

# Informality and Competition

## Informalidad y competencia

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Recibido: 22/10/2022 - Aceptado: 01/12/2022 - Publicado: 31/12/2022

### ABSTRACT

Based upon the changes of labor productivity for the economy decomposed by sectors and activities, this paper proposes three hypotheses on the relationship between the informal sector and competition for Peruvian economy in the period 2007-2018. The first one postulates that there might exist product market segmentation between formal and informal firms. The second postulates that the effects of the PTAs on the changes of labor productivity in activities and sectors have been diverse and unclear. The last and third hypothesis postulates that labor productivity changes in Peru and its within and reallocation components have been associated with the fluctuations and the rate of growth of the GDP and the terms of trade. These associations are consistent with the primary- export structure of the Peruvian economy.

**Keywords:** Informality, labor, productivity.

**JEL Code:** E26, F13.

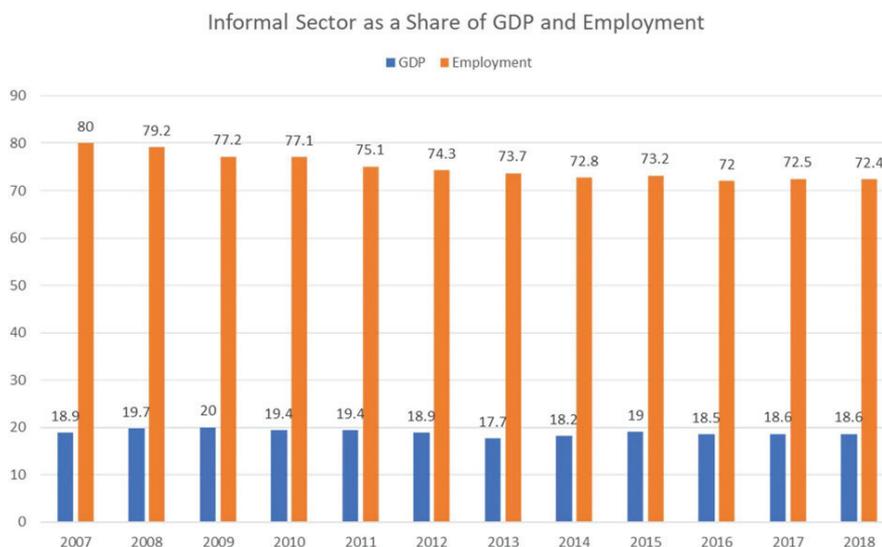
## **RESUMEN**

Basados en los cambios de la productividad laboral de la economía desglosada por sectores y actividades, este trabajo propone tres hipótesis sobre la relación entre el sector informal y la competencia para la economía peruana en el período 2007-2018. El primero postula que podría existir una segmentación del mercado de productos entre empresas formales e informales. El segundo postula que los efectos de los ACP sobre los cambios de productividad laboral en actividades y sectores han sido diversos y poco claros. La última y tercera hipótesis postula que los cambios en la productividad del trabajo en el Perú y sus componentes internos y de reasignación han estado asociados con las fluctuaciones y la tasa de crecimiento del PBI y los términos de intercambio. Estas asociaciones son consistentes con la estructura primario-exportadora de la economía peruana.

**Palabras clave:** Informalidad, mano de obra, productividad.

## Introduction

One of the development features of Peruvian economy is its large share of informal employment out of the total labor force, in average for the period 2007-2018, three out of four workers were employed in the informal sector. In contrast, informal output was close to a fifth of the total GDP. To what extent domestic and foreign competition affect informal activities is a question with no definitive answer according to the relatively scanty literature. In the case of Peru, the figure below shows a decline of informal employment share of the economy from 80% in 2007 to 72.8% in 2014. However, in the period 2014-2018, this share has remained constant around 72%. On the other hand, the informal output share has remained close to constant and around 18.6%. This meant that informal labor productivity increased throughout the period 2007-2018 as Table A6 shows. Based upon the changes of this productivity for the economy decomposed by sectors and activities, this annex section proposes three hypotheses on the relationship between the informal sector and competition for Peruvian economy in the period 2007-2018. The first one postulates that there might exist product market segmentation between formal and informal firms. The second postulates that the effects of the PTAs on the changes of labor productivity in activities and sectors have been diverse and unclear. The last and third hypothesis postulates that labor productivity changes in Peru and its within and reallocation components have been associated with the fluctuations and the rate of growth of the GDP and the terms of trade. These associations are consistent with the primary- export structure of the Peruvian economy.<sup>2</sup>

**Figure***Informal Sector as a Share of GDP and Employment*

Source: INEI (2019)

## 1. Competition and Labor Productivity of Peru by Sectors and Activities, 2007-2018

Tables 1 and 2 present the output and employment indicators of the informal activities as estimated by INEI (2019) in the period 2007-2018. In terms of GDP and employment, such activities are mainly concentrated in services, followed for the primary sector, and manufactures. Light industries and non-agricultural products dominate the supply of products of informal firms of the manufacturing sector. In this period, the trend of informal output and employment shares have been different among these three sectors. In the case of manufactures, these trends were negative for output and employment although with different rates of decline. Although labor productivity of informal activities in the three sectors increased throughout the liberalization period of 2007- 2018 (as it is shown in Table 5), except for the period 2015-2018 for the informal activities of the primary sector, labor productivity of informal producers in the non-tradable

services sector and the tradable primary sector have been higher than the respective labor productivity of manufactures. Thus, despite of the tariffs reduction of the period -concentrated mainly on manufacturing products, non-manufacturing sectors were more attractive for informal producers than the manufacturing sector. Informal producers in general do not export and the gains from trade liberalization comes from cheaper imports.

Increases of foreign competition due to trade liberalization may affect to manufacturing informal producers if they move out to formal activities within the sector or if they move out to other less profitable sectors, with lower labor productivity. In this latter case, the reallocation of informal labor to other non-manufacturing sectors was because of the profitability of these sectors rather than the exit incentive to leave the manufacturing sector due to trade liberalization. On the other hand, figures in Table 2 show that informal producers do not seem to have reallocated to formal activities within manufactures, rather it seems that informal manufacturing producers moved out to other sectors. Consequently, the changes in employment share between activities and sectors and their impact on labor productivity provide information on the impact of trade liberalization on the informal and formal activities. This analysis is presented in the next three sections.

