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Purchasing Power Parities or National Deflators?

A Note on Measures of Italian Productivity Relative to the Major European Countries

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Abstract

The dichotomy between Purchasing Power Parities (PPPs) and national deflators in international comparisons of real variables (GDP per capita and productivity) has returned to center stage in the recent debate on the gap between the EU and the US. This dichotomy does not only concern comparisons between structurally different countries. It is also present, to a lesser but still significant extent, in Europe and with reference to the Italian economy. This paper shows how, over the period 2005-2023, Italy's productivity performance compared to Germany and France is better if GDP is measured in PPPs (output side) rather than deflated with implicit prices from national accounts. The two types of measurement lead to dynamics that are difficult to reconcile. Examining the PPP-deflator gap, it is clear that this difference does not depend on the composition and structure of the weights used in constructing PPPs. Analysis of the expenditure categories that make up GDP and analysis of the specific household consumption items reveal a pervasive phenomenon, affecting both tradable and non-tradable products. It is argued that the structural similarity of economies lends robustness to PPPs. It is concluded that comparisons between countries under consideration based on data deflated with implicit prices from national accounts are less reliable, even in time series, than those based on PPPs due to the heterogeneous approaches of statistical offices in accounting for the quality of goods and services, the different granularity of underlying information, and the fixed structure of relative prices across economies.

1. PPPs and national deflators: incompatibility between levels and dynamics of relative productivity

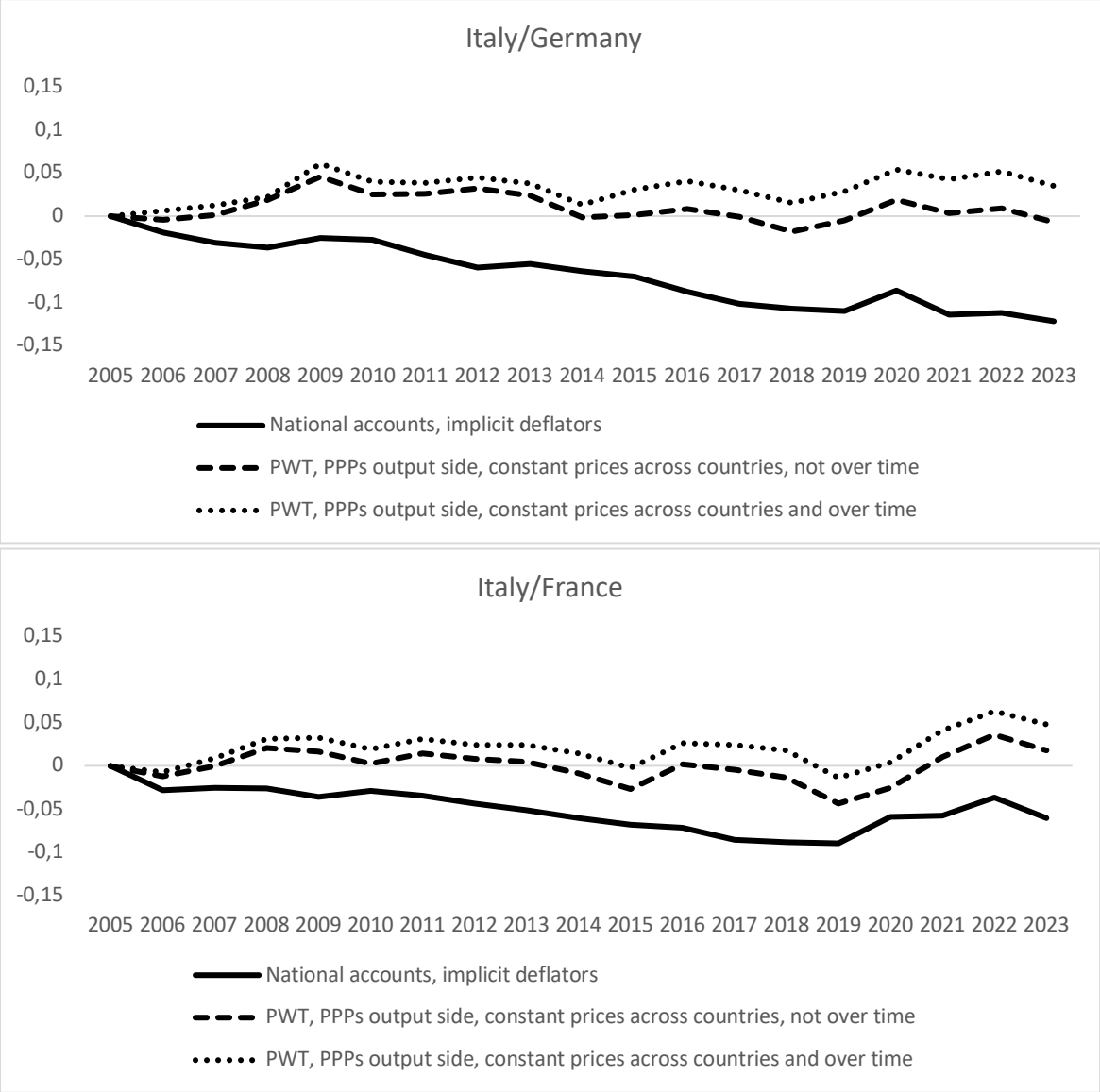
When comparing productivity among different countries, is it better to deflate economies' GDP (numerators of productivity indicators) with purchasing power parities (PPPs) or with national accounts price indices (so-called implicit deflators)? This is not a new discussion for price statisticians. It has seen renewed and lively interest in the dispute among analysts over the actual size of the productivity gap between Europe and the United States (the starting point of the Draghi Report), with proponents of PPPs (reporting a gap that has remained virtually unchanged since 2000; see, for example, Ackerman 2026 and Krugman 2026a, 2026b, 2026c) vigorously contested by supporters of implicit deflators (which instead show a prolonged relative deterioration of the EU; see, among others, Aghion et al. 2026a and 2026b, Garicano-Garicano 2026). This paper does not intend to enter into the debate over Europe's decline, but since, concurrently with this discussion, we have had to address the same issue (PPPs versus implicit deflators) with reference to productivity comparisons among the major European countries (De Nardis 2026), it seems appropriate to return to the topic to offer some new food for thought.

