Purchasing Power Parities and Relative Productivity Levels in Latin America: Evidence from the LA KLEMS Productivity Level Database

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Abstract

The LA KLEMS productivity level database provides a comparison of relative productivity levels and competitiveness at the industry level in eight Latin America countries and the United States over the period 1990 to 2018. The database presents the PPPs (purchasing power parities or relative price levels) of output and inputs (capital, labour and intermediate inputs) and a comparison of the levels of output, inputs and labour and total factor productivity at the industry level. This paper outlines the methodology and data sources used for estimating the purchasing power parities (PPPs) of inputs and output and the methodology for estimating the relative levels of output, inputs, labour, and total factor productivity that makes use of the estimated PPPs. The paper finds that the level of labour productivity in those eight LA economies was lower than that of the US in 2015. The relatively lower level of labour productivity is due to the lower level of total factor productivity, and the lower level of capital intensity in LA economies compared with that in the United States. The difference in skill levels between LA economies and the United States was small.

1. Introduction

International comparisons of productivity level are useful for the discussion on international competitiveness and the difference in living standards across the nations. Differences in productivity levels are important determinant of international competitiveness and living standards. Nevertheless, such comparison are often limited especially at disaggregated levels of economic activity due to requirements of data that are not collected in all countries or are not comparable among countries. Important contribution in this area dates back to Jorgenson and Nishmizu (1978) for a comparison of the levels of productivity between Japan and the United States. More recent efforts on a much large scale includes Inklaar, Timmer and van Ark (2007) for a comparison of productivity levels at the industry level for thirty OECD countries and Feenstra, Inklaar and Timmer (2015) for a comparison of productivity levels in the total economy in 183 countries.

This paper presents the LA KLEMS productivity level database and a comparison of the levels of productivity at the industry level for a select group of Latin American economies and the United States for the period 1990 to 2018.[1] It extends the growth and productivity accounts of the LA-KLEMS project documented in Hofman et al. (2016) by providing the comparative levels of output, inputs and productivity.

The LA KLEMS productivity level database includes the PPPs (purchasing power parities or relative price levels) of output and capital, labour and intermediate inputs and provides the comparison of the relative levels of output, inputs and labour and total factor productivity at the industry level in Latin America.

This version of the LA-KLEMS productivity level database includes data at the sector level for eight economies of Latin America (Chile, Colombia, Costa Rica, El Salvador, Honduras, Mexico, Peru and the Dominican Republic) and the United States for the period 1990-2018.

The comparison of levels of output, inputs and productivity is based on the volume index of output and inputs. For that purpose, purchasing power parities are constructed first and the nominal values of output and inputs are then deflated by purchasing power parities (PPPs) to remove the difference in relative prices between economies, where the PPPs reflect price relatives that show the ratio of the prices in national currencies of the good or service output or inputs in different economies.

The methodology for estimating PPPs and the relative volume index of output, inputs and productivity levels was developed by Jorgenson and Nishimizu (1978) and Jorgenson, Kuroda, and Nishimizu (1987) which provided a level comparison of output, inputs and productivity between the United States and Japan at both total economy level and industry level. That methodology is recently adopted and extended for constructing the Groningen Growth and Development Centre (GGDC) Productivity Level database, which provides a level comparison of output, inputs and productivity at a detailed industry level for a set of thirty OECD countries. It is also used for the level comparison of output, inputs and productivity between Canada and the United States and several other studies (Baldwin, Gu and Yan, 2008; Lee and Tang, 2002; Schreyer 2007).

The rest of the paper is organized as follows. Section 2 presents the methodology for estimating the PPPs of gross output, intermediated inputs, and capital and labour input. Section 3 presents the methodology for estimating the relative levels of gross output, intermediate inputs, capital and labour inputs and productivity levels and outlines the level accounting methodology that

[1] Not all countries have data up to 2018.

decomposes the difference in labour productivity into the difference in TFP and the difference in input intensity. Section 4 presents the data sources. Section 5 presents the main estimates from the database. Section 6 concludes and highlights main challenges and potential future work for improving the PPP estimates and productivity level database. The appendix presents the content and coverage of the PPPs database and KLEMS productivity level database.

2. Methodology for Estimating PPPs of Output, Intermediate Inputs, Capital and Labour Inputs

This section presents the methodology for constructing PPPs for gross output, intermediate inputs, capital input and labour inputs and value added. It starts with an overview of the methodology and it then presents the detailed discussion of the methodologies for estimating PPPs for output of inputs separately.

The relative labour productivity level measures the relative efficiency with which various economies transform labour into output. The relative total factor productivity (TFP) level compares the relative output differences across two countries, not just to labour input differences but also to capital input and intermediate inputs differences or to the difference in the combined capital, labour and intermediate inputs. It thus provides a more complete measure of overall efficiency. The relative TFP level captures the difference in the overall efficiency of an economy that arises from the use of superior production techniques, technology, firm organization and scale economies.

The measure of labour input and capital input in the productivity measurement framework of Jorgenson and his co-authors takes into account the difference in the marginal productivity of different types of labour input (e.g. more skilled vs less skilled workers) and the difference in marginal productivity of different types of capital assets (such as information and communication technology assets and other assets). This distinction between skill level of labour inputs and the asset mix of capital inputs provides an examination of the roles of cross-country differences in the skills and the asset mix towards more high tech assets in the relative level differences of labour productivity between countries.

In the LA KLEMS database for productivity growth comparison, workers are classified by age, education, and gender to take into account the difference in their marginal productivity, and the measure of labour input take into account the compositional shift of hours worked toward workers with different education levels and experiences (Hofman et al. 2021). The growth in labour input exceeds the growth in hours worked if there is a shift of hours worked towards more educated and more experienced workers.

Capital input in productivity measurement is the flow of capital services derived using capital assets in a period, and the price of capital input reflects the user cost of using capital assets over a period. The user cost of capital is higher for those assets with shorter service life and higher depreciation. To take in account those differences, capital input in LAKLEMS is based on the aggregation of capital stock that are grouped into several main assets with similar service life and similar depreciation rates using weights that are based on the user cost of capital. For this approach, capital services are assumed proportional to capital stock at the detailed asset level. The growth of capital service exceeds the growth of capital stock when there is a shift of capital assets towards assets with shorter service life such as M&E from those assets with longer service life (buildings).

The comparison of relative levels of output, inputs and productivity (labour and total factor productivity) is based on the volume index of output and inputs that abstract from price differences across countries and that is akin to physical concept. The output (gross output or

value added) or inputs measured in nominal prices need to be transformed into a statistic that is akin to a quantity concept. For purposes of productivity level comparison, it is not sufficient to know that Chile produced 100,000 in Chilean Pesos of wine per worker, and that Mexico produced 1,000 in Mexico Pesos per worker. For productivity estimates, we need to know whether Chile produced more physical output (litres of wine) per worker than Mexico did. For that purpose, a measure of relative prices is required. If the price of Chilean wine is 50 Chile Pesos per litre and that of wine in Mexico is 1 Mexico, per litre, then the relative price is 50 and the relative quantity of produced is 2 (100,000/1,000 divided by 50).

PPPs used for productivity level measurement represent this concept of the relative prices of a product or a bundle of goods and services between two different countries. More specifically, the PPPs of gross output reflect the price relatives that show the ratio of the prices in national currencies of the good or service output produced in different economies. The PPPs of intermediate inputs show the ratio of the prices in national currencies of the good or service input used in the production in different economies. As industries produce a large number of products and use a large number of goods and services as intermediate inputs, PPPs at detailed product levels are aggregated to derive PPPs of gross output and intermediate inputs. The weights for the aggregation are based on the nominal values of various outputs that the industry produce for PPPs of gross output and the nominal values of inputs that the industry use in the production for PPPs of intermediate inputs

Once PPPs for gross output and intermediate inputs are estimated, PPPs for value added is calculated from the identity that value added is the difference between gross output and intermediate inputs and using the double deflation method of gross output and intermediate inputs.

