aix-marseille school of economics

école d'économie d'aix-marseille

Working Papers / Documents de travail

Poverty Measurement under Income and Price Dispersions

Christophe Muller

WP 2022- Nr 04

Poverty Measurement under Income and Price Dispersions[1]

Christophe Muller

Aix-Marseille University, CNRS, AMSE, Marseille, France.

E-mail: christophe.muller@univ-amu.fr

March 2022

Abstract

This chapter discusses facts, methods and empirical results that pertain to poverty measurement under income and price dispersions. The correlation of prices and living standards is examined, and its origins are considered, in terms of whether such origins are related to consumer preferences, economic interactions and market imperfections.

Then, the relationship of price dispersion and aggregate social indicators - including poverty measures - is analysed by combining stochastic hypotheses about prices and incomes with normative properties of social and poverty indicators.

Finally, empirical results about how dispersed heterogeneous price indices affect poverty measurement, anti-poverty targeting and poverty-alleviation price reforms are reviewed.

Keywords: Poverty, Prices, Living Standards, Price Dispersion, Poverty Alleviation, Price Indices.

JEL Codes: C83, D43, E31, I32

---

[1] This paper was supported by the French National Research Agency (ANR) under the grant ANR-17-EURE-0020, and by the Excellence Initiative of Aix-Marseille University - A*MIDEX. It is a draft of a chapter for Silber, J. (Ed.) "Research Handbook on Measuring Poverty and Deprivation".

1. Introduction

Long ago, Pinstrup-Andersen (1985) pointed out that low food prices play an outstanding role in the well-being of the poor not only for meeting nutritional requirements but also for their impact on the wages and jobs of the poor. Since food price gaps across households can greatly contribute to inequality, governments tend to use food prices as a policy instrument. For example, subsidies to maintain low prices support the livelihood of urban workers and keep their wages low. They also assist the rural poor, who are net demanders of food products. Finally, governments are attentive to keep food prices low to avoid social unrest.

More generally, price deflation for all consumed goods and services is a core component of the measurement of poverty. In some countries, the spatial and time gaps in the prices that different households face are considerable, especially in poor and developing economies, which is our focus.

From an observational point of view, prices, defined as ratios of values over quantities, correspond to a given period of reference (month, week, day, etc.). For each specific product or service, several types of price dispersion exist such as spatial, temporal, across types of economic agents, across individuals in general, and even for the same individual at different times or for different types of transactions. Empirically, for poverty statistics, price levels are summarized with price indices, and price dispersion is summarized with the dispersion of price indices.

Price differences across regions or villages may emerge due to spatial transaction costs, especially transport costs. By hindering arbitrage, insufficient information flows may stand behind these price differences.

Other circumstances can explain why prices vary across households, even locally. First, the relationship between sellers and buyers can affect prices. For example, wealthy buyers may be asked to pay higher prices, while poor individuals may be given some discount. Moreover, prices may vary with the time of the transaction during the day, especially in traditional markets. Interactions between buyers and sellers may give rise to complex short-term price dynamics, as precisely investigated in Kirman (2010) in the case of the Marseille fish market.

Some practical features of the transaction may matter. For example, bulk purchases generally correspond to lower prices, while packaging costs and other transaction costs may generate markups in prices. Finally, other price differences may just be random, for example, when counting and weighting mistakes, or frauds are made during the transaction. To keep this review small, we do not dwell on dynamic changes in prices or on price volatility.

2. Correlated Prices and Living Standards

2.1 Facts

Substantial evidence of spatial local price gaps has appeared in the literature. An early finding in the US is Pratt, Wise and Zeckhauser (1979), who find substantial differences among quoted prices by sellers in Boston for the same product. Recently, large price gaps across sellers in the US were confirmed by Broda et al. (2009a, 2009b) and Kaplan and Menzio (2015) using the large Kilts-Nielsen Consumer Panel data.

One may think that the largest spatial price dispersion occurs in large countries. Thus, Deaton and Dupriez (2011), using unit values for Brazil, India and China, display substantial price gaps across regions and between urban vs. rural areas. However, even in Rwanda, which is a small rural country, Muller (2002) finds large and systematic market price differences detrimental to the poor, systematically along living standard levels, and across seasons. Thereafter, substantial spatial price dispersion that negatively affects the poor was found in Israel (Lach, 2002), Madagascar (Butler and Moser, 2010) and Malawi (Mussa, 2019), which suggests that this feature may be widespread, although reverse correlations have also been observed.

