	-0.00004	-0.008***	-0.001**	0.0001
	(0.0001)	(0.001)	(0.0008)	(0.0003)
Constant	0.0001	0.0003	0.001*	0.0001
	(0.0002)	(0.0005)	(0.0005)	(0.0001)

Observations	257	291	244	439
No. countries	43	59	47	50
Diff.	Yes	Yes	Yes	Yes
Year-country FE	Yes	Yes	Yes	Yes

Notes: Estimation based on ILO, World Bank and COMTRADE data for the period 2002–2011. The estimator used is a first-difference panel OLS with country and year fixed-effects. Robust standard errors reported in parentheses. Statistical significance levels: *** p<0.01, **<0.05, * p<0.1. The dependent variable is the growth of non-tradeables CPI (ILO+World Bank), net of the general CPI in the economy. The main regressors are the growth rates of the WGI and the EDB indexes, estimated using PCA. As control variables we include the growth of unemployment rate (World Bank), the increase of total imports of services (COMTRADE), and the growth of the GDP per capita in PPP (World Bank). Column 1 includes all LICs (i.e. income per capita below $1,025 in year 2011), column 2 reports the results for LMICs (i.e. income per capita between $1,026 and $4,035 in year 2011), column 3 for UMICs (i.e. income per capita between $4,036 and $12,475 in year 2011) and column 4 for all HICs in our sample (i.e. income per capita above $12,475 in year 2011). Complete list available in Table A1 in the appendix; thresholds for the different years available in Table A6 in the appendix.

Table A6: World Bank GDP per capita analytical classification for the period 2002–2011.

Year	2002	2003	2004	2005	2006
LIC	<= 735	<= 765	<= 825	<= 875	<= 905
LMIC	736-2,935	766-3,035	826-3,255	876-3,465	906-3,595
UMIC	2,936-9,075	3,036-9,385	3,256-10,065	3,466-10,725	3,596-11,115
HIC	> 9,075	> 9,385	> 10,065	> 10,725	> 11,115
Year	2007	2008	2009	2010	2011
LIC	<= 935	<= 975	<= 995	<= 1,005	<= 1,025
LMIC	936-3,705	976-3,855	996-3,945	1,006-3,975	1,026-4,035
UMIC	3,706-11,455	3,856-11,905	3,946-12,195	3,976-12,275	4,036-12,475
HIC	> 11,455	> 11,905	> 12,195	> 12,275	> 12,475

Source: World Bank.

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A4 Non-tradeable prices and urban wages

Annex 4 builds on Annex 3. The driving assumption is that non-tradeables are important wage goods, especially for urban workers. That is, LICs' (in particular) own-account production helps to set a reserve real wage based on rural living standards, such that nominal wages will be higher in urban areas where lots more goods and services need to be purchased rather than self-produced. The hypothesis investigated, then, is that non-tradeable price inflation raises urban wages more than general inflation. Of course, non-tradeable prices and basic wages are endogenous – wages are an important cost in the production of non-tradeables. Therefore, we instrument non-tradeable prices using the governance indicators from Annex 3. Effectively, then, this annex looks at the impact of extractive institutions on basic urban wages *via* non-tradeable prices.

Data and summary statistics

Data on the prices in the non-tradeable sectors, and on wages and compositions of local labour markets, for different countries have been mostly gathered from the ILO data centre. The ILO provides comparable longitudinal data for most of the countries in the world regarding CPIs, country profiles, labour migration, labour force skills, employment and wages by employment category, gender, industry and region from 1970 to 2015. Thanks to these comprehensive data, we first create time series on the evolution of prices in the non-tradeable sectors using CPIs. The ILO database provides estimated time series for the CPIs for different sectors between 1970 and 2011 for almost 224 countries, covering the non-tradeable industries of electricity, gas and water supply, housing rents, and miscellaneous other services sectors.

These CPI indexes measure changes in the price level of baskets of non-tradeable goods and services purchased by households, and are weighted in order to reflect their shares in total consumer expenditures. CPIs are indexed to a base year set equal to 100 in order to easily compare the increase in the price of goods and services across different time periods and countries. The resulting consumer price index for non-tradeable goods using the ILO data is an average of the CPIs for the electricity, gas and water supply industry, the housing sector, and miscellaneous other services sectors. We then calculate the net non-tradeable price index by taking the difference between the general CPI and the price index for the non-tradeable sectors. In this way, we identify the additional cost of non-tradeable goods and services in respect to the general level of prices, thus evaluating the evolution of prices in the non-tradeable sectors net of the general level of inflation in each country.

Secondly, we build different measures of wages by industry, classification and country using the ILO estimates. This database provides information on wages and employment distribution for almost 75 countries between 2000 and 2015, among which almost 30 are LICs and LMICs. The main variables of interest in this database are the mean nominal earnings of employees by sex, economic activity or occupation provided in local currency. Thus, we have proceeded first by converting these figures

from local currency into standardised international dollar values by using the World Bank PPP rates of currency conversion that equalise the purchasing power of different currencies by eliminating the differences in price levels between countries, using 2005 as a base year. Following this approach, we have been able to estimate real wages which are comparable across different countries and time periods, differentiating between manufacturing, services and the agriculture sectors, distinguishing between urban and rural wages, and finally estimating the different mean wages for the formal and the informal sectors[4].

