NOVAS Estimativas do Produto Marginal do Capital, 1970-2017[1]

NEW Estimates of the Marginal Product of Capital, 1970-2017

Marcelo de Albuquerque e Mello[2]

Resumo: Nós estimamos o produto marginal do capital (PMK) corrigido pelo preço relativo do capital. Com base em um painel amplo de 1970 a 2017, desde o início da década de 1980, o PMK corrigido pelo preço relativo do capital nos países em desenvolvimento é de aproximadamente 18%, enquanto nos países desenvolvidos está próximo de 14%. Ademais, a partir de meados de 2000, o preço relativo do capital nos países em desenvolvimento e desenvolvidos converge para o mesmo nível. Entre 2000 e 2017, realocações contrafactuais de capital teriam gerado ganhos substanciais de produto para os países em desenvolvimento. Entretanto, os ganhos líquidos de produto global seriam insignificantes. Estimativas geradas a partir de um painel alternativo confirmam nossos resultados. Nossa evidência empírica sugere o capital está eficientemente alocado entre os países, e que as grandes diferenças na relação capital-trabalho entre os países não podem ser explicadas por fricções nos mercados internacionais de capitais.

Palavras-chave: Produto marginal do capital; Preço relativo do capital; Relação capital-produto; Mercados de capitais internacionais.

Abstract: *We estimate the marginal product of capital (MPK) taking into account corrections for the relative price of capital. For a broad panel over the period 1970-2017, we find that since the mid-1980s the price corrected MPK in developing countries is approximately 18%, whereas in developed countries it is close to 14%. Furthermore, since the mid-2000s, we find that the relative price of capital in developing countries converges towards the level of relative price of capital in developed countries. From the early 2000s to 2017, counterfactual reallocations of capital would have yielded substantial output gains for developing countries. However, net gains in world output would be negligible. Estimates generated from an alternative panel confirm our initial findings. Overall, our results suggest that capital is efficiently allocated across countries, which suggests that the large observed cross-country differences in capital-labor ratios cannot be accounted for frictions in international capital markets.*

Keywords: Marginal Product of Capital; Relative Price of Capital; Capital-Output; International Capital markets.

Classificação JEL: E22; O41; O47; O50.

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1. Introduction

Caselli and Feyer (2007), henceforth CF, show that the Marginal Product of Capital (MPK), when correctly measured, is largely equalized around the world. This finding suggests that international capital markets are well-functioning and largely integrated, and that there should be negligible welfare gains from international reallocations of capital. In fact, CF find that counterfactual exercises assuming complete MPK equalization yield negligible gains in terms of world GDP. This result suggests that international credit frictions should be ruled out as a source of the huge observed cross-country differences in capital-labor ratios.

According to CF, the driving force behind cross-country convergence in the marginal product of capital comes from properly accounting for the role of the relative price of capital and the correct measure of the reproducible capital share in estimating the MPK. That is, the correct expression for the marginal product of capital is given by $PMPK = \alpha_R(P_y Y/P_k K)$, where P_y is the price level of output, P_k is the price level of capital, α_R denotes the reproducible capital share, and PMPK denotes the price-corrected MPK. The reproducible capital share only includes income earned from reproducible capital, as intended by the Solow model.

CF estimates of the price-corrected MPK were based on a cross-section of 53 countries, mainly due to limited data availability on estimates of the reproducible capital share. By assuming a constant capital share across time and space, Mello (2009) greatly extends the results in CF. More specifically, Mello (2009) constructs a broad panel with 95 countries over the period 1970-2000 and generates estimates of the MPK corrected for the relative price of capital. He finds that differences between developed and developing countries' price-corrected MPKs were significant in the 1970s, decreased substantially in the 1980s, and were negligible in the 1990s. Correspondingly, counterfactual reallocations of capital around the world to equalize its rate of return would have yielded significant output gains for developing countries in the 1970s, but gains in the 1990s would have been negligible. These findings suggest that international capital markets have been largely integrated since the early 1990s.

Recent work by Monge-Naranjo, Sánchez and Santaeulàlia-Llopis (2019), henceforth MSS, challenges the findings in CF based on MPK estimates generated from a panel dataset with new and refined measures of reproducible capital share. For a panel with 76 countries over the period 1970-2005, MSS find that the median price-corrected MPK decreases over time. However, it shows substantial differences across countries, so that counterfactual reallocations of physical capital would yield substantial gains in terms of world GDP. For instance, CF finds that the gain in world GDP in 1996 from counterfactual MPK equalization would be 0.52%, whereas MSS find that this estimate would be 2.51%. Although they claim this is a substantial difference, it might be so in relative terms, but not in absolute terms.

In line with MSS and in contrast with CF, recent work by Pellegrino, Spolaore and Wacziarg (2025) present a model with good empirical fit that generates persistent differentials in cross-country returns to capital, implying that capital is not efficiently allocated globally. They suggest three sources of frictions in international capital markets, namely, capital income taxation, political risk and geographic/cultural differences. In counterfactual exercises, they find that barriers to international investment are responsible for a reduction of 7% in world GDP.

In this article, we build on Mello (2009) and extend his work in two dimensions. First, we update and expand MPK estimates by using a newer version of the Penn World Tables (PWT) dataset (version 9.1). We construct two broad panels with data over the period 1970-2017, adding 17 years of data to the panel in Mello (2009). Second, PWT

version 9.1 provides data on the labor share, which allows us to estimate the capital share (residually) and, therefore, allows us to estimate the MPK taking account the variation in capital share. This gives us one more source of variation in MPK estimates, compared to Mello (2009), who assumes a constant capital share.

Our estimates suggest that developing countries' price-uncorrected MPK was close to 40% in 1970, whereas for developed countries it was close to 17%, making a differential of 23 percentage points (pp). By the mid-1980s, this differential was reduced to 14pp, by the mid-1990s it was 10.5pp, and by the mid-2000s it was 6pp. In 2017, the MPK differential was about 3.5pp. When the MPK is corrected for cross-country differences in the relative price of capital, a similar pattern emerges. In 1970, developing countries' price-corrected MPK was close to 27%, whereas for developed countries it was close to 16%. By the mid-1980s, these estimates were 18% and 13%, respectively. The PMPK differential stabilizes around 5pp for most of the 1980s and 1990s, increasing slightly in the 2000s, when the PMPK for developing countries reaches 19% and the PMPK for developed countries reaches 13%. These estimates are unchanged throughout the 2000s and 2010s.

The magnitude of PMPK differentials suggest that counterfactual reallocations of capital to equalize its return across countries would yield substantial output gains for developing countries. In fact, our estimates show that throughout the 1970s, PMPK equalization would have generated increases of up to 20% of their combined GDP. From the mid-1980s to the 2010s, output gains reduce to the range 8%-10% of the GDP. Interestingly, by the end of the sample period, in the 2010s, output gains for developing countries are equivalent to output losses from developed countries, so that net world output gain is negligible. Based on these results, we conclude that, to a first pass, capital is efficiently allocated across countries, at least to the point that international capital markets frictions should be ruled out as source of the huge international differences in capital-labor ratios. This conclusion is in line with previous works such as in Caselli and Feyrer (2007), Mello (2009), and Alfaro, Kalemli-Ozcam and Volosovych (2008).

The debate whether frictions in international capital markets are the root cause of the wide variability in cross-country capital-labor ratios has important policy implications. If the source of inefficient allocation of physical capital relies on barriers in international capital markets, then one should promote policies aimed at removing these barriers. For example, as discussed in Pellegrino, Spolaore and Wacziarg (2025), if geopolitical risks are the source of frictions in capital markets, then it would be optimal to reduce tax on capital income to compensate for this risk. On the other hand, if there is evidence that international capital markets are working efficiently, then policy makers should turn their attention to enhancing the accumulation of inputs complementary to physical capital, such as human capital and improving TFP levels. For example, by promoting free trade and best practices in the business environment.

This article is structured as follows. In section 2, we review the literature. In section 3, we present our methodology and data, describing how we go about estimating the MPK and its price-corrected version. In section 4, we present estimates of the marginal product of capital, with and without correction for the relative price of capital, for selected individual countries. In section 5, we present estimates of the MPK for developed and developing countries, based on a panel with 94 countries over the period 1970-2017. In section 6, we present estimates of the welfare gains from equalization of the price-corrected MPK. Additionally, we compare our results with the ones in CF and MSS. In section 7, as a robustness check, we present estimates of the MPK/PMPK from an alternative panel with 117 countries, divided up as developed, middle-income and low-income countries. Finally, section 8 concludes.