2.2 Consumer preferences

Several reasons concur with a statistical association of price indices and real living standards. Some of them originate from preference heterogeneity. First, the price indices used in poverty analyses are often calculated using unit values from household surveys rather than direct information on market prices. Unit values are computed as ratios of observed expenditure, for a given good, over the corresponding purchased quantities of the good. Typically, this calculus is carried out at household or cluster levels in surveys. This operation may generate correlations with living standards, particularly if different households choose different qualities of the same product. If wealthier households consume more expensive varieties than poorer households, idiosyncratic price indices and nominal living standards should be observed to be positively correlated, if nothing else happens. A related empirical issue is that the same uni-value information may be used to calculate the nominal living standard variable when it is based on consumption, which generates spurious correlations, notably when unit values include measurement errors. However, all these correlations may be attenuated or even reversed when deflating the living standard variable with a price index.

Structural modelling of consumption choices may be of assistance to correct these issues in demand systems, although complex identification issues often prevent this in practice.[2] By assuming the separability of quality in the preferences, Deaton uses income effects to recover

[2] Notably, for the methods proposed in: Deaton (1988, 1990, 1997), Ayadi et al. (2003) and Crawford, Laisney and Preston (2003).

the unobserved price effects. However, typically estimated elasticities of price to quality, when market price data are available, are larger than what Deaton's approach delivers (McKelvey, 2011). Alternatively, one may consider a trade-off between two inconveniences: (1) using data on unit values that include quality choices and (2) using market price data at a suboptimal spatial or temporal aggregation level, hence omitting some of the price dispersion. Muller (2004) provides an example of an algorithm implementing this trade-off by mixing unit-value and market price data.

Even when households face the same prices and there is no influence of quality choices, their individual true price indices may differ due to the heterogeneity of their preferences and their incomes. In that case, different households demand different quantities of each good, and the weights in their idiosyncratic Laspeyres or Paasche price indices also differ. Finally, when households face *different prices*, consumption substitution effects occur, which vary across heterogeneous households and further affect the heterogeneity of household-specific price indices. True price indices account for these substitution and income effects and can be calculated from an estimated demand system. However, correlated price indices and living standards can still occur empirically.

2.3. Other mechanisms

Other diverse economic mechanisms can generate correlations of prices and living standards. First, price dispersion is sometimes seen by theorists as stemming from distinct sellers charging different prices for an identical good, locally and during the same period. In that case, price dispersion is possible because of consumers' imperfect information about the prices set by each seller (e.g., Hopkins, 2008).

Second, the poor may be discriminated against in diverse markets, such as credit markets. This generates not only direct correlations but also general equilibrium correlations. For example, in areas where the poor are numerous and have limited access to credit, local prices may be higher as a consequence of insufficient intertemporal adjustment.

Inversely, 'positive' discrimination also exists for publicly provided goods and services. For example, in many countries, there are often discounts for education fees, health care expenses, public bus and train tickets, and housing rents provided to destitute individuals.[3] Van Praag and Baye (1990) investigate how the formulae of poverty measures should be adjusted when many destitute individuals pay reduced prices for rent, education and health care. Indeed, these prices are therefore income-dependent, and nominal incomes no longer accurately measure commands over commodities. However, even if these specific issues are important, we abstract from them in this chapter to focus on more general price dispersion issues.

Other market imperfections may connect prices and living standards. Transaction costs often amount to a larger share of consumption expenses for the poor than for the rich. In particular, liquidity constraints and lack of storage devices constrain the poorest households to buy goods in small quantities instead of cheaper bulk purchases and to buy at times when prices are not at their lowest.[4]

Deprived households may pay higher prices when they live far away from trade centres or lack vehicles, which implies higher search costs (Greenhult et al., 1987). Israel, Eizenberg et al. (2021) find that differential access to affordable grocery shopping causes residents of nonaffluent neighbourhoods to be charged higher prices than residents elsewhere. Financial services can be hard to access for the poor, not only because they lack collateral but also because of hefty financial charges. Moreover, since a substantial share of their consumption often comes

[3] E.g., Gupta et al. (2003), Schultz (2004), Guzman (2018).
[4] Musgrove and Galindo (1988), Rao (1997, 2000) and Attanasio and Frayne (2006).

from own-produced or gifted food, the poor may benefit less than other social categories from searching for the best price.[5]

Finally, within-country and even local migrations may contribute to linking the levels of real living standards and price indices. This is the case when households with low purchasing power move to cheaper locations or when wealthy households withdraw to exclusive areas with higher prices.