This kind of disaggregation is particularly relevant for our analysis. First, it will give us the opportunity to look at both the direct and indirect impact of non-tradeable prices growth on the labour costs of tradeable (manufacturing) and non-tradeable sectors (agriculture[5] and services). Secondly, we will be able to distinguish between the effect of non-tradeable prices on wages in urban versus rural areas, and to look at the possible different impact it might have on the formal and informal economy – particularly in least developed and developing countries. As a matter of fact, urban and informal wages might be more affected by an increase in the price of non-tradeable goods. First, especially in LICs with a very high rate of employment in agriculture, smallholder agriculture sets a reservation wage, and food, shelter and other goods and services are usually exchanged intra-family. In urban areas, by contrast, the waged workforce need to acquire food, shelter and everything else in the market, thus the prices of non-tradeable goods should have a larger impact on the reservation wage – the minimum wage at which workers are incentivised to leave smallholder agriculture and to get waged jobs. Secondly, the relevance of informal employment and grey labour markets in non-tradeable sectors – especially in developing countries (i.e. street vendors, provision of micro-scale consumer services, constructions, etc.).

[4] The informal sector is the part of an economy that is neither taxed nor monitored by any form of government.

[5] We include the agriculture sector in the non-tradeable category since, especially in many developing countries, agriculture production is mainly intended as a mean of self-sufficiency and, more generally, it is mostly intended for local production and consumption, registering very low rates of trade and industry agglomeration (Christiansen et al. 2010; Mano and Castillo 2015).

Table 1: Pairwise correlation coefficients and significance (at 10% level) between sectoral wages, relative non-tradeable price index and institutions' quality.

	General	Urban	Rural	Informal	Service	Ser. inf.	Agri	Agri inf.	Rel.NT-CPI	WGI	EDB
General	1										
Urban	0.9805*	1									
Rural	0.8997*	0.8387*	1								
Informal	0.9330*	0.9087*	0.8608*	1							
Service	0.9497*	0.9527*	0.8828*	0.8865*	1						
Service inf.	0.8997*	0.8458*	0.8188*	0.9506*	0.9574*	1					
Agri	0.9624*	0.9318*	0.8586*	0.7774*	0.9591*	0.8429*	1				
Agri inf.	0.8121*	0.7895*	0.7585*	0.8850*	0.8661*	0.9445*	0.9440*	1			
Rel. NT CPI	0.0135	0.1037*	0.0775	0.1391*	0.0499	0.0418	0.0134	0.2729*	1		
WGI ind.	0.2499*	0.2627*	0.1194*	0.0652	0.1433*	0.0189	0.1917*	0.1229*	-0.064*	1	
EDB-DTF	0.3286*	0.2964*	0.2542*	0.2990*	0.2113*	0.2080*	0.2501*	0.2914*	-0.0087	0.7521*	1

Table 1 presents the pairwise correlation coefficients and their significance at the 10% level between the main sectoral wages, differentiating between urban, rural, service, agriculture, and informal sectors, the relative non-tradeable price index and two measures of institutions' quality – the WGI index and the EDB, calculated using World Bank data, as explained in a previous OPM report[6]. First, it is possible to notice a strong a significant correlation between the general level of wages in a country and its different components – being particularly strong between the general level and wages in urban areas. Secondly, we find a significant positive correlation between the relative price of non-tradeable goods and the level of wages in urban areas, in the informal sector and in informal occupations in the agricultural sector. In addition, the institutions' quality variables seem to be significantly correlated with most of the level of wages, suggesting a possible relationship between governance quality, the ease of doing business, and the level of wages in some sectors. Finally, as demonstrated by the previous OPM report, we find a negative and significant correlation between the quality of governance and the relative price of non-tradeables.

[6] Following the OPM report by Vanino and Lee (2017), to measure institutions' quality we rely on two databases provided by the World Bank. First, the WGI project reports individual governance indicators for over 200 countries over the period 1996–2015, including six different dimensions of governance, such as voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. Secondly, the EDB project provides measures of business regulations and their enforcement across 190 economies between 2002 and 2015. This database compares the evolution of business environments in each country in terms of ease of starting a new business, getting construction permits, electricity access, registering property rights, getting credit, protecting minorities, paying taxes, trading across borders, enforcing contracts, and resolving insolvencies. Given the high correlation between the variables included in the two datasets, we use PCA to create two indicators of institutions' quality, one for each database, which are linearly uncorrelated and account for as much of the variability in the two datasets as possible. This results in two new indicators of governance quality and ease of doing business for each country-year based on the original underlying data. Each index statistically summarises the underlying data contained in the original datasets, weighting each single original indicator according to the additional variability and extra information provided in respect to the other indicators already included.

Table 2: Average growth rate of the main variables in high middle-income countries (HMICs) and in LMICs between 2002 and 2015.

