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MEASURING AND ACCOUNTING FOR THE DEPRIVATION GAP OF PORTUGUESE IMMIGRANTS IN LUXEMBOURG*

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This paper examines the relative well-being of Portuguese immigrants in Luxembourg by looking at indicators of material deprivation. We document material deprivation differences between immigrants and nationals—the "deprivation gap"—and measure the extent to which income differentials (and other sociodemographic differences) explain this gap using a combination of nonparametric methods and a versatile graphical device. We find a large and significant deprivation gap against Portuguese immigrants, whatever the indicator considered. The extent to which the gap is merely a reflection of differences in income, however, depends on what deprivation items are taken into consideration. Income differences almost fully account for material deprivation differences when the latter is measured using the items included in the official EU social indicator of material deprivation. Inclusion of housing condition indicators mitigates this relationship and we then find compelling evidence that the deprivation gap is not entirely accounted for by income differentials.

JEL Codes: I32, D63, C14

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1. Introduction

Scholarly work examining the socioeconomic integration of immigrants is abundant. Studies typically benchmark migrants against the native-born population to evaluate their performance in some relevant dimension(s) of this inherently multidimensional concept. Building on the seminal work of Chiswick (1978) and Borjas (1985), many studies focus on improving our understanding of the factors driving the immigrant earnings gap and on assessing the extent to which various immigrant cohorts are able to successfully catch up to their native-born counterpart over time; see recent contributions by Butcher and DiNardo (2002), Adsera and Chiswick (2007), Breunig *et al*. (2013), among many others. The literature has also explored other dimensions believed to shape the socioeconomic performance of immigrants such as occupational attainment (Green, 1999; Frenette *et al*., 2003), employment (Gorinas, 2014), homeownership (Borjas, 2002; Sinning, 2009), and wealth (Bauer *et al*., 2011).

In this paper, we adopt yet another perspective and examine the "deprivation gap" of Portuguese immigrants in Luxembourg—a gap with regard to non-monetary indicators of material deprivation. Our empirical strategy combines a fully non-parametric reweighing decomposition approach à la DiNardo *et al*. (1996) with a versatile graphical device proposed in Lasso de la Vega (2010), the "dimension deprivation curve".

Measures of material deprivation have gained popularity among statistical agencies and in policy debates. A measure of material deprivation has been one of the EU's official headline indicators on social protection and social inclusion since 2006 (Atkinson *et al*., 2002; European Commission, 2009) and the recent EU 2020 target on poverty and social exclusion is, in part, expressed in terms of material deprivation. Measures of material deprivation—also referred to as "lifestyle deprivation"—are derived from questionnaire data on direct indicators of people's living conditions, such as the possession of various durable goods, the ability to afford basic consumption goods, the capacity to face regular expenses, the quality of housing conditions, etc. All such indicators are normally considered basic necessities for living a decent life in the society; see Townsend (1979). This approach is meant to concentrate directly on the standard of living of individuals rather than on the resources required to achieve those conditions, namely earnings or income. It has grown in fashion in recognition of limitations of income to adequately identify people experiencing poverty and to capture the multi-dimensional nature of deprivation (Atkinson *et al*., 2002; Nolan and Whelan, 2010). Of particular concern is that income misses accumulated savings and (financial and non-financial) wealth, which may be strong determinants of living conditions in particular for some population subgroups such as the elderly. Arguments about income failing to properly reflect how accumulated wealth impacts on living conditions are germane to assessments of immigrants' socioeconomic performance too because migrants typically have specific savings behavior and lower accumulated wealth than natives (Carroll *et al*., 1994; Bauer *et al*., 2011). However, to the best of our knowledge, relatively little use has been made of material deprivation measures to study immigrants' performance; see Haisken-DeNew and Sinning's (2010) analysis of deprivation and social exclusion of immigrants in Germany for a recent example.