However, all these channels of interactions are subsumed and generally unobserved in the data. To generate insight, one must have a closer look at poverty measures and other social indicators.

3. Price index Dispersion and Poverty

3.1. Social welfare and poverty

A general issue is that household-level or cluster-level price indices cannot be observed or cannot be well observed. However, operational formulae of social indicators can still be obtained in plausible cases. Muller (2002) shows that the correlation of household (or cluster) price indices (P) and *nominal* living standards (x) can be much attenuated when compared to the correlation of price indices and *real* living standards (y). Therefore, assuming a weak statistical link of x and P can often be a plausible hypothesis, which has sometimes been found empirically satisfied. In that case, Muller derived formulae of social welfare and inequality indicators that can be exploited for using distinct data sources on prices and incomes or consumption. This approach relaxes the missing data constraint on prices. Specifically, under

[5] See the early works of Alcaly (1976), and Anglin and Baye (1987).

weak correlation conditions,[6] the Atkinson index of inequality with inequality aversion parameter *e* becomes equal to

$$I_A^e = 1 - (H/E(x)).\ [E(x^{1-e}).\ E(1/PI^{1-e})]^{1/(1-e)},$$

where H is the harmonic mean of the price indices. Similar formulae have been derived for the Theil index of inequality and the generalized entropy inequality measures and can be extended to any aggregate social indicator that can be written in terms of integrals whose kernel function is a polynomial of P and x.

Muller (2005a) provides further results for general social indicators, that is, even for nonpolynomial functional forms, or without precisely knowing the social indicator. Taking a utilitarian social welfare function: $U = \int u(y)\ dF(y)$. Then, the impact of price deflation on social welfare is by definition: $\int\int u(x/P)\ dF_{P|x}(P|x)\ dF_x(x) - \int u(x)\ dF_x(x)$. When price indices and nominal living standards are weakly linked (e.g., P and x are not linearly correlated, while weaker conditions suffice), and if u(.) is concave and the relative inequality aversion coefficient is not above 2, as typically assumed for reasonable social welfare functions used in empirical work, then

$$U \geq \int u(x/E(P))\ dF_x(x)$$

Therefore, under this weak link, *price dispersion reduces any utilitarian social welfare* with reasonable inequality aversion. The importance of this result deserves emphasis: without a substantial negative correlation of prices and living standards, price dispersion unambiguously improves aggregate social welfare. This effect has been overlooked in the empirical literature, which emphasizes correlations (as in 'the poor pay more' literature) without noting that with positive or null correlations, price dispersion favours social welfare.

[6] These conditions are implied by the absence of linear correlation between inverse price indices and nominal living standards, while they are much weaker.

Similarly, price dispersion unambiguously reduces inequality-sensitive poverty measures, provided the population of the poor and the poverty line are stable to deflation and that there is no strong negative link between prices and nominal living standards. In that case, *policies that augment price dispersion should reduce poverty*. This new brand of poverty-alleviation policies should be worth investigating.

When instead prices and nominal living standards are substantially correlated, explicit poverty formulae that include price dispersion can be based on parametric distributions. Muller (2005c) provides a simple example with a bivariate log-normal distribution, with m_x (σ_x) being the mean (standard deviation) of the log nominal living standards. Similarly, m_P (σ_P) is the mean (standard deviation) of the log price indices. Note that parameter σ_P is a measure of price dispersion. Finally, ρ is the linear correlation coefficient of the two logarithms. In that case, the head-count poverty index is equal to

$$P^0 = \Phi(Z/[\sigma_x^2 + \sigma_P^2 - 2\,\rho\,\sigma_x\,\sigma_P\,]^{1/2}),$$

and the Watts poverty measure is equal to

$$W = Z.\,\Phi(Z/[\sigma_x^2 + \sigma_P^2 - 2\,\rho\,\sigma_x\,\sigma_P\,]^{1/2})$$

$$+ [\sigma_x^2 + \sigma_P^2 - 2\,\rho\,\sigma_x\,\sigma_P\,]^{1/2}\,.\,\phi(Z/[\sigma_x^2 + \sigma_P^2 - 2\,\rho\,\sigma_x\,\sigma_P\,]^{1/2}),$$

where $Z = \ln(z) - m_x - m_P$, and Φ and ϕ are the cdf and pdf of the standardized normal distribution, respectively.