	HMICs		LMICs	
	Obs.	Growth rate	Obs.	Growth rate
General wage	641	2.20%	331	5.28%
Urban wage	406	-1.64%	102	3.12%
Rural wage	398	-0.19%	102	5.88%
Informal wage	125	-9.35%	201	7.40%
Service wage	790	3.50%	312	2.59%
Service Inf. wage	137	-13.60%	208	4.04%
Agriculture wage	535	1.83%	269	3.87%
Agri. inf. wage	112	-3.59%	177	6.44%
Rel. NT CPI	4568	-0.010%	1785	0.027%
WGI index	1690	0.003%	1715	0.007%
EDB index	1239	1.00%	1270	2.64%

Table 2 reports instead the average growth rate in HMICs and in LMICs of the level of wages by sector and category, the relative price of non-tradeable sectors, and the change in the institutions' quality variables[7]. Overall, it is possible to notice opposite trends in some of the main variables for LMICs and HMICs. Generally, we can notice a stronger growth in real wages in LMICs in respect to richer countries, mainly driven by a strong growth in the wages of rural areas and particularly relevant in the informal sector, which experienced growth by 7.40%, especially for informal workers in the agricultural sector (which increased by 6.44%). By contrast, real wages registered a weaker growth in developed countries, where employees in the manufacturing sector have been especially negatively affected. Real wages in the service and agricultural sectors have slightly grown during this period, driving a weak general growth in salaries, by almost 2.2%. However, it is possible to notice a sharp decrease in the level of real wages in the informal sector, especially in the service sector, where wages decreased by more than 13%, most probably because of a drastic reduction in the overall weight of informal jobs and unregulated markets in middle-income countries and HICs. Moreover, trends have also differed between LICs and HICs countries in terms of institutions' quality and prices of non-tradeable goods. In fact, despite a weak improvement in institutions' quality, LMICs have experienced an increase in the relative cost of non-tradeable goods. By contrast, institutions' quality in HMICs has increased

[7] According to the World Bank countries are considered as LMICs if they register an income per capita in 2011 below $4,035. Countries are considered as HMICs if they have an income per capita above $4,036 in 2011 (thresholds for all the different years available in Table A1 in the appendix).

at a slower pace than in less developed countries, but the relative cost of non-tradeable goods in respect to the overall level of inflation has decreased in these countries, probably due to the opening up of traditionally closed service sectors to both domestic and foreign new competitors.

Methodology

To identify the relationship between the quality of institutions in a country and the net cost of non-tradeable goods while controlling for time-variant and country-specific idiosyncratic effects we decide to estimate an econometric model using a simple OLS technique. Our final aim is to precisely identify the effect of a change in institutions' quality on the rent generation resulting from increases in the price of non-tradeable goods. In particular, we wish to estimate how an improvement in institutions, governance and business regulations quality affects the growth of prices in non-tradeable sectors, net of the overall rate of inflation. Thanks to our data, it is possible to measure the dynamic evolution of institutions' quality in each country using the WGI and EDB indexes, and to identify their impact on the additional growth of non-tradeables prices in respect to the overall level of inflation rate using the net CPI for non-tradeables.

To better identify the relationship connecting real wages, price of non-tradeable goods and the quality of institutions, we implement the following system of equations, in which we first try to estimate the impact of institutions on the generation of rents in non-tradeable sectors before estimating the impact of non-tradeable prices on the different categories of real wages:

$$\Delta CPI\_NT_{ct} = \beta_0 + \beta_1 \Delta WGI_{ct} + \beta_2 \Delta EDB_{ct} + \beta_3 \Delta PERF_{ct} + j_c + j_t + \varepsilon_{ct} \qquad (1)$$

$$\Delta RW_{ct} = \beta_0 + \beta_1 \Delta \overline{CPI\_NT_{ct}} + \beta_2 \Delta PERF_{ct} + j_c + j_t + \varepsilon_{ct} \qquad (2)$$

In the first stage of our model we follow the previous OPM report by Vanino and Lee (2017) estimating the impact of institutions' quality on the relative price in non-tradeable sectors $\Delta CPI_{NT\,ct}$. The key explanatory variables, ΔWGI_{ct} and ΔEDB_{ct}, are the two growth rates of the measures of institutions' quality built with the PCA, describing the evolution of the WGI index and the EDB index for each country across our time period. In addition, we control for time-variant and country-specific characteristics, including several measures of country economic performance and factors which could affect the additional growth of the relative price of non-tradeables, such as the GDP per capita growth in PPP from the World Bank, the unemployment rate obtained from the ILO database, and the growth of imports of services from abroad obtained from the COMTRADE database, and we finally include year and country fixed-effects j_c and j_t.

In the second step of our estimation we look at the relationship between the relative price of non-tradeable goods and the growth of real wages across different sectors, ΔRW_{ct}. Specifically, we will look at the effect on real wages in urban and rural areas, differentiating between manufacturing, service and agricultural sectors, and considering also the impact on wages for informal jobs. To achieve this, we instrument the relative price of non-tradeables with the linear prediction of the first-stage equation $\Delta \overline{CPI\_NT_{ct}}$, in order to take into account the overall impact of improvements in the quality of institutions on the growth of the relative price of non-tradeables in respect to

the overall level of prices in a country. In addition, we control for several dynamic country-specific characteristics, including different measures of factors which could potentially affect the growth of real wages in a country, such as the GDP per capita growth in PPP from the World Bank, the sector employment rate obtained from the ILO database, the sectoral labour productivity, calculated as added value per employee, an indicator of social and labour protection in each country, and finally year and country fixed-effects j_c and j_t.

By estimating this system of equations model, we will be able to precisely identify the relationship between institutions' quality, rent generation resulting from the growth of prices in non-tradeable sectors and the growth of real wages across different sectors and areas. In addition, the country-sector specific control variables, together with the country-year fixed-effects, will make our estimation more precise by taking into account the unobserved heterogeneity in terms of economic performance, level of development, dynamic trends, and other country-specific characteristics which might affect the level of non-tradeable prices and real wages.