2. Related Literature

In a classical paper, Lucas (1990) asks why capital doesn't flow from rich to poor countries. His question is motivated by the well-known property of the neoclassical growth model with free international capital mobility which states that, all else equal, capital will flow from capital-abundant countries where MPK is low to capital-scarce countries where MPK is high. The flow of capital will continue until MPKs are equalized across countries.

However, as is well known, we don't observe capital flowing from rich to poor countries, rather we observe the opposite, i.e., capital flowing from poor to rich countries. To explain this apparent puzzle, Lucas (1990) proposes as candidate answers cross-country differences in inputs complementary to capital, such as human capital, cross-countries differences in Total Factor Productivity (TFP), and/or frictions in international capital markets. He was skeptical whether frictions in international capital markets could be a barrier to capital flows and concluded that the explanation for apparent puzzle must lie in cross-country differences in inputs complementary to capital and TFP differences.

Building on the work of Hsieh and Klenow (2007), CF highlight the importance of taking account of the relative price of capital in generating estimates of the MPK. In fact, as mentioned above, CF show that when MPK estimates are corrected for the relative price of capital and the reproducible capital share, then cross-country differences in MPK are negligible, in other words, MPK is largely equalized across countries when properly measured. In this sense, Lucas's conjecture that capital market frictions is not a barrier to capital flows is correct.

More specifically, CF estimate the marginal product of capital as follows: $PMPK=\alpha_R(P_y Y/P_k K)$, where P_y is the price level of output, P_k is the price level of capital, α_R denotes the reproducible capital share, and PMPK denotes the price-corrected MPK. To generate estimates of the reproducible capital share, CF build on estimates of the capital share from Bernanke and Gurkaynak (2001) and data from a World Bank report containing estimates of the components of wealth, including natural capital[3]. Since Bernanke and Guykarnak (2001) contains a cross-section of 53 countries and the World Bank study is only available for one year, CF's sample is limited to a cross-section of 53 economies, i.e., for 1996.

Following the methodology in CF, Mello (2009) computes the price-corrected MPK for a broad panel over the period 1970-2000. To be able to compute the MPK estimates for the panel, he assumes that the capital share is constant across time and space. Mello (2009) finds that equalization of price-corrected MPK began taking place in the early 1990s. Interestingly, the convergence between developed and developing countries' price-corrected MPK occurs without correcting the capital share for natural capital.

A key issue in this literature concerns the value of the reproducible capital share and whether its correction for the share of natural capital is essential. CF claims that the share of natural capital must be deducted from the share of total capital, otherwise MPK estimates will be biased upwards. In their sample, the average total capital share is 0.35, whereas the average reproducible capital share (i.e., total capital share corrected for the share of natural capital) is 0.19, so if in fact the capital share is not corrected for the share of natural capital, then MPK estimates will be overestimated. This can be seen in CF's Table 2, where they compare the PMPK computed with and without the correction for natural capital. The PMPK with uncorrected (total) capital share is 12.6% for rich countries, and 15.7% for poor countries, whereas the PMPK with reproducible capital share is 8.4% for rich countries and 6.9% for poor countries.

[3] The World Bank publication is titled "Where is the Wealth of Nations?, released in 2006.

It is important to note that the problem does not lie with the bias on the level of MPKs, rather the main issue is that developing/poor countries tend to have a larger share of capital in the form of natural capital (i.e., land and natural resources) compared to developed/rich countries. If this is the case, then using total capital share instead of the reproducible capital share would overestimate developing/poor countries' PMPK relative to developed/rich countries, artificially amplifying cross-country PMPK differentials. In fact, we can observe this effect by looking at the CF´s estimates above: with corrections for the reproducible capital share, the PMPK for rich countries fell from 12.6% to 8.4%, whereas poor countries' PMPK fell from 15.7% to 6.9%, that is, a much bigger correction. These observations convey the main message in CF, i.e., to obtain MPK equalization, it is not enough to correct estimates of the MPK for the relative price of capital only, we must also correct for the share of natural capital in total capital.

Mello (2009) argues that the correction for natural capital has second order effects in the MPK equalization process. The argument goes as follows. First, what is important is whether the corrected capital share varies systematically with GDP per worker. CF correctly point out that developing countries have a larger share of capital in the form of natural capital compared to developed countries and that this could bias MPK estimates. However, the correlation between the capital share corrected for natural capital and GDP per worker in their sample is 0.35, whereas the correlation between the relative price of capital and GDP per worker is -0.70, and the correlation between the capital-output ratio and GDP per worker is 0.74. This suggests that the driving forces behind MPK dynamics are relative price of capital and the capital-output ratio, not the reproducible capital share.

Second, corroborating the observation above, Mello (2009) finds that for a large panel with 95 countries over the period 1970-2000, when one applies a constant capital share equal to 0.19 (which, as mentioned above, is the average value of the reproducible capital share in CF´s sample), the PMPK for developed countries is 7.8%, while it is 7.9% for developing countries. That is, we obtain PMPK equalization with correction for the relative price of capital only. Naturally, this finding does not necessarily invalidate CF´s emphasis on the need to correct for the share of natural capital, it simply says that while it is a theoretically valid point it is not empirically relevant.

MSS makes one more refinement on the measurement of the reproducible capital share. Instead of relying on stocks of natural resources and imposing strong assumptions on the data like CF, MSS obtains information on rent flows data and construct a new dataset with estimates of the output share of natural resources. They provide evidence that CF's measure of the share of natural capital is overestimated, particularly, for developing countries, which favors their result of MPK equalization. According to MSS, if one uses the "correct" measure of the share of natural capital to construct estimates of the reproducible capital share and the MPK, then the result of MPK equalization disappears.

It may be the case that MSS's estimates of the output share of natural capital represent an improvement over CF´s estimates. However, MSS's estimates are not free from potential biases. First, they compute the reproducible capital share residually, using the variable *labsh* (labor share) from PWT 8.0, as follows: $\alpha^R = 1 - labsh - \phi^N$, where α^R denotes the reproducible capital share, and ϕ^N denotes MSS's estimate of the share of natural capital. As is well known, any variable computed as a residual is subject to the estimation error of all components of the equation. Although PWT 8.0 is a high-quality dataset, labor share is a difficult variable to estimate and, therefore, even if MSS get right the share of natural capital, they are subject to the estimation error in *labsh*[4].

Second, the correlation between the share of natural resources with GDP per capita in MSS sample is low, in fact, close to zero. For instance, for the year 2000, with n=79, it is only -0.07. MSS is aware of that and claim that the problem lies with oil-exporting countries, for which the correlation between the output share of natural capital and

[4] We also construct measures of the capital share residually with the variable labsh from PWT 9.0 and, therefore, we are subject to the same criticism as MSS.

GDP per capita is -0.67. However, if this is case, then it may be a better strategy to treat oil-exporting countries as outliers and exclude them from the sample.

Finally, a more general point, instead of adding a tangible input to the production function, such as natural capital like MSS do, perhaps it would be a more productive enterprise to study how the inclusion of an intangible input, such as talent skill or knowledge, can affect the estimation of the marginal product of capital and the functioning of international capital markets. At least from a conceptual point of view, this may be a superior strategy, especially taking into consideration the fact that modern economies tend to derive more of their productivity gains from intangible inputs than from natural resources[5].

3. Methodology and Data

Our methodology follows CF and Mello (2009). Under perfectly competitive capital markets, the MPK equals the rate of return on capital. Therefore, by multiplying the MPK by the capital-output ratio, we obtain capital share in total output. Using traditional notation from the one-sector neoclassical growth model, the capital share is given by α = MPK·(K/Y). Based on this expression, we can recover the MPK by multiplying the capital share by the inverse of the capital-output ratio. That is, we can compute the MPK following the equation below:

$$\text{MPK} = \alpha \frac{\text{Y}}{\text{K}}. \tag{1}$$

Following CF the marginal product of capital corrected for the relative price of capital, denoted by PMPK, is given by equation (2):

$$\text{PMPK} = \alpha \frac{\text{P}_\text{Y} \cdot \text{Y}}{\text{P}_\text{K} \cdot \text{K}}. \tag{2}$$

We generate estimates of the marginal product of capital based on expressions (1) and (2) for two broad panels which we construct with aggregate annual data from the Penn World Tables (PWT) dataset version 9.1, released in 2019. The first panel, which we call Panel1, contains 94 countries, whereas the second panel, which we call Panel2, contains 117 countries. Both panels have the same time dimension, with the initial year being 1970 and the final year being 2017, totaling 48 years of observations for each country.

