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Martina Menon, Federico Perali, Ranjan Ray, Nicola Tommasi

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Martina Menon
University of Verona, Dept. of Economics, Verona, Italy
Federico Perali
University of Verona, Dept. of Economics, Verona, Italy
Ranjan Ray
Monash University, Dept. of Economics, Melbourne, Australia
Nicola Tommasi
University of Verona, Center of Economic Documentation (CIDE), Verona, Italy

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Abstract:

This study proposes a new method to estimate regional price parities accounting for differences in the quality of services. We estimate regional price parities to compare living standards across regions. The appeal of our application extends beyond Italy to the international context of cross-country PPP calculations. The average difference in "true" cost of livings between North and South of Italy is about 40 percent depending on the regions selected for comparison. Our evidence allows us to investigate why dependent workers living in the North do not move towards the South given the much lower cost of living there.

Keywords: Price Parities, Cost of Living, Quality of Public Services, Unit Values.

JEL codes : D12, I31, J3.

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1. Introduction

The measurement of the cost of living in Italy is both an empirically interesting exercise and a policy controversial issue. The empirical challenge is common to many other countries where individual prices cannot be derived from household budgets because quantities are not recorded. Further, nominal prices at the regional and local level for a high level of commodity definition are not available on a regular basis from official statistical sources.

1.1 Motivation

The principal motivation of this study is to propose a methodology to estimate True Cost of Living indices using pseudo unit values while adjusting for quality differences by modifying the estimated regional prices. The estimation of a utility-based price index is normally precluded in the many countries where the consumer expenditure survey does not report neither prices nor quantities. We also compare our results with non utility-based approaches to provide a robustness check of the estimates. We illustrate on Italian data the usefulness of the proposed methodology. As the brief survey of the literature below shows, the results of this study extend beyond Italy by addressing a significant gap in the available price information. A secondary motivation is to examine the effect of introducing the quality adjusted Regional Price Parities (RPP) on the inequality and poverty estimates.

1.2 Background Literature on Italy and other Countries

Previous estimates of regional price parities in Italy have mainly been based on basket product approaches and associated price indices (Biggeri, De Carli and Laureti 2008, ISTAT 2008, De Carli 2010, ISTAT 2010, Cannari and Iuzzolino 2009, Biggeri and Laureti 2014) rather than on the use of unit values as in the present paper. From a historical perspective, Amendola, Vecchi and Al Kiswani (2009) and Amendola and Vecchi (2017) estimate an average price differential of about 20 percent that testifies to the failure of the integration process between the North and South of Italy. In terms of real costs of living, the authors redesign the Italian map of welfare with a significantly smaller North-South gap coherently with the early evidence produced by Campiglio (1996). This reshuffling of the distribution of real household incomes has been documented also by Massari, Pittau and Zelli (2010), which find that providing subsidized housing is especially relevant, though not sufficient, in alleviating the cost of living of the poor people living in the South. It is worth noting that the estimates of regional price differentials between the North and the South of Italy, also reported in our study, are significantly higher than those found in larger and more heterogeneous countries such as China (Brandt and Holz 2006, Biggeri, Ferrari and Yanyun 2017) and India (Majumder, Ray and Sinha 2012) with the exception of rural India, or as compared to the East-West German price differentials (Roos 2006).

1.3 Policy Implications for Italy

The Italian North-South divide in cost of living is a public concern that attracts an intense policy debate, mainly centred on the economic efficiency and political opportunity of establishing wage zones. The debate around the "tale of the two Italies" stayed alive through the years because it was never based on exhaustive and conclusive evidence. Alesina, Danninger and Rostagno (2001) and Alesina and Giavazzi (2007) contend that public employment, which is much more diffused in the South than in the North, has served as a perverse system to support Southern Italy because public employees receive the same salary regardless of the region of residence, although in the South the cost of living is much lower. This source of spatial inflation poses a serious question of fairness. Comparing the standard of living of two public workers with same level of skills, same labor contract centrally negotiated by the State, and same fiscal treatment, the employee living in the South enjoys a much higher living standard. The same authors claim that even though ISTAT, the Italian Statistical Institute, does not publish official statistics on the differences in the cost of living across Italian regions, some studies estimate that the average difference in the cost of living between North and South is about 20-30 percent. Boeri *et al.* (2021) estimate a 30 percent price differential using housing costs as their benchmark cost of living (Moretti 2013). Aiming at explaining the North-South divergence in price parity and standard of living, D'Alessio (2017) places special emphasis on the socio-economic context as described by features of the labor market and the quantity and quality of the public services effectively accessible to Italian residents. The study shows that perceived standards of living are significantly affected by occupational opportunities, quality of health services, access to childcare and public safety.

If there exists such a South to North real wage gradient, a spontaneous policy question is to ask why Italians, and dependent workers in particular, do not move towards the South and why migrants go North and do not stay in the South of Italy? Or more, why jobless people from the South do not migrate to the North of Italy to search for a job? What is the relative importance of the differential quality of services in answering these questions? The robustness of our evidence helps explaining these questions.

To better understand this policy conundrum, we produce new refinements of the existing methodology. In most countries there is no information on prices across regions. When the information is available, it is limited to temporal changes in prices at the aggregate country level, from which we can work out spatial price indices at the level of all items, but not at the level of individual items. At the cross-country level, the International Comparison Project (ICP) (World Bank 2015) does not publish within country price information, and this makes the estimated Purchasing Power Parity (PPP) of a country's currency difficult to interpret in the context of a heterogeneous country where the purchasing power of the currency unit is likely to vary sharply between provinces. As Slesnick (1998, 2002) points out, the absence of information on cross-sectional price variation between regions in a country poses a significant obstacle to meaningful welfare comparisons between households in the same time period in view of the spatial variation in prices within a country. In support of this point, Brandt and Holz (2006) provide empirical evidence from China by showing that the inequality estimates are quite sensitive to the use of spatial price deflators that take into account price differences between the Chinese provinces. There is increasing appreciation of this issue that has led to the ICP signalling greater attention to the estimation of RPPs in future rounds.

While the focus of this study is on spatial prices within a country, it deviates from the recent literature by introducing differences between regions in the quality of life (proxied by Amenities and Affluence indices) in the RPP calculations. Deaton (1998) contends that "the largest and most intellectually challenging issue separating the Bureau of Labor Statistics from the Boskin Committee is how a price index should handle quality changes." As a method of quality adjustment, Deaton suggests thinking about quality as a factor that scales up or down the "goodness" of goods, so that "effective quantity" is quantity multiplied by quality. To the best of our knowledge, this is the first study that operationalize this idea in the context of the measurement of a cost of living index.

The results confirm that it is as important to make quality of life adjustment as the introduction of spatial prices themselves in making welfare comparisons between regions. This has wider implications in the international context of PPP calculations by the ICP. For example, while the basis of the PPP concept is the Balassa-Samuelson hypothesis on productivity differences in non-tradeable items between the affluent and the less developed countries, it does not allow for differences in the quality of an item and, more generally, in the basic amenities in the PPP calculations. The Italian evidence at the sub-national level, which is a tale of two economically separate Italies, points to the need to do so at the international level of the PPP exercise.

1.4 Literature on Regional Price Parities (RPP)

The interest in spatial prices is reflected in an increasing literature on RPPs. Evidence on spatial prices in large countries in the form of estimated RPPs, though largely but not exclusively restricted to prices of food items, is contained in, for example, Coondoo and Saha (1990), Coondoo, Majumder and Ray (2004), Coondoo, Majumder and Chattopadhyay (2011), Majumder, Ray and Sinha (2012) for India, Aten and Menezes (2002) for Brazil, Deaton and Dupriez (2011) for India and Brazil, Mishra and Ray (2014) for Australia, Gomez-Tello *et al.* (2018) for Spain, Montero *et al.* (2020) for Italy. Majumder, Ray and Sinha (2015) have explored the implication of allowing spatial price differences within countries for the calculation of PPP between countries in the bilateral country context of India and Vietnam. With the exception of Gomez-Tello *et al.* (2018), which utilised regional price information in early twentieth-century Spain, and Montero *et al*. (2020), which uses monthly price quotations for 19 out of 20 regional capitals of Italy related to seven items belonging to the food and non-alcoholic beverage CPI group and the kriging methodology to estimate the price levels for the missing regional capital, these studies are part of a recent tradition that seeks to overcome the absence of detailed item wise information on prices by using unit values. This tradition, however, has the significant limitation of being restricted to food items because the required expenditure and quantity information is only available for such items. Moreover, unit values are unsatisfactory proxies for prices, as they are not exogenously given and can reflect consumer choice. This may lead to inconsistencies in the estimated price effects due to the omission of quality effects and that of household characteristics on the unit values. Also, for several commodities like services, unit values may be difficult to tabulate. Yet, spatial price indices within countries are required for both cross-country and intra-country comparisons.

This paper addresses the issue of estimation of RPPs on limited price information by proposing alternative procedures that can be easily implemented on widely available information on prices and household expenditures. The alternative procedures only require published item wise Consumer Price Indices (CPIs) and disaggregated household level information on expenditure by items and household characteristics, which are available in the unit records of household surveys. The basis for the alternative procedures is the concept of 'pseudo unit value' (PUV) that was proposed by Lewbel (1989) as a proxy for the actual unit value of an item. Atella, Menon and Perali (2004) implement Lewbel's proposal on Italian data and find that the PUVs are close approximation of the actual unit values. Moreover, their "results showed that the matrix of compensated price elasticities is negative semidefinite only if 'pseudo' unit vales are used" (p. 195).[1] Based on PUVs, the present study proposes and implements alternative procedures for calculating RPPs on Italian data, both item wise and over all items. While one procedure uses the concept of 'True Cost of Living Index' (TCLI) due to Konüs (1939) and adjusts it for quality differences, the other uses the framework of the Household Regional Product Dummy (HRPD) model proposed originally in Coondoo, Majumder and Ray (2004) and extended recently in Majumder and Ray (2017). A comparison between the alternative sets of RPPs is an important motivation of this study. While the empirical implementation of the proposed procedures in this study is restricted to Italy, the positive experience reported later suggests considerable potential for application in any country that has household level expenditure information on items and household characteristics. The more disaggregated the breakdown of expenditures on items the better will be the implementation of the proposed procedures.

[1] Recently, Menon, Perali and Tommasi (2017) have made the task of estimation of PUVs simpler by presenting the pseudo unit command in Stata that estimates pseudo unit values in cross-section of household expenditure surveys without quantity information (p. 222).

The rest of the paper is organised as follows. The Lewbel (1989) based procedure used in deriving individual prices and the cost of living index theory as the basis of the empirical application are described in Section 2. This section also shows how intra-country regional differences in 'amenities' and 'affluence' can be incorporated in the spatial price calculations. The data set used is described in Section 3. The results are presented and analysed in Section 4. The paper concludes with Section 5.

2. Alternative Procedures for Estimating Regional Purchasing Power Parities

Both HRPD and TCLI procedures for estimating RPPs start by calculating the pseudo unit values following Lewbel (1989). The next section describes the methodology for the calculation of demographically varying PUVs. The remaining sections are devoted to the descriptions of the alternative procedures for estimating purchasing power parities including spatial variation and differences in the quality of services.

2.1 The Calculation of Demographically Varying PUVs in the Absence of Quantity Information

Define the unit value of a commodity as the implicit price paid per physical unit. When only expenditure information is available, the cross-sectional variability of actual unit values for the i-th consumption group can be estimated for each household h as follows (Lewbel 1989, Menon, Perali and Tommasi 2017)

$$\hat{P}_{D_h}^{i} = \frac{1}{k_i} \prod_{j=1}^{n_i} w_{ij}^{-w_{ij}}, \qquad (1)$$

where k_i is the average of the sub-group expenditure for the i-th group, n_i is the total number of goods in the i-th group and w_{ij} is the budget share of good j of the i-th consumption group.[2]

[2] As suggested by a referee, this index expressed in logarithm is a version of an entropy or Shannon index.