In the debate on the EU-US gap—particularly in the accompanying technical notes (Bergeaud 2026, Inklaar 2026)—it has been observed that the PPP/deflator dichotomy essentially concerns structurally different economies, such as those on either side of the Atlantic, but less so similar countries, such as European economies. We believe this observation is only partially valid. Certainly, compared to the starkly contrasting trends that the two measures (PPPs and deflators) provide for the United States and the EU, the European ones appear smaller. But they exist and are significant for Italy compared with Germany and France. Since we are talking about countries similar in terms of production technologies, consumer preferences, institutional structures, and even formal statistical rules, the divergence seems all the more notable and worthy of further investigation.

Figure 1 shows the trend (in logarithmic variations with respect to 2005) of Italy's hourly productivity compared to Germany and France over the 18 years between 2005 and 2023, according to three different measures: relative productivity measured using implicit national accounts deflators (solid line) and relative productivity measured using two versions of PPP (dashed and dotted lines). Both PPPs are output-side and compiled by Penn World Table (PWT). Output-side PPPs are those effectively appropriate for productivity comparisons. Expenditure-side PPPs, such as those estimated by Eurostat-OECD as part of the International Comparison Program (ICP), deflate GDP with relative prices referring to so-called domestic absorption (or total domestic demand). They serve to compare countries' spending capacity (i.e., living standards) and not their respective productivities. Output-side PPP PWT measures are obtained by deflating (unlike expenditure-side PPPs) the export and import components with appropriately estimated export and import prices (see Feenstra et al. 2015). Productivity assessed with output-side PPPs at constant prices across countries and variable over time (dashed line) is effectively productivity in current PPPs over the years, the ratio of which across countries (since the GDP of the different economies is converted into common prices) provides an indication, for each year, of Italy's GDP per hour worked relative to that of Germany and France. Productivity estimated with PPP

on the output side at constant prices across countries and over time (dotted line) is the PWT estimate that uses national accounts deflators to interpolate and extrapolate GDP values in years for which PPP estimates are not available (infra-benchmark). For European countries, the benchmarks are annual, so the dynamics of national accounts deflators are constrained by the information on relative price levels available for each year.

Figure 1 – Italy's hourly productivity relative to Germany and France (log changes since 2005)



Source: computations based on Eurostat e Penn World Table (PWT) data.

The signal obtained from Figure 1 is markedly different depending on the measure used.