It should be also recognized that other factors may have also affected output and employment in sectors and activities. Two of these factors are the changes in the internal demand measured through changes in GDP and the incentive to export measured through changes in the terms of trade. The declining output and employment share of informal manufacturing activities seems to be associated with the declining GDP rate of growth and, to a lesser extent, with the rate of growth of the terms of trade. These associations with the rates of growth of the GDP and the terms of trade suggest that trade liberalization effects on output and employment in sectors and activities could have been neutralized by the effects of the rates of growth of the GDP and the terms of trade. These associations are also presented in the next sections.

**Table 1**  
*Real Value Added of Informal Activities and Informal Output and Employment in Manufactures: Peru 2007-2018*

Year	Shares of the Informal Real Value Added by Sectors			Total	Share of the informal manufactured output out of total Manufacturing Output	Share of the Informal Employment in Manufacturing out of Total Employment of Manufactures	Share of the Manufacturing Output out of the GDP	GDP Growth	TT (Px/Pm) Growth
	Primary Sectors	Manufactures	Services						
2007	33.2	11.4	55.4	100	13.1	71.9	16.5	8.5	6.0
2008	34.8	10.1	55.1	100	12.2	72.1	16.4	9.1	-11.9
<b>2009</b>	35.7	10.3	54.1	100	13.4	69.1	15.2	1.1	-2.7
<b>2010</b>	34.5	9.6	55.9	100	12.0	70.1	15.4	8.3	21.0
2011	36.2	9.1	54.8	100	11.6	67.6	15.7	6.3	7.9
2012	36.7	8.7	54.7	100	10.9	66.5	15.0	6.1	-2.9
<b>2013</b>	35.3	8.7	56	100	10.4	67.2	14.9	5.9	-6.0
2014	35.5	7.6	56.9	100	9.9	64.1	14.4	2.4	-5.4
2015	34.5	6.7	58.9	100	9.2	63.3	13.8	3.3	-6.9
2016	35.2	7.1	57.6	100	9.8	62.3	13.3	4.0	-0.3
2017	33.7	7.1	59.2	100	10.2	63.2	13.1	2.5	7.5
2018	29.0	7.2	63.7	100	11.6	61.9	11.4	3.98	-0.38

**Source:** INEI (2019). Author's work. Correlation coefficients between the rate of GDP growth and informal GDP and employment shares of the total manufacturing sector are respectively 0.620 and 0.699. In addition, the correlation between the growth rates of GDP and the terms of in period 2007-2018 was 0.180. According to INEI (2019), the informal sector refers to household businesses (unincorporated productive units, excluding quasi-corporations) that are not registered with the tax administration (SUNAT). For the case of the productive units of the primary sector not incorporated in society, it is considered that all belong to the informal sector.

**Table 2**  
*Informal Employment: Peru 2007-2018*

Year	Shares of the Informal Employment by Sectors			Total	Share of the manufactured Formal Employment out of total Employment	Share of the manufactured Informal Employment out of total Employment	Share of the Manufacturing Employment out of Total Employment
	Primary Sectors	Manufactures	Services				
2007	35.5	10.1	54.4	100	3.14	8.05	11.19
2008	35.0	10.0	55.0	100	3.07	7.95	11.02
<b>2009</b>	35.0	9.5	55.5	100	3.27	7.30	10.57
<b>2010</b>	33.4	9.6	57.0	100	3.15	7.37	10.52
2011	34.4	9.1	56.5	100	3.28	6.83	10.11
2012	33.1	9.4	57.5	100	3.50	6.96	10.46
<b>2013</b>	33.2	9.2	57.5	100	3.32	6.80	10.13
2014	33.8	8.4	57.8	100	3.42	6.12	9.53
2015	34.7	8.2	57.1	100	3.46	5.97	9.43
2016	34.7	8.2	57.0	100	3.59	5.93	9.51
2017	33.6	8.2	58.2	100	3.46	5.94	9.39
2018	33.6	7.7	58.8	100	3.42	5.56	8.97

Source: INEI (2019).

## 2. Review of the literature of Informality and Domestic Competition: Product Market Segmentation

Table 3 presents and brief review of the literature on informality and competition. The literature identifies at least four ways that (domestic) formal and informal firms may or not be competitively related. First, if both types of firms compete in the same market, formal firms may or may not perceive informal firms as a competitive threat. There is evidence that suggest that the performance (in terms of sales, employment, and productivity) of firms that perceive informal firms as a competitive threat are lower than the performance of formal firms that do not perceive to informal firms as a threat. However, the informal threat perception seems to be associated with a lower level of economic development, too little government intervention and a level of institutional asymmetry. Second, due to the informal competition, formal firms might orient their production to exports. There is also evidence that informal firms encourage the propensity to export of formal firms. This propensity may be higher in the presence of regulatory obstacles and new product development.