The methodology proposed by Lewbel (1989) uses generalized "within-group" equivalence scales, defined as the ratio of the group sub-utility function to the corresponding sub-utility function of a reference household, estimated without price variation in place of "between-group" price variation. The method relies on the assumption that the original function is homothetically separable and "within-group" sub-utility functions are Cobb-Douglas.

As an example, one may suppose that a household budget is divided into $i = 1,2$ groups such as food and non-food, and that the food sub-group is composed by $j = 1,2,3$ items such as cereals, meat, and other food. The index $\hat{P}^i_{D_h}$ summarizes the cross-section variability of prices that can be added to spatially varying price indices to resemble unit values expressed in index form. In general, this technique allows the recovery of the household-specific price variability that can be found in unit values. The pseudo unit value is an index that can be compared to actual unit values after normalization choosing the value of a specific household as a numeraire. The construction of the household specific pseudo unit values begins with the reproduction of the demographic variability $\hat{P}^i_{D_h}$ to proceed by associating the variability to spatial price indexes generating the indexes $\hat{P}^i_{DI_{hrm}}$ and the information about price levels $\hat{P}^i_{DIL_{hrm}}$ as illustrated below.

The estimated index $\hat{P}^i_{D_h}$ is then used to add cross-sectional variability to group-specific price indices P^i_{rm}

$$\hat{P}^i_{DI_{hrm}} = \hat{P}^i_{D_h} \sum_{j=1}^{n_i} \left(P^{ij}_{rm} \omega_{ij} \right) = \hat{P}^i_{D_h} P^i_{rm}, \qquad (2)$$

where P^{ij}_{rm} is the consumer price index for the j-th good of the i-th consumption group collected monthly by national statistical institutes with months $m = 1, \ldots, M$, per each territorial level r with $r = 1, \ldots, R$. ω_{ij} are weights provided by national statistical institutes for each item j of group i. When not available, the subgroup budget shares can be used as aggregation weights. The price indices P_{rm}^{ij} are the same for all households living in the same region and interviewed in the same month, while the indexes $\hat{P}_{D_h}^i$, $\hat{P}_{DI_{hrm}}^i$ and $\hat{P}_{DIL_{hrm}}^i$ are also household specific. Higher variability, for example, may capture quality differences or the differential searching costs for lower prices of people with a full or part time job when shopping.

For pseudo unit values in index form to look like actual unit values, they have to be transformed into levels. The transformation in nominal terms is fundamental to properly capture complementary and substitution effects as shown in Atella, Menon and Perali (2004). Cross-effects would otherwise be the expression of the differential speed of change of the good-specific price indices through time only. Thus, the transformation of the index $\hat{P}_{DIL_{hrm}}^i$ is obtained as

$$\hat{P}_{DIL_{hrm}}^i = \hat{P}_{DI_{hrm}}^i \bar{y}_i, \tag{3}$$

where $\bar{y}_i$ is the average expenditure of consumption group i in the base year. Early experiments with pseudo unit values, on Italian household budget data (Perali 1999, Atella, Menon and Perali 2004, Menon and Perali 2010) and Hoderlein and Mihaleva (2008) for British household data, have provided comforting indications about the possibility of estimating regular preferences. Atella, Menon and Perali (2004) describe the effects on the matrix of cross-price elasticities associated with several price definitions and find that the matrix of compensated elasticities is negative definite only if pseudo unit values are used. Nominal pseudo unit values, which more closely reproduce actual unit values, give a set of own- and cross-price effects that is more economically plausible. The derived demand systems are regular and suitable for sound welfare and tax analysis. The authors conclude that the adoption of pseudo unit values does no harm because Lewbel's method simply consists in adding cross-sectional price variability to aggregate price data. Therefore, Lewbel's method for constructing demographically varying prices is potentially of great practical utility.

Let us now describe the alternative procedures for estimating the RPPs from the demographically varying PUVs.

2.2 The Weighted Household Regional Product Dummy (WHRPD) Model

The Weighted Household Regional Product Dummy (WHRPD) model is a natural vehicle for the present analysis because while retaining the spirit of the Country Product Dummy (CPD) model, which sought to address missing price information in the international context, it adapts the idea to the subnational context of the present study. It also serves as a benchmark estimate for the True Cost of Living Index approach. The basic premise of the approach is the concept of quality equation due to Prais and Houthakker (1955) in which the price/unit value for a commodity paid by a household is taken to measure the quality of the commodity group consumed and hence the price/unit value is postulated to be an increasing function of the level of living of the household.

A direct extension of the CPD model[3] due to Summers (1973) in a single cross-section context is

$$p_{jrh} = \alpha_j + \beta_r + \theta y_{rh} + \varepsilon_{jrh}, \qquad (4)$$

where p_{jrh} denotes the natural logarithm of the nominal price/unit value for the j-th commodity $j = 1, \ldots, N$ paid by the h-th sample household of region r, (r = 0, ..., R). y_{rh} denotes the natural logarithm of the nominal per capita income/per capita expenditure (PCE) of the h-th sample household in region r, while α_j and β_r capture the commodity and regional

[3] See Rao (2005) for a formal demonstration of the equivalence of the weighted CPD model and the 'Rao-system' in multilateral price comparisons. See Clements and Izan (1981) for an earlier demonstration of a similar result showing that 'Divisia index numbers can be interpreted and estimated as regression coefficients under a plausible error specification'.

effects, respectively. Majumder and Ray (2017) extend this model to adapt it to the household context by introducing household demographics. The regional effect is incorporated through a formulation of both the price/unit value of individual commodities and PCE in real terms.

The model is given by

$$p_{jrh} = \alpha_j^* + \phi_{jr} + \sum_{i=1}^{4} \delta_{ji}^* n_{irh} + (\lambda_j^* + \eta_{jr}^*) y_{rh} + \varepsilon_{jrh}, \qquad (5)$$

where α_j^* captures the pure commodity effect, which is the intercept in the numeraire region (r = 0) for item j, ϕ_{jr} captures the regional variability, and $\alpha_j^* + \phi_{jr}$ is the region-specific intercept. Thus, $exp(\phi_{jr})$ is the price relative of commodity j for region r ($\neq$0) with the numeraire region taken as the base. δ_{ji}^*'s are the slopes with respect to demographic variables (same for all regions), λ_j^* is the overall income slope (slope in the numeraire region), η_{jr}^* captures the differential slope component of each region and hence $\lambda_j^* + \eta_{jr}^*$ is the region specific income slope. Note that equation (5) reduces to the basic CPD model when $\phi_{jr} = \phi_j$ for all j; $\eta_{jr}^* = 0$ for all j, and r, and $\lambda_j^* = 0$ for all j. n_{irh} denotes the number of household members of the i-th age-sex category present in the h-th sample household in region r, i = 1, …, 4 denotes adult male, adult female, male child and female child categories, respectively, and ε_{jrh} is the random equation disturbance term. The term involving the demographic variables does not affect the basic structure of the CPD model.

An alternative interpretation of the model is as follows. Equation (5) can be written in the form of Coondoo, Majumder and Ray (2004) formulation as

$$p_{jrh} - \pi_r = \alpha_j + \sum_{i=1}^{4} \delta_{ij}\, n_{irh} + (\lambda_j + \eta_{jr})(y_{rh} - \pi_r) + \varepsilon_{jrh}, \quad (6)$$

where

$$\alpha_j^* + \phi_{jr} = \alpha_{jr} + (1 - \lambda_j - \eta_{jr})\pi_r$$

$$\delta_{ji}^* = \delta_{ji}, \lambda^*{}_{j} = \lambda_j, \eta_{jr}^* = \eta_{jr},$$

α_j, δ_{ij}, λ_{jt}, η_{jr} and π_r are the parameters of the model. In principle π_r's may be interpreted as the natural logarithm of the value of a reference basket of commodities purchased at the prices of region *r*. The left-hand side of equation (6) thus measures the logarithm of the price/unit value paid in real terms, and $(y_{rh} - \pi_r)$ on the right-hand side of equation (6) measures the logarithm of real PCE.

For estimation purposes, we follow the two-stage procedure suggested by Coondoo, Majumder and Ray (2004) and Majumder and Ray (2017). From equation (5), we can specify the first stage equation as

$$p_{jrh} = \alpha_j^* + \sum_{i=1} \delta_{ij} n_{irh} + +\lambda_j y_{rh} + \sum_r \eta_{jr} S_r \, y_{rh} + \epsilon_{jrh}, \quad (6a)$$

where S_r is a dummy variable associated with each Italian region *r* taking the value of 0 for the nation. For the numeraire region the expression reduces to

$$p_{j_0 h} = \alpha_j^* + \sum_i \delta_{ij} n_{i_0 h} + \lambda_j y_{0h} + \epsilon_{j_0 h}. \quad (6b)$$

By using the above parametric restrictions we can obtain π_r using the following second stage expression (Majumder and Ray 2017)

$$\hat{\phi}_{jr} = (1 - \hat{\lambda}_j - \hat{\eta}_j)\pi_r - (1 - \hat{\lambda}_j)\pi_0. \quad (6c)$$

The parameters $(\pi_r - \pi_0)$, with $r = 1, \ldots, R$, denote a set of logarithmic price index numbers for individual regions measuring the regional price level relative to that of the reference *numeraire* region ($r = 0$) and the spatial price index I_{ir} is given by the formula $I_{jr} = exp(\pi_r - \pi_0) = exp(\pi_r - 1)$. In the estimations reported below obtained from the joint implementation of a SUR procedure, we use the PUVs as prices in equations (4) - (6) and the spatial price in region *r* is estimated directly from equation (6).

As in Rao (2005) and in Majumder and Ray (2017), we also recognize the relevance of attaching higher weight to more representative price observations in making appropriate price level comparisons. To this end, we compute an importance weight w_{ij} given by the median expenditure share of the commodity in a given region. We then construct a transformed model where both the dependent variable and the regional dummy variables are multiplied by the square root of w_{ij} and estimate the weighted version of the model HRPD in equation (6). The use of regionally varying weights in the weighted HRPD model ensures that the estimated RPPs reflect not only the spatial variation in prices but also the spatial variation in the expenditure patterns.

2.3 Spatial Price Index as a True Cost of Living Index

Following Konüs (1939), the TCLI is the ratio of the cost of buying the same utility in two price situations. The methodology is based on the fact that a spatial price index can be viewed as a True Cost of Living Index as defined below.

The general cost function underlying the Rank 3 Quadratic Logarithmic (QL) systems (the Quadratic Almost Ideal Demand System (QAIDS) of Banks, Blundell and Lewbel (1997)) modified *a la* Gorman to introduce exogenous demographic characteristics via budget translating (Perali 2003) is of the form

$$C(u,p,d) = a(p)\, exp\left(\frac{b(p)}{(1/ln\, u)-\lambda(p)}\right) P^T\,(p,d), \quad (7)$$

where p is the price vector, $a(p)$ is a homogeneous function of degree one in prices, $b(p)$ and $\lambda(p)$ are homogeneous functions of degree zero in prices, $P^T(p,d)$ is an overhead function homogeneous of degree zero in prices, and u denotes a given level of utility. Gorman's 'committed total expenditure' is a fixed cost translating total expenditure. The vector of demographic characteristics d can contain both individual and household specific attributes. The budget share function for good i corresponding to the cost function (7) is of the form

$$w_i = P_i^{T\prime}(p,d) + b'_i(p)\ln\left(\frac{x^*}{a(p)}\right) + \frac{\lambda_i'(p)}{b_i'(p)}\left(\ln\frac{x^*}{a(p)}\right)^2, \quad (8)$$

where x denotes nominal per capita expenditure, $x^* = \frac{x}{P^T(p,d)}$. Demographic variation across households describes observed heterogeneity that it is included in the demand system as a translating effect as in Menon and Perali (2010).