1) According to the data based on implicit national accounts deflators (solid line), Italian productivity has steadily deteriorated compared to Germany over the 18-year period considered. The ratio between

Italian and German labor productivity decreased by approximately 11% between 2005 and 2023. The deterioration, although less marked, is also evident compared to France, except for the partial recovery in the most recent period, which helps contain the overall extent of the relative decline (approximately -6% between 2005 and 2023).

2) According to the estimate based on PPPs (dashed and dotted lines), no deterioration emerges. Italian productivity has instead moved at a similar pace to that of Germany and France (the lines fluctuate near the zero line). The difference between the PPP estimate based on prices that are constant across countries but vary over time (dashed line) and the PPP estimate based on prices that are constant across countries and over time (dotted line) appears small. The signal is therefore homogeneous, although the PPP estimate at constant prices across countries and over time shows a relatively better trend (fluctuation above the zero-variation line). According to this latter measure, therefore, Italian relative productivity would have increased marginally compared to 2005.

Can evidence 1) and 2) be simultaneously true? The rational answer is no, although there is a tendency among experts to say yes, and this will be discussed in more detail at the end of this paper. For now, we note that the difference in results is too large to be attributed to the specificities that distinguish different ways of measuring phenomena (price levels and dynamics), which are necessarily interrelated. Relative price levels (as measured by PPPs) must, over time, have some relationship, however weak, with the relative dynamics of deflators. It should be remembered that we are comparing structurally similar countries, and therefore we are in a comparability situation very different from that which characterizes Europe and the United States.

In what follows, we investigate the possible sources of divergence in measures of relative labor productivity among the three European countries, focusing on their exclusive cause: the dynamics of the price indices used to deflate the numerator of productivity measures.

2. From the Productivity Gap to the PPP-Deflator Gap

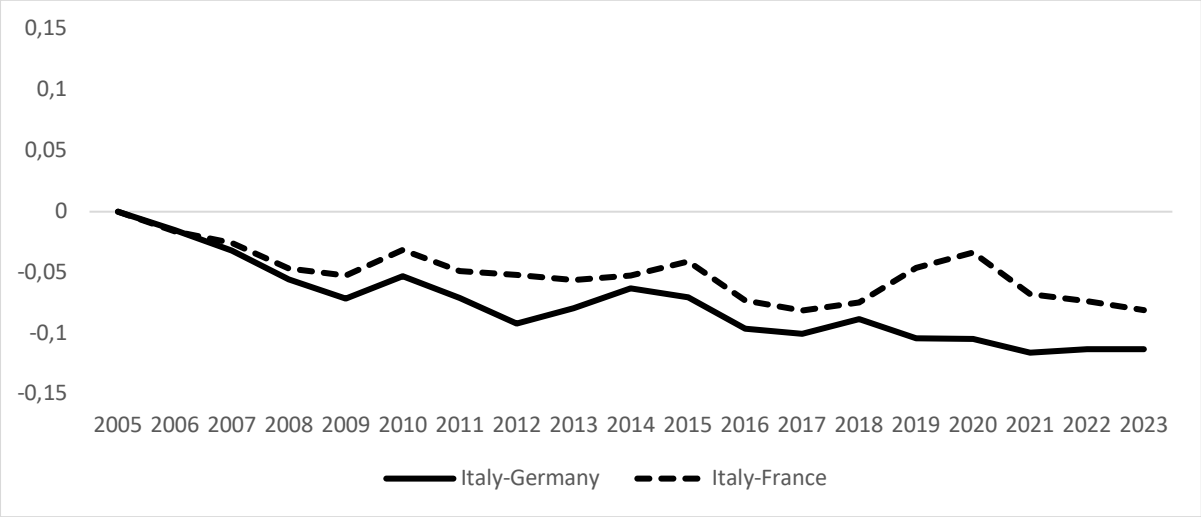
As argued by Bergeaud (2026) and Inklaar (2026), the difference between the relative dynamics of labor productivity measured in current PPPs and the relative dynamics of labor productivity in volume obtained by deflating GDP with implicit prices from national accounts coincides with the gap between the relative dynamics between countries of current PPPs and those of deflators. Therefore, comparing the evolutions of Italy to those of Germany, with respect to an initial time t=0 and indicating with $\pi_{It}^{constant,nat.accounts}$ and $\pi_{Ge,t}^{constant,nat.account}$ the productivities of Italy and Germany obtained with the national accounts deflators ($Deflat_{It,t}$ and $Deflat_{Ge,t}$) and with $\pi_{It,t}^{PPP}$ and $\pi_{Ge,t}^{PPP}$ the corresponding productivities obtained by applying the current PPPs ($PPP_{It,t}$ e $PPP_{Ge,t}$), we have