The effect on poverty of changes in price dispersion can be derived. There are two cases: (A) Relatively high poverty line, presumably for poor developing countries, with $\ln(z) > m_x - m_P$; and (B) Relatively low poverty line, presumably for industrialized or middle-income countries, with $\ln(z) < m_x - m_P$. In the first case, the sign of the partial derivative of P^0 with respect to σ_P is the sign of $\sigma_P - \rho\sigma_x$. Therefore, under large price dispersion (or low correlation of prices and nominal incomes), the poverty rate diminishes with price dispersion. In the second case, the effect is the opposite, with the poverty rate increasing with price dispersion. On the other hand, price dispersion decreases Watts poverty for relatively low and high poverty lines and augments it for intermediate poverty lines. Therefore, for poor countries, price dispersion again attenuates poverty.

Finally, one can turn to survey data without stochastic assumptions and use partially aggregated price indices, as in the next subsection.

3.2.Heterogeneous price indices

There is an obvious parallel in the effects of price dispersion and the effects of correction for price differences. Empirically, using distinct urban and rural price indices, rural-urban price gaps have been found to be so important that they are usually taken into account through stratification in estimating poverty lines and poverty indicators.[7] Beyond this dichotomy, regional price deflation can substantially influence poverty measurement, as found, for example, early in Cote d'Ivoire by Grotaert and Kanbur (1994), in large countries such as India and China,[8] and in VietNam (Gibson et al., 2016). The role of heterogeneous deflation can extend to several periods. For example, in Burkina-Faso, Günther and Grimm (2007) find that measured pro-poor growth can be much influenced by regional inflation inequality.

The impact of price correction, or dispersion, on poverty measurement may be more acutely observed with more detailed spatial and time grids and using market prices instead of unit values. Because seasonality and the lean period characterizing poverty in most developing countries, consumption and prices should be measured for the same households in several

[7] Black (1952), Ravallion and Bidani (1994) and Rao (2000).
[8] See Deaton and Dupriez (2011), Majumder et al. (2015) and Li and Gibson (2014).

seasons. Under these conditions, Muller (2008) finds that ignoring seasonal and local spatial price gaps generates biases in poverty estimates in 1988 rural Rwanda. In that case, the bias from using regional deflators instead of local price indices is moderate for chronic and annual poverty, but it is considerable for seasonal poverty that can be severely underestimated when ignoring local prices. Moreover, using annual deflators instead of seasonal deflators badly underestimates annual and chronic poverty levels and generates major biases in seasonal and transient poverty estimates.

In 1990 Tunisia, Muller (2010) further inspected the role of price deflation in assessing the anti-poverty impact of price subsidies and cash transfers by comparing no deflation, deflation with spatial Laspeyres price indices, and deflation with estimated true spatial price indices. In this case, alternative price correction methods have little effect on the ranking of these poverty alleviation policies because cash transfers are always much more efficient than subsidies. Thus, correcting for price dispersion may matter for poverty measurement, with magnitudes of an approximately 10 percent decrease in poverty measures when deflating in that case, but not always for selecting policies.

Accounting for income classes in price indices has also been found useful. Deaton and Tarozzi (2005), using NSS India data to compute household expenditure variables, construct Indian CPI estimates for 1987-88 and 1993-94 based on unit values. Their ‘democratic’ price indices for each rural/urban, state and round are based on average budget shares weighted by individuals instead of households. As a result, their estimated rural poverty rates fall much faster over the years than official poverty statistics.