**Table 3**  
*Summary of Literature on Informality and Competition*

<b>Authors</b>	<b>Results</b>	<b>Method</b>
William & Costa(2020)	The paper provide evidence on the hypothesis that “informal sector enterprises havea harmful impact on the performance of formal enterprises”. Sample: World Bank Enterprise Survey (WBES) data collected from 360 formal enterprises in Bosnia and Herzegovina in 2019. It finds that formal enterprises viewing informal competition as a severe obstacle do not witness significantly lower sales growth, employment growth or productivity growth. Contrarily, such enterprises witness significantly higher sales growth than those who do not view informal sector competitors as a severe obstacle.	LS, wherein ‘Y’ is a performance variable (sales, employment, and productivity growth) and perception of informal competition a dummy explanatory variable, both for formal firms.
Deb, Vardhan, Kumar(2020)	It examines the influence of informal competitive pressures in driving export propensity of formal firms. Sample: 9812 manufacturing firms spanning across theIndian sub-continent from the World Bank enterprise survey conducted in the year 2014. Its main result is that the level of competition from informal firms is positivelyassociated with the propensity to export. The primary relationship is also affected by various contingent factors such as regulatory obstacles, bribery and new product development.	Logit method wherein ‘Y’ is a dummy variable with one is a positive answer to “Does thiseestablishment currently export or is it considering entering the export market in the next 12 months” and one of ‘X’ variable is also a perception dummy variable of firms on informal competition.
Beltrán (2020)	It provides evidence on the negative association between informal competition andfirm productivity in the formal sector for sixty thousand manufacturing and servicesformal firms from over 127 using the World Bank’s Enterprise Survey (WBES)	OLS and IV was used for the estimations. Because of WBES, the informal factor is ‘measure’ by a perception dummy variable of firms on informal competition.
William & Liu (2019)	It explains variations in the extent to which formal enterprises witness competitionfrom unregistered or informal enterprises across Latin American and Caribbean countries. Sample: World Bank Enterprise Survey (WBES) data on 31 LatinAmerican and Caribbean countries for period 2006-2010. The main conclusion is that the propensity of formal enterprises to witness informal sector competitors is greater in countries where there is a lower level of economic development, too little government intervention and the level of institutional asymmetry is higher	Probit regression analysis, wherein ‘Y’ is a perception dummy variable of informal competition of formal firms. The ‘X’ variables are related to under development (modernization theory); high taxes and state over-interference (neo-liberal theory); too little state intervention (political economy theory), oran asymmetry between the laws and regulations of formal institutions and the unwritten socially shared rules of informal institutions (institutional theory)

**Table 3. Continuation**

Authors	Results	Method
Amin, Ohnsorge, and Okou (2019)	Using WBES survey data for 125 countries and period between 2008 and 2016, the paper assesses the gap in labor productivity between formal and informal firms in developing countries for which comparable data are available. It also investigates the impact of competition from informal firms on the labor productivity of formal firms. The results show that on average, the labor productivity of informal firms is about one-fourth that of formal firms. Moreover, the labor productivity of formal firms that face competition from informal firms is about 75 percent of the average labor productivity of formal firms that do not experience informal competition. This suggests that competition from the informal sector can erode formal firms' market share and the resources available to boost productivity where formal firms shoulder the additional cost of regulatory compliance.	The estimation method is OLS method with Huber-White robust standard errors. The informal variable is a binary dummy variable representing firms' report that is competing with informal firms
Allen & Schipper (2016).	Based upon a Melitz (2003) type of model, the authors reconcile the two extremes hypothesis of informality and competition. One, formulated by Rauch (1991) who postulates the two markets (labor and product) are completely segmented, and the other formulated by Nataraj (2011) (with data from India) that there is some room for competition, in the lowest tail of the formal-firms productivity and in the highest tail of informal-firms productivity	Using World Bank's Enterprise Survey (WBES) for period 2006-2016 (covering 140 different countries and over 124,000 firms), and LS and Pobit/Logit estimations method, the authors find: i) firms size decrease the probability that informal firms compete with formal firms; ii) the higher per capita GDP, the lower the probability that informal firms compete with formal firms.

Source: Authors' work.

Third, it seems that low labor productivity formal firms are the ones that compete with informal firms. Such firms may exit markets due this competition or whenever regulatory policies are tight. Fourth, there is some evidence that points out that highly productive formal firms do not compete with informal firms. That is, in the market share of the product supplied and dominated for highly productive firms, there exist market segmentation between formal and informal firms. Contrarily, in markets segments of low productivity firms, these may compete with highly productive informal firms.

This fourth group of evidence may be consistent with Peruvian data. Thus, in Table 4<sup>3</sup>, the figures indicate that about 75% of the consumer products prices of the informal activities, the prices of lowest income quartile consumers are lower than the respective prices of the highest income quartile consumers. Furthermore, the prices of all the consumers products belonging to the main informal manufacturing sectors (light industry and other manufactures) for the lowest income quartile group were much lower than the respective prices of the highest income quartile group. Evidence for segmented labor markets has also been found between formal and informal employment (Tello, 2015b).

A second piece of evidence, at least for some industries, is the existence of 'Economic Groups'. The Economic groups in Peruvian economy have been studied throughout the last 60 years.<sup>4</sup> These groups have changed from the dominance of multinational enterprises, MNE, oligarchy landowners and national enterprises in the 1960s to the dominance of MNE and economic groups from Peru and Latin American Countries (Durand, 2004) in the present century. Durand (2017) points out that the 'new economic groups', NEG are a conglomerated and diversified group of firms that create and buy firms acquiring market power.

They are highly competitive at local, continental and world level. They have the capacity of use their enormous resources to influence politics, establish favorable relationships with political parties and congressmen, and to maintain a narrow and productive relationship with the government. The main mechanisms of the relationship between NEG and Government are the financing of political campaigns, lobbies, revolving doors, interpersonal contacts, and bribery.