$$GAP_{PPP-deflat} = ln\left(\frac{\pi_{It,t}^{constant,nat.account} \Big/ \pi_{It,0}^{constant,nat.\ account}}{\pi_{Ge,t}^{constant,nat.account} \Big/ \pi_{Ge,0}^{constant,nat.account}}\right) - ln\left(\frac{\pi_{It,t}^{PPP} \Big/ \pi_{It,0}^{PPP}}{\pi_{Ge,t}^{PPP} \Big/ \pi_{Ge,0}^{PPP}}\right) =$$

$$= ln\left(\frac{PPP_{It,t} \Big/ PPP_{it,0}}{PPP_{Ge,t} \Big/ PPP_{Ge,0}}\right) - ln\left(\frac{Deflat_{It,t} \Big/ Deflat_{it,0}}{Deflat_{Ge,t} \Big/ Deflat_{Ge,0}}\right)$$

The worsening performance of Italy's labor productivity relative to Germany over the period 2005-2023, obtained with the implicit deflators of the national accounts compared to the current PPP measure (i.e., the unfavorable evolution of the solid line compared to the dotted one in Figure 1), therefore corresponds to the negative value of $GAP_{PPP-deflat}$. Figure 2 shows this gap for Italy-Germany and Italy-France.

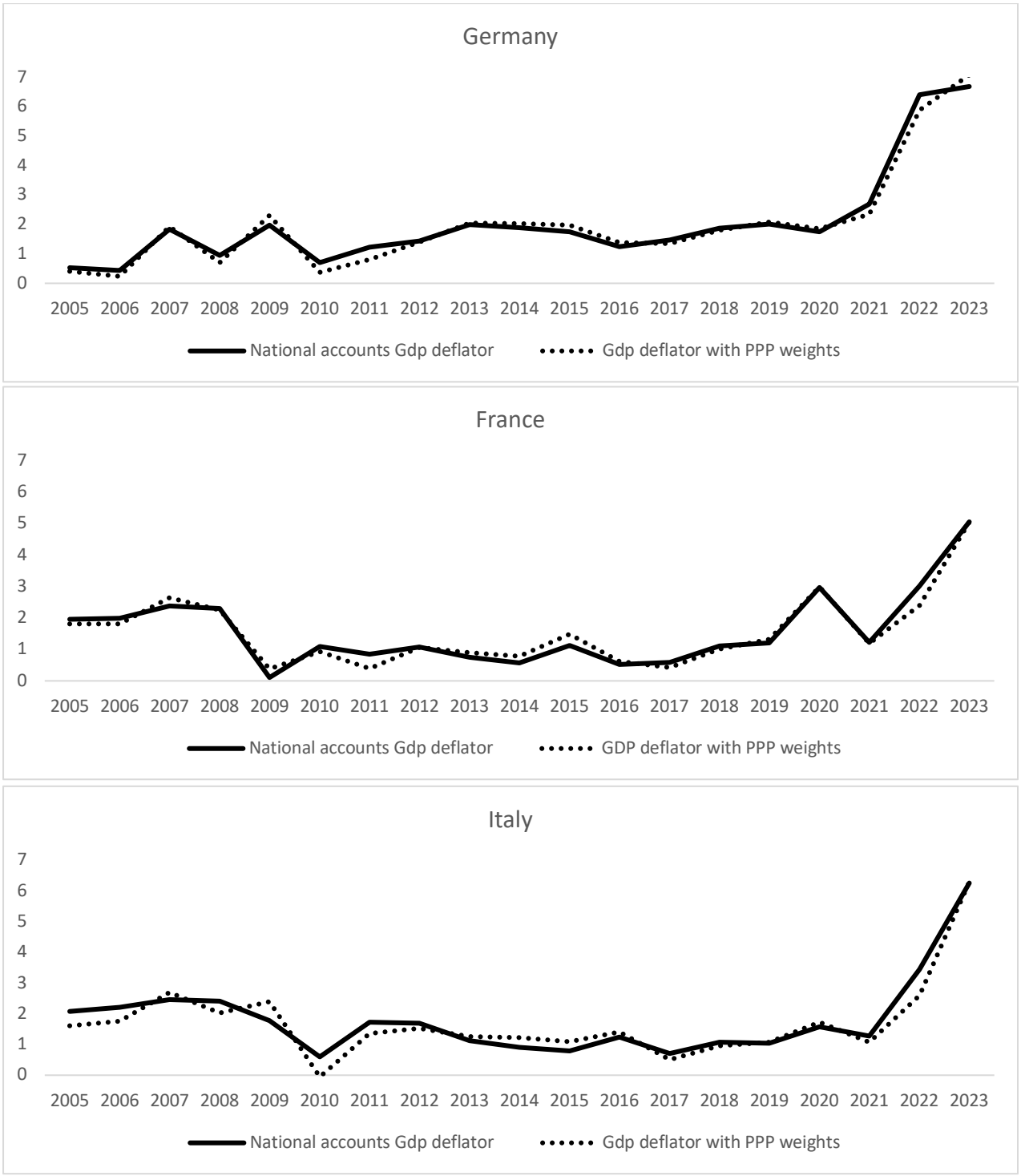
Figure 2 – Italy's PPP-Deflator GAP relative to Germany and France (log changes since 2005)