Finally, note that deflated poverty analyses are mostly only based on food price indices. Non-food products, especially locally traded or nontraded commodities, usually have no well-measured price data. To circumvent this issue for housing prices in 1991 Brazil, Timmins (2006) computes true spatial price indices by using census data combined with a multinomial logit model of household residential location choice. He finds that the heterogeneous U-shaped relationship between urbanization and price indices accounts for the spatial price dispersion in that case. This correction diminishes the estimated poverty rates, especially in the Northeast, and augments the estimated inequality, while race and education remain major covariates of poverty. In China, Li and Gibson (2014) claim that focusing on traded goods when studying regional inequality is an issue because the prices of these goods converge rapidly, which makes nontraded goods the main source of spatial price dispersion. Computing a spatial housing price index, they show that one quarter of the measured inequality across regions vanishes when this housing component is accounted for.

3.3. Prices and focusing estimation for targeting

Price dispersion also affects targeted transfer schemes. Muller (2005d) and Muller and Bibi (2010) are the seminal articles that introduced focused estimation for targeted schemes. This method is now broadly employed for cash transfer programs and has greatly improved their performance. For poverty, focusing implies accurately characterizing households whose living standards are close to the poverty line. For example, the predicted living standards, used to compute the cash amount to transfer to a household with certain characteristics, can be obtained by running a quantile regression of living standards on some household characteristics, using household survey data and a quantile close to the poverty line.

However, substantial unaccounted price dispersion can disturb the ranking of the predicted living standards. In that case, the selected quantile to focus the transfer scheme is biased, even though quantile regression estimators may be consistent due to their robustness to outliers. Then, the obtained transfer system may have large exclusion rates and severely degraded targeting.

3.4. Poverty-alleviating price reforms

Specific price reforms aimed at alleviating poverty have been investigated empirically, particularly food price subsidies. Thus, structural consumption models have been estimated to predict households' responses, not only to aggregate price changes but also to changes in price dispersion, by using price indices at a disaggregated spatial level. Thus, a reform can be assessed through microsimulations, based on household survey data, of consumption and price index responses that allow for cluster price effects. Ex post equivalent incomes, calculated from an estimated demand system, can be substituted for the initially observed living standards, which allows for flexible policy and poverty analyses. This approach requires ex ante accounting for price dispersion as well and neglects general equilibrium and dynamic effects.

An example is Ravallion and van de Walle (1991), who study hypothetical rice pricing reforms in Java by estimating rice demand functions using local unit values for rice. Uncompensated market liberalization is found to hurt the poor in that case. In this analytical context, Deaton and Ng (1998) proposed new estimation methods that can be employed to study the effect of price dispersion on poverty. For a food price reform in 1984-85 rural Pakistan, they show how to estimate the Almost Ideal Demand System and derive welfare consequences. Muller and Bibi (2010) apply this approach to price subsidies for staple food in 1990 Tunisia and the Quadratic Almost Ideal Demand System (QAIDS, Banks et al. 1997). They find huge poverty alleviation when these subsidies are substituted with cash transfer programs. Attanasio et al. (2013) and Sajjad et al. (2018) are recent examples of the same approach, again using QAIDS, respectively, for increases in food prices in Mexico and for food price subsidies in Khyber Pakhtunkhwan in Pakistan. Again, large gains brought by improved targeting of the social programmes to the poor are found.

References

Alcaly, R.E. (1976). Information and food prices. *The Bell Journal of Economics*, 658 – 671.

Anglin, P.M. & Baye, M.R. (1987). Information, multiprice search, and cost-of-living index theory. *Journal of Political Economy, Vol. 95*(6), 1179 – 1195

Araujo-Bonjean, C. & Simonet, C. (2016). Are grain markets in Niger driven by speculation? *Oxford Economic Papers, Vol. 68*, pp.714-735.

Arezki, R., Lederman, D. & Zhao, H. (2013). The Relative Volatility of Commodity Prices: A Reappraisal. *American Journal of Agricultural Economics, 96*(3), 939-951.

Attanasio, O., Di Maro, V., Lechene, V. & Philips, D. (2013). Welfare consequences of food prices increases : Evidence from rural Mexico. *Journal of Development Economics, Vol. 104*, 136-151.

Attanasio, O. & Frayne, C. (2006). Do the Poor Pay More ? *Mimeo Mario Einaudi Center for International Studies*, 1-25.

Ayadi, M., Krishnakumar, J. & Matoussi, M.S. (2003). Pooling surveys in the estimation of income and price elasticities: An application to Tunisian Households. *Empirical Economics, 28*, 181-201.

Banks, J., Blundell, R. & Lewbell, A. (1997). Quadratic Engel Curves and Consumer Demand. *The Review of Economics and Statistics, Vol. 79*(4), 527-539.