The corresponding TCLI in logarithmic form comparing price situation p^1 with price situation p^0 is given by $\ln C(u,p^1,d^1) - \ln C(u,p^0,d^0)$

$$\ln P(p^1,p^0,u^*) = [\ln a(p^1) - \ln a(p^0)] + \left[\frac{b(p^1)}{\frac{1}{\ln u^*}-\lambda(p^1)} - \frac{b(p^0)}{\frac{1}{\ln u^*}-\lambda(p^0)}\right] + [P^T(p^1,d^1) - P^T(p^0,d^0)], \quad (9)$$

where u^* is the reference utility level. Note that while “price situation” refers to the prices in a given year in temporal comparisons of prices and welfare, and in the spatial context of this study, it refers to the prices prevailing in a particular region. The first term of the right-hand side of equation (9) is the logarithm of the basic index (measuring the cost of living index at some minimum benchmark utility level) and the second term is the logarithm of the marginal index. Note that for $p^1 = \theta p^0$, and $\theta > 0$, $a(p^1) = \theta a(p^0)$, so that the basic index takes the value θ and can be interpreted as the component of TCLI that captures the effect of uniform or average inflation on the cost of living. For $p^1 = \theta p^0$, and $\theta > 0$, $b(p^1) = b(p^0)$, and $\lambda(p^1) = \lambda(p^0)$, the marginal index takes the value of unity. Thus, the marginal index may be interpreted as the other component of TCLI that captures the effect of changes in the relative price structure.

In our context, from equation (9), the spatial price of region *r* with reference to Italy, denoted by *I*, is given by

$$\ln P(p^r,p^I,u^*) = [\ln a(p^r) - \ln a(p^I)] + \left[\frac{b(p^r)}{\frac{1}{\ln u^*}-\lambda(p^r)} - \frac{b(p^I)}{\frac{1}{\ln u^*}-\lambda(p^I)}\right] + [P^T(p^r,d^r) - P^T(p^I,d^I)]. \quad (10)$$

To describe the contribution to the general TCLI aggregate index of each expenditure category we estimate commodity specific indices as the average regional expenditure for each good divided by the national average expenditure for the same good.

Using the translog functional form for $\ln a(p) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln p_i + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \ln p_i \ln p_j$, the Cobb-Douglas price aggregator for $b(p) = \prod_{i=1}^{n} p_i^{\beta_i}$ and $\lambda(p) = \sum_{i=1}^{n} \lambda_i \ln p_i$ as proposed in Banks, Blundell and Lewbel (1997) and the demographically varying PUVs obtained following the procedure outlined in Section 2.1, QAIDS is estimated using NLSUR in budget share form given by equation (8) for each region $r = 1, \ldots, R$, and on the combined data for all Italy from pooling the data for each region. The RPP of region r with respect to all Italy, I, is then calculated from equation (10) with the reference utility u^* calculated by inverting the estimated expenditure function for all Italy at median per capita household expenditure and the prices for the whole Italy (used as reference prices) normalised at one.

The estimation includes as controls the exogenous demographic characteristics related to the number of adult females and males, the number of boys and girls and the dummies for the Italian regions where the Centre is the excluded one. We also correct for potential endogeneity of total expenditure using a two-stage control function approach (Blundell and Robin 1999) with log income as an instrument.

2.4 Adjusting for Regional Differences in the Quality of Services

We assume that objectively measured differences in quality affect the subjective perception of price. Fisher and Shell (1972) suggest treating a quality improvement as equivalent to a shadow (subjective) price decrease in the good whose quality has changed associated with a larger shadow quantity as if the consumer would obtain more of the same "repackaged" good. This perceived quality effect is traditionally implemented using Barten household technologies (Barten 1964, Deaton 1998, Perali 2003, Chapter 2, Jorgenson and Slesnick 2008, Majumder, Ray and Sinha 2012, 2015). In our exercise we consider the index describing the quality of services in Italy. Such composite index capturing the quality of services is one of the 12 domains describing the equitable and sustainable well-being in Italy (ISTAT 2018). We term this index as the Amenity index (A_r) for region r and for all Italy (A_0). When $A_r = A_0$, then there is no spatial variation in amenities. It aggregates 10 service dimensions[4] using the Mazziotta and Pareto (2016) non-compensatory composite index for spatial comparisons (MPI), which corrects the arithmetic mean with a region-specific penalty proportional to the unbalance of the indicators.

As shown in Figure A1 in the Appendix, in the Northern regions the index is above 100 saying that the consumption of one unit of service comes packaged with better quality. It means that the consumption of one unit of service is larger than one in effective terms in the North as compared to the South. This implies that the effective (subjective) price is lower than the price objectively paid in the North. This construct has been first described by Barten (1964) who formalized the following relationship linking effective quantities and prices while leaving the budget unchanged

$$p^{*r} = \frac{p^r}{m(\iota)} \quad \text{and} \quad q^{*r} = q^r m(\iota) | p^{*r} q^{*r} = p^r q^r = y, \quad (11)$$

where the function $m(\iota)$ is any modifying function with arguments a vector of indices ι. We also assume that there is a positive and high correlation between the quantities of amenities, or quality, offered for a given unit of consumption, as captured by the Amenity index (A_r) for region r and for all Italy (A_0), and the level of incomes. Therefore, we also compute an Affluence index given by the median per capita expenditure of each region $\boldsymbol{y_r^{med}}$ and for all

[4] The dimensions are: 1) Beds in residential health care facilities (‰ beds per 1,000 inhabitants), 2) Children who benefited of early childhood services (%), 3) Integrated home assistance service (%), 4) Composite index of service accessibility (three year average), 5) Broadband coverage (%), 6) Irregularities in water supply (three-year average number of interruptions), 7) Irregularities in electric power distribution (average number of interruptions), 8) Place-Km of public transport networks (places-km/inhabitants), 9) Time devoted to mobility (minutes), 10) Satisfaction with means of transport (%).

Italy $\boldsymbol{y_0^{med}}$. The regional variation of the Affluence index is also illustrated in Figure A1 in the Appendix. The correlation between the two indices is 0.89, while their respective coefficient of variation is 0.11 and 0.19.

We then specify the Barten scaling function $m(\iota)$ for $\iota = \{A_r, \boldsymbol{y_r^{med}}\}$ in exponential form as

$$m(A_r, \boldsymbol{y_r^{med}}; \theta) = m_A(A_r) m_y(\boldsymbol{y_r^{med}}) = (\exp A_r)^{\theta_1} (\exp \boldsymbol{y_r^{med}})^{\theta_2}, \quad (12)$$

where θ is the vector of parameters θ_1 and θ_2 associated respectively with the Amenity and Affluence index. Note that $m_A(A_r) = (\exp A_r)^{\theta_1} \gtreqless 1$ if $A_r \gtreqless 1$ and $\theta_1 \gtreqless 0$. Similarly for $m_y(\boldsymbol{y_r^{med}})$. Note that the Barten technology is the same for all-prices. We opt for this technology specification because we do not have price-specific indices describing, for examples, regional differences in the quality of the provision of health, transportation, or other services. Further, it has the advantage of being parsimonious in the parameters to estimate.

In the version incorporating the Amenity and Affluence index for region *r* through Barten scaling of individual prices, the cost function of equation (7) becomes

$$C(u, p^r, d, A_r, \boldsymbol{y_r^{med}}) = \mathrm{a}(p^{r*}, d)\, exp\left(\frac{b(p^{r*},d)}{(1/\ln u) - \lambda(p^{r*},d)}\right) \mathrm{P}^T(p^{r*}, d). \quad (13)$$

Because the scaling functions m_A and m_y are not price specific, then we can rewrite

$$\mathrm{a}(p^{r*}, d) = \frac{a(p^r,d)}{m_A(A_r) m_y(y_r^{med})} = \frac{a(p^r,d)}{(\exp \boldsymbol{A_r})^{\boldsymbol{\theta_1}} (\exp \boldsymbol{y_r^{med}})^{\boldsymbol{\theta_2}}}. \quad (14)$$

The overhead term is specified as $P^T(p,d) = \sum_{j=1}^N t_{ij}(d_i) \ln p_{ij}^*$, where the translating function is specified as $t_{ij}(d_i) = \sum_{j=1}^N \tau_{ij} \ln d_i$.

The budget share equations are then

$$w_i = a_i(p^{r*}) + b_i(p^{r*}) \ln\left(\frac{y_{rh}^*}{a(p^{r*})}\right) + \frac{\lambda_i(p^{r*})}{b(p^{r*})} \left(\ln \frac{y_{rh}^*}{a(p^{r*})}\right)^2, \quad (15)$$

where $y_{rh}^* = y_{rh} P^T$.

Now, under the modified set up $\ln(\text{TCLI}) = \ln C(u, p^{1*}, d^1) - \ln C(u, p^{0*}, d^0)$ is given by

$$\ln P\left(p^r, p^0, u^*, d, A_r, \boldsymbol{y}_r^{\boldsymbol{med}}\right)=[\ln \mathrm{a}(p^{r*}) - \ln \mathrm{a}(p^{0*})] + \left[\frac{b(p^{r*})}{\frac{1}{\ln u^*}-\lambda(p^{r*})} - \frac{b(p^{0*})}{\frac{1}{\ln u^*}-\lambda(p^{0*})}\right] +$$

$$+ [P^T(p^{r*}, d^r) - P^T(p^{0*}, d^0)], \qquad (16)$$

which can be written as

$$\ln P\left(p^r, p^0, u^*, d, A_r, \boldsymbol{y}_r^{\boldsymbol{med}}\right) = (\pi_r^* - \pi_0^*) + \left[\frac{b(p^{r*})}{\frac{1}{ln\,u^*}-\lambda(p^{r*})} - \frac{b(p^{0*})}{\frac{1}{ln\,u^*}-\lambda(p^{0*})}\right] + [P^T(p^{r*}, d^r) -$$

$$P^T(p^{0*}, d^0)].$$

Like the Slutsky decomposition of substitution and income effects, the Barten-Gorman household technology rotates the budget constraint by modifying the effective prices with the scaling substitution effects and translates the budget line through its fixed cost element.

The parameters for the price specific modifications have been estimated including the homogeneity restriction that insures both identification of all parameters and the regularity of the modified cost function (Perali and Cox 1996, Perali 2003, Menon, Pagani and Perali 2016).

2.5 Allowing for Spatially Autocorrelated Price Movements via Contiguity Matrices

Many studies report statistical evidence that price movements are often spatially correlated (Majumder and Ray 2017). Prices in neighbouring regions are likely to be correlated because of cross border movements in both consumers and the items they purchase due to competition generated by market forces. Spatial correlation is traditionally modelled by constructing a matrix of distances to be used as a weight matrix of a spatial error model. The present study is in the same mainstream. The choice between a contiguity or an inverse distance matrix[5] has

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[5] A contiguity matrix records adjacent regions as follows $Wc_{i,j} = \begin{cases} d_{i,j} & \text{if } i \text{ and } j \text{ are neighbors} \\ 0 & \text{otherwise} \end{cases}$, where the symmetric weighting matrix W_c has the same positive weights $d_{i,j} = 1$ for contiguous spatial units and a zero weight for all other units. The contiguity matrix for Italy considers Liguria, Tuscany, Lazio, Campania and

been made on an economic ground because the Moran test for spatial dependence based on a χ^2 distribution was not helpful in discriminating between the two distance matrices, which were both highly significant in rejecting the null hypothesis that the residuals of HRPD and WHRPD models are independent and identically distributed for all prices.