Results and discussion

We base our main empirical analysis on the CPI data for non-tradeable goods and on the real wages by sectors provided by the ILO, in addition to the World Bank data on government and institutions' quality. Table 3 illustrates the complete results of our system of equations for the general sample of countries, providing the results of the first stage in the first column on the effect of institutions' quality on the price of non-tradeables, and then in the following columns reporting the estimations of the second stages considering the impact of non-tradeables' prices on general real wages, differentiating between wages in urban and rural areas, and wages in service and agricultural sectors, and finally looking at the impact for the informal sectors.

Table 3: Results of the system of equations model on the relationship between impact of institutions' quality, relative prices of non-tradeables and sectoral real wages sectors.

General	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Rel.NT CPI	General	Urban	Rural	Informal	Service	Serv. inf.	Agri.	Agri. inf.
WGI index	-0.008***								
	(0.0032)								
EDB index	0.00001								
	(0.0002)								
Unemployment	0.0009								
	(0.0007)								
Import service	-0.0005**								
	(0.0002)								
GDP per cap.	0.0001***								
	(0.00006)								
Rel. NT CPI		1.418**	1.843*	1.932	1.588	1.307**	1.324	0.6926	0.1988
		(0.6579)	(0.9615)	(1.032)	(0.852)	(0.7269)	(1.185)	(0.7219)	(0.8256)
Inflation		0.0512***	0.0438***	0.0330**	0.0153*	0.0209*	0.0740***	0.0320**	0.0110

		(0.0103)	(0.0135)	(0.0144)	(0.0076)	(0.0121)	(0.0215)	(0.0124)	(0.0157)
GDP growth		0.0434**	0.0974***	0.0188	0.0760**	0.00909	0.0269	0.0398*	-0.0331
		(0.0189)	(0.0263)	(0.0277)	(0.0327)	(0.0216)	(0.0392)	(0.0212)	(0.0270)
Employm. rate		-0.170***	-0.167***	-0.170***	-0.235***	-0.169***	-0.231**	-0.275***	-0.342***
		(0.0446)	(0.0603)	(0.0628)	(0.0759)	(0.0510)	(0.0931)	(0.0523)	(0.0644)
Lab. Protection		0.00815	0.0523***	0.00443	0.0535	0.0521***	0.0177	0.0295	0.0137
		(0.0307)	(0.0194)	(0.0375)	(0.0349)	(0.0179)	(0.0326)	(0.0203)	(0.0262)
Lab. prod.		0.0736**	0.0358**	0.0311	0.0404	0.0772*	-0.0180	-0.0145	-0.0116
		(0.0287)	(0.0150)	(0.0418)	(0.0253)	(0.0464)	(0.0481)	(0.0645)	(0.0267)
Observations	1,049	687	435	426	249	758	254	562	222
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Estimation based on ILO, World Bank and COMTRADE data for the period 2002–2015. The estimator used is a panel OLS with country and year fixed-effects. Robust standard errors reported in parentheses. Statistical significance levels: *** p<0.01, **<0.05, * p<0.1. Column 1 reports the first stage of our system of equations, in which the dependent variable is the growth of non-tradeables CPI (ILO), net of the general CPI in the economy. Columns 2 to 9 report the second stages, in which the dependent variables are the general level of real wages in the economy, real wages in urban and rural areas, wages in the informal sector, real wages in the service and agricultural sectors, and finally real wages for informal workers in the service and agricultural sectors, all provided by the ILO. In the second stages, the relative growth of non-tradeable prices has been instrumented with the predicted values of the impact of institutions on non-tradeable prices estimated in the first stage

Column 1 presents the results of the first stage of our system of equations, in which we first estimate the relationship between institutions' quality and the growth of non-tradeable prices. The results are in line with the previous OPM report by Vanino and Lee (2017), finding a negative impact of an increase in the quality of governance in a country on the additional growth of non-tradeable prices, net of general inflation. This negative and significant impact indicates that an improvement in the quality of governance leads to a decrease in the prices of the services sectors, which are usually less exposed to foreign competition and more prone to the generation of rents. However, an improvement in business regulations does not seem to affect the net rate of CPI in non-tradeable sectors. The results also confirm the negative and significant impact of service imports growth on the net growth of CPI of non-tradeable sectors, demonstrating that an increase in the penetration of services provided by foreign companies creates a more competitive environment, with a positive, even if small, effect on the decrease of inflation in the non-tradeable sectors – typically more closed to international trade – in respect to the overall level of inflation in the country.