**Table 4**  
*Prices of Goods by Sectors of Perú, by Per capita Income Quartile 2015*

Sector	Good	Unit	Price Range								Average Price by Income Group			
			R1		R2		R3		R4		P1	P2	P3	P4
			Min	Max	Min	Max	Min	Max	Min	Max				
	Pescado Jurel	Kg./soles	3.0	16.0	2.5	17.0	3.0	15.0	2.8	16.0	7.4	7.3	7.2	7.3
	Pescado Bonito	Kg./soles	3.3	18.0	3.0	18.0	3.0	20.0	1.0	18.3	7.9	7.8	7.7	8.3
	Pescado Paiche	Kg./soles	1.0	32.0	1.0	36.0	1.5	35.0	1.2	60.0	8.4	8.9	9.6	12.2
	Filete de Atún	Kg./soles	8.5	52.9	9.8	45.8	9.8	55.4	5.0	53.3	26.7	27.1	27.7	28.3
	Arroz Corriente a Granel	Kg./soles	1.4	5.0	1.4	5.0	1.5	4.0	1.5	4.0	2.6	2.6	2.7	2.7
	Arroz Extra a Granel	Kg./soles	1.5	4.6	1.2	4.5	0.6	5.0	1.5	5.0	2.9	3.0	3.0	3.1
	Leche Evaporada	Kg./soles	3.7	17.6	3.1	14.7	3.7	12.9	3.0	12.9	8.1	7.9	7.7	7.6
S1-15	Papa Blanca	Kg./soles	0.3	4.0	0.3	3.6	0.3	4.6	0.4	4.0	1.4	1.4	1.4	1.5
	Azúcar Rubia	Kg./soles	1.5	4.3	1.4	4.0	1.5	4.0	1.0	4.0	2.5	2.4	2.4	2.4
	Fideos Envasados	Kg./soles	2.4	10.4	1.8	16.0	1.8	8.3	2.4	15.8	3.4	3.5	3.7	3.9
	Fideos Tallarin Envasados	Kg./soles	2.5	18.0	2.4	10.0	2.5	8.8	2.4	13.6	3.4	3.5	3.7	3.9
	Aceite Vegetal Envasado	Lt./soles	3.0	15.0	3.2	12.5	3.0	12.5	2.4	18.8	6.4	6.4	6.4	6.6
	Aceite de soya	Lt./soles	1.0	60.0	1.9	52.2	1.0	56.0	3.0	88.0	6.2	7.1	9.6	19.3
	Queso Fresco de Vaca	Kg./soles	5.0	30.0	3.3	35.0	3.5	35.0	5.0	40.0	12.1	12.9	13.3	13.8
	Yogurt	Lt./soles	3.0	12.5	3.0	13.3	2.5	15.0	15.0	13.3	5.4	5.3	5.2	5.1
	Plátano de Seda	Kg./soles	0.5	5.0	0.5	5.0	0.6	5.0	0.5	6.7	1.5	1.5	1.6	1.6

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Table 4. Continuation

Sector	Good	Unit	Price Range								Average Price by Income Group			
			R1		R2		R3		R4		P1	P2	P3	P4
			Min	Max	Min	Max	Min	Max	Min	Max				
S2-8	Carne de Res Bistec	Kg./soles	5.0	25.0	7.0	28.0	6.0	26.0	8.0	28.0	16.0	16.7	17.5	18.2
	Carne de Res Corte Único	Kg./soles	6.0	20.0	5.0	19.4	5.0	20.0	5.9	44.0	10.3	11.0	11.4	11.6
	Carne de Cordero	Kg./soles	6.7	18.8	7.5	20.0	7.0	20.0	7.0	20.0	12.1	12.5	12.9	13.3
	Carne de Chanchó	Kg./soles	8.0	20.0	6.0	20.0	8.0	21.0	8.0	24.0	11.4	12.0	12.6	13.2
	Pollo Eviscerado	Kg./soles	4.0	23.3	4.0	22.9	3.8	24.0	3.0	23.0	9.3	8.9	8.7	8.7
	Cerveza	Lt./soles	3.8	12.5	4.5	11.9	4.0	12.8	3.3	15.5	7.0	7.0	6.8	6.9
S3-5	Gaseosa	Lt./soles	0.6	7.0	0.9	6.0	1.0	7.0	0.6	6.2	2.4	2.5	2.7	2.8
	Comida para perros	Kg./soles	1.5	24.2	1.0	10.7	1.0	26.7	1.0	45.0	6.0	5.9	6.1	6.4
	Telas	Und./Soles	3.0	350	3.0	230.0	4.0	500	2.0	800	37.6	38.4	49.4	75.6
	Prendas de vestir para adultos	Und./Soles	0.5	1200	2.0	1200	2.0	3000	1.0	3275	93.8	119.4	167.0	269.5
	Prendas de vestir para niños	Und./Soles	1.0	1150	2.0	1200	3.0	2500	2.5	2500	76.1	103.6	131.8	196.4
	Calzado para adultos	Und./Soles	2.0	650	2.0	1165	2.5	1000	2.0	2600	53.9	73.5	107.5	183.8
S4-9	Calzado para niños	Und./Soles	2.0	360	2.0	800	3.0	700	2.0	1200	39.5	56.0	71.3	113.5
	Radio	Und./Soles	5	538	5	622	5	705	6	835	62	71	82	103
	TV a color	Und./Soles	10	3443	21	5633	20	6023	10	9296	540	707	894	1250
	Equipo de sonido	Und./Soles	54	3743	50	4465	76	4091	43	8191	676	784	889	1056
	Computadora	Und./Soles	181	4620	124	5204	50	6608	27	8292	1690	1749	1796	1991
	Cocina a gas	Und./Soles	12	4650	17	6090	6	3072	21	5375	206	318	445	671
S4-9	Refrigeradora/congeladora	Und./Soles	102	3579	50	3487	80	5812	63	7160	1140	1172	1242	1365
	Bicicleta	Und./Soles	11	1264	15	2172	17	2239	20	5006	168	188	216	309
	Auto, camioneta	Und./Soles	2019	114821	401	1141	1036	1410	1039	3807	18260	2059	22535	3584
	Motocicleta	Und./Soles	212	32962	101	1446	198	1614	296	2016	2857	3011	3401	4011
			212	32962	101	1446	198	1614	296	2016	2857	3011	3401	4011

Source: INEI-ENAH0 (2020). Authors' work.

Data reported in Tello (2020) show that NEG have interest on mining exports, non-traditional exports (XNT) (particularly dairy products, manufacture of grain mill products and manufacture of wearing apparel, except fur apparel; and fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing) and domestic products (such as manufacture of other food products; building of complete constructions or parts thereof, and civil engineering; manufacture of soft drinks; production of mineral waters; wholesale of machinery, equipment and supplies, and storage and warehousing). Thus, non-traditional exporters' NEG would be interested in reducing trade barriers on inputs and capital goods and domestic producers NEG would be interested to impose barriers on final consumer goods and to eliminate trade barriers to inputs and capital goods. The enormous resources generated by the NEG<sup>5</sup> also generate government fiscal dependency with respect to the economic performance of these groups.<sup>6</sup> Consequently, it is unlikely that informal firms may compete with these groups of highly productive and competitive firms.