Source: computations based on Eurostat and PWT data

The PPP-Deflator gap can arise, at the aggregate GDP level, from various causes. According to Inklaar (2026), who analyzes the EU-US comparison, the gap is not the result of a compositional or structural effect of the weights, which differ in PPPs from those in the national accounts. This conclusion is substantially shared by Bergeaud (2026), who argues that differences in weights and composition can explain why there is no perfect equality between the dynamics of deflators and PPPs, but they are unable to account for large divergences.

Figure 3 – National accounts GDP deflator and GDP deflator estimated by weighting expenditure components with PPP expenditure weights (annual % changes)



Source: computations based on Eurostat and PWT data

In the assessments conducted here, due to a lack of information, it is impossible to delve into the disaggregation in depth, but the limited relevance of the weights seems confirmed. The three panels of Figure 3 show the GDP deflators of the national accounts for each economy and their estimate, obtained

by weighting the variations in the deflators of the expenditure components of GDP (government consumption, household consumption, gross investment, exports, and imports) with the PPP weights.

As can be seen, discrepancies emerge, but they are limited and not so great as to cause the deflator estimated with PPP weights to contradict the "history" of the national accounts deflator. A similar result, which we do not report, is obtained for the deflator of the specific expenditure components of final household consumption: an estimate obtained by applying PPP weights to the variations in the deflators of the twelve analytical expenditure categories (COICOP) replicates the final household consumption deflator of the national accounts of the three countries considered, with very limited divergences. As mentioned, it is not possible to delve into more detailed levels, but it is reasonable to assume that this result holds even when digging deeper. The implication of this evidence is that the PPP weights, although different from those of the national accounts, do not explain the divergence observed in aggregate between the dynamics of PPPs and deflators. The reason for this limited influence likely lies in the fact that these countries are very similar in terms of citizens' preferences and, therefore, expenditures. Thus, the multilateral weightings that characterize the construction of PPPs, starting from the most basic product level, ultimately lead, when comparing the major European countries, to weighting structures that are not too far removed from those of the national accounts of each economy.