Broda, C., Leibtag, E. & Weinstein, D.E. (2009a). The Role of Prices in Measuring the Poor's Living Standards. *Journal of Economic Perspectives, Vol.* 23(2), 77-97, Spring.

Broda, C. & Romalis, J. (2009b). The Welfare Implications of Rising Price Dispersion. University of Chicago mimeo, April 24, 1-35.

Butler, J.S. & Moser, C. (2010). Structural Model of Agricultural Markets in Developing Countries. *American Journal of Agricultural Economy, 92*(5), 1364-1378.

Burdett, K. & Judd, K.L. (1983). Equilibrium Price Dispersion. *Econometrica, Vol. 51*(4), 955-970, July.

Byrne, J.P., Fazio, G. & Fiess, N. (2013). Primary commodity prices: Co-movements, common factors and fundamentals. *Journal of Development Economics. 101*, 16-26.

Caplovitz, D. (1963). *The Poor Pay More: Consumer Practices in Low Income Families*. Free Press of Glencoe.

Crawford, I., Laisney, F. & Preston, I. (2003). Estimation of household demand systems with theoretically compatible Engel curves and unit value specifications. *Journal of Econometrics, 114*, 221-241.

Deaton, A. (1987). Estimation of own- and cross-price elasticities from household survey data. *Journal of Econometrics*, N. 36, 7-30.

Deaton, A. (1988). Quality, Quantity, and Spatial Variation of Price. *The American Economic Review*, pp 418-430.

Deaton, A. (1990). Price Elasticities from Survey Data. Extensions and Indonesian Results. *Journal of Econometrics*, N. 44, 281-290.

Deaton, A., (1997). *The Analysis of Household Survey: A Microeconomic Approach to Development Policy*. John Hopkins University Press.

Deaton, A. & Dupriez, O. (2011). Spatial price differences within large countries. *Working Papers* 1321, Princeton University, Woodrow Wilson School of Public and International Affairs, Research Program in Development Studies.

Deaton, A, & Ng, S. (1998). Parametric and Non-parametric Approaches to Price and Tax Reform. *Journal of the American Statistical Association, Vol. 93*(443), 900-909.

Deaton, A. & Tarozzi, A. (2005). *Prices and Poverty in India*. Chapter 16 in Deaton, A. and Kozel, V., The Great Indian Poverty Debate. New Delhi, MacMillan.

Gibson, J., Le, T. & Kim, B. (2016). Prices, Engel Curves, and Time-Space Deflation: Impacts on Poverty and Inequality in Vietnam. *The World Bank Economic Review*, 1-34.

Gilbert, C.L. & Christiaensen, L. & Kaminski, J. (2017). Food price seasonality in Africa: Measurement and extent. *Food Policy. Vol. 67,* 119-132.

Greenhut, M.L., Norman, G. & Hung, C.-S. (1987). *The Economics of Imperfect Competition: A Spatial Approach*. Cambridge University Press, Cambridge, UK.

Grotaert, C. & Kanbur, R. (1994). A New Regional Price Index for Côte d'Ivoire using Data from the International Comparisons Project. *Journal of African Economies*, *Vol. 3*(1), April, 114–142.

Günther, I. & Grimm, M. (2007). Measuring pro-poor growth when relative prices shift. *Journal of Development Economics, Vol. 82,* 245-256.

Gupta, S., Verhoeven, M. Tiongson, E.R. (2003). Public Spending on Health Care and the Poor. *Health Economics, 12*(8), 685-96.

Guzman, L.A. (2018). Accessibility, Affordability and Equity: Assessing 'Pro-Poor' Public Transport Subsidies in Bogota. *Transport Policy, Vol. 68,* 37-51, September.

Hopkins, E. (2008). Price Dispersion. Chapter in Durlauf, S.N; & Blume, L.E. *The New Palgrave Dictionary of Economics,* 2nd Edition.

Kaplan, G. & Menzio, G. (2015). The Morphology of Price Dispersion. *International Economic Review, Vol. 56*(4), 1165-1206.

Kirman, A., (2010). *Complex Economies*. Routledge, Abingdon.

Lach, S. (2002). Existence and Persistence of Price Dispersion: An Empirical Analysis. *The Review of Economics and Statistics, Vol. 84*(3), 433-444, August.