If the hypothesis of product market segmentation holds for Peruvian manufactured products, then competition and trade liberalization policies, although might affect formal firms, would not affect informal producers in products markets.

### **3. Informal Activities and Foreign Competition: Trade Liberalization, Terms of Trade and Economic Growth**

Similar, to the literature on informality and domestic competition, the relatively scanty literature on informality and foreign competition through trade liberalization has not yielded definitive answers. This literature shows, on the one hand, that there might be short run micro and medium to long run macro effects, and on the other hand, that the effects seem to be associated with the degree of development and the labor force institutional framework of the economy. Based upon, the shift-share decomposition of labor productivity formulated by Chenery Robinson, and Syrquin (1986), Timmer and de Vries (2008) and Rodrik and McMillan (2011), this section presents a medium-long-run macro analysis of the labor flows in three (tradable and non-tradable) sectors and (formal and informal) activities and their impact on the labor productivity of Peru in the liberalization period 2007-2018. The shift-share labor productivity analysis allows

identifying, on the one hand, the changes of labor productivities in sectors and activities either through changes of productivities within a sector or through reallocations of labor towards other sectors and activities. On the other hand, allows measuring the contributions of sectors and activities in the changes of the labor productivity of the Peruvian economy. The shift-share analysis for the three sectors (primary, manufacturing, and tertiary) and two activities (formal and informal) in period 2008-2018 using data of INEI (2021) is based upon of equations from [1] to [5].

$$[1] P_t = \sum_s \omega_{fst} \cdot P_{fst} + \sum_j \omega_{ifst} \cdot P_{ifst}; \omega_{fst} = L_{fst}/L_t; \omega_{ifst} = L_{ifst}/L_t;$$

$$[2] \Delta P_t = WE_t + RE_t;$$

$$[3] WE_t = \sum_s \Delta P_{fst} \cdot \omega_{rfs0} + \sum_s \Delta P_{ifst} \cdot \omega_{rifs0};$$

$$[4] RE_t = \sum_s \Delta \omega_{fst} \cdot P_{fs0} + \sum_s \Delta \omega_{ifst} \cdot P_{ifs0} = \sum_s \Delta \omega_{fst} \cdot (P_{fs0} - P_{ifs0}) + \sum_s \Delta \omega_{st} \cdot P_{ifs0};$$

$$[5] P_{fs0} = 0.5(P_{fst} + P_{fs(t-1)}); P_{ifs0} = 0.5(P_{ifst} + P_{ifs(t-1)});$$

$$\omega_{fs0} = 0.5(\omega_{fst} + \omega_{fs(t-1)}); \omega_{ifs0} = 0.5(\omega_{ifst} + \omega_{ifs(t-1)}); \sum_s \Delta \omega_{st} = 0 = \sum_s (\Delta \omega_{fst} + \Delta \omega_{ifst});$$

Equation [1] defines the labor productivity at period  $t$  of the economy ( $P_t$ ) – ratio of the real value- added over the total economic active and occupied population, as the weighted average of the labor productivity of the activities, formal ( $P_{fst}$ ) and informal ( $P_{ifst}$ ) in each sector ‘ $s$ ’ at period  $t$ . The weights are the respective labor shares of the activities,  $\omega_{fst}$  and  $\omega_{ifst}$  for each sector ‘ $s$ ’ at period  $t$ .

Equation [2] defines the change of the labor productivity of the economy at period ‘ $t$ ’, as de sum of the changes of the productivities within each sector and activities,  $WE_t$ , and the changes of the productivities due to the labor flows between sectors and activities,  $RE_t$ . These are denominated respectively the within and reallocation effects.

Equation [3] defines the ‘within effects’ of the changes in labor productivity ( $WE_t$ ) as the weighted average of the respective within effects of each activity for each sector. A positive value means that labor productivity at period  $t$  has increased and a negative value that its value has decreased. These changes in labor productivity within sectors and activities can be attributed to the liberalization process, economic growth, the changes in the terms of trade, and other internal and external factors within sectors or activities.

Equation [4] defines the reallocation effects between sectors and formal and informal activities. The weight  $\Delta\omega_{fst}$  means the change of labor flows between formal and informal activities within a sector 's', and the weight  $\Delta\omega_{st}$  means the change of the labor flows between sectors. The productivity difference ( $P_{fs0} - P_{ifs0}$ ) has been positive for all 2007-2018 period. A negative value of these weights means that labor is moving from high productive formal activities to low productive informal activities within the sector. The reverse occurs if the value is positive. In addition, it should be noted that the component  $\Delta\omega_{st} \cdot P_{if2s0}$ , measures the change of labor flows of informal y/o formal workers of different sectors. Similar, to the former case, these reallocation effects can be attributed to the liberalization process, economic growth, the changes of the terms of trade, and other internal and external factors between sectors or activities. Thus, the first term of the right-hand side of equation [4], if positive, could mean that the liberalization period, has generated movement from the informal activity to formal activity, in such case, this term can be interpreted as the degree of market (sector) competition between activities. However, if the term is negative, could mean, that there not market (sector) competition between activities and formal workers of the sector have moved out to other sectors.

On the other hand, the second term of the right-hand side of equation [4], could mean that (formal or informal) labor has moved out from other sectors to a particular sector 's' if the term is positive, and that (formal or informal) labor has moved out to other sectors if the term is negative. In the first case, liberalization process, because of reduction of input or output tariffs, has incentivized and made more profitable a particular sector 's'. In the second case, liberalization has no yielded incentive to remain in a particular sector 's'. Equations in [5] complete the set of formulas.