Table 4: Results of the system of equations model on the relationship between impact of institutions' quality, relative prices of non-tradeable and sectoral real wages sectors in LMICs

LMIC	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Rel.NT CPI	General	Urban	Rural	Informal	Service	Serv. inf.	Agri.	Agri. inf.
WGI index	-0.029***								
	(0.00794)								
EDB index	-0.000151								
	(0.000463)								
Unemployment	0.00134								
	(0.00126)								
Import service	-0.0005**								
	(0.00005)								

GDP per cap.	0.0003***								
	(0.00014)								
Rel. NT CPI		0.8109*	2.225*	-1.284	1.106*	1.003	1.499*	-0.6183	0.6021
		(0.4188)	(1.241)	(1.301)	(0.6462)	(0.7815)	(0.8499)	(0.6483)	(0.6348)
Inflation		0.0386***	0.0294**	-0.0179	0.0838***	0.0535**	0.114***	-0.00762	0.0352
		(0.0194)	(0.0126)	(0.0311)	(0.0234)	(0.0260)	(0.0287)	(0.0225)	(0.0226)
GDP growth		0.00425	0.103*	-0.0690	0.0920**	0.0298	0.0408	0.000740	-0.0477
		(0.0293)	(0.0523)	(0.0499)	(0.0364)	(0.0370)	(0.0477)	(0.0302)	(0.0343)
Employm. rate		-0.267***	-0.648***	-0.661***	-0.436***	-0.314***	-0.563***	-0.368***	-0.549***
		(0.0803)	(0.141)	(0.135)	(0.0893)	(0.105)	(0.125)	(0.0842)	(0.0885)
Lab. protection		0.0265	0.0353**	-0.0012	0.0335	0.0480***	0.0863	0.0209	-0.0173
		(0.0172)	(0.0182)	(0.0191)	(0.0277)	(0.016)	(0.0688)	(0.0183)	(0.0325)
Lab. productivity		-0.0255	0.0878***	0.0736***	0.00434	7.284***	-4.454	2.686***	-1.621*
		(0.0197)	(0.0275)	(0.0287)	(0.0321)	(1.472)	(3.929)	(0.65)	(0.932)

Observations	520	198	80	80	142	188	138	167	120
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: LMICs considered according to the World Bank countries if register an income per capita in 2011 below $4,035. Estimation based on ILO, World Bank and COMTRADE data for the period 2002–2015. The estimator used is a panel OLS, with country and year fixed-effects. Robust standard errors reported in parentheses. Statistical significance levels: *** p<0.01, **<0.05, * p<0.1. Column 1 reports the first stage of our system of equations, in which the dependent variable is the growth of non-tradeables CPI (ILO), net of the general CPI in the economy. Columns 2 to 9 reports the second stages, in which the dependent variables are the general level of real wages in the economy, real wages in urban and rural areas, wages in the informal sector, real wages in the service and agricultural sectors, and finally real wages for informal workers in the service and agricultural sectors, all provided by the ILO. In the second stages, the relative growth of non-tradeable prices has been instrumented with the predicted values of the impact of institutions on non-tradeable prices estimated in the first stage.

Columns 2 to 9 report the second stages, in which we instrument the relative growth of non-tradeable prices with the predicted values of the impact of institutions on non-tradeable prices estimated in the first stage, before estimating its impact on the general level of real wages in the economy, real wages in urban and rural areas, wages in the informal sector, real wages in the service and agricultural sectors, and finally real wages for informal workers in the service and agricultural sectors. In addition, to include time and country fixed-effects, we include several control variables which could affect the level of real wages in a country, such as the general level of inflation, the GDP growth, the sectoral employment rate, and labour productivity, and an index of labour and social protection. It is possible to notice that, after controlling for the effect of institutions' quality, an increase in the relative price of non-tradeable goods significantly increases the labour cost in the overall economy, generally increasing real wages across countries. In particular, from columns 3 and 6 we can infer that this effect is mainly driven by the impact of non-tradeable prices on the real wages of workers in urban areas, and in particular in the services sector. This evidence corroborates the prediction that non-tradeable prices are much more relevant in urban areas, where the waged workforce need to acquire food and services in the market, depending mainly on non-tradeable sectors, thus with a larger impact on the reservation wage. At the same time, the results highlight a strong and significant relationship between prices and wages in the service sectors, the main providers of non-tradeable goods.

Table 4 focuses on the results of the system of equations, looking at the relationship between institutions' quality, relative prices of non-tradeable and sectoral real wages sectors in LMICs. We focus on less developed countries, where the quality of institutions is lower and the generation of rents in non-tradeable sectors is more likely, as stressed in the previous OPM report by Vanino and Lee (2017), and where the impact on real wages might be more significant than in developed countries, where strong institutions and competition prevent the creation of distorted rents. The results from the first stage in column 1 are consistent with the previous evidence, with a slightly larger negative marginal effect of governance quality on the relative price of non-tradeables. The estimations of the second stages are generally consistent with the results highlighted in Table 3 for the general sample of countries, with a significant and positive relationship between the cost of non-tradeable goods and the real wages in the overall economy of least developed countries. Again, one of the main drivers of this relationship is the effect on real wages in urban areas. However, it is possible to notice from columns 5 and 7 the predominant effect of relative prices of non-tradeable goods on the growth of wages in the informal sector, especially for informal workers in the service sectors. As previously stressed, informal employment and grey labour markets are particularly relevant in developing countries, especially for non-tradeable sectors, where most of the workforce providing small-scale services, such as street vendors, provision of consumer services, construction, etc. are not structured in institutionalised labour markets. The wages of these categories might be more exposed to the variation of non-tradeable prices, both as consumers and suppliers of non-tradeable goods, with direct consequences for the reservation wage, especially in informal service sectors.

Appendix

Table A1: List of countries included in our study and income classification in 2002 and 2011.