We find it meaningful to define spatial lags based on neighbouring areas only rather than modelling effects across distances that decrease with increasing distance. Prices for goods such as energy, local public transportation, communication, or housing do not vary in relation to distance as it may be the case for perishable goods and associated transportation costs. This type of goods, whose prices are related to distance, represent a relatively small proportions of larger aggregates such as food. On the other hand, it is likely that price levels are similar for adjacent regions that may share similar standard of living.

Like the choice between a spatial lag model, obtained multiplying the spatial weight matrix times the vector of observations, and the spatial error model, where the spatial weight matrix is multiplied by an error term, has been based on the contention that the pattern of spatial dependence is mainly due to omitted random factors responsible for spatial autocorrelation error covariances being non-zero. We also deem that specifying an explicit model of spatial interaction is a demanding task especially for aggregate prices that hardly depend on neighbours' values. In line with these considerations, we adopt a contiguity matrix as a spatial weight and model spatial dependence as a spatial error process for all HRPD, WHRPD and TCLI models.

3. Data

We use the 2013 Italian household budget survey conducted by the National Statistical Institute

Calabria as adjacent regions of both islands of Sicily and Sardinia. The distance matrix W_d is also a symmetric matrix with elements equal to the reciprocal of distance between regional centroids as derived from ISTAT provided shapefiles.

(ISTAT), which gathers expenditure data exclusively. The dataset comprises more than 23,000 households that are interviewed at different times during the year. The ISTAT budget survey is representative at the regional level. Table A1 in the Appendix lists the 20 Italian regions organized by the North, Centre and South macro-areas. For convenience of presentation of the results, the Valle d'Aosta region, which is very small both in size and population, is aggregated to the Piedmont region. The analysis is then conducted for a total of 19 regions.

As explained in Section 2.1, we apply Lewbel's (1989) theory to compute pseudo-unit values first implemented in Atella, Menon and Perali (2004) using the information traditionally available in expenditure surveys and in the ISTAT survey, such as budget shares and demographic characteristics, which help reproduce the distribution of the unit-value variability as closely as possible. We construct Divisia Index Numbers based on our estimated PUVs to provide a formal description of the constructed household specific prices (Clements and Izan 1981, Clements, Izan and Selvanathan 2006) and to obtain an additional term of comparison to judge the statistical and economic robustness of the estimated WHRPD and TCLI indices. The Divisia Indices[6] are computed as

$$\ln P_{rs} = \sum_i \bar{w}_{rs}^i \ln \frac{\bar{p}_r^i}{\bar{p}_s^i}, \text{ for each } r \quad (17)$$

where $\bar{w}_{rs}^i = 0.5(\bar{w}_r^i + \bar{w}_s^i)$ for each good i in region r, $\bar{w}_r^i$ is the average budget share of good i in region r and $\bar{w}_s^i$ is the average budget share of good i for Italy denoted with the subscript s. Similarly, $\bar{p}_r^i$ is the average price (pseudo unit value) of good i in region r and $\bar{p}_s^i$ is the average price of good i for Italy.

Household expenditures in the dataset have been aggregated into eleven groups: food and beverages, clothing and footwear, housing, heating and energy, furniture and other

[6] The index is more properly a Törnqvist index (in log form) because the Divisia is a continuous index. The Törnqvist index is one of the discretization of the Divisia index. As such, it is a subset of the Divisia family. As it is frequent in the literature, Divisia and Törnqvist are used synonymously also in the present study.

domestic appliances, health, transportation, communications, education, leisure, health, and other non-food categories. Table A2 lists the eleven commodity groups and the subgroups used to derive the pseudo unit values.

This level of commodity detail is chosen for a better understanding of the regional differences in purchasing power parities and costs of living across Italy. For example, we decided to keep housing expenditure separate from heating and energy expenditure to account for the specific weight of these two items on the budget of Italian households. Due to differences in weather conditions, the consumption of heating is markedly higher in the North of Italy rather than the South. In the largest cities of the North of Italy, it is often the cause of what is termed "housing poverty" because many poor households cannot afford the payment of heating costs.

Similarly, there are large cost fluctuations at different latitudes along Italy's boot that we may not be able to capture at a higher level of commodity aggregation. This comes at the cost of higher computational burden due to the large expansion of the parameter space and the necessity to deal with corner solutions. We treat zero expenditures as the outcome of infrequent purchases and imputed non-consumption before estimation using the Blundell and Meghir (1987) modelling strategy.

ISTAT collects information about consumer price indices based on the consumption habits of the whole population available monthly for each of the 106 Italian provinces with the COICOP level of disaggregation.[7] We choose January 1997 as the base year. Price indices[8] are matched to the household survey, accounting also for the period of the year when the household

[7] Eurostat adopts the classification of individual consumption by purpose (COICOP), which is a nomenclature developed by the United Nations Statistics Division to classify and analyse individual consumption expenditures incurred by households, non-profit institutions serving households, and general government according to their purpose. National statistical institutes traditionally publish consumer price indices per each COICOP category monthly, which are collected at the provincial level.

[8] ISTAT publishes NIC (official for the entire national community) and FOI (weights based on the consumption basket of dependent workers) consumer price indices by 1481 elementary COICOP products.

is interviewed. This means that households interviewed for instance in March are matched with prices collected in the same month.

After determining the expenditure groups as described in Table A2, we construct the corresponding consumer price indices starting from the COICOP categories available for territorial disaggregation and months. Once collected the consumer price indices available from official statistics and associate them with each household in the survey, then, to improve the precision of the estimated price elasticities as shown in Atella, Menon and Perali (2004), we reproduce as best as we can the price variation of actual unit values. The estimation of PUVs is described in Atella, Menon and Perali (2004) and Menon, Perali and Tommasi (2017). Table A3 reports the variable definitions and descriptive statistics of the data used both for the HRPD and TCLI estimations.

The estimated cost of living, the regional wage levels for dependent workers,[9] and the regional individual and household income levels are then adjusted for differences in the quality of services using the Amenity and Affluence indices described in Section 2.4 and illustrated in Figure A1.[10]

4. Results

The first part of the section describes in order the econometric estimates of the HRPD, WHRPD and TCLI models along with its associated elasticities. The second part interprets the evidence related to the price parities estimated from both models, the commodity specific cost indices, and discusses the reverse migration conundrum and other policy issues associated with the impact of the estimated parities on real incomes.

[9] The wage levels for dependent workers are ISTAT estimates from data of the Observatory on Dependent Workers of the Istituto Nazionale di Previdenza Sociale, INPS.
[10] Figures A1 to A6 can be found in the Appendix.

4.1 Spatial variation of prices

The estimated parameters for the HRPD, with (495 parameters) and without spatial correction (484 parameters), WHRPD, with and without spatial correction, and the TCLI model with spatial error correction are reported in the Appendix (Table A4, A5 and A6 respectively). The parameters of the HRPD model of equation (5) and WHRPD, obtained using a joint SUR estimation of all 11 price equations, are all generally significantly different from zero at the 1 percent significance level.

Inspection of Table A4 and A5 reveal interesting regularities. All the parameters associated with the demographic variables in each equation are positive and significantly different from zero at the 1 percent significance level. The impact of most regional dummies is also positive in all equations, while the interaction terms with the logarithm of per capita expenditures are generally negative and significantly different from zero. This regular pattern reveals that the regional controls are relevant.

All the parameters associated with per capita expenditure are also positive and significantly different from zero at the 1 percent significance level. The spatial error terms are all significantly different from zero (but for clothing and footwear) signalling that spatial correlation is an important factor to control for in both HRPD and WHRPD models. The comparison of the results with and without spatial correction reveal that the general pattern is maintained, but the size of the coefficients, and their relative impact, changes significantly both for the total expenditure term and the regional dummies.

Based on likelihood ratio tests, we prefer the model with spatial correction both for the HRPD (LRT=3136.54 with 11 df) and weighted WHRPD (LRT=3135.44 with 11 df) versions. Because the HRPD and WHRPD models are non-nested, we discriminate between the two models using the Akaike Information Criterion (AIC) that selects the model that minimizes the information loss. In our case, AIC_{HRPD}(439360.6) is larger than AIC_{WHRPD}(-789359.4) associated with the spatial versions. We therefore prefer the spatial WHRPD model.

Table A6 shows the parameter estimates of the NLLS estimation for the Quadratic Demand System with both the correction for expenditure endogeneity and spatial correlation described by the same error correction adopted in the HRPD and WHRPD models. In general, the parameters are significantly different from zero at the 1 percent significance level. The income parameters β associated with the linear term of total per capita expenditure in the heating and energy, communication and education equations are not significant, but the corresponding non-linear terms λ, as well as all other λ parameters, are. This evidence supports the quadratic in total expenditure specification of the demand system. Both the spatial error parameters and the parameters associated with the control term correcting for endogeneity are significantly different from zero at the 1 percent level in 8 out of 11 cases as it is reported at the bottom of Table A7.

The income elasticities calculated at the data mean are significantly different from zero for all the budget equations (Table A7). As it is reasonable to expect, the most elastic goods with an elasticity greater than one are transportation, education and other goods and services. Standard errors are bootstrapped with 200 replications. Table A8 shows the compensated price elasticities computed at the data means along with the associated standard errors and *t*-values. The underlying Slutsky matrix is regular judging by the negative own-price elasticities. With the exception of the own-price elasticity for the communication good, all price elasticities are significantly different from zero at the 1 percent level of significance. The pattern of cross-elasticities shows that almost all goods are substitute. The substitution effects are especially strong for housing.

Table 1 compares the estimated Cost of Living levels with Individual and Household Income Levels in both nominal and real terms.[11] As expected, the Cost of Living, derived using expenditure data, is lower than household income in all regions but Molise. Real figures are obtained by deflating individual and household incomes using the TCLI PPP. Once deflated, the North-South income gap dissipates. Differences across regions do not reveal substantial differences in standard of living with the notable exception of the Molise region. Figure A2 compares the yearly nominal levels of the cost of living, individual incomes and household disposable income between the Italian regions presented in Table 1.[12]

Individual incomes are lower than household costs for all regions. An income source alone is not sufficient to sustain the cost of living of a household. When comparing the average regional levels of household disposable incomes with the cost of living, then we observe a positive savings margin for all regions except for the small central region of Molise. This suggests that households have been drawing on non-income sources of resource inflows to fund their cost of living, sometimes drawing more than needed. The maps of Figure A2 reveal a marked North - South divide both in terms of cost of living and incomes. The green to violet gradient seems very persuasive in this respect. The picture radically changes when regional differences in purchasing power parity are considered. The parity effect is shown in the maps grouped in Figure A3 where the cost of living map is compared with both individual and household real incomes. The regional income differentials in real terms are markedly reduced producing an effective purchasing power parity with negligible differences across regions. The income maps in real terms show a dispersion of colours throughout the country. The standard

[11] Information about incomes comes from the 2013 Living Condition Survey (IT-SILC-ISTAT) because the Italian household budget survey is a consumption not a consumption and income survey. So, it is reasonable to expect that the income poorest region of Italy (Molise) shows negative savings due to measurement errors.
[12] The colours of the figures graduate from dark green associated with the highest values of the distribution to dark violet associated with the lowest values of the distribution. In general, the different gradations of violet pertain to regions belonging to the low tercile of the distribution, the gradations of grey are associated with the regions of the middle tercile, the gradations of green are for the top tercile regions.

of living of Sicily, Calabria and Puglia is higher than the one in Trentino-Alto Adige, Veneto and Piedmont, while Campania, in South Italy, is almost as high as Veneto.

4.2 Impact of spatial variation and the quality adjustment on real wages, incomes, and poverty

Table 2 describes the PPP using the DIVISIA, WHRPD and TCLI approaches. The maps included in Figure A4 compare the DIVISIA, WHRPD and TCLI PPPs. The three PPPs reveal a clear North-South gradient, though the WHRPD PPP is significantly more variable with respect to both the DIVISIA index and TCLI PPP measured by the standard deviation. The DIVISIA index is highly and positively correlated with the TCLI PPP (0.92) and to a lesser extent with the WHPRD PPP (0.71). The highest WHRPD index is 1.15 for Lombardy while the TCLI index reaches 1.25 for the Trentino-Alto Adige region. The lowest value for the WHRPD regional index is 0.43 for Sardinia, while for the TCLI is 0.72 for Sicily. Estimates obtained with the TCLI approach are more smooth and closer to common expectations.