Because of these labor flows, labor productivities of activities and sectors have changed as figures in Table A6 show. On the one hand, labor productivity in Peruvian economy has had an increasing trend mainly due to the positive trend of the labor productivity of the tertiary non-tradable sector<sup>7</sup> in both activities. In contrast, labor productivity of the primary and manufacturing sectors in formal activities had a decreasing trend throughout the 2007-2018 period. However, the informal activities in these sectors had a positive trend in such a period.<sup>8</sup> Despite the differences

in the trends of the productivities between formal and informal activities, the latter labor productivities have been much lower than the respective formal activities in the three sectors. On average, the ratio between both labor productivities ranks from 2.6% for manufactures to 10.1% for the tertiary sector. On the other hand, labor productivities of formal activities in the primary and manufacturing sector have been associated positively and significantly to the GDP rate of growth whereas labor productivities of the tertiary sector in both informal and informal activities have been negative and significantly associated with the same rate. The changes of informal employment and the labor productivity of sectors and activities suggest that the effects of the reduction of tariffs (preferential and MFN) on labor productivity were not able to compensate the respective opposite effects that might be produced by the decreasing rate of GDP growth and the negative rate of growth of the terms of trade in most of the years of period 2008-2019.

Regarding the effects on labor productivities at the initial year of the PTAs, these have been diverse. Thus, labor productivities of formal activities decreased at the initial year of the Peru- USA PTA in all sectors. In the case of the Peru-China PTA, labor productivities of the informal activities in the no-manufacturing sectors decreased, and at the respective year of the Peru-EU PTA the labor productivities of the manufacturing sector and activities, and informal activities of the primary sector decreased. For the rest of sectors and activities, at the initial year of PTAs labor productivities increased. However, it should be noted in such years either the rate of growth of the GDP or the level of the terms of trade decreased.

Tables 6 and 7 present the figures of the within and reallocation effects for the period 2008-2018. Figures in Table 6 correspond to equation [3]. For each of the three sectors (primary, manufacture, and tertiary o services) there have been changes of labor productivity of the formal (F-F) and informal (IF-IF) activities. Figures in Table 7 correspond to equation [4]. For each of the three sectors (primary, manufacture, and tertiary o services) there have been changes of labor productivity due to reallocation of workers between formal and informal activities (F-IF) and/or between sectors (S-S).

**Table 5**  
*Labor Productivity by Activities and Sectors of Peru 2007-2018*

Year	Primary			Manufactures			Tertiary			Total
	Formal	Informal	Total	Formal	Informal	Total	Formal	Informal	Total	
2007	32898.8	1930.8	10622.9	108724.5	1590.0	5161.1	19778.6	1730.2	6555.6	6601.3
2008	35029.3	1888.0	11125.1	90596.8	1764.2	4929.1	21077.7	1987.0	7290.9	7034.9
2009	30220.9	2099.2	10788.1	71246.5	1788.9	4432.0	20235.4	2067.9	7526.2	7000.6
2010	35160.5	2042.2	11948.5	87324.7	1901.4	5417.7	20492.3	2019.4	7519.4	7420.5
2011	35778.1	2262.3	13138.2	94362.7	2047.2	6433.7	19703.2	2070.7	7788.0	7961.9
2012	34780.0	2131.5	13061.2	76150.3	2234.0	6130.2	21659.5	2132.1	8526.5	8377.6
2013	36964.6	2087.7	13530.3	73569.1	2064.0	5802.4	23151.9	2194.8	9258.4	8797.4
2014	33193.5	2033.9	13206.7	60890.7	2042.9	5219.2	24063.8	2437.3	9936.5	9020.0
2015	31322.7	1837.7	12654.1	50153.4	2005.6	4736.7	25577.3	2834.4	10648.0	9246.7
2016	29474.7	1942.7	12323.1	56014.0	2074.6	5140.3	25340.9	2767.3	10859.6	9483.0
2017	29818.4	1974.6	12225.3	67087.1	2109.2	5763.9	25922.6	2692.0	10776.6	9617.2
2018	29678.0	2388.5	12778.5	65104.8	2174.8	5973.0	27350.9	2729.1	11263.8	10030.7
$r_{\text{gYPt}}$	0.673***	-0.115	-0.218	0.783***	-0.394	0.226	-0.552**	-0.657**	-0.633**	-0.558**
$r_{\text{gTTPt}}$	0.042	0.195	-0.107	0.381	-0.070	0.320	-0.256	-0.207	-0.220	-0.159

**Source:** INEI (2021), INEI (2019), Author's work.  $r_{\text{gYPt}}$  and  $r_{\text{gTTPt}}$  correlation coefficients between labor productivity and the rates of growth of GDP and the terms of trade, respectively. \*, \*\*, \*\*\* 10%, 5%, 1% levels of significance

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**Table 6**  
*Within Effects of the Changes of Labor Productivity by Activities and Sectors of Peru, 2007-2018*

Año	Primary			Manufacture			Tertiary			Total		
	F-F	IF-IF	WE	F-F	IF-IF	WE	F-F	IF-IF	WE	F-F	IF-IF	WE
2008	1.00	-0.05	0.95	-2.75	0.74	-2.01	3.21	1.69	4.90	1.46	2.38	3.85
2009	-2.17	0.23	-1.94	-2.88	0.10	-2.78	-2.10	0.50	-1.61	-7.15	0.82	-6.33
2010	2.26	-0.06	2.20	2.50	0.42	2.92	0.68	-0.30	0.38	5.44	0.06	5.51
2011	0.27	0.21	0.48	1.14	0.51	1.64	-2.07	0.30	-1.78	-0.67	1.02	0.34
2012	-0.42	-0.11	-0.54	-3.04	0.59	-2.45	5.06	0.33	5.39	1.59	0.81	2.40
2013	0.89	-0.04	0.85	-0.42	-0.50	-0.92	3.78	0.32	4.09	4.25	-0.22	4.03
2014	-1.44	-0.04	-1.48	-1.99	-0.06	-2.05	2.28	1.17	3.44	-1.16	1.07	-0.09
2015	-0.71	-0.13	-0.84	-1.74	-0.10	-1.85	3.71	1.85	5.56	1.25	1.61	2.86
2016	-0.70	0.07	-0.64	0.96	0.19	1.15	-0.57	-0.30	-0.87	-0.32	-0.05	-0.36
2017	0.13	0.02	0.15	1.73	0.09	1.82	1.39	-0.33	1.06	3.25	-0.22	3.03
2018	-0.05	0.25	0.20	-0.31	0.17	-0.14	3.35	0.16	3.51	2.99	0.58	3.57
Mean	-0.09	0.03	-0.06	-0.62	0.19	-0.42	1.70	0.49	2.19	0.99	0.71	1.71
$r_{gyWEt}$	0.839***	-0.330	0.823***	0.156	0.570**	0.256	0.236	0.040	0.215	0.562**	0.231	0.646***
$r_{gTTWEt}$	0.480*	0.167	0.513**	0.821***	0.208	0.852***	-0.450*	-0.714***	-0.583**	0.329	-0.555**	0.206