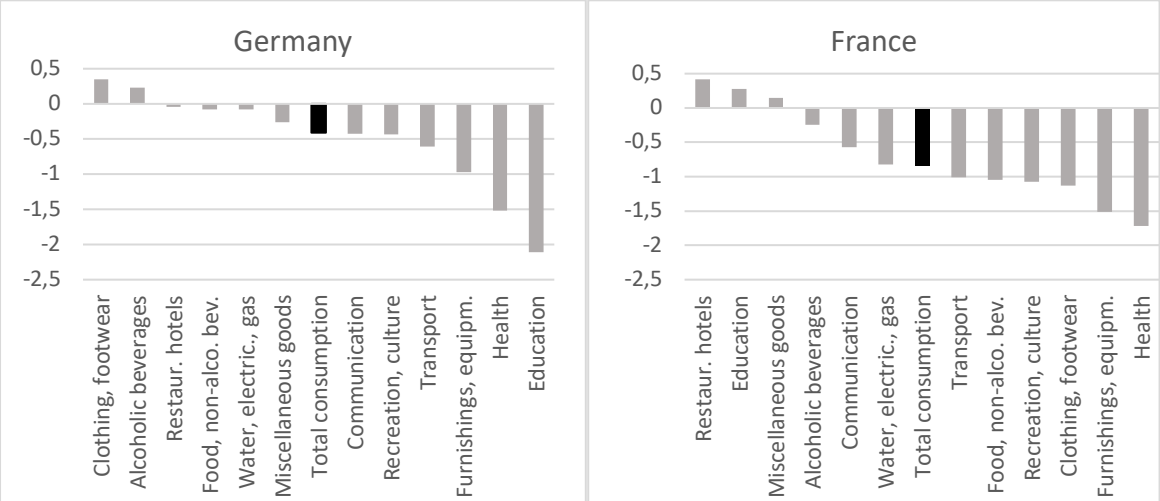
Further insights into the PPP-deflator gap at the GDP level are obtained from the analysis of individual expenditure categories (Table 1). Between 2005 and 2023, negative gap values (i.e., Italy's PPP dynamics relative to the two European economies lower than those of the deflators) characterized all components of domestic demand, albeit with varying impacts for each country. Compared to Germany, the largest gap is found in public consumption, where PPPs appear more in line with the relative wage developments of the two countries in the general government, but the gap is also significant for investment and household consumption. The latter is the most negative component of the gap between Italy and France. With regard to domestic demand, it is also noted that while, compared to Germany, the negative PPP dynamics merely amplify declines in relative prices, which were also detected by the deflators (i.e., the direction of the change was confirmed), the negative gaps with respect to France are the consequence of reversals in the sign of PPPs compared to the deflators. In other words, the national accounts show higher inflation in Italy than in France for domestic spending components, while the relative prices recorded in PPPs indicate the opposite process. Regarding exports and imports, for these components too, Italy's relative PPP dynamics are lower than those of the deflators, but the net effect in terms of trade is a slightly positive gap with both Germany and France.

Table 1 – PPPs (PWT) and deflators, average annual log changes (×100), 2005–2023						
	Italy/Germany			Italy/France		
	PPP (PWT)	Deflator	Gap	PPP (PWT)	Deflator	Gap
Househ. cons.	--0,5	-0,1	-0,4	-0,3	0,3	-0,6
Capit format.	-1,0	-0,6	-0,4	-0,2	0,1	-0,3
Public cons.	-1,2	-0,5	-0,7	-0,1	0,1	-0,2
Exports	0,2	0,3	-0,1	0,3	0,3	-0,1
Imports	0,3	0,5	-0,2	0,1	0,3	-0,2
Pil	*-1,0*	*-0,3*	*-0,6*	*-0,2*	*0,2*	*-0,4*

Source: computations based on Eurostat and PWT data

Figure 4 analyzes the evolution of the PPP-deflator gap for the 12 COICOP (classification of individual consumption by purpose) expenditure categories that make up household final consumption. In this case, the PPPs considered are those from Eurostat (for which the necessary detail is available) and the period examined is the 17 years between 2005 and 2022. There are also widespread negative gaps for the COICOP categories. Compared to Germany, the gap between PPPs and consumption deflators is driven by expenditure on tradable goods and services (communications, recreation and culture, transportation) and, to a greater extent, by some non-tradable services (healthcare and education). Compared to France, the impact of expenditure on a broader range of tradable goods and services (communications, transportation, food, recreation and culture, clothing and footwear, furniture and household services) and on two types of non-tradable services (healthcare and utilities) is highlighted.

Figure 4 – Household final consumption and COICOP components: PPP (Eurostat)–Deflator Gap, average annual log changes (×100), 2005–2022



Source: computations based on Eurostat data

We summarize the messages emerging from this set of findings in the following points.

- They show that the PPP-GDP deflator gap does not reflect compositional effects on demand (Krugman's initial hypothesis in the EU-US comparison). The negative value of the gap is indeed found in all components of domestic demand, although in the Italy/France comparison it is higher for household consumption, while in the Italy/Germany comparison it is comparatively higher for public consumption (Table 1). The phenomenon is pervasive. In the Italy/France case, however, the reversal of sign in the price dynamics of these components, moving from deflators to PPPs, is striking: almost an indication that deflators and PPPs are measuring two different realities. Net foreign demand, on the other hand, plays a substantially neutral role in the gap between PPP and deflator-based assessments.

- A significant influence on the gap appears to be ruled out by the weights used in PPP estimates: the discrepancies with the national accounts are small and cannot lead to gaps such as those shown in Figure 1.