Figure A6, Panel 1, describes the correlation between the TCLI and WHRPD index that is 0.619. The figure shows that TCLI and WHRPD PPPs are coherent for the North-Western regions Piedmont and Lombardy along with Trentino-Alto Adige and Emilia-Romagna. Veneto and Friuli-Venezia Giulia, in the North-East, and Sicily, Sardinia and Puglia, in Southern Italy, are the more discordant.

On the other hand, the TCLI compares very well with both the index of individual and household incomes (Table 2 and Figure A5). We exploit this evidence to select the TCLI PPP as our preferred deflator to derive real individual and household annual and monthly incomes (Table 1). On the basis of this True PPP and considering the northern regions of Lombardy, Trentino-Alto Adige and Veneto as representative of the North with an average index of 1.19 and Sicily, Calabria and Campania as representative of the South, with an average index of

0.77, we can conclude that the cost of living in the South is 64% with respect to the cost of living in their North, corresponding to a 36% North-South differential that reduces to 28% when considering all regions of the North and the South.

Comparing the standard deviations of nominal and real incomes (Table 1), we observe a 1/3 reduction of standard deviation showing a remarkably accurate inter-regional equalizing effect except for the small Molise region. The evidence described in Table 1 and 2 and Figure A2 to A6 clearly explains why people from the South do not longer move to the North. Dependent workers from the North do not move to the South because there are no extra gains, especially for families considering that the labor market in the North is more efficient and offers more job opportunities to married women. In the dataset used in this study the female participation rate to the labor market is 51.28% in the North of Italy, 50.28 % in the Centre and 32.57% in the South of Italy. For married couple with children and single mothers, the proportion in the South reduces to 23.92%.

It is less clear why immigrants move to the North and do not stay in the South. One possible explanation is that immigrants cannot compete with state jobs considering that the State in the South is the largest provider of job opportunities only for Italians, thus providing a sort of legal barrier. Immigrants move to the North independently of the higher housing costs that they probably offset by implementing housing sharing. We can gain further insights by exploring the composition of the cost of living in each region.

Table 3 shows the descriptive statistics of the cost levels of each expenditure group. While food expenditure is about 20 percent higher in the North than in the South, housing costs mainly formed by rents are about 100 percent higher. Heating and energy are about 30 percent higher in the North because winters are sensibly more rigid in the North. The use of the car is relatively more important in the North considering that transportation costs are almost twice as high in the North. Lifestyles differ markedly as well, judging by the level of leisure expenditures in the North.

In general, differences in regional cost levels, as compared with the mean, are negative for all commodities only in the Southern regions. Table 4 reports differences with respect to the mean level of regional expenditure by class from the estimates obtained from the TCLI model. The difference turns negative for all commodity groups for the Abruzzo region and for all other regions in the South. Interestingly, this clear-cut change seems to demarcate the South from the rest of Italy. Negative differences are especially high for all commodities in the Calabria and Sicily regions.

In terms of budget shares, food is relatively more important in the South (Table 5). The housing share and heating and energy share are almost as important in the North as in the South. Similarly, for transportation and leisure. In general, it is reasonable to contend that expenditure patterns are similar across Italian regions.

Table 6 shows the commodity specific indices specific for each region along with their standard deviations and the correlation index with the TCLI PPP index. The expenditure categories that are more closely related with the general index presenting a correlation index around 0.94 are housing, thus reinforcing the methodology implemented by Moretti (2013), but also health, transportation, and leisure. Interestingly, the correlation between HRPD PPP and the housing index is 0.458 (Figure A6).

Table 7 reports the regional cost of living indices, yearly incomes and wages for dependent workers expressed both in nominal and real terms using both the HRPD and TCLI PPP deflator. The reported indices show that the TCLI is highly and positively correlated with both the wage index (0.89) and the index of individual incomes (0.94), while the HRPD deflator has a significantly lower correlation (0.57 and 0.58 respectively). Table 10 further compares nominal and real yearly wages of dependent workers with individual incomes. The salary of dependent workers, which is the result of a bargaining process between the unions and the State at the national level, vary across regions mainly because of differences in the skill mix of the labor force. Wages are larger than individual incomes in all regions. The average percentage difference is about 30%. The TCLI index reduces the north-south distance because the standard deviation of both real wages and incomes is more than halved, while the HRPD deflator increases the distance because the variance almost doubles. Because of this evidence, we select the TCLI as our preferred PPP index that will be used for the subsequent analysis.

Tables 8a and 8b report the estimates of the price scaling parameters introduced in the demand system to model spatial differences in the quality provision of services (Section 2.4). All Barten parameters associated with the Amenity index or the Affluence index or both are statistically significantly different from zero. The Amenity index is negative, while the affluence is positive. Considering for example the Amenity index for which $m_A(A_r) = (\exp A_r)^{\theta_1} \gtrless 1$ if $A_r \gtrless 1$ and $\theta_1 \gtrless 0$ and noting that A_r is less than 1 for all regions south of the Lazio region, Lazio included (Figure A1), then $m_A(A_r) < 1$ because $\theta_1 < 0$. In the Barten construct (equation 11), the modified price $p^* > p^r$ and the associated effective or quality adjusted quantity consumed is less than the observed quantity as it is reasonable to expect.

As a referee observed, the indices may affect the food share in a significantly different way with respect to an expenditure share of a service, such as health or transportation. We address this issue by conducting the specification tests reported in Table 8a, where the quality modified models are compared among each other and with the benchmark model without quality adjustment and estimating a completely unrestricted model described in Table 8b. The partial effect specification (Model E) in Table 8a is obtained eliminating the modifying functions adjusting prices for differences in the quality of services for the goods Food & Beverage, Clothing and Footwear, Furnitures and Domestic Appliances, Communications, Other goods & services. Model (E) is statistically preferrable on the basis of the likelihood ratio test (Table 8a last line, last column) with respect to Model (D), where the modifying parameters affect all expenditure shares in the same way. In the partial effect specification, the effects of the amenity and the affluence indices are stronger and have the same sign. The check, which varies as we vary the assumptions about the shares to be eliminated, suggests that the quality index may affect each expenditure share in a specific way. This observation led us to estimate a fully unrestricted model as reported in Table 8b that is statistically preferrable to all restricted Models A, B, C, D and E. The estimates clearly show that the Amenity and Affluence indices affect each share differently. A Likelihood ratio test establishes the rejection of the restricted model in Table 8a in favour of the unrestricted model in Table 8b.

The statistically preferred specification is therefore the one incorporating the Barten modification including both the Amenity and the Affluence index varying in each expenditure as in the unrestricted model in Table 8b. The results that will be presented below related to the quality adjustment refer to the estimates of the share specific unrestricted Barten model.

Poverty analysis should account for spatial differences in the cost of living either by adjusting the absolute and relative poverty line, as it is the case of the official poverty lines adopted in Italy, or by estimating poverty using real figures. Official poverty lines in Italy do not adjust for quality differences. Therefore, we present poverty figures only in terms of relative poverty lines computed as 60% of the median of each cost of living distribution chosen for comparison.

Table 9a shows the impact of the spatial price variation on the regional poverty headcount ratios using our estimates of nominal, real and the quality adjusted cost of living. As it is reasonable to expect, in nominal terms, that is when the cost of living is not corrected for spatial price variation across regions, the incidence of poverty in the North (4.8 percent on average) is much lower than in the South (23.9 percent on average). Average relative poverty in nominal terms in Italy is 12.4 percent. Table 9a also shows that accounting for differences in purchasing power drastically reduces relative poverty in the South to a level (about 10%) that is comparable to the level of relative poverty in the Centre and in the North of Italy. In real terms spatial differences almost disappear. The Italian (and macro-regional) average is about 10 percent.

Quality adjusted figures show that, as compared with figures in real terms, the incidence of poverty in the North decreases (7.4 percent on average), while in the South it increases (12.5 percent on average). It is instructive to compare how controlling for spatial differences in prices and for quality differences affect the measure of poverty in the Calabria region, the poorest region in nominal terms recording an incidence of 32.8 percent, with the Veneto region showing the lowest poverty rate of 3.3 percent in nominal terms. Accounting for purchasing power differences, the poverty rate is around 10 percent for both regions, while controlling also for quality differences raises the poverty rates for Calabria at around 13.2 percent and reduces to 8.1 percent in Veneto.

The impact of spatial price variation on inequality is negligible within macro area, but it is significant at the national level when controlling for both spatial differences in both observed prices and prices corrected for differences in the quality of services (Table 9b). When accounting for differences in purchasing power, the Gini coefficient reduces from 0.268 to 0.252. Considering also quality differences, the Gini coefficient increases to 0.256.

4.3 The Relevance of the Quality of Services and Real Wages

While wages expressed in real terms are very close in the North and South of Italy, real individual incomes are significantly lower in the North (Table 10). The North-South gap almost disappear when we refer to total disposable real household income. This is because the participation rate to the labor market of females is, as explained in Section 4.2, about 30%

higher in the North. This feature of the Italian labor market virtually overrides the South advantage generated by an almost 40% lower cost of living.

This is not the only factor contributing to the counterbalancing of the direction of the North-South gradient. The households' perception of the North-South differences between the quantity and quality of the public services is also important (D'Alessio 2017 for the Italian case and Aaberge *et al.* 2010 for Norway). The idea is that 1 Euro becomes equivalent to more than 1 Euro if the quality coefficient is greater than one for a "better quality area" and reverse for an "inferior quality area". This rescaling captures the repackaging effect of getting more services in a better-quality area for the same unit of public service available at the same nationally fixed price.

The quality correction reveals a clear North advantage. The comparison of real individual household incomes with the quality adjusted real individual incomes shows that the quantity and quality provision of public services per se is not sufficient to clearly revert the standard of living in favour of the North.

The strength and direction of the labor market and quality of public services' effects are probably better grasped when aggregating the figures shown in Table 10 at the level of the North, Centre and South macro area. Panel (a) in Figure 1, summarising the first three columns of Table 10, reproduces the equivalising effect of the more efficient job market in the North of Italy, especially in terms of job market opportunities for married women. The real salary of a household living in the South is comparable with the wage level of a dependent worker living in the North. A household with a single income earner fares better in the South than in the North. When there are two earners in the household, a situation that is much more frequent in the North, the South advantage due to a higher purchasing power parity is essentially cancelled. Panel (b) in Figure 1 describes the impact of the quality of public services on real wages and incomes. This transformation gives an estimate of the effective purchasing power of the households living in the different macro-areas of Italy. The North has a significantly higher standard of living only when both the labor market and the provision of public services are taken into account. These two factors together explain the policy conundrum associated with the observation that Italians living in the North do not migrate to the South of Italy in spite of the large purchasing power differential. Households living in the South are not sufficiently attracted by the "bright lights" of more and better public services. They do not longer move to the North because of the uncertainty associated with the perceived low likelihood of capturing labor market opportunities often saturated by the excess supply of migrant labor mainly concentrated in the Centre and North of Italy. Interestingly, migrant labor does not establish its residence in the South (Frigenti and Rosati 2018), where life would be sensibly less costly, mainly because of difficulties in competing for State jobs, that is by large the main source of labor opportunities in the South of Italy. These final graphs exhaustively summarize the tale of the Italian divide.