**Source:** INEI (2021), INEI (2019). Author's work.  $r_{gyWEt}$  and  $r_{gTTWEt}$  correlation coefficients between within effects of the rate of change of labor productivity and the rates of growth of GDP and the terms of trade, respectively. \*, \*\*, \*\*\* 10%, 5%, 1% levels of significance.

**Table 7**  
*Reallocation Effects of the Changes of Labor Productivity by Activities and Sectors of Peru, 2007-2018*

Year	Primary			Manufacture			Tertiary			Total		
	F-IF	S-S	RE	F-IF	S-S	RE	F-IF	S-S	RE	F-IF	S-S	RE
2008	-0.35	-0.05	-0.40	0.66	-0.16	0.49	2.39	0.23	2.63	2.71	0.02	2.72
2009	0.85	-0.13	0.72	0.53	-0.15	0.38	4.44	0.30	4.74	5.82	0.02	5.84
2010	-0.52	-0.01	-0.53	0.40	-0.33	0.07	0.57	0.38	0.95	0.46	0.04	0.49
2011	0.60	-0.12	0.48	2.16	0.06	2.22	4.20	0.06	4.26	6.96	-0.01	6.95
2012	0.92	0.10	1.01	0.87	-0.29	0.58	1.04	0.19	1.23	2.82	0.00	2.82
2013	-0.72	-0.08	-0.80	-0.16	-0.04	-0.20	1.86	0.12	1.98	0.98	0.00	0.98
2014	0.36	-0.14	0.22	0.40	0.04	0.44	1.85	0.11	1.96	2.61	0.01	2.62
2015	0.14	-0.02	0.12	0.72	0.20	0.91	-1.16	-0.22	-1.38	-0.30	-0.05	-0.35
2016	0.39	0.02	0.41	-0.11	-0.09	-0.20	2.61	0.10	2.71	2.89	0.03	2.92
2017	-0.38	-0.02	-0.40	-0.33	-0.15	-0.48	-0.96	0.22	-0.74	-1.67	0.05	-1.61
2018	-0.12	-0.10	-0.22	0.72	0.01	0.72	0.12	0.11	0.23	0.71	0.02	0.73
Mean	0.11	-0.05	0.06	0.53	-0.08	0.45	1.54	0.15	1.69	2.18	0.01	2.19
$r_{gyRE}$	-0.389	0.308	-0.344	0.274	-0.416*	0.165	0.056	0.269	0.077	0.028	-0.024	0.027
$r_{gTTRE}$	-0.166	0.104	-0.150	0.079	-0.402*	-0.013	-0.114	0.428*	-0.076	-0.099	0.440*	-0.094

**Source:** INEI (2021), INEI (2019), Author's work.  $r_{gyRE}$  and  $r_{gTTRE}$  correlation coefficients between reallocation effects of the rate of changes of labor productivity and the rates of growth of GDP and the terms of trade, respectively. F-IF is the reallocation effect between activities in each sector and for the Peruvian economy and S-S is the reallocation effect between sectors and for the Peruvian economy. \*, \*\*, \*\*\*, 10%, 5%, 1% levels of significance. + 11% level of significance.

The figures in these tables indicate:

First, in Table 6, partly of the decreasing trend of the labor productivities of the tradable sectors in the liberalization period 2008-2018 has been for the negative within effects of formal activities of these sectors which were greater, in absolute value, than the within effects of informal activities. The contrary occurred in the non-tradable sector, its increasing trend was due to both within effects of formal and informal activities. These latter effects contributed more to the increasing trend of the labor productivity of the economy than the within effects of the tradable sectors.

Second, except for the within effects of informal activities in the primary sector, all within effects of labor productivity of Peru and in sectors and activities have been associated significantly either to the rate of GDP growth, the terms of trade or both. These associations have been negative only with the rate of growth of the terms of trade and the non-tradable sector and its activities.

Third, at the initial year of the Peru-US PTA, the within effects in formal activities of all sectors have been negative. In the case of the Peru-EU preferential trade agreement, the within effects were negative for the informal activities of the primary sector and for the activities of the manufacturing sector, and at respective year of the Peru-China PTA, the within effects of informal activities of the primary and tertiary sectors were negative. For the remaining within effects and for all three PTAs the within effects were positive. In contrast to the statistical significant association between the within effects and the rate of growth of the GDP and the terms of trade, these facts suggest that the PTAs impacts on within effects have been diverse by sectors and activities.

Fourth, the former facts seem to suggest, on the one hand, that the effects of trade liberalization on formal labor productivity within both tradable sectors were overcome by the effects of the rate of growth of GDP, and the terms of trade and, in average, for the 2008-2018 period, formal labor productivity in these sectors decreased due to decreasing GDP rate of growth or the terms of trade deterioration in most of the years of the period. On the other hand, that the positive within effect of the informal labor productivity for both tradable sectors, could be due to the fact the informal labor moved toward the non-tradable sector rather than a

positive effect of trade-liberalization on the economic performance of informal activities within both tradable sectors.