We apply two filters to select the countries. First, we require countries to have at least one million inhabitants in 1985. This is one way to ensure that we include countries whose economies can be reasonably described by the neoclassical growth model, i.e., that their economies come close to a "modern industrial economy", as in the original description of the model by Robert Solow. By applying this filter, a number of small countries, such as small islands in the Pacific and the like, are excluded. Second, we only include countries for which all data required for the estimation of the MPK are available over the entire period, i.e., 1970-2017. This second filter is an attempt to ensure that we only include countries with high quality data. The idea is that economies with complete time series data have good standards in collecting and compiling national account statistics. One noteworthy exclusion caused by this requirement concerns the ex-Communists economies, since initial year of their data series is 1990. The remaining excluded countries are those with poor quality data and do not constitute an important omission.

The difference between Panel 1 and Panel 2 concerns the availability of data on labor share, which we use to estimate the capital share. In Panel 1, we only include countries for which the series on labor share is complete. In Panel 2, we assume that the capital

[5] See Corrado, et alii (2002) for more on intangible capital and modern economies. In addition, Corrado, Hulten and Sichel (2009) show how a growth accounting exercise with intangible inputs can give different results. For instance, for the U.S. economy, they show that when intangible inputs are counted as capital, output per worker increases, capital deepening becomes the dominant source of growth, TFP growth has a reduced role and, interestingly, the labor share is also reduced.

share equals 0.4 for all countries at all times, so that we do not need data on the labor share. Because we do not require data on labor share in Panel 2, we are able to add 23 countries to the country-list in Panel 1.

Our measure of output is the variable CGDPO (output-side real GDP at PPP in millions of 2005 USD), the measure for the aggregate stock of physical capital is the variable *Cn* (capital stock at PPP in millions of 2005 USD), and the measure of workers is the variable EMP (number of individuals engaged in production). GDP per worker is calculated as the ratio CGDPO/EMP, and the capital-output ratio is computed as CK/CGDPO. The capital share, denoted by α, is computed residually as follows α =1-*labsh*, where *labsh* is the labor share from PWT.

We compute the relative price of capital as follows. The nominal GDP is given by $p_y \cdot Y = p_c \cdot C + p_G \cdot G + p_I \cdot I + p_X \cdot X - p_M \cdot M$, so we can write the price level of output as $p_y = p_c \cdot (C/Y) + p_G \cdot (G/Y) + p_I \cdot (I/Y) + p_X \cdot (X/Y) - p_M \cdot (M/Y)$. That is, the price level of output is a weighted average of the price level of GDP components where the weights are given by the share of each component in total GDP. The PWT version 9.1 provides estimates of the aggregate shares (i.e., share of consumption in GDP, share of investment in GDP, and so on), and the price level of each aggregate. Therefore, using PWT legends, our measure of the price level of output is given by:

$$p_y = pl\_c \cdot csh\_c + pl\_g \cdot csh\_g + pl\_i \cdot csh\_i + pl\_x \cdot csh\_x - pl\_m \cdot csh\_m. \quad (3)$$

We obtain the relative price of capital by dividing the PWT variable *pl_n*, which is the price level of the capital stock, by the price level of output obtained from the expression in (3), that is, our measure of the relative price of capital is given by, *pl_n/p_y*.

In Panel 1, we group countries according to the following procedure. For each year, countries are ranked according to their GDP per capita (RGDPO/POP) and classified as either developed if they are in the top 25 positions, or developing if not. This corresponds to the same grouping used by Mello (2009). Since Panel 1 contains 94 countries, being considered "developed" means that the country ranks in the top 27% of the GDP per capita distribution.

In Panel 2, we construct the country groupings as follows. We consider the top 25 countries, ranked by their GDP per capita each year, as developed economies, the next 67 countries as middle-income economies, and the remaining bottom 25 countries as developing economies. This strategy follows Mello (2009), who also considers a panel in which countries are divided up into three groups according to their GDP per capita.

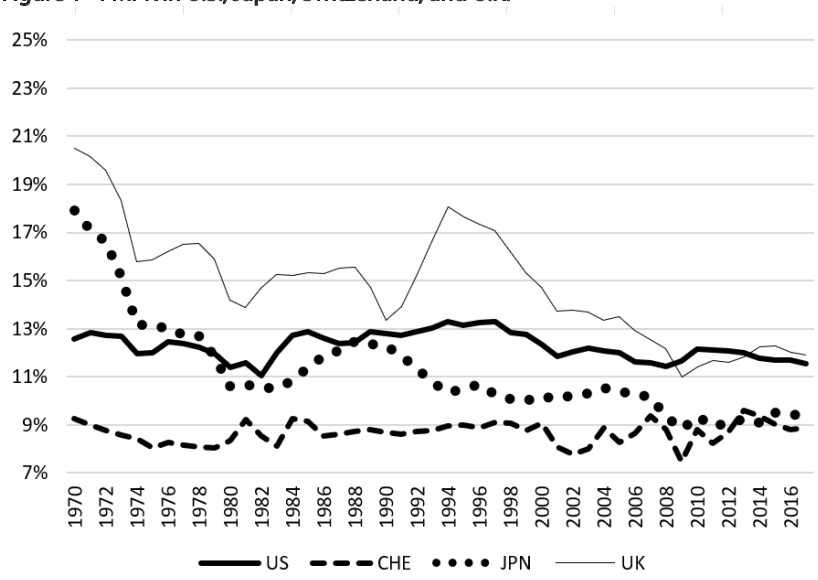
4. Estimates of the PMPK for Selected Individual Countries

We initially present estimates of the price-corrected MPK and its main components for selected individual countries before exploring aggregate estimates. This way we get a sense of the magnitude and the time evolution of PMPK estimates as well as its components, namely the capital-output ratio, the relative price of capital, and the capital share. In addition, by looking into individual countries we might identify any unusual pattern in the estimates and, therefore, check for any estimation errors. Figure 1 displays PMPK estimates for the U.S., Switzerland, Japan and U.K.

Figure 1 shows that the estimated PMPK for U.K. and Japan was high in the 1970s, at around 18%-20%, decreasing fast in the early 1980s, and reaching approximately 9% and 12% in the 2000s respectively. The PMPK for the U.S. and Switzerland (CHE) exhibit a different pattern, being stable throughout the sample period at around 9% and 12%, respectively. Towards the end of the sample period, after 2010, we observe convergence in PMPKs for the U.S. and U.K. to a level around 11%, and convergence of PMPK for Japan and Switzerland to a level around 9%. These estimates follow the same pattern as in

Mello (2009). More specifically, estimates in Mello (2009) suggest that PMPK for the U.S. and the U.K. converge to around 15% and PMPK estimates for Japan and Switzerland converge to around 10% in year 2000.

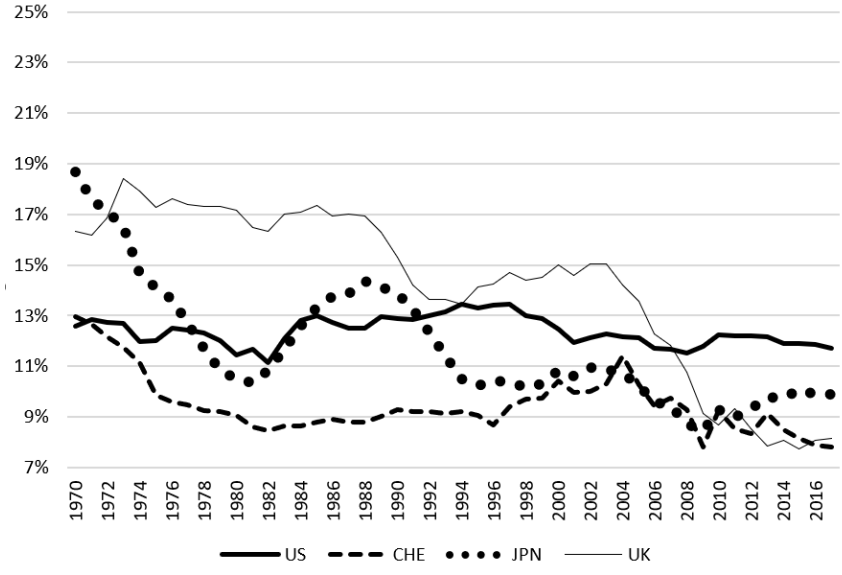
Figure 1 - PMPK in U.S., Japan, Switzerland, and U.K.