Luxembourg is the country with the largest share of foreign-born residents in the EU and Portuguese immigrants form the largest foreign community in the country, with 41 percent of foreign residents in 2007 (Berger, 2008). As with many foreign populations in industrialized countries, they have been consistently reported to record lower socioeconomic achievements than natives (and most other foreign communities) as measured by earnings and employment (Langers, 2006), by income (Hartmann-Hirsch, 2007), education (Alieva, 2010), or by indicators of satisfaction with financial conditions (Van Kerm and Villeret, 2007). Portuguese communities sharing similar migration profiles have also settled in two large neighboring countries—France and Germany (Baganha *et al*., 2005; Borges, 2011). Evidence from Kalter and Granato (2002) corroborate their poor economic performance in Germany. Brinbaum and Kieffer (2009) document the low educational achievements of second generation Portuguese immigrants in France. Portuguese have also established sizeable communities in Switzerland and Canada since the late 1950s. In all these countries, the first cohort of Portuguese migrants were brought in to fulfil shortages of "low-skilled" and "manual trades" workers (Afonso, 2010; Bauer *et al*., 2002; Teixeira and da Rosa, 2009). After the immigration stoppage in Europe in 1973 or the establishment of a point system in Canada in 1967, Portuguese migrants continued to settle in these countries mainly through family reunification programs. Up to this day, Portuguese migrants continue to be characterized by low educational attainment and remain disproportionally concentrated in low skilled blue-collar jobs (Afonso, 2010; Bauer *et al*., 2002; Borges, 2011; Clifton, 2010). It remains, however, that little scholarly work has explored in depth their socioeconomic integration internationally. In this context, the availability of rich survey data on a relatively large sample of Portuguese immigrants in Luxembourg—thanks to their sheer size in the population—offers unique opportunity to fill this gap.

To preview our results, we find that the deprivation gap of Portuguese immigrants is large and significant, and is robust over a broad spectrum of definitions of material deprivation. Combining "dimension deprivation curves"—a graphical device similar to the inverse generalized Lorenz curve (Lasso de la Vega, 2010)—and a fully non-parametric version of sample reweighting techniques à la DiNardo *et al*. (1996) and Barsky *et al*. (2002) to account for differences in population characteristics, we show that the contribution of income differences to explain the deprivation gap crucially depends on the items considered in indices of material deprivation. The gap is largely accounted for by income (and demographic characteristics) when based on the nine deprivation items selected by the European Commission for the official EU indicator of material deprivation. A significant unexplained gap, however, remains once additional items are included to reflect differences in housing conditions.

The paper is organized as follows. We first detail our summary measures of material deprivation and the "dimension deprivation curves" in Section 2. Section 3 describes in non-technical terms the reweighting methods we adopt to adjust for differences in population characteristics (leaving full technical details in Appendices A and B). Our data and the specific items of deprivation we examine are described in Section 4. We present and discuss our results in Section 5. We finally offer some concluding remarks in Section 6.

2. Measures of Material Deprivation and Dimension Deprivation Curves

In essence, we aim to examine the deprivation gap of Portuguese immigrants in Luxembourg, where the deprivation gap (Δ) is simply defined as the difference in a summary index of material deprivation (θ) calculated over the population of Portuguese immigrants and the same index calculated over the population of Luxembourg citizens in the country: $\Delta = \theta_{PT} - \theta_{LU}$. We adopt a conventional "weighted counting" framework to the calculation of such summary indices of material deprivation (Lasso de la Vega, 2010; Bossert *et al.*, 2013). These indices are nicely connected to the dimension deprivation curves—defined shortly—and are amenable to inspection using simple non-parametric reweighting procedures.

The degree of material deprivation experienced by an individual i is first determined from a vector $\mathbf{d}_i \equiv (d_{i1}, d_{i2}, \ldots, d_{iK})$ where each d_{ik} is a binary indicator variable taking the value 1 if individual i is "deprived" of a particular commodity (e.g. some basic consumption, or durable good) or experiences a given "bad" (such as financial stress, etc.). The official EU indicator of material deprivation considers nine such items: whether a household (*i*) can face unexpected expenses; (*ii*) can afford a one week annual holiday away from home; (*iii*) has the capacity to pay regular bills (mortgage or rent, utility bills or hire purchase instalments); (*iv*) has the capacity to afford meat, chicken or fish every second day; (*v*) has the capacity to keep the home adequately warm; (*vi*) could possess a washing machine (if desired); (*vii*) could possess a colour TV; (*viii*) could possess a telephone; and (*ix*) could possess a personal car (European Commission, 2009). Authors have often considered broader sets of indicators by including, e.g. indicators of housing conditions or of social interactions (see e.g. Whelan *et al.*, 2008). Despite the limitation of considering only nine items, the official status of the EU definition makes it a fixed point of reference, which we will compare to some more encompassing measures (see Section 4).