Country	2002	2011	Country	2002	2011	Country	2002	2011	Country	2002	2011
Albania	LM	LM	Germany	H	H	Jordan	LM	UM	Pakistan	L	LM
United Arab Emirates	H	H	Denmark	H	H	Japan	H	H	Panama	UM	UM
Argentina	UM	UM	Dominican Rep	LM	UM	Kazakhstan	LM	UM	Peru	LM	UM
Armenia	LM	LM	Algeria	LM	UM	Kenya	L	L	Philippines	LM	LM
Australia	H	H	Ecuador	LM	UM	Kyrgyz Republic	L	L	Papua New Guinea	L	LM
Austria	H	H	Egypt	LM	LM	Cambodia	L	L	Poland	UM	H
Azerbaijan	L	UM	Spain	H	H	Korea, Rep.	H	H	Portugal	H	H

Burundi	L	L	Estonia	UM	H	Kuwait	H	H	Paraguay	LM	LM
Belgium	H	H	Finland	H	H	Lao PDR	L	LM	Qatar	H	H
Benin	L	L	Fiji	LM	LM	Sri Lanka	LM	LM	Russia	LM	UM
Burkina Faso	L	L	France	H	H	Lesotho	L	LM	Rwanda	L	L
Bangladesh	L	L	Gabon	UM	UM	Lithuania	UM	UM	Saudi Arabia	UM	H
Bulgaria	LM	UM	United Kingdom	H	H	Luxembourg	H	H	Senegal	L	LM
Bahrain	H	H	Georgia	L	LM	Latvia	UM	UM	Singapore	H	H
Bahamas	H	H	Ghana	L	LM	Morocco	LM	LM	Solomon Islands	L	LM
Bosnia Herzegovina	LM	UM	Guinea	L	L	Madagascar	L	L	El Salvador	LM	LM

Belarus	LM	UM	Gambia, The	L	L	Maldives	LM	UM	Serbia	..	UM
Belize	UM	LM	Guinea-Bissau	L	L	Mexico	UM	UM	Slovak Republic	UM	H
Bolivia	LM	LM	Greece	H	H	Macedonia	LM	UM	Slovenia	H	H
Brazil	LM	UM	Guatemala	LM	LM	Mali	L	L	Sweden	H	H
Brunei Darussalam	H	H	Guyana	LM	LM	Mongolia	L	LM	Swaziland	LM	LM
Botswana	UM	UM	Hong Kong	H	H	Mozambique	L	L	Chad	L	L
Central African Rep	L	L	Honduras	LM	LM	Mauritania	L	L	Togo	L	L
Canada	H	H	Croatia	UM	H	Mauritius	UM	UM	Thailand	LM	UM
Switzerland	H	H	Haiti	L	L	Malawi	L	L	Trinidad & Tobago	UM	H

Chile	UM	UM	Hungary	UM	H	Malaysia	UM	UM	Tunisia	LM	UM
China	LM	UM	Indonesia	L	LM	Namibia	LM	UM	Turkey	LM	UM
Côte d'Ivoire	L	LM	India	L	LM	Niger	L	L	Uganda	L	L
Cameroon	L	LM	Ireland	H	H	Nigeria	L	LM	Uruguay	UM	UM
Congo, Rep.	L	LM	Iran	LM	UM	Nicaragua	L	LM	United States	H	H
Colombia	LM	UM	Iraq	LM	LM	Netherlands	H	H	Venezuela	UM	UM
Cabo Verde	LM	LM	Iceland	H	H	Norway	H	H	Yemen	L	LM
Costa Rica	UM	UM	Israel	H	H	Nepal	L	L	South Africa	LM	UM
Cyprus	H	H	Italy	H	H	New Zealand	H	H	Zambia	L	LM

Czech Republic	UM	H	Jamaica	LM	UM	Oman	UM	H	Zimbabwe	L	L

Notes: Thresholds for 2002: Low-income country (L), below $735; low middle-income country (LM), between $736 and $2,935; upper middle-income country (UM), between $2,936 and $9,075; high-income country (H), above $9,075. Thresholds for 2011: low-income country (L), below $1,025; low middle-income country (LM), between $1,026 and $4,035; upper middle-income country (UM), between $4,036 and $12,475; high-income country (H), above $12,475. Thresholds for the different years available in Table A6 in the appendix.

Table A2: World Bank GDP per capita analytical classification for the period 2002–2011.

Year	2002	2003	2004	2005	2006
LIC	<= 735	<= 765	<= 825	<= 875	<= 905
LMIC	736-2,935	766-3,035	826-3,255	876-3,465	906-3,595
UMIC	2,936-9,075	3,036-9,385	3,256-10,065	3,466-10,725	3,596-11,115
HIC	> 9,075	> 9,385	> 10,065	> 10,725	> 11,115
Year	2007	2008	2009	2010	2011
LIC	<= 935	<= 975	<= 995	<= 1,005	<= 1,025
LMIC	936-3,705	976-3,855	996-3,945	1,006-3,975	1,026-4,035
UMIC	3,706-11,455	3,856-11,905	3,946-12,195	3,976-12,275	4,036-12,475
HIC	> 11,455	> 11,905	> 12,195	> 12,275	> 12,475

Source: World Bank.

A5 Input-output data and the institutions-elasticity of tradeable sector costs

Annex 5 is the final part of the quantitative analysis conducted by OPM. The previous two annexes show estimates of the impact of improvements in institutional scores (which we take to indicate reductions in extractive institutions) on the relative price of non-tradeables and on wages, especially urban wages. Our observation is that non-tradeables and labour are major inputs in the production of tradeables and therefore anything that impacts on the costs of these inputs has an indirect impact on the competitiveness of tradeable sectors. To estimate the amount of impact, we look at input-output tables, which show the goods, services, and factors used in the production of broad economic sectors/industries in a large number of economies.