Source: Elaborated by the author.

Figure 2 displays price-uncorrected estimates of the MPK for U.S., Japan, Switzerland and the U.K. We observe a different pattern from the one in Figure 1. Estimates are more dispersed and show little tendency to converge, except for U.K. and Switzerland after 2014. Contrary to estimates in Figure 1, towards the end of the sample period we have the Switzerland and U.K. estimate of the MPK converging to around 8%, the Japanese MPK converging to 10%, and the U.S. estimate somewhat stable over the entire period at around 14%.:

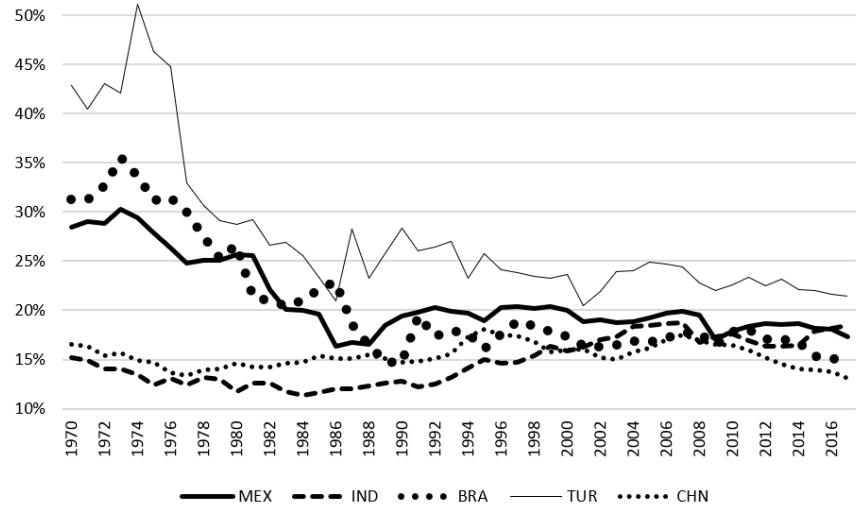
Figure 2 - MPK in U.S., Japan, Switzerland, and U.K.



Source: Elaborated by the author.

Figure 2 highlights the importance of correcting MPK estimates for differences in the price of capital relative to the price of output. While Figure 2 suggests that there is no convergence in MPKs, Figure 1 suggests exactly the opposite. As mentioned in section 2, the importance of international differences in the relative price of capital has been emphasized by Hsieh and Klenow (2007).

Figure 3 - PMPK in Brazil, Mexico, India, China and Turkey.



Source: Elaborated by the author.

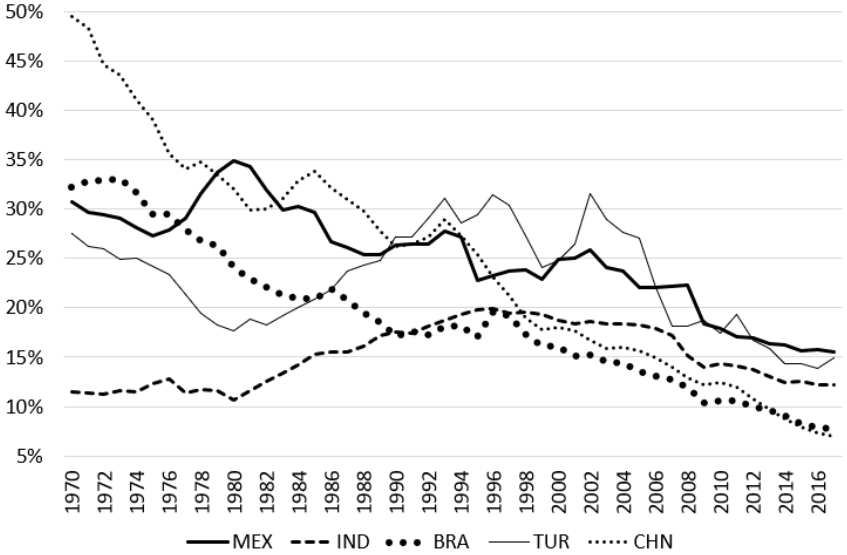
Figure 3 displays PMPK estimates for Brazil, China, India, Mexico and Turkey. As can be observed above, there was considerable dispersion among these countries' PMPK in the early 1970s, which decreases and stabilizes in the range 12%-25% around the mid-1980s. Towards the end of the sample period, China had the lowest estimated PMPK, around 13%, and Turkey the highest, around 22%. Comparable estimates in Mello (2009) suggest a similar temporal pattern, with some degree of convergence taking place around the mid-1980s.

Figure 4 below displays the price-uncorrected MPK for Brazil, China, India, Mexico and Turkey. MPK estimates are widespread in the 1970s, ranging from 10% in India, to 50% in China. Around the 1990s, a slow process of convergence starts to take place, accelerating in the 2000s and reaching the end of 2010s in the range 7.5%-15%.

Turning to the components of the marginal product of capital, Table 1 displays the capital-output ratio for the nine countries that appear in Figures 1-4. The U.S., the U.K. and Switzerland present the highest initial capital-output ratio, whereas China, Brazil and Mexico the lowest. The capital-output ratio increases smoothly for the four developed countries. The growth in the capital-output ratio is faster in developing countries, particularly for China that exhibits a steep growth, going from less than unity in 1970 to close to six in 2017.

What is clear from Table 1 is that, among these nine countries, the capital-output ratio exhibits a similar growing trend and, therefore, it is unlikely to be the driver of relevant cross-country differences in marginal product of capital. In fact, this finding is well-established in the development accounting literature, as discussed in the comprehensive survey by Caselli (2005). Additionally, the increase in the capital-output ratio is consistent with the prediction of the neoclassical model, namely, the higher the capital-output ratio, the lower the marginal product of capital and, therefore, consistent with estimates in Figures 1-4.

Figure 4 - MPK in Brazil, Mexico, India, China and Turkey.



Source: Elaborated by the author.

Table 2 below presents the relative price of capital for the above nine countries. The ratio P_k/P_y is stable for the U.S. and Japan, whereas it decreases for the U.K. and Switzerland. For Mexico and India, the relative price of capital exhibits a mildly decreasing pattern, whereas for Brazil it decreases and for China it shows a strong decreasing pattern. For Turkey it presents an inverted-U pattern, having ended at about the same level where it started. On average though, the relative price of capital decreases over time, suggesting that capital is getting relatively cheaper over time in terms of output units. Moreover, the relative price of capital displays a richer and more varied dynamics than the capital-output ratio, suggesting it is a stronger force than the capital-output ratio behind the evolution of the PMPK.

Table 1 - Capital-Output ratio for selected countries, 1970-2017.

Year	US	CHE	JPN	UK	MEX	IND	BRA	TUR	CHN
1970	2.79	2.62	2.04	2.75	1.85	2.13	1.51	2.17	0.82
1975	3.11	3.45	2.71	2.60	2.09	1.98	1.65	2.47	1.04
1980	3.28	3.75	3.63	2.62	1.63	2.46	2.02	3.39	1.27
1985	3.06	3.87	2.96	2.59	1.92	1.97	2.32	2.85	1.20
1990	2.98	3.66	3.08	2.77	2.17	1.81	2.84	2.20	1.55
1995	2.95	3.75	3.91	3.22	2.69	1.89	2.51	2.03	1.71
2000	2.91	3.35	3.86	2.72	2.42	2.15	2.87	2.40	2.27
2005	3.26	3.39	4.37	3.02	2.83	2.72	3.43	2.20	2.76
2006	3.36	3.89	4.66	3.30	2.87	2.89	3.51	2.71	2.97
2007	3.39	3.88	4.78	3.40	2.87	3.01	3.60	3.30	3.20
2008	3.43	4.02	5.00	3.79	2.88	3.27	3.78	3.28	3.47
2009	3.47	4.45	5.06	4.31	3.29	3.48	4.23	3.19	3.66
2010	3.36	3.97	4.74	4.52	3.46	3.41	4.25	3.34	3.63
2011	3.34	4.23	4.76	4.30	3.70	3.46	4.17	3.06	3.75
2012	3.32	4.25	4.62	4.71	3.77	3.55	4.33	3.43	4.09
2013	3.35	3.87	4.50	5.10	3.81	3.73	4.47	3.65	4.44
2014	3.41	4.19	4.49	5.12	3.85	3.89	4.77	3.99	4.83
2015	3.40	4.31	4.43	5.31	3.97	3.92	5.11	3.97	5.28
2016	3.42	4.43	4.42	5.10	3.99	3.95	5.36	4.10	5.69
2017	3.44	4.47	4.44	5.04	4.05	3.97	5.44	3.81	5.95

Source: Elaborated by the author.