5. Conclusions

While projects, such as the International Comparisons Project (ICP) of the United Nations, have focussed much attention and resources on spatial price differences between countries in calculating 'true' purchasing power parity (PPP) of a country's currency, less attention has been paid to spatial price differences within countries and the consequent neglect of the measurement of intra-country 'Regional Purchasing Parity' (RPP) between the various regions. Yet, the former has implications for the latter because the assumption in traditional PPP calculations that the country's currency has the same purchasing power in all the regions within the country is unlikely to be valid in case of most countries, especially ones with heterogeneous prices and preferences. RPPs are required in a host of policy applications such as real expenditure-based welfare comparisons, assessment of cost of living differences and inequality and poverty comparisons between the different regions in the country.

The lack of reliable information on RPPs provides a serious bottleneck for such comparisons. RPPs are difficult to calculate in the absence of spatial price information from different regions in a country. Such information is rarely available unlike data on temporal price movements. The evidence on RPP provided in the ICP exercise has been largely limited to rural price differences. Moreover, the recent literature on RPPs is largely based on large developing countries and emerging economies such as Brazil, India and Indonesia, and uses the 'unit values' of (mostly) food items as proxy for the regional price information. The present study is the first of its kind to conduct the exercise of estimating a TCLI for a developed and relatively homogeneous country such as Italy. Unlike the recent literature, this study is not based on 'unit values' because the consumer expenditure data used in the analysis does not report quantity data and thus only pseudo unit values can be constructed.

The study shows how 'pseudo unit' values can be constructed from expenditure and demographic information at the household level contained in the unit records of HES data set thus avoiding the need for regional price information or the unsatisfactory use of unit values as proxy for prices. The study also takes into account spatial variation in the quality of public services in Italy alongside the spatial variation in prices. As stated in the Introduction, the implication of the evidence on this interaction between spatial variation in prices and in 'quality of life' extends beyond Italy to the international context of the ICP exercise.

This study deviates from both these aspects in the recent literature on RPPs. The contribution of this paper is both methodological and empirical. On the former, the paper is among the few to use the Lewbel (1989) procedure to generate pseudo-unit values (PUV) that avoid the need for regional price information. The study shows how the PUVs can be used in conjunction with the HRPD and TCLI models to calculate alternative sets of RPPs that are compared between the two procedures. This study goes beyond the conventional calculations of spatial price differences by introducing regional differences in amenities and affluence in the RPP calculations.

The paper is of policy interest as well. The latter is underlined by the sensitivity of the North-South divide in poverty rates to adjustment for spatial price differences and in the 'quality of life' between the North and South of Italy. While spatial price adjustment tends to narrow the North-South divide in Italy, the overall picture that emerges from this study is one of sharp heterogeneity. The North-South purchasing power imparity can be explained through the lenses of the Balassa-Samuelson effect that imputes to differences in productivity between the tradable goods and higher service quality produced in the north and the non-tradable goods of the less developed South. The robustness of our evidence lends support to the Balassa-Samuelson effect.

A key result of this study is the sharp North-South divide in regional prices. The magnitude of the divide is even larger than the spatial price variation found in much bigger and diverse countries such as China and India. The simultaneous consideration of spatial variation in prices and in quality of services is a distinctive feature of this study. Since the North is associated with both higher prices and higher quality of services, the simultaneous consideration of both, as the Italian evidence demonstrates, helps to moderate the sharp correction to the nominal wages and incomes due to spatial prices. The overall message from this exercise is that spatial comparisons of living standards within a country such as Italy must simultaneously take note of spatial differences in prices, wages, employment opportunities and in the quality of essential services. A lesson that may serve as a short-term cure of the North-South divide in PPP consists in adjusting the wage system reinforcing wage negotiation agreements coordinated at the regional and local level.

The paper also provides added evidence in support of RPPs by examining the sensitivity of inequality and poverty comparisons to the use/omission of RPPs. A result of some significance is that the poverty rates decline sharply once we move from the 'nominal' to the 'real' poverty line by using the spatial price deflators. In contrast, the effect on inequality estimates is minimal.

Notwithstanding the considerable potential of the proposed procedures for calculating spatial prices when price information is not available, as this study demonstrates, in future estimations of RPPs, they cannot take the place of real price information from different regions in the country. The central message of this study is two-fold: (a) statistical agencies should embark on a country wide program of collecting regional price information on a wide variety of items at a disaggregated level, and (b) until such information becomes publicly available the proposed procedures can be used to estimate spatial prices covering a larger group of items than just food items. To add to these, the study demonstrates the need to obtain information on the availability and quality of public services in the various regions in a country. This aspect has clear implications for the cross country ICP exercise which does not collect information on quality of services between countries. As our exercise for Italy shows, spatial variation in prices along with that in services, need to be jointly considered in assessing differences in levels of living, both within and between countries. In case of most countries, the collection of regional prices and quality of services can be coordinated with the ICP exercise on a global scale. The subject of spatial prices within a country, or RPP, needs much greater attention than it has received to date. The present study provides a strong case for further research into RPP.

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Table 1. Regional Cost of Living Levels and Incomes

Region	Cost of Living	Difference from Mean	Disposable Household Income / Month	Household Income - Cost of Living	Individual Income / Year	Disposable Household Income / Year	Real Disposable Household Income / Month	Real Individual Income / Year	Real Disposable Household Income / Year
	Euro / month	Euro / month	Euro / month	Euro / month	Euro / year	Euro / year	Euro / month	Euro / year	Euro / year
Piedmont	2,752.56	188.19	3,023.66	271.10	16,632.78	36,283.93	2816.93	15495.60	33803.19
Lombardy	3,040.42	476.05	3,693.04	652.62	19,056.88	44,316.42	3114.80	16073.08	37377.64
Trentino-Alto Adige	3,194.43	630.07	3,663.48	469.04	18,826.89	43,961.73	2940.90	15113.49	35290.76
Veneto	2,948.24	383.87	3,278.81	330.57	16,526.28	39,345.70	2851.90	14374.50	34222.76
Friuli-Venezia Giulia	2,735.48	171.11	3,274.42	538.95	17,322.65	39,293.07	3069.60	16239.09	36835.21
Liguria	2,650.86	86.49	3,082.31	431.45	17,372.55	36,987.69	2981.74	16805.73	35780.88
Emilia-Romagna	2,925.44	361.07	3,671.19	745.75	19,234.86	44,054.30	3218.08	16860.80	38616.91
Tuscany	2,774.71	210.34	3,216.85	442.14	16,681.35	38,602.17	2972.99	15416.77	35675.83
Umbria	2,599.45	35.09	3,051.94	452.49	15,281.24	36,623.28	3010.75	15074.98	36128.96
Marche	2,615.86	51.49	3,239.61	623.75	15,184.76	38,875.37	3175.84	14885.85	38110.11
Lazio	2,615.77	51.40	3,009.98	394.21	15,693.50	36,119.81	2950.83	15385.11	35410.02
Abruzzo	2,382.49	-181.88	2,668.95	286.47	12,856.57	32,027.45	2872.70	13838.04	34472.42
Molise	2,309.53	-254.84	2,084.43	-225.09	11,119.70	25,013.21	2314.44	12346.67	27773.23
Campania	2,158.77	-405.59	2,344.11	185.34	11,264.81	28,129.36	2784.53	13381.26	33414.35
Puglia	2,160.68	-403.69	2,565.71	405.04	12,623.91	30,788.57	3045.08	14982.51	36540.99
Basilicata	2,101.51	-462.86	2,416.82	315.31	11,567.54	29,001.88	2949.13	14115.29	35389.54
Calabria	1,896.32	-668.04	2,274.24	377.91	11,389.47	27,290.84	3075.41	15401.79	36904.94
Sicily	1,843.94	-720.43	2,156.15	312.21	10,526.32	25,873.75	2998.55	14638.95	35982.61
Sardinia	2,109.65	-454.72	2,524.71	415.05	12,170.96	30,296.46	3068.88	14794.31	36826.60

Table 2. Comparison between Divisia Index, WHRPD, TCLI PPP and Housing PPP indexes and Income Indexes

Region	Divisia Index	WHRPD PPP	TCLI PPP	Housing PPP	Individual Income	Disposable Household Income
Italia	1	1	1	1	1	1
Piedmont	1.12	1.13	1.07	1.06	1.07	1.00
Lombardy	1.24	1.15	1.19	1.29	1.22	1.22
Trentino-Alto Adige	1.12	1.13	1.25	1.27	1.21	1.21
Veneto	1.20	0.66	1.15	1.14	1.06	1.08
Friuli-Venezia Giulia	1.13	0.83	1.07	1.09	1.11	1.08
Liguria	0.88	0.65	1.03	1.11	1.12	1.01
Emilia-Romagna	1.21	1.14	1.14	1.15	1.24	1.21
Tuscany	1.05	0.71	1.08	1.21	1.07	1.06
Umbria	1.03	0.99	1.01	0.93	0.98	1.00
Marche	1.02	0.89	1.02	0.99	0.98	1.07
Lazio	0.97	0.97	1.02	1.17	1.01	0.99
Abruzzo	1.02	1.03	0.93	0.86	0.83	0.88
Molise	0.95	0.80	0.90	0.77	0.71	0.69
Campania	0.74	0.50	0.84	0.82	0.72	0.77
Puglia	0.83	0.63	0.84	0.77	0.81	0.84
Basilicata	0.80	1.06	0.82	0.60	0.74	0.80
Calabria	0.73	0.55	0.74	0.58	0.73	0.75
Sicily	0.69	0.56	0.72	0.68	0.68	0.71
Sardinia	0.71	0.43	0.82	0.82	0.78	0.83
Standard deviation	0.18	0.24	0.15	0.22	0.19	0.17

Note. The correlation between the Divisia and WHRPD index is 0.71; the correlation between the Divisa and TCLI index is 0.92. The correlation between the WHRPD and Housing based PPP is 0.458, while the correlation between the TCLI and Housing index is 0.941.

Table 3. Cost Levels per Each Expenditure Category by Region (Euro)

Region	Food & Bevarages	Clothing	Housing	Heat & Energy	Furniture, & Appliances	Health	Transportation	Communication	Education	Leisure	Other goods
Piedmont	577.44	166.68	711.27	163.76	183.30	168.36	379.80	45.59	59.11	132.85	166.57
Lombardy	585.05	179.54	867.75	159.68	232.84	174.38	405.10	51.15	76.35	146.34	166.02
Trentino-Alto Adige	581.96	200.12	849.62	135.11	247.70	184.86	473.85	49.78	80.18	176.89	191.66
Veneto	551.66	173.53	764.76	166.53	232.60	181.42	421.57	49.49	62.22	142.10	178.10
Friuli-Venezia Giulia	554.01	156.10	730.86	143.44	195.15	175.00	384.30	46.74	53.81	128.32	147.12
Liguria	588.14	167.51	742.90	135.11	239.84	156.55	288.14	39.71	48.31	120.89	138.84
Emilia-Romagna	574.76	171.90	769.32	166.51	200.99	182.94	417.64	48.95	61.62	152.37	156.01
Tuscany	573.14	163.58	810.63	150.32	166.33	163.65	384.76	49.63	51.48	116.69	141.82
Umbria	554.42	148.99	627.78	133.43	234.52	136.08	375.74	41.66	43.48	144.76	154.24
Marche	561.14	160.42	664.17	138.85	183.38	147.80	379.96	44.95	55.05	134.20	145.28
Lazio	598.85	169.66	783.83	125.39	150.87	132.41	319.15	45.80	47.52	103.77	141.23
Abruzzo	548.06	165.07	577.81	132.85	230.61	112.40	280.66	41.73	43.08	97.16	117.80
Molise	530.21	157.43	518.83	123.83	250.51	125.78	245.07	41.74	61.29	91.90	122.00
Campania	560.92	156.19	550.62	101.47	143.43	98.60	240.95	39.51	45.82	73.83	106.63
Puglia	511.85	168.56	519.68	110.26	176.60	117.94	246.84	38.49	47.14	76.55	107.51
Basilicata	486.45	173.17	399.84	141.62	194.37	109.03	254.26	41.78	59.20	81.65	123.41
Calabria	484.63	156.14	386.51	135.10	137.65	105.90	226.41	33.12	47.67	63.38	84.47
Sicily	491.68	154.82	458.36	92.46	145.61	106.99	203.08	33.30	33.13	63.67	87.05
Sardinia	456.02	155.49	554.05	116.37	182.95	119.13	294.71	36.36	37.58	74.51	107.09
Mean	553.43	118.08	671.29	137.04	192.72	109.80	335.24	43.80	54.85	134.34	137.57
Standard deviation	41.05	11.63	150.00	20.95	37.61	30.26	80.10	5.53	11.97	33.93	29.78