Li, C. & Gibson, J. (2014). Spatial Price Differences and Inequality in the People's Republic of China: Housing Market Evidence. *Asian Development Review*, *Vol. 31*(1), pp. 92–120.

Majumder, A., Ray, R. & Sinha, K. (2015). Spatial Comparisons of Prices and Expenditure in a Heterogeneous Country: Methodology with Application to India. *Macroeconomic Dynamics, Vol. 19*(5), 931-989, July.

McKelvey, C. (2011). Price, unit value, and quality demanded. *Journal of Development Economics*, vol. 95(2), 157-169.

Muller, C., (2002). Prices and Living Standards. Evidence for Rwanda. *Journal of Development Economics, Vol. 68*, 187-203.

Muller, C. (2005a). Price Index Dispersion and Utilitarian Social Evaluation Function. *Economic Letters*, 89, 141-146.

Muller, C. (2005b). The valuation of non-monetary consumption in household surveys. *Social Indicators Research, 72*(3), 319–341.

Muller, C. (2005c). Poverty and Inequality under Income and Price Dispersion. *The Canadian Journal of Economics, Vol. 38*(3), 879-998, August.

Muller, C. (2005d). Optimising Anti-Poverty Transfers with Quantile Regressions. *Applied and Computational Mathematics, Vol. 4*(2).

Muller, C. (2008). The Measurement of Poverty with Geographical and Temporal Price Variability. Evidence from Rwanda. *Review of Income and Wealth, Vol. 54*(1), 27-49, March.

Muller, C. (2010). Anti-Poverty Targeting Errors and Spatial Prices. *Journal of Development and Economic Policies, Vol. 12*(2), 85-112, July.

Muller C. & Bibi, S. (2010). Refining Targeting against Poverty: Evidence from Tunisia. *Oxford Bulletin of Economics and Statistics*, Vol. 72(3).

Mussa, R. (2019). Food Price Heterogeneity and Income Inequality in Malawi: Is Inequality Underestimated? *MPRA Paper 56080*, September.

Myers, R.J. & Jayne, T.S. (2012). Multiple-Regime Spatial Price Transmission with an Application to Maize Markets in Southern Africa. *American Journal of Agricultural Economics. Vol. 94*(1), 173-188.

Pinstrup-Andersen, P. (1985). Food prices and the poor in developing countries. *European Review of Agricultural Economics, 12*, 069 – 085.

Pratt, J.W., Wise, D.A. & Zeckhauser, R. (1979). Price Differences in Almost Competitive Markets. *The Quarterly Journal of Economics, Vol. 93*(2), 189-211, May.

Rao, V. (1997). Are prices higher for the poor? Price heterogeneity and 'Real' inequality in rural Kranataka. *Economic and Political Weekly*, 10-14, November 29.

Rao, V., (2000). Heterogeneity and ''Real'' inequality: a case study of prices and poverty in rural south India. *Review of Income and Wealth, 46*(2), 201 – 211.

Ravallion, M. (1985). The Performance of Rice Markets in BanglaDesh During the 1974 Famine. *The Economic Journal, Vol. 95*, 15-29, March.

Ravallion, M. & Bidani, B. (1994). How robust is a poverty profile? *The World Bank Economic Review, 8*(1), 75 –102.

Ravallion, M. & van de Walle, D. (1991). The Impact on Poverty of Food Pricing Reforms: A Welfare Analysis for Indonesia. *Journal of Policy Modeling, Vol. 13*(2), 281-299.

Sajjad, ul Haq, Z. & Ullah, Z. (2018). Food Price Subsidy and its Effects on Poverty in Khyber Pakhtunkhwa, Pakistan. Global Social Sciences Review, Vol. III(III), 54-73, Summer.

Schultz, T.P. (2004). School Subsidies to the Poor: Evaluating the Mexican Progresa Poverty Program. *Journal of Development Economics, Vol. 74*(1), 199-250.

Timmins, C. (2006). Estimating spatial differences in the Brazilian cost of living with household location choices. *Journal of Development Economics, Vol. 80*, 59-83.

Van Praag, B.M.S. & Baye, M.R. (1990). The Poverty Concept when Prices are Income-Dependent. *Journal of Econometrics, Vol. 43*, 153-166.