Figure 5 displays the estimated capital share for countries listed above. With the notable exception of India, which exhibits an increasing trend in its capital share, all remaining eight series shows a stable and trendless pattern. Since the capital share displays an overall trendless pattern, its variation across time must have negligible effects on the dynamics of the MPK/PMPK. On the other hand, its cross-section dimension does show some variation, which affects cross-country levels of MPK estimates. However, given the trendless pattern in capital share, its contribution to the overall convergence in MPKs

must be negligible. This point is explored in more detail in Mello (2009), who argues that the observed convergence in MPKs is driven by the dynamics of the relative price of capital, and that variation in capital share plays a minor role in the convergence process.

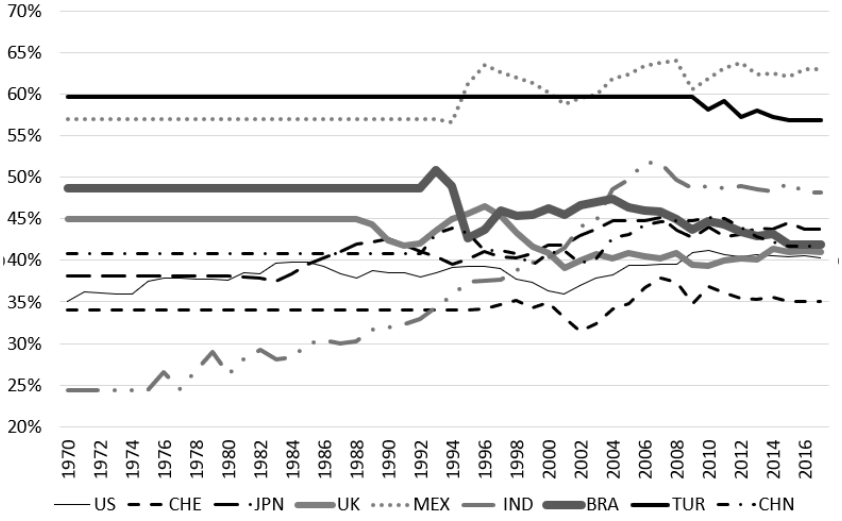
Table 2 - The Relative Price of Capital (P_k/P_y) for selected countries, 1970-2017.

Year	US	CHE	JPN	UK	MEX	IND	BRA	TUR	CHN
1970	1.00	1.40	1.04	0.80	1.08	0.76	1.03	0.64	3.00
1975	1.00	1.22	1.08	1.09	0.98	1.00	0.95	0.52	2.67
1980	1.01	1.09	0.99	1.21	1.36	0.91	0.90	0.61	2.19
1985	1.01	0.96	1.17	1.13	1.51	1.31	0.94	0.89	2.21
1990	1.01	1,07	1.13	1.15	1.35	1.37	1.17	0.96	1.78
1995	1.01	1.01	0.98	0.80	1.20	1.32	1.06	1.14	1.41
2000	1.01	1.15	1.06	1.02	1.24	1.18	0.93	1.05	1.13
2005	1.01	1.24	0.98	1.00	1.15	0.99	0.81	1.09	0.97
2006	1.01	1.09	0.94	0.95	1.12	0.96	0.76	0.89	0.87
2007	1.01	1.04	0.93	0.94	1.12	0.91	0.72	0.74	0.80
2008	1.01	1.05	0.94	0.88	1.14	0.91	0.68	0.80	0.76
2009	1.01	1.05	0.96	0.83	1.08	0.81	0.63	0.85	0.74
2010	1.01	1.05	0.99	0.76	1.00	0.81	0.59	0.77	0.75
2011	1.01	1.04	1.01	0.80	0.93	0.83	0.59	0.83	0.75
2012	1.01	0.96	1.03	0.74	0.91	0.84	0.59	0.74	0.71
2013	1.01	0.95	1.06	0.66	0.88	0.80	0.56	0.69	0.66
2014	1.01	0.91	1.07	0.66	0.87	0.76	0.54	0.65	0.62
2015	1.02	0.90	1.06	0.63	0.86	0.70	0.53	0.65	0.57
2016	1.02	0.90	1.05	0.67	0.87	0.67	0.52	0.64	0.53
2017	1.02	0.88	1.05	0.68	0.90	0.66	0.51	0.70	0.53

Source: Elaborated by the author.

There is one important observation here. Although PWT version 9.1 provides estimates of the labor share that are trendless, in line with Gollin (2002), there is a growing literature that provides evidence that the labor share is decreasing over time and, consequently, that the capital sharing is increasing over time. For instance, Elsby, Hobijn and Sahin (2013) and Karabarbounis and Neiman (2014), suggest that the labor share has been decreasing since the mid-1980s. This literature started out with the provocative work of Piketty (2014) and his three fundamental laws of capitalism, one of which establishes that the capital share grows with the capital-output ratio. In section 6, we discuss in more detail the role of the capital share in generating estimates of the MPK/PMPK.

Figure 5 - Capital Share for selected individual countries, 1970-2017.



Source: Elaborated by the author.

5. Estimates of the Marginal Product of Capital

Table 3 displays estimates of the PMPK and MPK for developed and developing economies, for selected years. As discussed in section 3, the top 25 countries ranked by their GDP per capita are considered "developed economies", whereas the remaining 69 countries are considered "developing economies".

Estimates in Table 3 suggest that in the 1970s there were large differences between developed and developing countries' marginal product of capital, even after correcting for cross-country differences in the relative price of capital. For instance, in 1970 the MPK differential between developed and developing economies was about 22 percentage points (pp), whereas the PMPK differential was about 11pp. In the 1980s, these differentials were reduced to approximately 15pp and 8pp, respectively.

Table 3 - The MPK and the price-corrected MPK, 1970-2017.

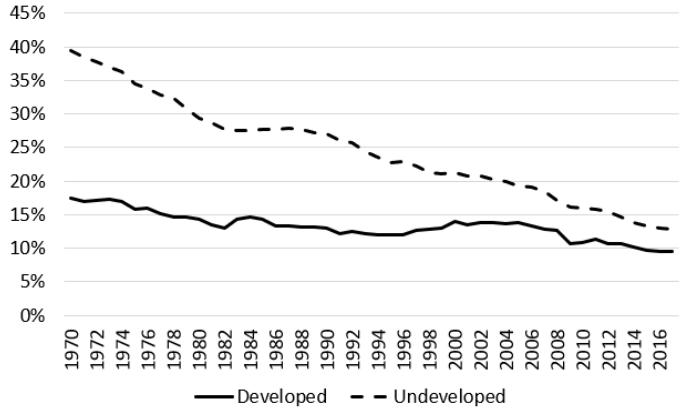
Year	*Developed MPK*	*Developing MPK*	*Developed PMPK*	*Developing PMPK*
1970	17.38%	39.39%	15.56%	26.72%
	(23.17%)	(50.27%)	(12.75%)	(12.13%)
1980	14.25%	29.41%	13.39%	21.62%
	(14.35%)	(29.81%)	(17.19%)	(10.43%)
1985	14.30%	27.72%	13.42%	18.16%
	(10.76%)	(29.78%)	(9.13%)	(11.91%)
1990	12.96%	27.04%	12.82%	17.38%
	(4.56%)	(25.31%)	(6.37%)	(11.72%)
1995	12.03%	22.74%	13.35%	17.80%
	(4.22%)	(16.78%)	(7.09%)	(10.63%)
2000	13.94%	21.26%	13.09%	18.69%
	(5.02%)	(13.94%)	(6.97%)	(10.77%)
2005	13.87%	19.35%	13.47%	19.13%
	(6.89%)	(12.95%)	(9.52%)	(11.60%)
2010	10.85%	15.92%	12.98%	19.25%
	(6.71%)	(9.41%)	(10.86%)	(9.22%)
2015	9.74%	13.39%	13.27%	18.72%
	(4.66%)	(7.85%)	(14.60%)	(8.43%)
2017	9.45%	12.81%	13.01%	18.86%
	(3.42%)	(7.32%)	(12.64%)	(8.21%)

Source: Elaborated by the author.