Fifth, regarding the reallocation effects of Table 7, considered as a measure of structural change, have been also varied throughout the period and at the initial year of the PTAs. About a third of those effects, have been negative and decreased the labor productivities of the sectors and that of the Peruvian economy. Most of such negative effects have been concentrated in the primary and manufacturing sectors. These have meant that labor have moved from high to low labor productivities sectors and/or activities.<sup>9</sup> Thus, the negative reallocation effects in the primary sector have been due to labor flows between activities and sectors, i.e., labor has moved from formal to informal activities within the sector (column F-IF), and to different sectors (column S- S). In the case of manufactures, the negative reallocation effects dominant has been of formal activities of different sectors (column S-S), y to less extent between activities within the sector (column F-IF). The scanty number of negative reallocation effects in the tertiary sector have been due to the labor flows between activities within the sector (column F-IF) and the informal workers moving to different sectors (also of informal activities, column S-S).

Sixth and like the case of the within effects, there exist a statistical significative association between the rate of growth of GPP or terms of trade and some components of the reallocation effects that determines the changes of the labor productivity of Peru. That is the case, for the positive and significative association between the rate of growth of the terms of trade and the sectoral reallocation effects of the changes in labor productivity<sup>10</sup> (column S-S) of the tertiary sector and the economy. The association is close to significative, although with negative sign, with manufactures<sup>11</sup> (column S-S). Contrarily, the association between the rate of GDP and the S-S reallocation component of manufactures was positive and statistically significative. The reallocation effects in the rest of sectors and activities the associations with GDP and terms of trade growth were not significative.

These statistical associations together with the fact that in most of the years of period 2008-2018, the reallocation effects between sectors (column S-S) for the tradable goods were negative would suggest that

the effect of foreign competition on informal (and formal) activities were small or negligible compared to the effects of the rate of growth of GDP and the terms of trade. That is, labor movements from sector to sectors were more due to the trends of GDP and/or terms of trade than the reduction of tariffs of the tradable sectors. However, it should be noted, that there existed, in average for the period, labor flows of informal employment towards formal employment within both tradable sectors, although their contribution to the rate of growth of the labor productivity of the economy was lower than 0.6%. Furthermore, and considering the within and reallocation effects, the overall contribution of both tradable sectors, in average for the period, to the labor productivity of the economy was very-small, lower than 0.04%.

Seventh, regarding the effects of PTAs, about 70% of reallocation effects at the initial year of the PTAs of tradable sectors were negative and its contribution to the changes of the labor productivity of Peru, except for the Peru-PTA, was small. This result reinforces the former one that the magnitude of the foreign competition effect through trade liberalization was small compared with the effects of GDP and the terms of trade rates of growth.

In summary and in average for the liberalization period 2008-2018, the reallocation effects of the changes of labor productivity of Peru have dominated the within effects, and these effects in the non-tradable sector explains most of the increase of the labor productivity of Peruvian economy. Contrary to what should have expected that the trade liberalization favors the performance of tradable goods, the non-tradable sector explains most of the changes in productivity. These changes have been more associated with the rate of growth of the GDP and the terms of trade. Foreign competition effects on activities (formal and informal) were small or negligible.

## **Conclusions**

This annex has provided exploratory evidence supporting three hypotheses on the relationship between (domestic and foreign) competition and informality. One is that there might exist product market segmentation between formal and informal firms. Another one is that the effects of the

PTAs on the changes of labor productivity in activities and sectors have been diverse and unclear. The last one is that labor productivity changes of Peru and its within and reallocation components have been associated more with the fluctuations and the rate of growth of the GDP and the terms of trade than with the trade liberalization. These associations seem to be consistent with the primary-export structure of the Peruvian economy. Thus, despite the trade liberalization in the period 2007-2018, informality has not decreased substantially and labor has moved from tradable sectors to non-tradable sectors. This means either the effects of trade liberalization have been negligible or that other factors such as economic growth and the terms of trade are more important than trade liberalization on their effect on the economic performance of the sectors in the Peruvian economy.

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## Notas al final

1 Profesor de la FCE de la UNMSM y Departamento de Economía de la PUCP. Este trabajo se basa en el documento de antecedentes del proyecto de Competition and Trade Liberalization, auspiciado por el Banco Mundial. El autor agradece la asistencia de Rodrigo Silupo.

2 This structure means that the drivers of GDP growth are primary exports (and in the case of Peru, the mining products), fueled for the terms of trade, and capital growth (public and private investment). The primary export sectors, particularly mining, and manufacturing are sectors intensive in the use physical and human capital not demanding enough unskilled workers with low education levels relatively to the supply of such workers. These labor intensities and demand explain the level and the growth of informal activities that are seen for workers as the only option to generate income, although with low labor productivity. The negative reallocation effects found in Table A8 are consistent with this productive structure, wherein workers move from high to low productivities sectors and/or activities, for fluctuations and the drivers of growth of the GDP.

3 Notice, however, that some manufactured products among income groups may be differentiated for some product features (such as quality, used products, etc.)

4 Examples are the studies of Malpica (1966, 1989); Alcorta (1987); Anaya (1990), Vasquez (2005); and Durand (2004, 2017).

5 In 2015, income of the NEG represented 7.8% of GDP and 47% of total export revenues.

6 In 2015, firms' income tax of 280 companies explained 45.6% of the total Peruvian firms' tax income.

7 This sector is composed by the highly productive formal activities in sectors of building, and transport and telecommunications, hotels and restaurants, and services intensive in knowledge, and the low productive informal activities in services sectors as trade.

8 It should be noted that these changes in part can be attributed to the labor flows from high to low productivities activities and/or sectors.

9 The negative (positive) reallocation effect of the first column of each sector of Table 7 means that the labor moves from formal (informal) to informal (formal) activities within the sector. The reallocation effect of the second column of each sector measures the labor flows of formal or informal activities to the respective activities but of different sectors. The negative value means the labor flows of high productivity to low productivity activities or sectors and the reverse for positive values. The order of labor productivities of the activities and sectors are obtained from the figures of Table 2.

10 The sectoral reallocation effect correspond to the term  $\sum_s \Delta \omega_{st}$  of equation [4] and second column of each sector in Table 7.

11 Close to 10% of level of significance.