PPPs for labour input level comparison reflect the ratio of the prices or compensation of labour in domestic currency for each similar unit of labour input. When there are different types of labour input in production, PPPs for labour input are derived from an aggregation of relative hourly compensation across various types of workers using weights based on their total labour compensation.

PPPs for capital input level comparison reflect the ratio of the user cost of capital in domestic currency for a unit of capital input. When there are many different types of capital assets used in production, PPPs for capital input at the industry level are aggregated from data on relative user costs of capital and capital stock by various asset types.

PPPs for output, capital, labour and intermediate inputs at the industry level are all derived from aggregation of the price relatives or PPPs at the detailed product and input levels. Two alternative aggregation method can be used: one is CCD multilateral T*ö*rnqvist aggregation (Caves, Christensen and Diewert, 1982), the other is based on bilateral comparison.

For CCD multilateral comparison, an artificial reference economy created as an average of all economies in the data set, and then used as a bridge making binary comparisons between two economies. The CCD index is transitive and is base-economy invariant in the sense that all economies are treated symmetrically (Caves, Christensen and Diewert 1982).

Alternatively, one country is chosen as a benchmark for comparison and all other countries are compared with that benchmark country. However, this bilateral index is not transitive and is sensitive to the choice of benchmark country. Therefore, the CCD multilateral index chosen for constructing PPPs and LA KLEMS productivity level database. That is also the aggregation used in EU KLEMS (Inklaar and Timmer, 2008).

For the presentation of the database, PPPs of gross output, and capital, labour and intermediate input estimated using CCD multilateral index are normalised with US dollar as 1 in the PPP database. When US dollar is normalized as 1, PPPs for a country is the price of output and input in local currency unit in that country that would cost one US dollar in the United States.

Those PPPs at the industrial sector are then aggregated PPPs for gross output, value added, intermediate, capital and labour inputs are all first constructed at the industry level, to derive PPPs at the total economy level using the CCD aggregation.

2.1 PPPs for Gross output, Intermediate Inputs and Value added

An industry produces various products and use various products as intermediate input. The data used for estimating PPPs of gross output, intermediate inputs and value added for an industry consists of the relative prices at the product level and the nominal value of output and intermediate inputs at the product level.

Let p_{ic}^{GO} be the relative price or PPP of product i in domestic currency relative to the US dollars in country c. Let V_{ic} be the nominal value of output for product i that an industry produces in country c. There are a total of I products, and a total of N countries. In this version of the database, I = 72 and N=9 as there are 72 products and 9 countries (8 LA economies plus the United States). For simplicity of presentation, the subscript for industries is not explicitly referenced. It is also useful to define $v_{ic}=V_{ic}/\sum_{i=1}^{I} V_{ic}$ $(c=1,2,\ldots,N)$ as the share of product i in the nominal output of the industry in country c which sums up to one.

As an industry produces multiple products, PPPs or p_{ic}^{GO} at the product level needs to be aggregated to derive the PPPs for gross output at the industry level. The CCD multilateral Törnqvist aggregation is used, as that index has a number of desirable properties: it is transitive and base country independent.

For CCD aggregation, an artificial or benchmark country is created as the average of the countries, and all countries are then compared with the benchmark country. In that benchmark country, the price of product i is the geometric average of the relative prices of product i in all countries, $\overline{lnp_i^{GO}}=\left(\sum_{c=1}^{N} lnp_{ic}^{GO}\right)/N$, and the share of product i in the nominal value of gross output is the avearge of the nominal share of product i in all countries: $\bar{v}_i=¿$.

The PPPs or relative price of gross output in country c can be written as follows:

(1) $\ln PPP_G O_c=\sum_i \hat{v}_{ic}\,¿¿$,

Where,

- $PPP_G O_c$: PPP of gross output for country c, expressed in domestic currency relative to the price level of an average country,
- p_{ic}^{GO}: the relative price of output i in country c, expressed in domestic currency relative to US dollars,

- $\overline{lnp_i^{GO}}$: the geometric average of the price of output i over all countries indexed by c=1,..,N and N is the number of countries, $\overline{lnp_i^{GO}} = \left(\sum_{c=1}^{N} lnp_{ic}^{GO} \right) / N$,
- $\hat{v}_{ic} = \left(v_{ic} + \sum_{c} v_{ic} / N \right) / 2$, where v_{ic} is the nominal share of output i in total nominal output of an industry in country c.

The relative price of output i in country c, expressed in domestic currency relative to US dollars p_{ic}^{GO} is obtained from the ICP (World Bank, 2015).

A similar formula is used to estimate PPPs for intermediate inputs (denoted $P_I I$). For PPPs of intermediate inputs, the share of an input in total intermediate input is used to aggregate the PPPs at the product level to derive PPPs of intermediate input at the industry level.

PPPs for value added ($PPP_V A$) is estimated using double deflation from the PPPs of gross output and intermediate inputs. The CCD index for double deflation is guaranty for consistency with aggregation for other variables, which is essentially equivalent to the procedure adopted in EUKLEMS with a mix of CCD and EKS. EUKLEMS applied the CCD index for estimating PPPs of output and intermediate input and then the EKS index for the double deflation of value added.[2]

For value added, two alternative PPPs can be used: one based on the deflation of gross output and intermediate input PPPs (in a procedure known as double deflation) and one based on gross output PPP only (single deflation). The choice of the single deflation over double deflation is based on the view that there are inherent measurement errors and large variability that are often associated with double deflation. However, for LAKLEMS, the estimates based on double deflation are sensible and robust. Therefore, the double deflation for value added is adopted for LA KLEMS.

In the productivity and growth accounts, productivity is examined from the producer perspective: output is valued at basic price that excludes net product tax, and transport and trade margins, while inputs are valued at purchaser price that includes net product taxes, and transport and trade margins. To be consistent with the growth accounts, the PPPs of output for the level comparison reflects the relatives of basic prices for gross output and the PPPs for inputs are the relatives of purchaser prices for capital, labour and intermediate inputs.

2.2 PPPs of Labour Input

PPPs (PPP_c^L) or the relative price of labour input is the price of labour input in a country in domestic currency compared with the average price of the average economy and it can be written as:

(2) $\ln P PP¿ L_c ¿ \sum_{l} \hat{v}_{lc} ¿¿$,

[2] Essentially, the CCD index is the multilateral counterpart of the bilateral Törnqvist index, while EKS is the multilateral counterpart of the bilateral Fisher index. In practice, both indexes yield similar estimates. But the Törnqvist index is commonly used in growth accounting and productivity database. World Bank (2015) provided a detailed discussions of those indexes.

Where,

- PPP_c^L : PPP of labour input for country c, expressed in domestic currency relative to the average price of labour input in an average country.
- p_{lc}^L: the hourly compensation of worker type l in country c, expressed in domestic currency.
- $\overline{\ln p_l^L}$: the geometric average of hourly compensation of worker type l over all countries indexed by c=1,..,N and N is the number of countries. $\overline{lnp_l^L} = \left(\sum_{c=1}^{N} lnp_{lc}^L \right) / N$.
- $\hat{v}_{lc} = \left(v_{lc} + \sum_c v_{lc} / N \right) / 2$, where v_{lc} is the nominal share of worker type i in total labour compensation of an industry in country c. $\left(\sum_c v_{lc} / N \right)$ is the average of that share in all economies.

For LA KLEMS, labour is cross-classified by gender (male and female) and age group (15–29, 30–49, and 50 and over) and skill levels (low skilled, medium skilled, and high skilled) for a total of 18 types of workers (Appendix Table A1).