Table 4. Differences with respect to the Mean in Estimated Commodity Expenditures by Region Using TCLI

Region	Food & Beverage	Clothing	Housing	Heat & Energy	Furniture & Appliances	Health	Transportation	Communication	Education	Leisure	Other goods
Piedmont	40.937	11.954	49.820	12.033	13.369	11.128	21.982	3.289	3.788	8.935	10.958
Lombardy	95.448	29.328	142.054	27.081	35.730	27.344	51.756	8.518	10.499	23.172	25.120
Trentino Alto Adige	123.204	41.394	180.323	28.909	48.473	37.238	73.599	10.339	14.019	35.566	37.004
Veneto	75.323	23.943	106.142	23.469	30.440	24.057	45.176	6.990	7.531	18.783	22.017
Friuli Venezia Giulia	36.480	10.933	48.291	9.930	12.688	11.004	18.352	3.201	3.185	8.212	8.833
Liguria	19.248	5.726	25.111	4.632	8.124	5.072	7.479	1.376	1.579	3.905	4.238
Emilia Romagna	74.778	21.605	100.297	22.318	27.001	22.922	40.818	6.369	7.398	19.162	18.403
Tuscany	45.285	12.742	64.149	12.054	13.674	12.550	22.985	3.928	3.654	8.953	10.372
Umbria	7.869	2.179	9.212	1.887	2.900	1.908	3.948	0.618	0.564	2.008	1.993
Marche	11.276	3.226	14.032	2.913	3.839	2.928	6.094	0.934	0.970	2.673	2.607
Lazio	12.030	3.294	16.028	2.572	2.975	2.616	5.439	0.942	0.855	2.032	2.619
Abruzzo	-43.168	-13.041	-45.714	-10.70	-20.198	-9.270	-17.73	-3.244	-3.047	-7.410	-8.359
Molise	-59.362	-18.471	-59.415	-14.50	-32.455	-13.671	-23.95	-4.805	-5.931	-10.36	-11.92
Campania	-108.450	-30.372	-109.364	-20.64	-28.327	-19.618	-38.95	-7.743	-8.893	-14.27	-18.97
Puglia	-99.223	-32.875	-102.024	-22.91	-33.409	-23.198	-40.15	-7.604	-8.699	-14.85	-18.75
Basilicata	-113.824	-39.056	-92.825	-33.46	-43.438	-24.643	-51.16	-9.788	-11.33	-18.90	-24.43
Calabria	-177.869	-57.023	-139.653	-51.05	-55.122	-37.743	-70.38	-12.304	-15.14	-23.77	-27.99
Sicily	-190.228	-61.049	-180.884	-36.99	-61.327	-40.734	-67.47	-13.347	-11.57	-26.23	-30.59
Sardinia	-99.665	-35.842	-123.141	-26.22	-40.606	-26.652	-48.05	-8.238	-8.041	-16.99	-21.28
Standard Deviation	92.07	29.46	102.09	23.40	32.42	22.62	41.86	7.19	8.16	17.10	19.49

Table 5. Estimated Cost Shares per Each Expenditure Category by Region

Region	Food & Beverages	Clothing	Housing	Heat & Energy	Furniture & Appliances	Health	Transportation	Communication	Education	Leisure	Other goods
Piedmont	0.2175	0.0635	0.2647	0.0639	0.071	0.0591	0.1168	0.0175	0.0201	0.0475	0.0582
Lombardy	0.2005	0.0616	0.2984	0.0569	0.0751	0.0574	0.1087	0.0179	0.0221	0.0487	0.0528
Trentino-Alto Adige	0.1955	0.0657	0.2862	0.0459	0.0769	0.0591	0.1168	0.0164	0.0222	0.0564	0.0587
Veneto	0.1962	0.0624	0.2765	0.0611	0.0793	0.0627	0.1177	0.0182	0.0196	0.0489	0.0574
Friuli Venezia Giulia	0.2132	0.0639	0.2822	0.058	0.0742	0.0643	0.1073	0.0187	0.0186	0.048	0.0516
Liguria	0.2225	0.0662	0.2903	0.0536	0.0939	0.0586	0.0865	0.0159	0.0183	0.0451	0.049
Emilia-Romagna	0.2071	0.0598	0.2778	0.0618	0.0748	0.0635	0.113	0.0176	0.0205	0.0531	0.051
Tuscany	0.2153	0.0606	0.305	0.0573	0.065	0.0597	0.1093	0.0187	0.0174	0.0426	0.0493
Umbria	0.2243	0.0621	0.2626	0.0538	0.0827	0.0544	0.1125	0.0176	0.0161	0.0572	0.0568
Marche	0.219	0.0627	0.2725	0.0566	0.0746	0.0569	0.1183	0.0181	0.0188	0.0519	0.0506
Lazio	0.234	0.0641	0.3118	0.05	0.0579	0.0509	0.1058	0.0183	0.0166	0.0395	0.051
Abruzzo	0.2373	0.0717	0.2513	0.0588	0.1111	0.051	0.0975	0.0178	0.0168	0.0407	0.046
Molise	0.2329	0.0725	0.2331	0.0569	0.1274	0.0536	0.094	0.0189	0.0233	0.0407	0.0468
Campania	0.2674	0.0749	0.2696	0.0509	0.0698	0.0484	0.096	0.0191	0.0219	0.0352	0.0468
Puglia	0.2458	0.0814	0.2527	0.0567	0.0828	0.0575	0.0995	0.0188	0.0215	0.0368	0.0464
Basilicata	0.2459	0.0844	0.2005	0.0723	0.0938	0.0532	0.1105	0.0211	0.0245	0.0408	0.0528
Calabria	0.2663	0.0854	0.209	0.0764	0.0825	0.0565	0.1054	0.0184	0.0227	0.0356	0.0419
Sicily	0.264	0.0847	0.2511	0.0513	0.0851	0.0565	0.0937	0.0185	0.0161	0.0364	0.0425
Sardinia	0.2192	0.0788	0.2708	0.0577	0.0893	0.0586	0.1057	0.0181	0.0177	0.0374	0.0468
Standard deviation	0.0224	0.0091	0.0293	0.0073	0.0160	0.0043	0.0093	0.0011	0.0026	0.0071	0.0050

Table 6. Regional Commodity Specific PPPs and General TCLI and WHRPD PPP

Region	Food & Beverages	Clothing	Housing	Heat & Energy	Furniture & Appliances.	Health	Transportation	Communications	Education	Leisure	Other goods	TCLI PPP	WHRPD PPP
Piedmont	1.047	0.998	1.059	1.194	0.951	1.152	1.133	1.040	1.078	1.162	1.198	1.07	1.13
Lombardy	1.060	1.075	1.292	1.165	1.208	1.194	1.208	1.167	1.392	1.281	1.194	1.19	1.15
Trentino Alto Adige	1.055	1.198	1.265	0.985	1.285	1.265	1.413	1.136	1.462	1.548	1.379	1.25	1.13
Veneto	1.000	1.039	1.139	1.215	1.207	1.242	1.257	1.129	1.135	1.243	1.281	1.15	0.66
Friuli Venezia Giulia	1.004	0.934	1.088	1.046	1.013	1.198	1.146	1.067	0.981	1.123	1.058	1.07	0.83
Liguria	1.066	1.003	1.106	0.985	1.245	1.071	0.859	0.906	0.881	1.058	0.999	1.03	0.65
Emilia Romagna	1.042	1.029	1.146	1.214	1.043	1.252	1.246	1.117	1.124	1.333	1.122	1.14	1.14
Tuscany	1.039	0.979	1.207	1.096	0.863	1.120	1.148	1.133	0.939	1.021	1.020	1.08	0.71
Umbria	1.005	0.892	0.935	0.973	1.217	0.931	1.121	0.951	0.793	1.267	1.109	1.01	0.99
Marche	1.017	0.960	0.989	1.013	0.952	1.012	1.133	1.026	1.004	1.174	1.045	1.02	0.89
Lazio	1.085	1.016	1.167	0.915	0.783	0.906	0.952	1.045	0.867	0.908	1.016	1.02	0.97
Abruzzo	0.993	0.988	0.860	0.969	1.197	0.769	0.837	0.952	0.786	0.850	0.847	0.93	1.03
Molise	0.961	0.942	0.773	0.903	1.300	0.861	0.731	0.953	1.118	0.804	0.878	0.90	0.80
Campania	1.017	0.935	0.820	0.740	0.744	0.675	0.719	0.902	0.836	0.646	0.767	0.84	0.50
Puglia	0.928	1.009	0.774	0.804	0.917	0.807	0.736	0.878	0.860	0.670	0.773	0.84	0.63
Basilicata	0.882	1.037	0.595	1.033	1.009	0.746	0.758	0.953	1.080	0.714	0.888	0.82	1.06
Calabria	0.878	0.935	0.576	0.985	0.714	0.725	0.675	0.756	0.869	0.555	0.608	0.74	0.55
Sicily	0.891	0.927	0.683	0.674	0.756	0.732	0.606	0.760	0.604	0.557	0.626	0.72	0.56
Sardinia	0.827	0.931	0.825	0.849	0.949	0.815	0.879	0.830	0.685	0.652	0.770	0.82	0.43
standard deviation	0.07	0.07	0.22	0.15	0.20	0.21	0.24	0.13	0.22	0.30	0.21	0.15	0.24
correlation with TCLI PPP	0.80	0.62	0.94	0.73	0.56	0.93	0.94	0.93	0.73	0.95	0.96	0.62	
correlation with WHRPD	0.54	0.54	0.46	0.59	0.46	0.49	0.58	0.66	0.64	0.67	0.66	0.62	

Table 7. Regional Cost of Living Indices, Yearly Incomes and Wages for Dependent Workers

Region	WHRPD PPP	TCLI PPP	Wage Index	Nominal Yearly Wages	Real Wages (TCLI)	Real Wages (WHRPD)	Index Indiv. Income	Nominal Indiv. Income	Real Indiv. Income (TCLI)	Real Indiv. Income (WHRPD)
Italy	1	1	1	21103	21103	21103	1	15566	15566	15566
Piedmont	1.13	1.07	1.09	22906	21340	20295	1.07	16633	15496	14737
Lombardy	1.15	1.19	1.21	25596	21588	22163	1.22	19057	16073	16501
Trentino Alto Adige	1.13	1.25	1.02	21576	17320	19112	1.21	18827	15113	16676
Veneto	0.66	1.15	1.03	21684	18861	32757	1.06	16526	14375	24965
Friuli Venezia Giulia	0.83	1.07	1.04	21961	20587	26421	1.11	17323	16239	20841
Liguria	0.65	1.03	1.01	21365	20668	33085	1.12	17373	16806	26903
Emilia Romagna	1.14	1.14	1.07	22657	19861	19839	1.24	19235	16861	16842
Tuscany	0.71	1.08	0.95	19981	18466	28174	1.07	16681	15417	23521
Umbria	0.99	1.01	0.88	18492	18242	18685	0.98	15281	15075	15441
Marche	0.89	1.02	0.87	18407	18045	20718	0.98	15185	14886	17091
Lazio	0.97	1.02	1.06	22273	21835	22939	1.01	15694	15385	16162
Abruzzo	1.03	0.93	0.80	16924	18216	16451	0.83	12857	13838	12497
Molise	0.80	0.90	0.74	15558	17275	19343	0.71	11120	12347	13825
Campania	0.50	0.84	0.74	15614	18548	31068	0.72	11265	13381	22414
Puglia	0.63	0.84	0.74	15575	18485	24583	0.81	12624	14983	19925
Basilicata	1.06	0.82	0.72	15098	18423	14241	0.74	11568	14115	10911
Calabria	0.55	0.74	0.67	14187	19185	25675	0.73	11389	15402	20612
Sicily	0.56	0.72	0.74	15674	21798	27982	0.68	10526	14639	18792
Sardinia	0.43	0.82	0.76	16018	19471	37453	0.78	12171	14794	28458
Standard deviation	0.24	0.15	0.16	3418.13	1501.9	6251.70	0.19	2980.06	1118.67	4824.78