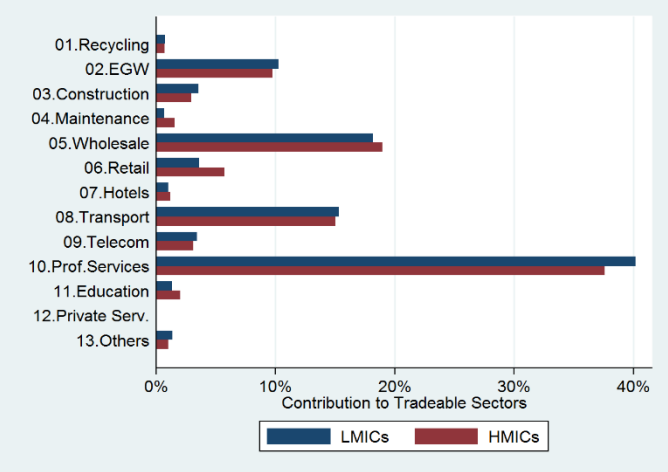
Data and methodology

We gathered data on the productive structure of tradeable and non-tradeable sectors from the EORA multi-region input-output table MRIO database. This dataset provides a time series of high-resolution input-out (IO) tables for almost 190 countries over the period 1990–2012. This is the most comprehensive input-out database available, with a high-resolution 25-sector harmonised classification, including both tradeable and non-tradeable industries.[8]

Each individual country table contains the domestic IO or SUT tables, including information about the primary input and final demand blocks, imports and exports itemised by partner, consumption and demand by industry and country, taxes, subsidies, net operative surplus, mixed income, cost of inputs of production, compensation of employees, capital investments, and added value. Thanks to these highly-disaggregated industry-to-industry data it is possible to calculate the metrics relative to the contribution of non-tradeable sectors to the production of tradeable industries and to estimate the labour content of different traded industries.

[8] The 25 sectors include: agriculture, fishing, mining, food and beverage, textiles and wearing apparel, wood and paper, petroleum, chemical and non-metallic mineral products, metal products, electrical and machinery, transport equipment, other manufacturing, recycling, electricity gas and water, construction, maintenance and repair, wholesale trade, retail trade, hotels and restaurants, transports, post and telecommunications, financial intermediation and business activities, public administration, education, health and other services, private households, and other services.

Figure 1: Contribution of each non-tradeable sector to the overall production of tradeable industries in LMICs and HMICs as a share of total inputs from non-tradeable industries.



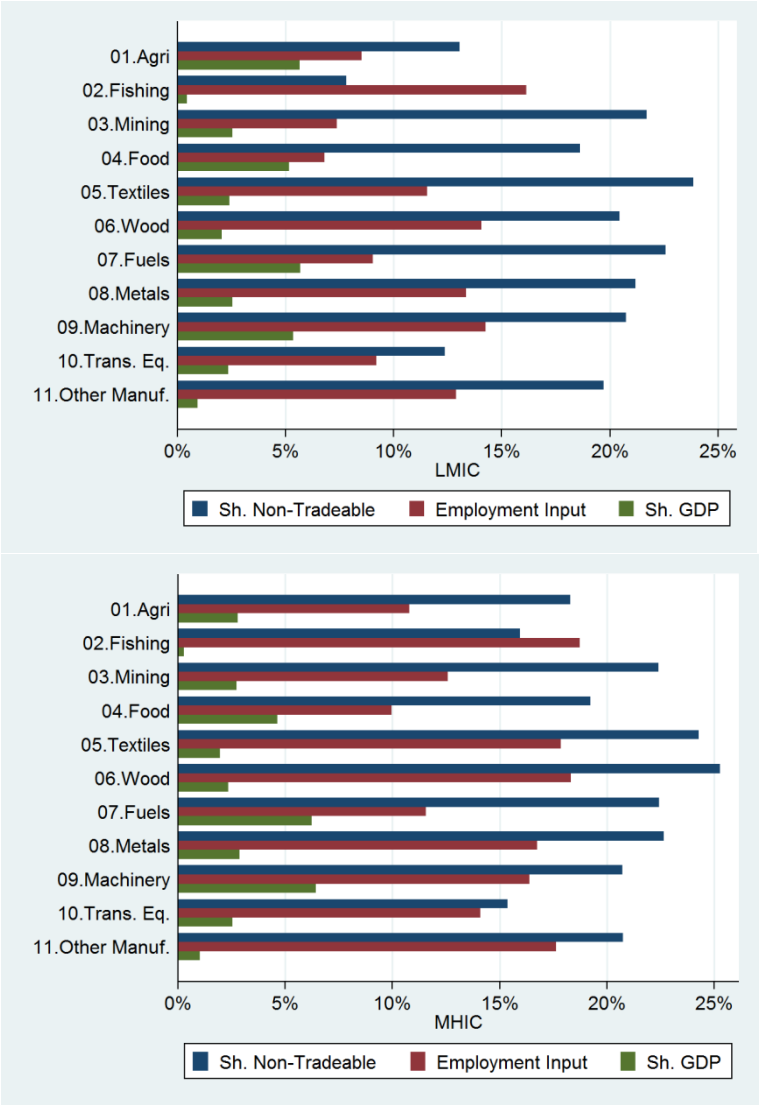
Note: Statistics based on the EORA-MRIO input-output tables over the period 2001 to 2011. LMICs and HMICs defined as in Table A2 in the appendix. Contribution to tradeable sectors measured as consumption by tradeable industries of goods and services by each non-tradeable industry over total consumption of non-tradeable inputs.