If hours worked is homogeneous or no distinction is made between different types of workers with different marginal product or hourly compensation, PPPs or the relative price of labour input will be equal to the ratio of hourly compensation in domestic currency between the two countries, and hours worked is the volume measure of labour input for productivity level comparison. If hours worked is heterogeneous and workers in one country is more educated and more experienced than those in the other country, PPPs of labour input will be different from the ratio of hourly compensation in domestic currency in two countries. This is because PPPs for labour input takes into account the difference in the skill mix of hours worked in the two countries. Essentially, difference in the hourly compensation in the two countries may reflect the difference in the skill mix in the two countries. PPPs of labour input controls for the difference in the skill mix between two countries and it measures the relative price of a unit of labour input in the two countries. Therefore, the difference in relative hourly compensation and relative prices of labour input between countries represents the difference in the difference in skill levels between the two countries.

2.3 PPPs of Capital Input

Capital input is the flow of capital services derived using capital assets in a period, and the price of capital input reflects the user cost of using capital assets over a period. Therefore the PPPs PPP_c^K of capital input is the relative user cost of capital input in a country in domestic currency compared with the user cost of the average economy and it can be written as:

(3) $\ln PPP¿K_c¿\sum_k \hat{v}_{kc}¿¿$,

Where,

- PPP_c^K : PPP of capital input for country c, expressed in the user cost of capital in domestic currency relative to the average user cost of capital in an average country.
- p_{kc}^K: the user cost of capital asset k in country c, expressed in domestic currency.
- $\overline{lnp_k^K}$: the geometric average of the user cost of capital asset k over all countries indexed by c=1,..,N and N is the number of countries. $\overline{lnp_k^K} = \left(\sum_{c=1}^{N} lnp_{kc}^K \right) / N$.
- $\hat{v}_{kc} = \left(v_{kc} + \sum_c v_{kc} / N \right) / 2$, where v_{kc} is the nominal share of asset type k in total capital compensation of an industry in country c. $\left(\sum_c v_{kc} / N \right)$ is the average of that share in all economies.

In LA KLEMS, capital assets are classified into 8 asset types (Appendix Table A2), residential structures, no-residential structures, transportation equipment, M&E, other products and 3 information technology and communication products (computing equipment, communication equipment, and software. The same depreciation rates are used to estimate the capital stock for those 8 assets for all LA economies to provide comparability of capital stock estimates.

The user cost of capital for asset type k in a country c is estimated using the exogenous rate of return and it can be estimated as:

$$p_{kc}^K = p_{kc}^I (\delta_k + \gamma),$$

where p_{ic}^I is the investment price of capital asset k in country in c in domestic currency relative to US dollars, δ_k is the depreciation rate for asset type k and γ is the real rate of return which is assumed to be 4%.

It should be noted that two alternative approaches can be used to estimate the real rate of return and the user cost of capital. For the exogenous or ex-ante approach for estimating the user cost of capital, the real rate of return in set equal to the average real return from markets for bonds or equities. For the endogenous or ex-post approach for estimating the user cost of capital, the rate of return is solved from the equation that the sum of user costs of capital across all assets is equal to ex post capital compensation that is often estimated residually as the difference between value added and labour compensation.

The endogenous approach will be preferred approach if there are perfect foresight, constant returns to scale and competitive markets (Jorgenson, Gollop and Fraumeni, 1987). When some of assumptions are not valid or when a set of assets in productivity measurement are not complete, the ex post or exogenous approach is preferred (Diewert, 2000, Schreyer, 2004). The exogenous approach is also preferred for a practical reason as the endogenous rate of return is often volatile and may not represent the cost of using the capital in a period. Baldwin, Gu and Macdonald (2010) provided detailed discussion about the assumptions required for those two approaches the effect of alternative approaches on the estimates of capital input growth.

For LA KLEMS productivity level database, the exogenous rate of return method is chosen to estimate PPPs and relative levels of capital input and the real rate of return is set equal to 4%. This approach is also adopted in EU KLEMS level database (Inklaar and Timmer, 2008). This differs from the approach used to estimate the user cost of capital in the LA KLEMS and EU

KLEMS productivity growth database where the endogenous rate of return approach is used (Hofman, 2021, Inklaar et al, 2003).

The investment price and PPPs of assets is from the ICP (World Bank, 2015). For the estimation of the PPPs of capital input, we distinguish five asset types that include ICT, transportation equipment, other M&E, residential structures and non-residential construction. That is because data on PPPs for investment goods are limited from the ICP and no PPPs for separate categories ICTs are available from the ICP.

3. Level Accounting and KLEMS Productivity Level Database

This section outlines the construction of KLEMS productivity level database and provides the level accounting of labour productivity difference between countries that traces the difference in labour productivity level into the difference in input intensity and the difference in TFP level.

The construction of KLEMS level database starts with the construction of the KLEMS level database in the benchmark year (2011 for this database). This includes the relative levels of output, intermediate input, capital and labour input and TFP and labour productivity levels at the sector level for benchmark year 2011. These relative levels of output, inputs and productivity in benchmark year are then extrapolated to other years using the growth rates of those variables. The relative volume measure of gross output in the benchmark year in country c is derived from deflating the nominal value of gross output in domestic currency by the relative price or PPPs of gross output in a country c.

$$QGO_c = GO_c / PPP_G O_c,$$

where $Q_G O_c$ is the relative volume of gross output in benchmark year and $PPP_G O_c$ is the PPPs of gross output, and GO_c is nominal value of gross output in domestic currency.

Similarly, the relative volume of intermediate inputs and value added is estimated by deflating the nominal values in domestic currency by their PPPs:

$$Q_I I_c = I I_c / PPP_I I_c, \text{ and}$$

$$Q_V A_c = V A_c / PPP_V A_c,$$

II denotes intermediate inputs and VA denotes value added.

The relative volume measure of labour input in the benchmark year in country c is derived from deflating the nominal value of labour input (which is labour compensation in domestic currency) by the relative price or PPPs of labour input in a country c.

$$Q¿L_c¿LAB_c / PPP¿L_c❑$$

where LAB denotes labour compensation in domestic currency.

Similarly, the relative volume measure of capital input in the benchmark year in country c is derived from deflating the nominal value of capital input (which is capital compensation estimated using exogenous rate of return specification of user cost estimation) in domestic currency by the relative price or PPPs of capital input in a country c.

$$Q¿K_c¿CAPE_c / PPP¿K_c❑,$$

where CAPE is the nominal capital compensation based on the exogenous rate of return estimation of user cost formula. It is equal to capital stock times the user cost of capital, which is equal to $p_{kc}^{K} = p_{kc}^{I}(\delta_k + \gamma)$, where γ is exogenous rate of return in real terms.

It should be noted that this ex post capital income estimated using the exogenous rate of return may differ from the capital income in the KLEMS database that reflects ex post capital income and is calculated residually as the difference between nominal value added and labour compensation. The difference may reflect the unmeasured inputs such as intangibles and natural inputs and excess profits (Schreyer 2004).

The relative TFP levels can be based on gross output or value added. The relative TFP level based on gross output involves the comparison of gross output and capital, labour and intermediate inputs and is calculated as follows:

(4) $\ln TFP_G O_c = (\ln Q_G O_c - \ln Q_G O) - 0.5(shgoK_c + shgoK)$¿

The variables $shgoK_c, shgoL_c, shgoII_c$ are the share of capital income, labour income and in intermediate inputs in nominal gross output in country c. $shgoK, shgoL, shgoII$ are average share of capital, labour and intermediate inputs in gross output in all countries., where capital income CAP from the KLEMS database is used to calculate the share of capital income in output.

The variables $\ln Q_G O, \ln Q_K, \ln Q_L, \ln Q_I I$ are the geometric averages of the volumes of gross output, capital input, labour input and intermediate inputs in all countries.