Table 8a. Quality Adjustment: Estimates of the Price Scaling Parameters and Specification Tests – Restricted model

	Model w/out Quality Adjustment (A)	Model w/ Amenity Index (B)	Model w/ Affluence Index (C)	Model w/ Amenity and Affluence Index (D)	Partial Effects Model w/ Amenity and Affluence Index * (E)
Amenity Parameter		−0.223		−1.020	−1.22
(Standard Deviation)		*−0.015*		*0.074*	*0.073*
Affluence Parameter			−0.265	0.771	1.371
(Standard Deviation)			*−0.020*	*0.070*	*0.087*
Log likelihood value	328588.6	328726.4	328749.1	328785.1	328899.4
Likelihood Ratio Test		275.7 (A) / (B)	320.9 (A) / (C)	393.1 (A) / (D)	228.6 (D) / (E)

Note: * The partial effects model is obtained eliminating the modifying functions adjusting prices for differences in the quality of services for the goods Food & Beverage, Clothing and Footwear, Furnitures and Domestic Appliances, Communications, Other goods & services.

Table 8b. Quality Adjustment: Estimates of the Price Scaling Parameters – Unrestricted model (F) Likelihood value 329055.4

	Amenity	Coeff.	S.E.	P value	Affluence	Coeff.	S.E.	P value
Food&Beverage	θ_{1_1}	−0.009	0.037	0.797	θ_{2_1}	−0.004	0.004	0.270
Clothing&Footwear	θ_{1_2}	0.262	0.126	0.038	θ_{2_2}	0.019	0.012	0.102
Housing	θ_{1_3}	−0.040	0.040	0.311	θ_{2_3}	0.003	0.004	0.477
Heating&Energy	θ_{1_4}	0.943	0.442	0.033	θ_{2_4}	0.020	0.044	0.652
Furniture&Appliances	θ_{1_5}	−0.279	0.100	0.005	θ_{2_5}	0.013	0.020	0.527
Health	θ_{1_6}	−0.791	0.342	0.021	θ_{2_6}	0.013	0.033	0.692
Transport	θ_{1_7}	−0.051	0.045	0.256	θ_{2_7}	0.001	0.007	0.932
Communication	θ_{1_8}	−0.027	0.093	0.771	θ_{2_8}	−0.001	0.005	0.891
Education	θ_{1_9}	−1.138	0.578	0.049	θ_{2_9}	−0.138	0.062	0.026
Leisure	$\theta_{1_{10}}$	0.287	0.153	0.061	$\theta_{2_{10}}$	0.036	0.018	0.043

Note: The Likelihood Ratio Test is between the restricted Model (E) with the highest likelihood value and the unrestricted Model (F): 312.0.

Table 9a. Relative Poverty (%) for Nominal, Real and Quality Adjusted Cost of Living by Region Relative Poverty Line - 0.6 Median (Nominal 1341.8, Real 1360.6, Quality 1291.6)

Region	Nominal Cost of Living	Real Cost of Living	Quality Adjusted Cost of Living
Piedmont	0.0611	0.1023	0.0687
Lombardy	0.0356	0.0996	0.0820
Trentino-Alto Adige	0.0439	0.1198	0.0439
Veneto	0.0331	0.0932	0.0809
Friuli-Venezia Giulia	0.0667	0.0803	0.0955
Liguria	0.0672	0.0995	0.0578
Emilia-Romagna	0.0486	0.0938	0.0812
Tuscany	0.0615	0.0936	0.1165
Umbria	0.0883	0.0901	0.1027
Marche	0.0716	0.0955	0.1404
Lazio	0.0964	0.1182	0.1482
Abruzzo	0.1612	0.1007	0.1007
Molise	0.2266	0.1634	0.1786
Campania	0.2013	0.1104	0.1255
Puglia	0.2305	0.1005	0.1402
Basilicata	0.2426	0.1255	0.0979
Calabria	0.3277	0.1060	0.1325
Sicily	0.2829	0.0837	0.1290
Sardinia	0.1941	0.0823	0.0823
North	0.0482	0.0993	0.0736
Centre	0.0790	0.1012	0.1293
South	0.2390	0.1037	0.1255
Italy	0.1235	0.1012	0.1025

Table 9b. Inequality: Gini Index for Nominal, Real and Quality Adjusted Cost of Living by Macro-Region

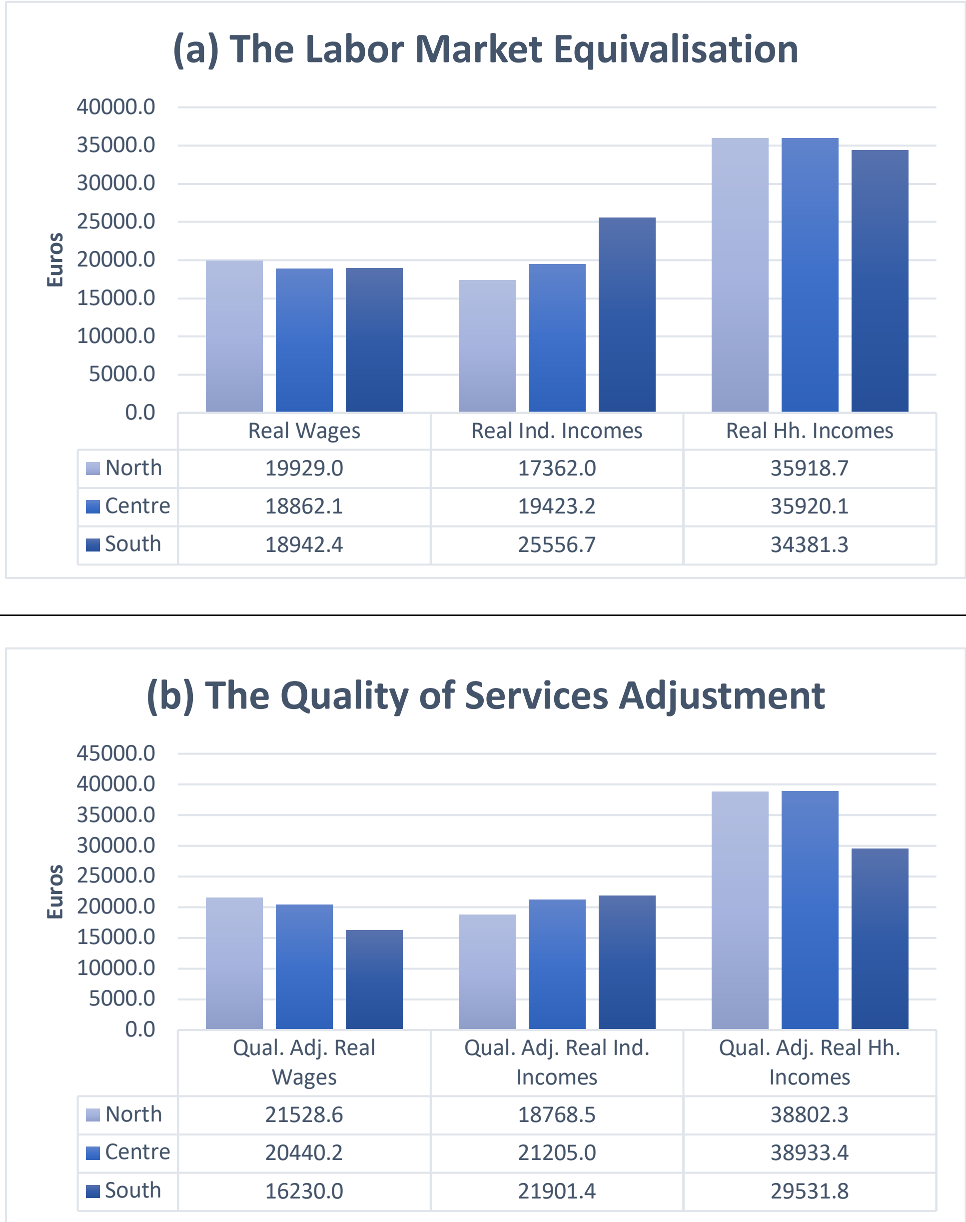
Macro-Region	Nominal Cost of Living	Real Cost of Living	Quality Adjusted Cost of Living
North	0.2551	0.2534	0.2563
Centre	0.2519	0.2516	0.2518
South	0.2550	0.2516	0.2531
Italy	0.2679	0.2524	0.2564

Table 10. Quality Adjusted Real Wages, Individual and Household Incomes

Region	Amenity Index	Affluence Index	Quality Adjusted TCLI	Real Wages	Real Individual Incomes	Real Household Incomes	Quality Adjusted Real Wages	Quality Adjusted Real Individual Incomes	Quality Adjusted Real Household Incomes
Piedmont	109.4	1286.9	104.2	21340	19971	33803	22229	20803	35212
Lombardy	104.1	1316.1	118.5	21588	17634	37378	25583	20897	44295
Trentino Alto Adige	112.4	1397.5	100.8	17320	14320	35291	17451	14428	35557
Veneto	115.1	1263.3	114.9	18861	17765	34223	21674	20415	39327
Friuli Venezia Giulia	104.0	1239.7	109.7	20587	18499	36835	22582	20292	40404
Liguria	109.4	1332.0	98.4	20668	18519	35781	20327	18214	35191
Emilia Romagna	107.2	1309.3	114.0	19861	16072	38617	22648	18327	44036
Tuscany	100.7	1200.4	118.0	18466	17231	35676	21792	20334	42101
Umbria	98.0	1276.4	106.3	18242	18582	36129	19383	19745	38389
Marche	101.8	1109.2	115.3	18045	18498	38110	20809	21332	43948
Lazio	97.7	1231.4	115.0	21835	21658	35410	25114	24911	40728
Abruzzo	93.9	1036.8	92.6	18216	22055	34472	16874	20430	31932
Molise	96.5	955.1	94.2	17275	24182	27773	16270	22775	26158
Campania	83.5	795.9	89.7	18548	25629	33414	16646	23001	29988
Puglia	85.1	887.4	89.9	18485	22793	36541	16615	20487	32845
Basilicata	88.1	846.0	77.8	18423	24791	35390	14337	19292	27541
Calabria	77.4	820.9	80.2	19185	26220	36905	15382	21023	29590
Sicily	82.0	785.2	84.2	21798	32234	35983	18355	27143	30300
Sardinia	97.6	877.4	85.1	19471	24902	36827	16574	21196	31347
Italy	100.0	1106	100.0	19245	20781	35407	19400	20625	35756
CV	0.1043	0.1821	0.1268	0.0740	0.2018	0.0616	0.1585	0.1193	0.1528

Note. CV is the coefficient of variation. Wages and incomes refer to the year.

Figure 1. (a) The labor market equivalization effect; (b) the quality of services effect



Note. Qual. Adj. stands for Quality Adjustment, Ind. for Individual, Hh. for Household.