In 2000, MPK differentials between developed and developing countries were 7.3pp and 5.6pp, respectively. Interestingly, MPK differentials between developed and developing countries decrease continuously until 2017, when they reached 3.7pp. On the other hand, PMPK differentials between developed and developing countries reached approximately 6pp in the mid-1980s and kept hovering around this level until the end of the sample period. This finding is in line with MSS, and contrasts with the full PMPK equalization in CF and Mello (2009). Note, however, that it may be an overstatement to interpret a 6pp differential in PMPK to be a sign that there are huge barriers in international capital markets, and that these barriers can account for the cross-country variability in capital-labor ratios.

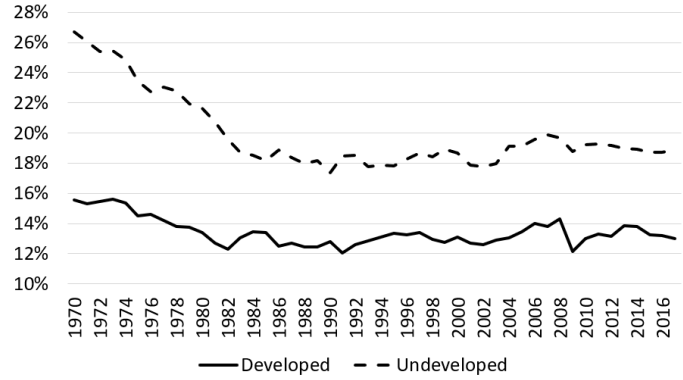
We can observe the entire time series for the MPK and PMPK in Figures 6 and 7, respectively, confirming the initial analysis above.

Figure 6 - MPK estimates, n=94.



Source: Elaborated by the author.

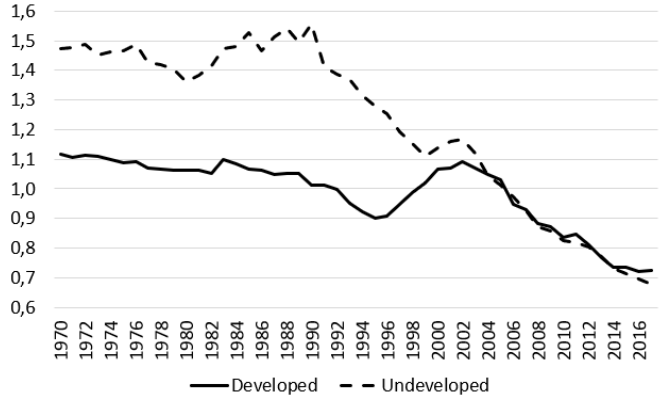
Figure 7 - PMPK estimates, n=94.



Source: Elaborated by the author.

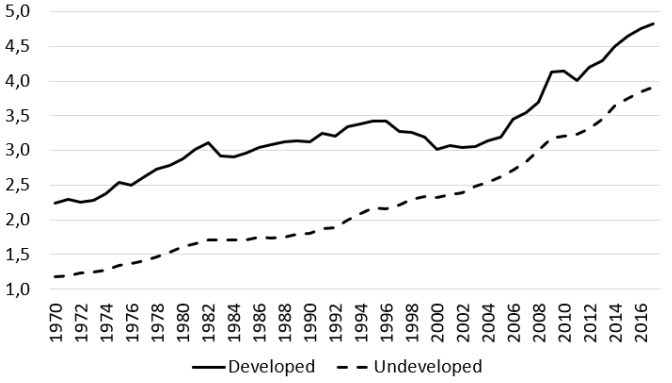
Figure 8 displays the relative price of capital for developed and developing countries. There seems to be a relatively stable differential between developed and developing countries' relative price of capital until the early 1990s, when a convergence process takes place, reaching full convergence in the mid-2000s. Figure 9 exhibits the capital-output ratio for developed and developing countries.

Figure 8 - Relative Price of Capital, n=94.



Source: Elaborated by the author.

Figure 9 - The Capital-Output ratio for Developed and Developing countries.



Source: Elaborated by the author.

Notably, the average capital-output ratio is strongly increasing for both groups, developed and developing countries. Additionally, the initial average capital-output ratio for developed countries is substantially greater than for developing countries. The difference remains large until the late 1990s, when it is slightly reduced. After then the difference remains relatively constant, with the average capital-output ratio for developed countries close to five, and close to four for developing countries.

6. Welfare Gains from PMPK Equalization

To compute the welfare gains from PMPK equalization, we follow the methodology in CF. We briefly describe their methodology following Mello (2009). Essentially, CF's methodology consists of calculating a counterfactual world PMPK that would emerge in a world without frictions in capital markets. Then, they use the counterfactual world PMPK to compute the counterfactual level of output that would prevail in a world under perfect PMPK equalization. The welfare gain from PMPK equalization is defined to be the percentage gain in output that would be obtained under perfect PMPK equalization.

CF assume that the production function in sector j in country i is given by a Cobb-Douglas technology as follows $Y_{ij} = K_{ij}^{\alpha_i}\left(A_{ij}L_{ij}\right)^{1-\alpha_i}$. Additionally, denote by P_{ij} the price of output *j* in country *i*, and by P_k the price of capital. Rates of return are equalized within countries if $PMPK_{ij} = PMPK_i$, for $j = 1,2,\ldots J$. That is, the following condition must hold:

$$\mathrm{PMPK}_{ij} = \frac{P_{ij}}{P_k}\alpha_i K_{ij}^{\alpha_i - 1}\left(A_{ij}L_{ij}\right)^{1-\alpha_i} = \mathrm{PMPK}_i. \tag{4}$$

Suppose capital was reallocated across countries such that all economies exhibited the same PMPK. Let´s denote this cross-country equalized PMPK by $PMPK^*$. Assuming labor input would not change in the reallocation process, then the new value of capital, denoted by K_{ij}^*, would have to satisfy the following equation:

$$\frac{P_{ij}}{P_k}\alpha_i\left(K_{ij}^*\right)^{\alpha_i - 1}\left(A_{ij}L_{ij}\right)^{1-\alpha_i} = \mathrm{PMPK}^*, \text{ for all i,j.} \tag{5}$$

Combining equations (4) and (5), we obtain an expression relating the counterfactual level of capital in sector *j* in country *i* to the realized level of capital, the PMPK, and the $PMPK^*$:

$$K_{ij}^* = \left(\frac{\mathrm{PMPK}_i}{\mathrm{PMPK}^*}\right)^{\frac{1}{1-\alpha_i}} K_{ij}. \tag{6}$$

Equation (6) establishes that, for any sector *j* in country *i*, the counterfactual amount of capital, given by K_{ij}^{*}, is proportional to the realized amount of capital, given by K_{ij}. More specifically, the amount of counterfactual capital changes by the same proportion in each sector, that is, the term $\left(\frac{PMPK_i}{PMPK^*}\right)^{\frac{1}{1-\alpha_i}}$ is independent of *j*. Summing across sectors *j*, we obtain the total amount of capital in country *i*:

$$K_i^* = \sum_j K_{ij}^* = \left(\frac{PMPK_i}{PMPK^*}\right)^{\frac{1}{1-\alpha_i}} K_i. \quad (7)$$

From equation (7), summing over countries i, we have that:

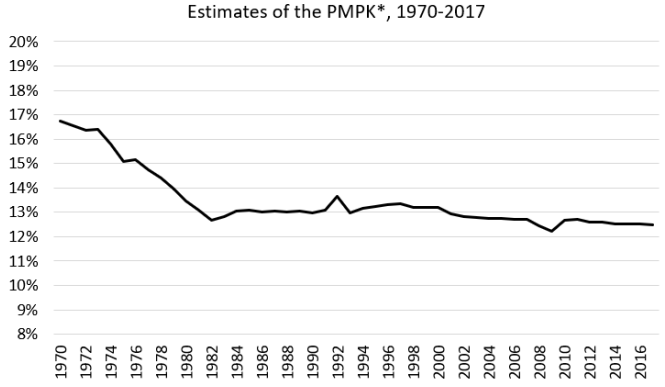
$$\sum_i K_i^* = \sum_i \left(\frac{PMPK_i}{PMPK^*}\right)^{\frac{1}{1-\alpha_i}} K_i. \quad (8)$$

The resource constraint requires that the world counterfactual stock of capital to be equal to the existing world stock of capital, that is, it must be the case that $\sum_i K_i^* = \sum_i K_i$. Therefore, we can write that:

$$\sum_i K_i^* = \sum_i K_i = \sum_i \left(\frac{PMPK_i}{PMPK^*}\right)^{\frac{1}{1-\alpha_i}} K_i. \quad (9)$$

Note that the two rightmost terms of expression (9) form an equation in which the only unknown is the counterfactual world PMPK, i.e., *PMPK**. We can use this equation and a simple non-linear procedure to obtain the *PMPK**. In the particular case in which we assume that the capital share is the same across countries, that is, if we assume that $\alpha_i = \alpha$ for all *i*, we can obtain a closed-form solution for *PMPK**, given by $PMPK^* = \left[\frac{\sum_i (PMPK_i)^{\frac{1}{1-\alpha}} K_i}{\sum_i K_i}\right]^{1-\alpha}$.