Excluding both compositional and weighting effects from the explanation of the PPP-GDP deflator gap leaves the residual explanation, which Beregeaud and Inklaar call "product sampling", on the table. This is, in effect, a catch-all explanation that includes several additional possibilities. These include not only the possible differences in the basic goods and services used to construct the two price types, but also structural differences (between PPP and implicit deflators) involving the treatment of quality, as well as the estimation methodologies adopted by national statistical institutes to transform price indices (e.g., the Harmonized Index of Consumer Prices) into national accounts deflators (e.g., the consumption deflator). Given the publicly available information, it is difficult to delve deeper into this issue, but some insights can be gleaned from the gap analysis by consumer spending category (conducted using Eurostat's PPPs). This is what is highlighted in the following point.

- The COICOP category analysis shows that negative gaps in the Italy/Germany and Italy/France comparisons are widespread, affecting both tradable and non-tradable goods and services. This finding differs from that of Inklaar (2026) regarding the EU-US comparison, where only expenditure on tradable products shows negative PPP-deflator gaps, while non-tradable services, on the other hand, are characterized by positive gaps. Inklaar interprets the sharper decline in PPPs compared to deflators in tradables (internationally traded goods and services for which it is easier to identify similar products across countries) as a signal in favor of PPPs over deflators: EU prices for these products have actually fallen more over time relative to the US than the deflators suggest. Conversely, the positive gap in non-tradables (particularly education and healthcare) is seen as an indication of difficulty in international comparison. The identification of truly similar services is hampered by the strong institutional differences that characterize the United States and the European Union. This is a factor that works against PPPs, so the gap (although positive) with deflators in services cannot be considered a reliable signal of actual price divergence. In the case of the three European countries, however, economies are much more similar in terms of institutional and regulatory frameworks. Thus, the greater pervasiveness of negative gaps in services purchased by households, found both in

the Italy/Germany comparison (healthcare and education) and in the Italy/France comparison (healthcare and public utilities), may suggest actual price gaps that do not emerge in the deflators due to the different methods of construction and quality adjustment followed by the national statistical offices.

To sum up, while it is clearly impossible to provide a smoking gun, it seems to us that the structural similarities of European countries lend robustness to the signals coming from PPPs, leading us to seriously consider the possibility that Italy's relative GDP prices have actually fallen more than those of Germany and France compared to what the deflators and national accounts indicate. Consequently, Italian productivity relative to the two economies would have not consistently deteriorated over the period under consideration, to the extent shown by the solid line in Figure 1, but would have rather moved at a pace not dissimilar to that of the German and French economies. Below, we address the typology of product sampling divergences that, in our view, characterize the gap between PPPs and deflators.

3. GDP per hour in PPPs and deflated by implicit prices from national accounts: a new quantum superposition?

In the debate over the preferability of PPPs or deflators for making international growth comparisons (of GDP, GDP per capita, GDP per employee and hours worked) one is generally led to seek explanations as to why the former lead to divergent dynamics from those resulting from the latter, and not vice versa. It is PPPs that must provide a justification for the deviation from deflators, not the other way around. And, indeed, this paper has also taken this path. But, upon closer inspection, it is not a mandatory path because national accounts deflators cannot be considered immaculate statistics and, therefore, a benchmark to which we must conform. In particular, when used to make comparisons between different economies, deflators are far from being the verb. They have serious flaws that make them unsuitable for comparisons.

There's no doubt that PPPs—fully justified for international comparisons by decades of theoretical and empirical research—introduce contradictions with national accounts that are difficult to explain. Saying that PPPs should be used to measure differences in levels between countries in each year, while differences in dynamics over time should be measured exclusively by national deflators, leads to such interpretative inconsistencies that it defies quantum superposition itself. The cat is simultaneously alive and dead, just as the steady decline in Italy's hourly GDP relative to Germany (deflators) between 2003 and 2025 and the fact that the gap between the two countries' productivity levels appears similar in 2023 to 2005 (PPP) are simultaneously true. Some observers resolve this contradiction by arguing that the two estimates (deflators and PPPs) aim to measure different phenomena (temporal on the one hand, spatial on the other) and, taking this difference into account, are – yes - both true. We consider this approach difficult to accept when dealing with divergences such as those represented in Figure 1. Particularly, we believe that what we have defined as a sort of quantum superposition should not be

rationalized, but rather that a simpler explanation should be sought, starting by examining the problems of implicit deflators in national accounts.