Combining together all these different databases, our final sample consists of 180 countries over the period from 2001 to 2011, of which 46 are LICs, 50 LMICs, 32 UMICs and 51 HICs[9]. Thanks to these comprehensive data, we have the possibility to analyse how the relationship between institutions' quality and the price of non-tradeable goods (as investigated in OPM note 1), and the link between non-tradeable prices and wages (analysed in OPM note 2) indirectly affect the productivity of tradeable industries, through the non-tradeable inputs and the labour content components of production.

We start our analyses by looking at the net contribution of different non-tradeable sectors to the production of tradeable industries. Thanks to the input-output tables, in fact, it is possible to estimate for each country and year the share of inputs of production used by tradeable industries that originated from non-tradeable suppliers. Figure 1 reports the contribution of each non-tradeable sector to the overall production of tradeable industries in LMICs and HMICs, as a share of their total inputs from non-tradeable industries. It is possible to notice that most of non-tradeable sectors have a larger contribution towards the production of tradeable sectors in LMICs in comparison to HMICs, showing how these sectors have a larger incidence in the overall production of tradeable goods in developing rather than mature economies. This is particularly true for the professional service industry (by far the largest contributor to tradeable goods production), the transports sector, and the suppliers of electricity, gas and water. This evidence might suggest a more intensive utilisation of these factors in the production of tradeables, but could also highlight the higher cost of these services in developing countries, thus affecting the production of tradeable goods to a larger extent.

9 Tables A1 and A2 in the appendix report the list of countries included in this study and their income per capita distribution.

Figure 2: Share of non-tradeable inputs and labour content of production of each tradeable industry (over total production) and its share of GDP in LMICs and UMICs



Note: Statistics based on the EORA-MRIO input-output tables over the period 2001 to 2011. LMICs and HMICs defined as in Table A2 in the appendix. Share of non-tradeable inputs measured as consumption by each tradeable industry of non-tradeable inputs over total consumption of inputs of production. Employment input measured as cost of labour compensation in each tradeable industry over total production in each sector. Tradeable industry share of GDP measured as industry total production over country total GDP.

Figure 2 reports instead the share of non-tradeable inputs, the labour content of production and the overall share of GDP of each tradeable industry in LMICs and UMICs. The contribution of non-tradeable inputs to the production in each tradeable industry is quite similar between LMICs and HMICs, suggesting that the industries mostly depending on non-tradeable inputs are the textile and apparel sector, the wood industry, fuels and chemicals, mining and the production of basic metals, and metal products. We focus on LMICs because we know from previous analysis that this is the

group where institutions make the most difference to the costs of non-tradeable inputs and wages.

The distribution of labour content across tradeable industries in LMICs and UMICs is less similar than the use of non-tradeable inputs – higher wages make labour a more significant input in richer countries (despite higher labour productivity).

By itself these data show that non-tradeable inputs and wages are both significant cost items for most traded sectors, so that issues which push up the costs of non-tradeables and/or wages could have a substantial impact on total costs, and therefore competitiveness of traded sector production.

Next, we estimate the magnitude of impact on traded sector competitiveness from the sorts of shift in non-tradeable and wage costs associated with movements in WGI scores.

We take the WGI as a measure of extractive institutions, and the WGI-elasticity of non-tradeable prices was estimated in Annex 3 and the WGI-elasticity of urban wages was estimated in Annex 4. Taking these estimates and the shares of non-tradeables and labour in production from the IO data shown in Figure 2 above, it is possible to estimate the WGI-elasticity of total costs in traded industry production. Table 1 shows the estimated cost reduction of a 10% improvement in WGI score based on LMIC estimates of elasticities of non-tradeable prices. From this table it is clear that most non-tradeables see a 3%–5% decrease in costs as a result of a 10% improvement in WGI score: for example, for -0.9 to -1.

These estimates are averages in a large group of countries and are driven by correlations rather than necessarily being a proven causal link. However, the purpose of reporting them here is to show that the difference in mean WGI scores in LICs compared with LMICs is between -2.1 in LICs and -1.04 in LMICs, i.e. a 50% reduction LICs to LMICs – with perhaps a 25% reduction in total production costs associated.

Table 1 Estimated reduction in total costs of traded sectors resulting from 10% improvement of WGI (LMICs)

	Via non-tradeable inputs	Via urban wages	Combined impact via non-tradeable inputs and urban wages
Agriculture	3.39%		3.39%
Fishing	0.34%		0.34%
Mining and quarrying	2.43%	2.42%	4.84%
Food and beverages	2.41%	2.09%	4.50%
Textiles and wearing Apparel	2.99%	2.13%	5.13%
Wood and paper	2.04%	2.46%	4.50%
Chemical and mineral Products	1.64%	2.09%	3.73%
Metal products	1.47%	2.27%	3.74%
Electrical and machinery	0.88%	1.70%	2.58%
Transport equipment	0.27%	1.50%	1.78%
Other manufacturing	1.31%	2.10%	3.41%