Figure 10 - Counterfactual world *PMPK**.



Source: Elaborated by the author.

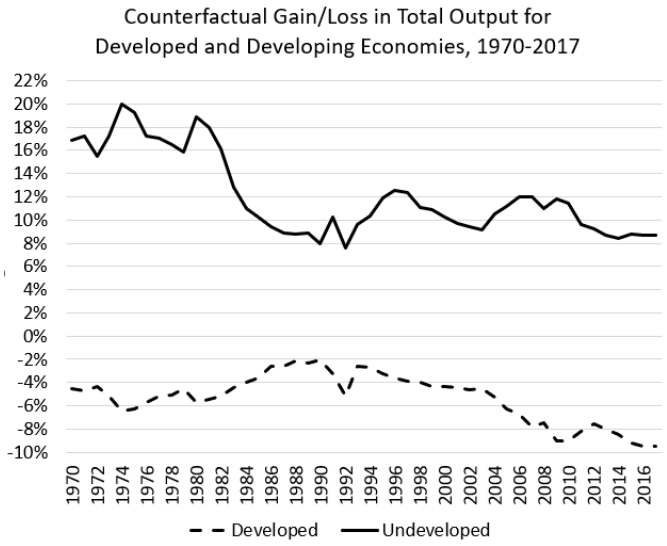
Figure 10 shows that the counterfactual world PMPK starts its descending trajectory in the early 1970s, around the time of the collapse of the Bretton Woods system and the relaxation of capital controls. Already in the early 1980s, the PMPK reaches the 12%-13% range and oscillates within this narrow range until the end of the period. For the sake of comparison, Mello (2009) finds a similar pattern for his estimates of the *PMPK**.

Figure 11 displays welfares gains, measured as the percentage change in GDP for developed and developing countries. As can be seen in Figure 11, welfare gains from reallocations of capital were substantial for developing countries in the 1970s, reaching

almost 20% of their combined GDP. On the other hand, welfare gains for developed countries were negative throughout the 1970s and early 1980s, turning negligible in the second half of the 1980s and throughout the mid-2000s, when they turn negative again, reaching almost -10% of the GDP around 2010.

Starting in the mid-2000s, the welfare gains from developing countries closely match the welfare losses from developed countries in absolute values, so that on average they cancel each other out, which means that the world welfare gains from capital reallocations are close to zero. In fact, net gains in world GDP reach 2% in the 1970s, decreasing to 1% in the 2000s, 0,7% in 2010 and only 0.3% in 2017. These estimates are consistent with those in Mello (2009), who finds that welfare gains from reallocations of capital across countries are close to zero from the mid-1980s to 2000, for both developed and developing countries. However, in the 1970s, welfare gains from reallocations of capital were significant for developing countries, reaching up to 10% of their combined GDP.

Figure 11 - Welfare gains from capital reallocations, 1970-2017.



Source: Elaborated by the author.

Finally, the above welfare estimates were generated assuming that capital is the only movable input. In a world with completely movable inputs, human capital would flow to where it is more productive, and this could translate into large welfare gains. In fact, Monge-Naranjo et alii (2019), in a companion paper to MSS, estimate that world output gains from equalization of the marginal product of human capital would be around 40%.

7. MPK Estimates from Alternative Country Groupings

As a robustness check, in this section we estimate the MPK and its price-corrected version using a broader sample consisting of 117 countries from PWT version 9.1. In this panel, we assume that all countries have the same constant capital share equal to 0.4. Hence, we now denote the marginal product of capital and its price-corrected version as MPK4 and PMPK4, respectively. As discussed above and elsewhere in the literature (e.g., Gollin (2002), Mello (2009), among others), this is a plausible first-pass assumption. In addition, recall that we divide the panel into three groups, developed countries (top 25 countries), middle-income (middle 67 countries) and low-income (bottom 25 countries). Table 4 displays the MPK4 and the PMPK4 for Developed, Middle-Income and Low-Income economies.

Table 4: The MPK4 and the price-corrected MPK4, 1970-2017.

Year	Developed MPK4	Middle-Inc. MPK4	Low-Inc. MPK4	Developed PMPK4	Middle-Inc. PMPK4	Low-Inc. PMPK4
1970	17.53%	30.66%	53.64%	15.26%	21.45%	27.87%
	(13.17%)	(20.03%)	(77.32%)	(5.50%)	(7.33%)	(13.43%)
1975	15.65%	26.81%	43.12%	14.54%	18.76%	24.69%
	(10.27%)	(16.50%)	(54.68%)	(9.67%)	(7.43%)	(13.93%)
1980	14.50%	22.25%	35.38%	13.05%	16.92%	22.39%
	(7.35%)	(13.56%)	(45.79%)	(7.85%)	(7.03%)	(9.85%)
1985	13.67%	21.15%	36.04%	12.63%	14.04%	20.85%
	(5.68%)	(16.68%)	(38.49%)	(3.68%)	(7.23%)	(11.72%)
1990	12.73%	20.57%	28.49%	12.37%	13.81%	16.36%
	(3.39%)	(18.70%)	(22.23%)	(3.56%)	(8.15%)	(9.62%)
1995	11.59%	17.76%	22.85%	12.80%	14.12%	13.88%
	(2.65%)	(11.15%)	(17.69%)	(3.70%)	(7.47%)	(7.63%)
2000	13.38%	16.06%	21.62%	12.63%	14.46%	16.73%
	(2.55%)	(7.14%)	(12.76%)	(3.31%)	(5.66%)	(9.17%)
2005	12.49%	14.23%	18.52%	12.21%	14.04%	19.00%
	(2.85%)	(6.15%)	(11.20%)	(3.91%)	(4.93%)	(13.99%)
2010	9.63%	11.84%	15.33%	11.65%	14.58%	17.29%
	(2.67%)	(5.13%)	(9.06%)	(4.58%)	(5.84%)	(7.28%)
2015	8.53%	10.08%	13.53%	11.68%	14.08%	17.38%
	(1.88%)	(4.58%)	(6.66%)	(7.56%)	(5.09%)	(7.44%)
2017	8.30%	9.69%	12.58%	11.40%	14.57%	17.09%
	(1.51%)	(4.37%)	(6.21%)	(6.50%)	(5.23%)	(7.06%)

Note: Standard deviation in parentheses.
Source: Elaborated by the author.

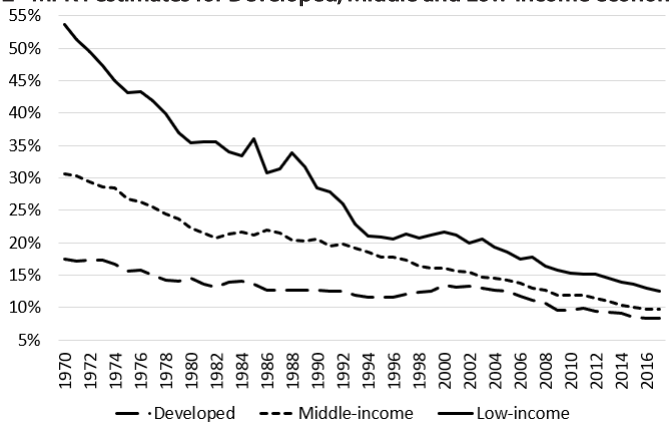
Estimates in Table 4 suggest that the MPK4 in developed economies converges to the range 8%-14% in the mid-1980s, exhibiting further convergence to around 8.5% in the last decade of the sample period. For middle-income countries, estimates for the MPK4 show a decreasing trend, converging to approximately 10%. A similar pattern can be seen for MPK4 estimates for low-income countries, which convergence to 12%-13% range.