The relative TFP level based on value added involves comparison of value added and capital and labour inputs are calculated as follows:

(5) $\ln TFP_V A_c = (\ln Q_V A_c - \ln Q_V A) - 0.5(shvaK_c + shvaK)$¿

The variables $shvaK, shvaL$ are the share of capital income and labour income in value added.

The relative TFP level involve comparison of output with all inputs. However, the most commonly used productivity measure is the partial productivity measure such as labour productivity for international comparison. This is generally defined as an output measure divided by hours worked. The labour productivity level based on gross output is estimated by dividing the relative volume of gross output by hours worked. The labour productivity level based on value added can be estimated by dividing value added by hours worked.

$LPGO_c = Q_G O_c / H_c$, and

$LPV A_c = Q_V A_c / H_c$,

LPGO is labour productivity based on gross output, LPVA is labour productivity based on value added and H is hours worked

Finally, the relative levels of labour productivity are related to the relative levels of TFP and relative levels of capital and labour compensation according to the level accounting equation:

(6) $$(\ln LP_V A_c - \ln LP_V A) = 0.5(shvaK_c + shvaK)(\ln KPH_c - \ln KPH) + 0.5(shvaL_c + shvaL)(\ln LPH_s - \ln LPH) + (\ln TFP_V A_c - \ln TFP_V A)$$

Where KPH is capital service per hour worked and LPH is labour services per hour worked. According to the level accounting, relative levels of labour productivity can be decomposed into the difference in capital intensity, difference in labour composition or labour skills, and relative TFP level differences.

Similarly, we can relate labour productivity level based on gross output to TFP level based on gross output and the difference in intermediate input per hour worked, capital input per hour worked and labour composition.

As the final step for preparing the KLEMS productivity level database for all years, the estimates of output, inputs and productivity levels in the benchmark year are to be extrapolated to all other years using the gross rates of output, inputs and productivity over time.

Labour productivity level is then expressed in US dollars per hour worked, capital input per hour worked is expressed as US dollars per hour worked. It should be noted that relative TFP level and relative labour input per hour worked has no natural units and they will be normalized with US as 1.

4. Data Sources

The data used for construction the LA KLEMS productivity level database consists of KLEMS growth accounts for eight LA economies and the United States and the data sources used to estimate the PPPs of output and inputs for a reference year. The LA KLEMS growth accounts for eight LA economies is constructed by Hofman et al. (2021). For the United States, the data are from the EU KLEMS (Inklaar, Timmer and van Ark, 2007, Jorgenson, Ho and Stiroh, 2005 for detailed discussion of the US data).

For the PPPs estimation, the year 2011 is chosen as benchmark year. The choice of the reference year is based on the availability of the relative price data for the LA economies and the United States. The data on the relative prices at the product level used to estimate PPPs for output and intermediate inputs are obtained from the International Comparison Program (ICP). The ICP is a worldwide statistical initiative that estimates purchasing power parities (PPPs) to compare real GDP and its expenditures components (consumption and investment) across economies. The ICP program for reference year 2011 covers 199 economies that includes eight LA economies and the United States covered in the LA-KLEMS database on PPPs. The PPPs are available at the basic heading level (155 products) for year 2011 from the ICP. The PPPs are expressed in domestic currency per unit of US dollar.

The two main data sources used for estimating the PPPs of gross output, value added and intermediate inputs are the Supply and Use Tables (SUTs) and PPPs at the basic headings from the ICP.

The SUTs for Chile, Colombia, Mexico, Costa Rica and the United States are from OECD database on SUTs. The SUTs provide data for 72 products and for 72 industries (shown in Appendix Table A3) for all economies except for Colombia. For Colombia, the level of industry aggregation is more aggregated, but the level of product aggregation is at 72-product level.

The supply use tables for the Dominican Republic, El Salvador, Honduras, and Peru are obtained from LA KLEMS. For those countries, the tables are rectangular and the number of products are more than number of industry in the SUTs. To convert those tables to square tables as in the OECD database, the market share assumption is used. For Honduras, the number of products are small and therefore they are directly mapped to the 72 products.

The SUTs at 72 product and 72 industry levels for most countries are used to estimate PPP for gross output, intermediate inputs, and value added at the industry level. To estimate PPPs at the sector level, the 72 products in the SUTs are mapped to the 155 basic headings in the ICP data to obtain PPPs for those products.

While most products in the SUTs are mapped to ICP basic headings, there are 14 products in the SUTs are not mapped to ICP data (Appendix Table A4). Those products are primarily used as intermediate inputs. That is because the ICP only provides information on the relative prices of products that are used as final consumption as the purpose of ICP program is to measure real GDP from the expenditure or final demand side and it does not provide data on the relative prices of products that are used for intermediate inputs. Those products not matched to ICP basic headings include forestry, mining products, metals products, chemicals and etc. For most of those products that are traded on international markets, we used exchange rates as proxy for those PPPs. For other products, we use GDP deflator as a proxy.

In the KLEMS database, gross output is valued at basic price and intermediate input is valued at purchaser price. The relative prices in ICP reflects the market price or purchaser price. To calculate PPPs for gross output, the PPPs from ICP needs to be converted to basic prices by peeling off the tax and transport margins as in Jorgenson, Kuroda, and Nishimizu (1987), Inklaar and Timmer (2008) and Baldwin, Gu and Yan (2008). To calculate PPPs for intermediate inputs, the ICP PPPs can be used as the valuation is the same between ICP and the KLEMS productivity database (purchaser price). Those margins rates and tax rates are available from the SUTs.

PPPs for output for productivity comparison reflects the prices of domestic production that is either used for domestic uses and or exported broad, while PPPs from the ICP reflect the prices of final expenditure on products, which are either produced domestically or imported from abroad. Ideally, the PPPs from the ICP needs adjustments for prices of imports and exports to derive PPPs for domestic production. Baldwin et al. (2005) outlined a procedure how this can be done using assumptions on the prices of exports and imports. Inklaar and Timmer (2008) constructed PPPs for manufacturing products for domestic production using the unit value ratios from the production surveys. Neither approach is entirely satisfactory. The assumption about export and import prices needs to be tested for the approach by Baldwin et al. (2005), while the PPPs based on unit value ratios are often not available for the approach by Inklaar and Timmer (2008). For the LA-KLEMS productivity level database, no adjustment is made to take into accounts the differences in the prices of imports, exports and domestic production.

The last complication arises when the multiple products at the basic heading level is mapped to one product used for estimating industry PPPs. For example, the products at the basic headings such as Rice, Fresh or chilled vegetables, Fresh or chilled potatoes are mapped to the products of agriculture, hunting and related services used at the SUT product level. The aggregation of the product headings to the SUT products are based on the expenditure data at the national level that is available from ICP and uses those expenditure shares as weights. Ideally, the aggregation should be based on the production and intermediate inputs data for the estimation of PPPs for output and intermediate input. However, such data are not available.

The data used for estimating the PPPs of labour input consist of the hourly compensation and hours worked by types of workers are available from the LA KLEMS growth accounts. The data used for estimating the PPPs of capital input consists of capital stock by assets types available from the LA KLEMS growth accounts and relative price of investment assets from the ICP.

5. Main Findings

This section presents estimates of PPPs and provides and a comparison of the levels of productivity between eight LA economies and the United States.

5.1 PPPs of Gross output, Intermediate Inputs, Value Added and Capital and Labour Inputs

Table 1 presents the PPPs of gross output, intermediate inputs and value added for year 2011. For comparison, the table also presents the PPPs for GDP in total economy from the International Comparison Project (ICP). For the total economy, PPPs for value added constructed for LA KLEMS are broadly similar to the ones from the ICP. This is re-assuring as the estimates of PPPs for this paper are estimated from production side and using double deflation while the PPPs from the ICP is constructed from the expenditure side of GDP. The other difference is PPPs for value added for KLEMS level based on the valuation of basic price. In contrast, PPPs for value added from ICP is based on the valuation of market prices that differs from the valuation of basic price by trade and transport margins and net product taxes.