In the weighted counting framework, an individual-level deprivation score $s_i = \sum_{k=1}^{K} w_k d_{ik}$ is obtained as the weighted sum of the K deprivation items where the non-negative weights w_k reflect the relative importance of being deprived of item k. Practitioners have adopted an array of approaches to determine item weights; see Decancq and Lugo (2013) for a recent survey. The simplest and most common option is equal weighting: the score is just the deprivation count. This is the approach underlying the EU indicator of material deprivation. It is also common to weight items proportionally to the prevalence of the deprivation item in the population: higher weight is given to relatively infrequent deprivation items to reflect the view that suffering from a "rare" deprivation takes a greater toll on people's standard of living (Cerioli and Zani, 1990). Such a "prevalence weighting" scheme is adopted for example in the UK "Households Below Average Income" statistics on children and pensioners material deprivation (Department for Work and Pensions, 2013).

We adopt prevalence weighting but implement it with an extra layer of sophistication proposed by Betti and Verma (1998) which involves a double-weighting rule sensitive to both the relative frequency of items (prevalence

weighting) and the correlation among items.[1] The correlation is taken into account so that two perfectly correlated items "count as one" and only two uncorrelated items fully "count as two". To achieve this, Betti and Verma (1998) and Betti *et al.* (2008) define item weights as the product of two components

$$\omega_k^{\text{bv}} \propto \left(\omega_k^a \cdot \omega_k^b\right),$$

with ω_k^a being a "prevalence weight" and

$$\omega_k^b = \left(1 + \sum_{m=1}^{M} \rho_{km} \mathrm{I}(\rho_{km} < \rho_H)\right)^{-1} \left(\sum_{m=1}^{M} \rho_{km} \mathrm{I}(\rho_{km} \geq \rho_H)\right)^{-1},$$

where ρ_{km} is the correlation between items k and m and $\mathrm{I}(\cdot)$ is an indicator function equal to 1 if the expression in brackets is true and 0 otherwise. ρ_H is a pre-determined cut-off correlation level.[2] ω_k^b is the inverse of a measure of "average correlation" of item k with all the other items. The larger the average correlation with item k, the lower the resulting weight for item k. We adopt the Cerioli and Zani (1990) prevalence weight as the first component

$$\omega_k^a = \log\left(\frac{1}{\bar{d}_k}\right),$$

where $\bar{d}_k$ is the mean of item d_{ik} in our sample. Weights are normalized to sum to one.

Note that we evaluate the deprivation of all individuals (Luxembourg nationals and Portuguese immigrants) on the basis of a common set of item weights. We discard any potential interpersonal or inter-group (cultural) differences in social perceptions about the importance of different items. We take it as desirable in our context as we do not want the immigrants/nationals comparison to be mitigated (or exacerbated) by adopting different sets of item weights, but see Haisken-DeNew and Sinning (2010) for a different point of view.[3]

Summary indices of material deprivation in a population are derived by averaging the individual scores

$$\theta = \frac{1}{N} \sum_{i=1}^{N} s_i,$$

where N is the sample (or population) size so the aggregate index (θ) is an average of individual-level deprivation contributions s_i, which itself is a linear combination of specific deprivation items d_{ik}; see Bossert *et al.* (2013) for an axiomatic characterization of such a measure.

In addition to the summary index (θ), we use a complementary graphical device—the "dimension deprivation curve"—proposed by Lasso de la Vega

[1]Results based on alternative sets of weighting schemes are available in Hildebrand *et al.* (2012). The choice of weighting scheme does not have much influence on the main conclusions of our analysis.

[2]ρ_H separates high and low correlations. We follow Betti and Verma (1998) who suggest setting ρ_H as to divide the ordered set of correlations at the point of the largest gap.

[3]See Dickes *et al.* (2010) on variations in social perceptions of deprivation items in the EU, and Bellani and D'Ambrosio (2011) or Bellani (2013) for methodological discussions.

(2010). The curve plots the cumulative deprivation score accrued to the fraction p of the most severely deprived individuals against $p = \frac{i}{N}$

$$D(p) = \frac{1}{N} \sum_{i=1}^{pN} s_{(i)},$$

where the sample values of s_i are ordered such as $s_{(1)} \geq s_{(2)} \geq \ldots \geq s_{(N)}$. The curve is, in effect, a discrete data version of the inverse generalized Lorenz (IGL) curve introduced for comparing distributions of poverty gaps in Spencer and Fisher (1992) and Jenkins and Lambert (1997).