Estimates of the PMPK4 for developed economies quickly converge to 12% in the mid-1980s and stay around this level until the end of the sample period. For middle-income economies, we observe stability at around 14%-15% since the mid-1980s, whereas for low-income economies, estimates of the PMPK4 decrease from 28% in 1970 to around 17% in the 2010s. Figure 12 below displays graphically estimates for the MPK4 for the three groups of countries.

Figure 12 confirms the basic descriptive analysis given above based on Table 4. We observe fast convergence of MPK4 estimates for low-income economies, and slower rates of convergence for middle-income and developed economies. Note that MPK4 differentials start to narrow substantially around the mid-1990s.

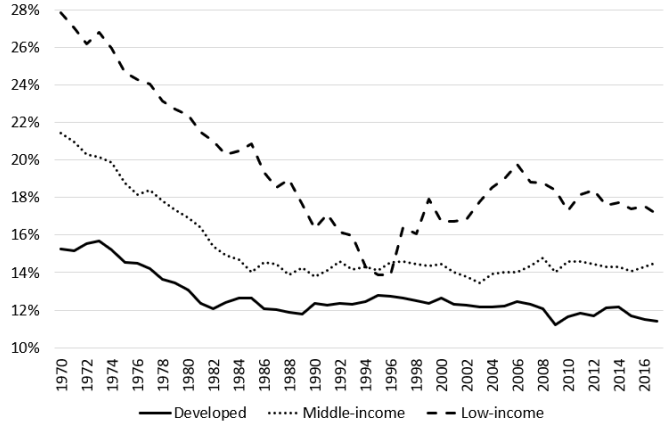
Figure 13 displays the PMPK4 for the three country groups. First, we observe fast convergence for estimates of PMPK4 for low-income economies, and slower rates of convergence for middle-income and developed economies. Second, this convergence process stops in the mid-1990s, when the PMPK4 starts diverging from a level of 14% to a 18% level. Third, PMPK4 differentials between developed and middle-income countries are stable from the mid-1980s to the end of the sample period, at around two percentage points.

Figure 12 - MPK4 estimates for Developed, Middle and Low-income economies.



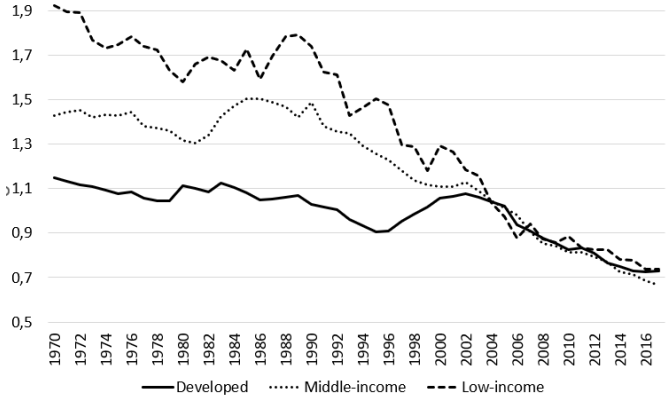
Source: Elaborated by the author.

Figure 13 - PMPK4 estimates for Developed, Middle and Low-income economies.



Source: Elaborated by the author.

Figure 14 - Relative Price of Capital for Developed, Middle and Low-Income countries.

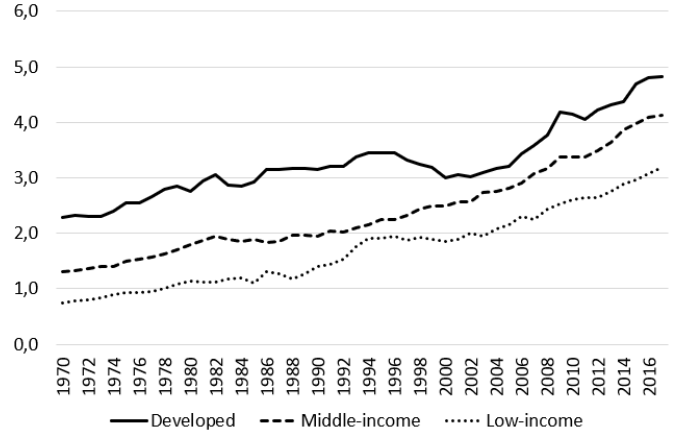


Source: Elaborated by the author.

Figure 14 displays the relative price of capital for the three groups of countries. The striking aspect of Figure 14 is the complete convergence in relative prices for the three sets of economies starting in the mid-2000s and onwards.

Figure 15 shows that the capital-output ratio trends upwards over time. In addition, the magnitude of the estimated capital-output ratio seems to be in line with plausible numbers for this quantity, i.e., between 1 and 5, and the fact that the capital-output ratio is greater in developed countries compared to middle-income and low-income countries. Finally, the pattern depicted in Figure 15 is consistent with previous estimates of the capital-output ratio in Mello (2009).

Figure 15 - Capital-Output ratio for Developed, Middle and Low-Income countries.



Source: Elaborated by the author.

8. Conclusion

We build on Mello (2009) and update estimates of the marginal product of capital taking into account cross-country and time series variation in the relative price of capital and the capital share. We work with two panels over the period 1970-2017, adding 17 years of data from previous estimates of the marginal product of capital. The first panel consists of 94 countries for which we are able to have an estimate of the capital share, whereas the second panel we have 117 countries in which we assume that the capital share is constant and equal to 0.4. We use aggregate data from the Penn World Tables version 9.1.

We find that the price-corrected MPK for developing countries was approximately 27% in 1970, and it decreases to close to 19% in 2017, whereas the price-corrected MPK for developed countries was 16% in 1970 and it decreases to 13% in 2017. Therefore, we do not find evidence of complete cross-country MPK equalization, however, we do observe a tendency towards reduction in cross-country MPK differentials.

Counterfactual reallocations of capital across countries to equalize the MPK would yield substantial output gains for developing economies, especially in the 1970s and mid-1980s. Overall, the gain in world GDP would be negligible, reaching 2% in the 1970s and only 0,3% in 2017. world to 2000, a result we corroborate here. Overall, our findings suggest that the capital is efficiently allocated across countries, at least to the point that we can safely rule out international credit market frictions as a barrier to the development and growth of the nations.

An interesting agenda for future research would be to take account of intangible inputs in the production function. According to the World Intangible Investment Organization, spending on intangible assets is greater than spending on tangible assets

since the late 1990s. The U.S. economy is by far the largest investor in intangible assets. As it is well-known intangible inputs such as, talent skills, knowledge, brand value, database, intellectual property, among others, have very different properties compared to physical inputs. For instance, intangible inputs are more scalable, non-rival (yielding increasing returns to scale), promote synergies (complementarities) and spillovers (externalities).

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Appendix

List of Countries Panel 1 (n=94) : Angola, Argentina, Australia, Austria, Burundi, Belgium, Benin, Burkina Faso, Bulgaria, Bolivia, Brazil, Botswana, Central African Republic, Canada, Switzerland, Chile, China, Ivory Coast, Cameroon, Colombia, Costa Rica, Germany, Denmark, Dominican Republic, Ecuador, Egypt, Spain, Finland, France, United Kingdom, Guinea, Greece, Guatemala, Hong Kong, Honduras, Hungary, Indonesia, India, Ireland, Iran, Iraq, Israel, Italy, Jamaica, Jordan, Japan, Kenya, Republic of Korea, Kuwait, Lao People's D.R., Lebanon, Sri Lanka, Lesotho, Morocco, Mexico, Mongolia, Mozambique, Mauritania, Mauritius, Malaysia, Namibia, Niger, Nigeria, Nicaragua, Netherlands, Norway, New Zealand, Oman, Panama, Peru, Philippines, Poland, Portugal, Paraguay, Romania, Rwanda, Saudi Arabia, Senegal, Singapore, Sierra Leone, Sweden, Chad, Togo, Thailand, Trinidad and Tobago, Tunisia, Turkey, Taiwan, Tanzania, Uruguay, United States, Venezuela, South Africa, and Zimbabwe.

List of Countries Panel 2 (n=117); In addition to the 94 countries listed above, Panel #2 includes the following 23 countries : Albania, United Arab Emirates, Bangladesh, D.R. of the Congo, Congo, Algeria, Ethiopia, Ghana, Haiti, Cambodia, Liberia, Madagascar, Mali, Myanmar, Malawi, Nepal, Pakistan, State of Palestine, El Salvador, Syrian Arab Republic, Uganda, Vietnam, and Zambia.