There are inter-industry differences in PPPs of gross output, intermediate inputs and value added across industries due to the difference in industry output mix and intermediate input mix. This suggests that it is important to estimate PPPs at the industry side if we want to have accurate estimates of industry productivity levels.

Table 2 presents PPPs of capital and labour inputs for year 2011. The PPPs of capital input is estimated using equation (3) while the PPPs of labour input is estimated using equation (2). The PPPs of capital input reflects the ratio of the user cost for a unit of capital input in domestic currency between the two countries, while the PPPs of labour input represents the ratio of the price of a unit of labour input in domestic currency between the two countries where workers are classified by age, gender, and education.

In Table 2, PPPs is normalized to one for United States. Therefore, the PPPs for labour input in a country represents the price in domestic currency for a unit of labour input that would cost 1 US dollar in United States. There are differences in PPPs of labour input across industries. Those inter-industry differences are partly due to differences in labour input used in different industries in the two countries, and partly due to the difference in the relative price of a unit of labour input in different industries in the two countries. If the labour market is perfectly competitive and labour are fully mobile, the hourly compensation will be equalized across industries and the difference in PPPs of labour input between industries will only reflect the difference in the relative price of labour input between industries.

The ratio of PPPs for labour input to the exchange rate or the PPPs for GDP across countries can be interpreted as the relative costs of labour in those countries (Jorgenson and Kuroda, 1985). Those ratios were all less than one for the eight LA economies that shows that the unit costs of labour in LA economies are lower than that in the United States.

The PPPs of capital input are similar across industries. It is assumed that the user cost of capital for an asset is the same across all industries as the same exogenous rate of return is used to estimate the user cost of capital in all industries. This implicitly assumes that capital market is perfectly competitive and the rate of return is equalized across industries. The difference in PPPs of capital input between industries in Table 2 therefore is due to the difference in asset mix or capital input between industries.

5.2 International Comparison of the Levels of Labour and Total Factor Productivity

The LA KLEMS level database provide two measures of labour and total factor productivity, one based on value added and the other based on gross output. It is often argued that productivity measure based on gross output is the right measure at the industry level, as gross output reflects the production of goods and services. For total economy, value added is the right concept as it is more closely related to the living standards and gross output measure at the total economy level is sensitive to the degree of integration in production and is subject to the double counting of intermediate inputs between industries (Schreyer 2001).

Table 3 presents labour productivity and total factor productivity level that is based on value added in 2015 with United States normalized as 1. The year 2015 was chosen, as the US data is available up to years 2015.

As expected, all eight LA economies have labour productivity levels that are much lower than that of the United States in 2015. Among the eight LA economies, Chile has the highest labour productivity level, followed by Mexico. Honduras and El Salvador have the lowest labour productivity levels.

All eight LA economies have total factor productivity levels lower than that of the United States in 2015. Among the eight LA economies, Chile has the highest TFP level, followed by Mexico. Again, Honduras and El Salvador have the lowest total factor productivity levels.

The relative levels of TFP in LA economies compared with that of the US was higher than their relative levels of labour productivity. This suggests that the relative lower levels of labour productivity in LA economies was partly due to the lower levels of TFP. The remainder was due to the lower levels of input intensity.

Table 4 presents the levels of labour productivity and total factor productivity based on gross output in 2015 with the United States normalized as 1. The differences mirror the differences for productivity measures based on value added in Table 2.

The Penn World Table (PWT) provides an international comparison of GDP per capita across countries, recently expanded to include also comparisons of TFP and labour productivity levels on value added at the total economy level (Feenstra and Inklaar, 2013). However, the PWT does not provide information on productivity level differences at the industry level that is important if one wants to understand the TFP level at the industry level and their contribution to the overall TFP level differences. Such information on TFP level at the industry level is available from LA KLEMS for comparison of LA economies and EU KLEMs for comparison of EU economies.

Figure 1 presents the levels of labour productivity for eight LA economies and the United States from LA KLEMS and PWT 10. Labour productivity levels for El Salvador and Honduras are not available from the PWT. While the ranking of the relatively levels of labour productivity is similar between the two database, there are differences in the two estimates.

Figure 2 compares the levels of total productivity for eight LA economies and the United States from LA KLEMS with those from PWT 10. Once again, the ranking of the relatively levels of total productivity is similar between the two database. However, again there are differences in the two estimates.

Those differences are due to a number of differences between the two databases, some conceptual and others methodological. First, the valuation of output from the PWT is at market

price, while the valuation of output is at basic prices in LA KLEMS database. The difference between the two concepts are tax rates and distribution margins. It is argued that productivity measurement should be viewed from producer perspective and output valued at basic price. Second, while both LA KLEMS and PWT use PPPs from the ICP, PWT adjusts PPPs of government services from ICP for the differences in productivity in the provision of government services (Feenstra and Inklaar, 2013). Therefore, some of the differences could be due to the adjustment that PWT made to PPPs for government services from ICP. Third, there are also differences in the estimation method of labour input and capital input. While both PWT and LA KLEMS use the concept of capital and labour input that accounts for the difference in asset mix and skill mix, the exact implementation are different. Finally, PWT includes close to 200 economies that are at the various stage of development. The aggregation index that is adopted by PWT that make use of information for all those 200 economies could affect the final estimates for LA economies.

5.3 International Comparison of Capital Intensity and Skill Levels

The productivity level accounting shows that the difference in the levels of labour productivity can be accounted for by the difference in capital intensity and skills level between countries.

Table 5 presents capital intensity and skills levels as measured by education and age (experience) for eight LA economies and the United States in 2015. All eight LA economies has capital intensity that were much lower than that of the United States in 2015.

The table also shows that the difference in the skills levels between LA economies and the United States was small. For some countries, the skill levels were actually higher than that of the United States.

The evidence on the relative levels of productivity, capital intensity and skill levels suggest that the relative lower levels of labour productivity in LA economies was partly due to the lower levels of TFP and was partly due to the lower capital intensity. The difference in skill levels between LA economies and the United States was small.

6. Conclusions

This paper outlines the methodology, data sources and results for estimating the purchasing power parities (PPPs) of inputs and output. It also details the methodology for estimating the relative levels of output, inputs and labour and total factor productivity that makes use of the estimated PPPs.

The paper finds that the level of labour productivity in those eight LA economies was lower than that of the US in 2015. The lower level of labour productivity is due to the lower level of total factor productivity and the lower level of capital intensity in LA economies compared with those in the United States. The difference in skill levels between LA economies and the United States was small.

This paper has also highlighted many data challenges for constructing the KLEMS productivity level database.

The PPPs of output and inputs are sensitive to the level of dis-aggregation for output and inputs. Ideally, the increase in the product details will improve accuracy of the estimates of PPPs and relative productivity levels.

The ICP provides data on PPPs for products that are used for final expenditures. No data are available for products that are used for intermediate inputs. The progress needs to be made to collect PPPs for intermediate products to improve the accuracy of relative productivity levels. A recent attempt that combine ICP data and unit costs from the production survey from the national statistical agencies to estimate PPPs for productivity level comparison is documented in Inklaar and Timmer (2016).

The PPPs for investment goods need to be expanded to include more investment goods such as information and communication products. The other challenge is related to PPPs of services such as health and education and no-market services. The improved estimates of PPPS for those service products are needed to have accurate estimates of productivity levels for those service industries.

The comparability of output and inputs needs to be carefully examined for constructing KLEMS productivity level database. We will need to carefully examine the concept, survey and estimation methods used to estimate those variables. We hope that our estimates will serve as starting point for those improvement.

The benchmark year chosen for this version of the database is 2011. The PPPs may be sensitive to the benchmark year as the product and input mix change over time. The accuracy of the productivity estimates for more recent years require the updating of PPPs for more recent years.