The methodologies for constructing deflators, formally pursued by European countries under the umbrella of Eurostat regulations (contained in a voluminous manual), are in fact heterogeneous due to the different granularity of information in the databases on which they are based, the approximations implemented, and the way quality is treated not only in technologically advanced goods and services. This last point is the most obvious, but it interacts closely with the other two (granularity of information and approximations).

France has long widely adopted hedonic price estimates in its accounts for the main expenditure categories of GDP and has its own procedures for addressing qualitative changes in services purchased by households (COICOP items), particularly in healthcare. Germany makes more limited use of hedonic prices, complementing them with other methodologies, while paying particular attention to identifying qualitative improvements in household expenditures on education (COICOP-10) and healthcare (COICOP-06), translating them into increases in output rather than prices. Furthermore, for healthcare, it benefits from consistent detailed information with a highly integrated and centralized register of hospital billings. This disaggregated information can also be found in the GOFOG functions of public consumption, which has an impact on better defining volumes. Italy (similarly to Spain) is even more conservative in its use of hedonic estimates, preferring different approaches. Meanwhile, qualitative adjustments in services are hampered by less granular information, primarily from administrative sources and (for healthcare) from a highly decentralized and non-homogeneous system. It should be noted that the issue is not determining the best procedures or databases, but rather identifying and properly accounting for the lack of homogeneity in the measurement of a variable (the deflator) crucial for determining the numerator (GDP or value added in volume) of productivity indicators.

PPPs are certainly imperfect price measures, but they are so in the same way for all countries. This is their great advantage. Deflators, on the other hand, are measures developed by each statistical institute, under Eurostat's general guidelines, to account for qualitative changes in goods and services and arrive at the most possible precise estimates, under the constraints imposed by datasets and methodologies, of the price indices used in the deflation of nominal quantities. While they are accurate, they vary in accuracy across economies. This is their major drawback. When comparing real variables internationally, a prerequisite is that the price effect be eliminated equally across countries. This condition is currently met much better by PPPs than by deflators.

However, skeptics about PPPs observe that current PPPs are indices constructed for spatial comparisons, not for comparisons over time. The length of the yardstick used to measure prices can change from year to year, because the purpose is, precisely, to compare the levels of the variables in each year, and if such a comparison requires it, the unit of measurement is changed compared to the previous year. It is not the temporal comparison that guides, but the spatial one at any given moment in time. This is true. But, again, the relevant point is that when the yardstick changes, it happens homogeneously for all countries, without significantly altering the evolution of the ratios between their respective GDP volumes. Further proof of this assertion lies in the fact that PPP estimates that are

constant both across countries and over time, such as those conducted on the output side by PWT (estimates constructed expressly to be interpreted over time, see the dotted line in Figure 1), lead to relative dynamics of GDP per hour not dissimilar from those resulting from current PPPs. Output-side PPPs are, therefore, a more suitable yardstick for measuring productivity changes than those based on deflators, which are not calibrated uniformly across economies and, by construction, do not take into account changes over time in relative price structures. Deflators use the same price structure across countries identified in a single year, keeping it unrealistically unchanged in the time series. This is a serious problem that adds to their heterogeneity in construction. This is what leads Eurostat to state in the metadata description regarding PPP estimates: "When presented in index form (with, for instance, EU27=100) and per capita terms, they can be used as an analytical tool in temporal comparisons." With caution, adds the European Statistical Institute. But caution is what is completely missing in the highly problematic approach adopted when comparing deflated data across countries with implicit prices from national accounts.

Summarizing this discussion, we identify three main weaknesses of deflators that limit their use for international comparisons: a) different methodologies across countries for treating changes in the quality of goods and services, which should be attributed to changes in volumes rather than prices; b) different richness, granularity, and accuracy of underlying information across countries, which, especially in services, can lead to different results in measuring volumes and deflators even with the same methodologies; c) crystallization of relative price structures across countries at a base year, while in reality they vary over time series, constituting an essential element for accurately comparing economies. On all three fronts, PPPs offer better results.

In conclusion, it seems to us that the contradictions between PPP measures and deflator-based measures are not a naturally occurring phenomenon, to be accepted as it is, with bold and unlikely explanations. We are not dealing with an unclosed space-time rectangle of an imaginary geometry. The inconsistencies, however, can be substantially overcome when all economies (i.e., their statistical offices) operate on microdata bases that are much more homogeneous than the current ones and share the same procedures for constructing deflators. Before then, it is worth seriously considering what PPPs have to say.

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