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Table 1. PPPs of gross output, intermediate inputs and value added, 2011, US= 1

	Chile	Colombia	Costa Rica	Dominican	El Salvador	Honduras	Mexico	Peru	US
Gross output									
Total economy	337.8	1121.1	326.1	19.7	0.5	10.3	7.4	1.5	1.0
Agriculture	465.8	1419.6	573.2	22.6	0.8	13.7	8.0	1.8	1.0
Mining	606.1	1903.8	548.7	46.0	0.8	17.5	11.2	2.8	1.0
Manufacturing	498.9	1791.2	531.9	38.0	0.9	18.7	11.2	2.6	1.0
Utility	650.1	1677.5	336.1	35.1	0.7	22.8	14.3	2.3	1.0
Construction	240.6	837.6	230.0	13.9	0.4	6.6	6.4	1.1	1.0
Wholesale &retail	356.4	1199.8	338.5	18.4	0.6	11.4	7.9	1.7	1.0
Transport & communications	288.7	1138.0	210.7	15.0	0.3	7.1	7.5	1.2	1.0
Finance	314.6	855.5	225.5	15.4	0.4	6.6	8.1	1.1	1.0
Community and other	189.2	685.0	294.0	9.5	0.3	6.1	3.1	0.9	1.0
Intermediate inputs									
Total economy	412.6	1328.2	360.8	23.9	0.6	11.7	9.4	1.8	1.0
Agriculture	430.5	1414.8	418.4	26.7	0.7	13.2	9.5	1.9	1.0
Mining	426.6	1478.2	361.5	25.6	0.7	12.3	10.7	1.9	1.0
Manufacturing	496.6	1496.7	455.6	29.2	0.8	14.6	10.4	2.1	1.0
Utility	527.1	1368.2	376.3	26.8	0.7	14.4	10.4	2.0	1.0
Construction	416.9	1442.3	408.7	27.0	0.7	10.1	10.3	2.1	1.0
Wholesale &retail	344.3	1180.2	298.7	19.3	0.5	9.4	8.8	1.5	1.0
Transport & communications	357.5	1290.6	290.3	21.1	0.5	10.5	9.0	1.7	1.0
Finance	367.5	1152.5	267.5	17.9	0.5	8.9	9.2	1.4	1.0
Community and other	371.1	1206.3	309.1	20.8	0.5	10.2	9.1	1.6	1.0
Value added									
Total economy	292.6	992.4	304.6	16.7	0.4	9.5	6.2	1.3	1.0
Agriculture	512.0	1435.2	810.5	20.3	1.0	14.2	7.0	1.7	1.0
Mining	735.3	2207.8	707.8	79.5	1.0	21.6	12.1	3.5	1.0
Manufacturing	510.2	2533.1	712.6	58.6	1.2	32.6	12.3	3.9	1.0
Utility	831.8	2093.5	304.6	44.3	0.6	53.6	19.9	2.7	1.0
Construction	137.4	478.1	123.9	3.3	0.2	4.3	4.0	0.6	1.0
Wholesale	365.	1210.8	371.	17.1	0.6	12.9	7.6	1.8	1.0

&retail	6		3						
Transport & communications	240.3	1033.7	158.2	10.1	0.1	4.8	6.3	0.9	1.0
Finance	292.8	758.0	209.0	14.4	0.4	5.8	7.5	1.0	1.0
Community and other	143.5	530.7	268.3	6.9	0.2	4.9	2.1	0.7	1.0
Exchange rate	483.7	1848.1	505.7	38.1	1.0	18.9	12.4	2.8	1.0
GDP PPP	348.0	1161.9	346.7	19.4	0.5	9.9	7.7	1.5	1.0

Source: Authors' calculation.

Table 2. PPPs of capital and labour inputs, 2011, US = 1

	Chile	Colombia	Costa Rica	Dominican	El Salvador	Honduras	Mexico	Peru	US
Capital input									
Total economy	445.4	1502.9	409.1	26.0	0.7	12.9	9.4	2.0	1.0
Agriculture	539.2	2014.2	574.9	38.7	0.9	17.7	11.8	2.9	1.0
Mining	509.1	1582.9	415.9	26.5	0.6	12.4	9.0	2.1	1.0
Manufacturing	545.6	2158.3	592.6	41.0	1.0	18.8	12.3	3.0	1.0
Utility	541.6	1661.7	423.4	28.4	0.8	13.7	9.8	2.1	1.0
Construction	501.9	2185.7	639.1	38.2	1.0	19.0	12.0	3.1	1.0
Wholesale &retail	531.5	1918.6	461.8	29.3	0.8	15.6	10.0	2.5	1.0
Transport & communications	558.8	2106.2	623.0	35.5	1.0	19.5	11.3	3.0	1.0
Finance	281.2	1007.6	285.1	17.7	0.5	8.7	7.6	1.4	1.0
Community and other	534.1	1529.2	373.2	25.2	0.6	12.1	9.0	1.8	1.0
Labour input									
Total economy	92.8	311.2	78.7	4.0	0.1	1.7	2.2	0.2	1.0
Agriculture	90.6	303.5	94.6	4.3	0.1	2.2	1.7	0.2	1.0
Mining	102.7	562.3	20.5	10.9	0.2	1.0	2.1	0.5	1.0
Manufacturing	84.0	260.4	73.9	4.0	0.1	1.7	1.7	0.2	1.0
Utility	102.3	191.1	61.6	4.3	0.1	2.9	2.7	0.3	1.0
Construction	130.6	302.9	86.2	7.0	0.0	1.0	1.9	0.3	1.0
Wholesale &retail	89.5	296.0	66.5	7.6	0.1	1.8	1.9	0.2	1.0
Transport & communications	92.1	281.1	78.5	4.4	0.1	1.6	2.1	0.2	1.0
Finance	144.9	451.9	97.2	4.0	0.1	1.5	2.0	0.2	1.0
Community and other	115.6	359.2	102.2	2.9	0.1	2.3	3.7	0.2	1.0
Exchange rate	483.7	1848.1	505.7	38.1	1.0	18.9	12.4	2.8	1.0
GDP PPP	348.0	1161.9	346.7	19.4	0.5	9.9	7.7	1.5	1.0

Source: Authors' calculation.

Table 3. Labour and total factor productivity based on value added in 2016, US=1

	Chile	Colombia	Costa Rica	Dominican	El Salvador	Honduras	Mexico	Peru	US
Value added per hour worked									
Total economy	0.58	0.27	0.27	0.26	0.14	0.12	0.51	0.18	1.00
Agriculture	0.21	0.11	0.06	0.12	0.03	0.06	0.26	0.06	1.00
Mining	0.16	0.27	0.08	0.20	0.05	0.01	0.29	0.14	1.00
Manufacturing	0.26	0.09	0.10	0.08	0.04	0.03	0.18	0.06	1.00
Utility	0.22	0.22	0.17	0.12	0.29	0.03	0.18	0.18	1.00
Construction	1.61	1.00	0.77	3.14	0.49	0.24	0.85	0.68	1.00
Wholesale &retail	0.37	0.13	0.17	0.25	0.06	0.08	0.52	0.10	1.00
Transport & communications	0.56	0.17	0.56	0.52	0.59	0.20	0.43	0.22	1.00
Finance	1.15	0.53	0.58	0.51	0.34	0.29	0.94	0.44	1.00
Community and other	0.99	0.64	0.39	0.44	0.36	0.44	1.34	0.41	1.00
TFP on value added									
Total economy	0.93	0.57	0.54	0.55	0.39	0.34	0.76	0.43	1.00
Agriculture	0.68	0.77	0.39	1.22	0.17	0.43	0.61	0.54	1.00
Mining	0.37	0.61	0.62	0.23	0.30	0.13	0.44	0.50	1.00
Manufacturing	0.76	0.32	0.26	0.24	0.18	0.12	0.41	0.27	1.00
Utility	0.57	0.35	0.56	0.41	1.55	0.04	0.42	0.71	1.00
Construction	1.82	2.41	1.19	4.77	0.85	0.37	1.64	1.34	1.00
Wholesale &retail	0.93	0.39	0.45	0.61	0.22	0.38	0.70	0.36	1.00
Transport & communications	1.23	0.59	1.92	2.00	2.81	0.70	1.36	1.09	1.00
Finance	5.89	2.21	2.23	1.16	1.19	1.97	1.13	1.16	1.00
Community and other	1.05	0.73	0.46	0.65	0.52	1.16	1.90	0.42	1.00

Source: Authors' calculation.

Table 4. Labour and total factor productivity based on gross output in 2016, US=1

	Chile	Colombia	Costa Rica	Dominican	El Salvador	Honduras	Mexico	Peru	US
Gross output per hour worked									
Total economy	0.50	0.25	0.25	0.21	0.11	0.13	0.42	0.17	1.00
Agriculture	0.22	0.08	0.08	0.08	0.03	0.05	0.16	0.04	1.00
Mining	0.25	0.34	0.16	0.43	0.08	0.03	0.31	0.20	1.00
Manufacturing	0.26	0.13	0.13	0.10	0.05	0.07	0.24	0.09	1.00
Utility	0.40	0.40	0.17	0.24	0.27	0.22	0.28	0.23	1.00
Construction	0.98	0.78	0.62	0.77	0.26	0.17	0.46	0.40	1.00
Wholesale &retail	0.42	0.16	0.22	0.23	0.07	0.10	0.41	0.12	1.00
Transport & communications	0.52	0.17	0.42	0.27	0.33	0.17	0.32	0.20	1.00
Finance	0.93	0.40	0.47	0.40	0.26	0.24	0.68	0.37	1.00
Community and other	0.64	0.53	0.30	0.28	0.22	0.28	0.74	0.31	1.00
TFP on gross output									
Total economy	0.97	0.74	0.71	0.71	0.59	0.57	0.86	0.63	1.00
Agriculture	0.85	0.91	0.65	1.21	0.39	0.66	0.78	0.73	1.00
Mining	0.50	0.74	0.68	0.46	0.46	0.32	0.64	0.62	1.00
Manufacturing	0.92	0.67	0.63	0.59	0.55	0.52	0.73	0.64	1.00
Utility	0.75	0.60	0.71	0.64	1.27	0.30	0.64	0.84	1.00
Construction	1.33	1.48	1.09	1.46	0.91	0.63	1.27	1.14	1.00
Wholesale &retail	0.96	0.57	0.62	0.72	0.41	0.55	0.80	0.54	1.00
Transport & communications	1.12	0.76	1.48	1.40	1.63	0.83	1.19	1.05	1.00
Finance	3.54	1.76	1.69	1.09	1.12	1.63	1.06	1.11	1.00
Community and other	1.07	0.82	0.56	0.75	0.63	1.15	1.66	0.56	1.00

Source: Authors' calculation.

Table 5. Relative capital input and labour input per hour worked in 2015

	Chile	Colombia	Costa Rica	Dominican	El Salvador	Honduras	Mexico	Peru	US
Capital input per hour worked (US dollar per hour)									
Total economy	3.61	2.55	2.71	2.50	1.39	1.72	5.99	1.50	16.97
Agriculture	1.33	0.35	0.43	0.16	0.66	0.35	2.58	0.16	16.28
Mining	23.24	26.95	3.79	59.47	4.52	4.93	44.56	12.82	82.97
Manufacturing	2.64	2.12	3.64	2.75	1.43	1.39	4.44	1.09	20.30
Utility	29.51	52.39	20.10	18.63	11.95	71.88	33.52	16.06	110.91
Construction	1.21	0.32	0.82	0.72	0.64	0.68	0.52	0.37	2.54
Wholesale &retail	0.71	0.42	0.76	1.00	0.30	0.21	2.71	0.27	9.31
Transport & communications	6.33	2.78	2.95	2.45	1.80	3.23	3.58	1.07	44.65
Finance	5.04	7.67	8.43	18.63	10.69	4.41	45.84	14.06	87.37
Community and other	1.84	2.71	1.60	0.64	0.62	2.64	4.11	1.94	15.85
Labour input per hour worked or (labour skills, USA =1)									
Total economy	1.31	1.02	1.08	1.06	0.91	0.75	0.94	1.14	1.00
Agriculture	0.94	0.78	0.85	0.87	0.80	0.66	0.77	0.83	1.00
Mining	1.12	0.95	1.86	1.09	0.80	0.30	0.76	1.04	1.00
Manufacturing	1.11	0.95	0.99	0.98	0.83	0.79	0.91	1.09	1.00
Utility	1.02	1.10	1.02	1.13	0.92	1.15	0.96	1.10	1.00
Construction	1.12	0.87	0.91	1.01	0.85	1.00	0.88	1.06	1.00
Wholesale &retail	1.12	0.94	0.99	0.99	0.85	0.71	0.92	0.99	1.00
Transport & communications	1.14	0.93	0.94	0.94	0.92	0.85	0.97	1.08	1.00
Finance	1.43	1.05	1.08	1.21	1.00	0.71	1.01	1.32	1.00
Community and other	1.29	1.14	1.16	1.06	1.00	0.47	0.88	1.32	1.00

Source: Authors' calculation.

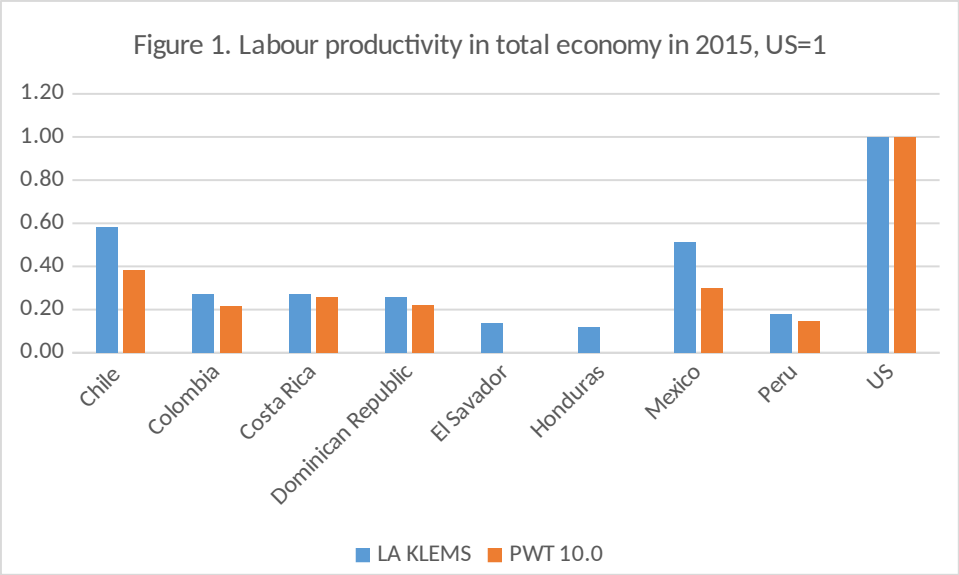
Figure 1. Labour productivity in total economy in 2015, US=1
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Chile
Colombia
Costa Rica
Dominican Republic
El Savador
Honduras
Mexico
Peru
US
LA KLEMS
PWT 10.0

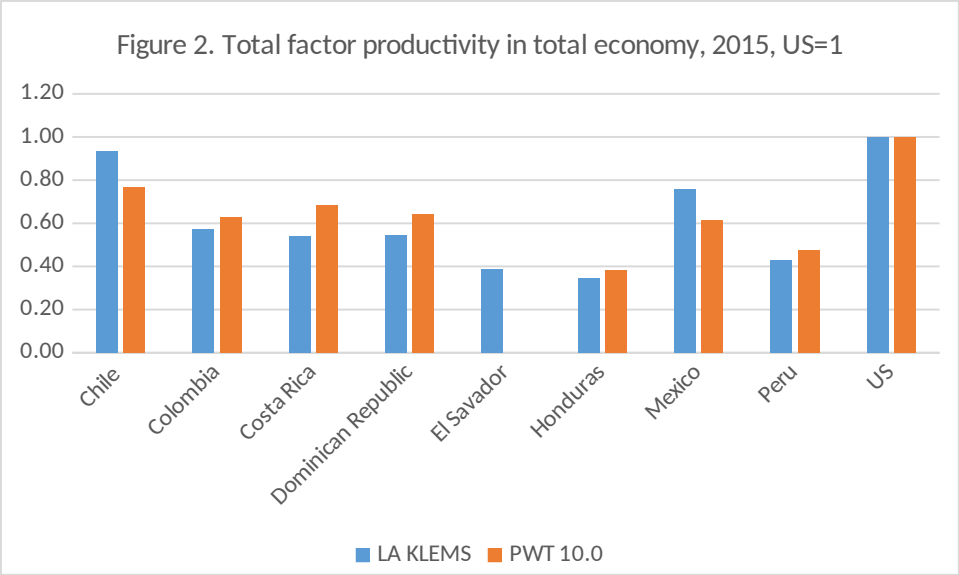
Figure 2. Total factor productivity in total economy, 2015, US=1
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Chile
Colombia
Costa Rica
Dominican Republic
El Savador
Honduras
Mexico
Peru
US
LA KLEMS
PWT 10.0

Appendix Table A1. Types of Workers in LA KLEMS

Characteristics	Categories
Gender	Female, Male
Age	Aged 15–29, Aged 30–49, Aged 50 and over
Education	Low skilled, Medium skilled, High Skilled

Table A2. Asset types in LA-KLEMS

Broad asset categories	Detailed asset types
Total construction	Residential structures
	Total non-residential investment
Non-information and communication equipment (ICT) M&E	Transport equipment
	Machinery and equipment
	Other products
ICT	Computing equipment
	Communications equipment
	Software

Appendix Table A3. The list of products used for PPP calculation

Sequential number	Products
1	Products of agriculture, hunting and related services
2	Products of forestry, logging and related services
3	Fish & other fishing products, aquaculture prod., support serv. to fishing
4	Coal and lignite
5	Crude petroleum and natural gas
6	Metal ores
7	Other mining and quarrying products
8	Mining support services
9	Food, beverages and tobacco products
10	Textiles, wearing apparel, leather and related products
11	Wood & prod. of wood & cork, exc. furniture, of straw & plaiting materials
12	Paper and paper products
13	Printing and recording services
14	Coke and refined petroleum products
15	Chemicals and chemical products
16	Basic pharmaceutical products and pharmaceutical preparations
17	Rubber and plastic products
18	Other non-metallic mineral products
19	Basic metals
20	Fabricated metal products, except machinery and equipment
21	Computer, electronic and optical products
22	Electrical equipment
23	Machinery and equipment n.e.c.
24	Motor vehicles, trailers and semi-trailers
25	Other transport equipment
26	Furniture and other manufactured goods
27	Repair and installation services of machinery and equipment
28	Electricity, gas, steam and air conditioning
29	Natural water, water treatment and supply services
30	Sewerage services, sewage sludge, waste collection & management serv.
31	Buildings and building construction works
32	Constructions and construction works for civil engineering
33	Specialised construction works
34	Wholesale and retail trade and repair serv. of motor vehicles & motorcycles
35	Wholesale trade services, except of motor vehicles and motorcycles
36	Retail trade services, except of motor vehicles and motorcycles
37	Land transport services and transport services via pipelines
38	Water transport services
39	Air transport services
40	Warehousing and support services for transportation

Sequential number	Products
41	Postal and courier services
42	Accommodation services
43	Food and beverage serving services
44	Publishing services
45	Audiovisual and broadcasting services
46	Telecommunications services
47	Computer programming, consultancy and related serv., Information serv.
48	Financial services, except insurance and pension funding
49	Insurance, reinsurance & pension funding services, exc. compulsory S.S.
50	Services auxiliary to financial services and insurance services
51	Imputed rents of owner-occupied dwellings
52	Real estate services excluding imputed rents
53	Legal, accounting, head offices services, management consultancy serv.
54	Architectural and engineering services, tech. testing & analysis services
55	Scientific research and development services
56	Advertising and market research services
57	Other professional, scientific and tech. services and veterinary services
58	Rental and leasing services
59	Employment services
60	Travel agency, tour operator & other reservation services & related serv.
61	Security & investigation serv., serv. to buildings & other business support
62	Public administration and defence services, compulsory S.S. services
63	Education services
64	Human health services
65	Residential care services, social work services without accommodation
66	Creative, arts, entertainment, library, museum, other cult., gambling serv.
67	Sporting services and amusement and recreation services
68	Services furnished by membership organisations
69	Repair services of computers and personal and household goods
70	Other personal services
71	Services of households as employers of domestic personnel
72	Undifferentiated goods and services produced by private HH for own use

Appendix Table A4. The list of products that have no information on PPPs from ICP

Products of forestry, logging and related services
Metal ores
Other mining and quarrying products
Mining support services
Paper and paper products
Printing and recording services
Coke and refined petroleum products
Chemicals and chemical products
Rubber and plastic products
Basic metals
Wholesale and retail trade and repair serv. of motor vehicles & motorcycles
Wholesale trade services, except of motor vehicles and motorcycles
Retail trade services, except of motor vehicles and motorcycles
Undifferentiated goods and services produced by private HH for own use

Appendix: Content and Coverage of LA KLEMS productivity level database

The LA KLEMS productivity level database includes the PPPs (or relative price levels) of output and capital, labour, and intermediate inputs at the industry level for eight LA economies and United States for 2011 and the relative levels of output and inputs and labour and total factor productivity for the total economy and nine major industry sectors over the period 1990 to 2018.

Economies covered:

Chile, Colombia, Costa Rica, El Salvador, Honduras, Mexico, Peru, Dominican Republic and the United States

Sectors covered total economy and nine sectors of the total economy

- Total economy TOT
- Agriculture, hunting, forestry, and fishing AtB
- Mining and quarrying C
- Total manufacturing D
- Electricity, gas, and water supply E
- Construction F
- Wholesale, retail trade, and hotels and restaurants GtH
- Transport and storage and communication I
- Finance, insurance, real estate, and business services JtK
- Community social and personal services LtQ

Relative prices (PPPs) of output and inputs for 2011 (USA =1)

- PPP_GO PPP for gross output
- PPP_II PPP for intermediate inputs
- PPP_VA PPP for value added (double deflated)
- PPP_L PPP for labour
- PPP_K PPP for capital
-

Nominal value all in local currency, 000s, unless specified otherwise

- GO Gross output at current basic prices
- II Sectoral intermediate inputs at current purchase prices
- VA Gross value added at current basic prices
- LAB Labour compensation
- CAP Capital compensation
- HOURS Total hours worked in thousands

Volume index, USA =1 in 2015 unless specified otherwise

- Q_GO Gross output
- Q_II, Intermediate inputs
- Q_VA Value added
- H Hours worked, 000s
- Q_LAB Labour input
- Q_CAP Capital input
- LP_VA Gross value added per hour worked, US dollar per hour worked
- LP_GO Gross output per hour worked, US dollar per hour worked

- MFP_VA Total factor productivity (value added based), US = 1
- MFP_GO Total factor productivity (Gross output based), US =1
- LAB_QPH Labour input per hour worked, US =1
- CAP_QPH Capital input per hour worked, US dollar per hour worked