Like the IGL curve, a dimension deprivation curve reveals more than a single index such as θ and provides a compact description of the incidence, intensity and inequality dimensions of the distribution of deprivation scores. The value of $D(p)$ at $p = 1$ gives index value θ, namely the average deprivation score. The point S_U on the horizontal axis at which the curve becomes flat gives the fraction of individuals deprived in at least one item ($S_U = \inf\{p \text{ s.t. } D(p) = D(1)\}$). This fraction corresponds to the multidimensional poverty headcount ratio according to a "union" approach where a person is considered poor if she is deprived in at least one dimension. Similarly, the point S_I on the horizontal axis, at which the slope of the curve becomes smaller than 1, gives the fraction of individuals deprived in all items. This fraction corresponds to the multidimensional poverty headcount ratio according to an "intersection" approach where a person is considered poor if she is deprived in all possible dimensions. Also, the greater the curvature of the curve the more deprivation is concentrated on few individuals with a high degree of deprivation—in other words, the more deprivation is unequally distributed in the population.

Non-intersection of dimension deprivation curves for two populations has also been shown to provide a criteria to rank the populations according to a broad range of material deprivation and multidimensional poverty measures; see Lasso de la Vega (2010) and Aaberge and Peluso (2011) for details.

3. Accounting for the Deprivation Gap

We refer to the difference in our aggregate measures of material deprivation between Portuguese immigrants and Luxembourg nationals as the "deprivation gap" of Portuguese immigrants. As we show *supra* the deprivation gap is substantial. But the populations compared are also different, with Portuguese immigrants being, e.g., much younger and with lower levels of educational achievements. Levels of income are also different. Assessing how much of the deprivation gap is a reflection of an "income gap" is central to judging the usefulness of deprivation measures as a complement to income-based indicators.

To capture the extent to which the gap can be accounted for by differences in population characteristics, we implement a non-parametric, reweighting-based standardization approach similar to DiNardo *et al*. (1996), Barsky *et al*. (2002). For the sake of brevity, full details of the procedure are only provided in Appendices A and B. Such reweighting approaches are popular among labor economists

on account of their simplicity and versatility; see the review of Fortin *et al*. (2011). In a nutshell, the procedure involves determining adjustment weights for each observation in our sample of Luxembourg nationals, where weights are calibrated so that the weighted sample of nationals has the same characteristics as the sample of immigrants on a set of key control covariates. Computing the deprivation gap between our sample of Portuguese immigrants and the reweighted sample of nationals identifies a gap netted out of the effect of differences in population characteristics.[4]

We apply this procedure to control for population differences with respect to the age of household head, household composition, the education of household head, the labor market attachment of the household, and household income. The adjustments are sequential and cumulative. We first control for age differences, then for household composition conditional on age adjustments, and so on, until we finally control for income differences conditionally on all previous characteristics. We therefore treat the dependence between covariates using an explicit chain of conditional distributions and consider the marginal impact of netting out each of the covariates in turn to identify their impact on the deprivation gap. This particular chain of conditional distributions of household characteristics is adopted to account for the dependence (i) of educational achievements on age, (ii) of labor market attachment on age and education, and (iii) of income on employment, education, age, and household composition. Alternatively, household composition could reasonably be conditioned on educational achievements; this makes little difference to our substantive conclusions however.

This reweighting approach is particularly well-suited to our purpose. First, it allows us to remain free of any parametric modeling assumption. Regression-based alternatives would require a parametrized model relating covariates to the multinomial distribution of deprivation indicators using, e.g., multivariate binary choice models (Cappellari and Jenkins, 2007; Fusco and Dickes, 2008) or—more commonly—to the deprivation scores themselves using, e.g. linear, count or censored, Tobit-type regression models as in Klasen (2000), Berthoud and Bryan (2011), Figari (2012), Bárcena-Martín *et al*. (2014). Reweighting approaches do not require any such modeling assumptions since the distribution of deprivation conditional on covariates is not estimated directly (and as we show in Appendix B our reweighting factors are calculated entirely non-parametrically). Second, it allows us to analyze multiple versions of aggregate material deprivation indicators, the dimension deprivation curves, as well as single deprivation items in a single coherent framework based on straightforward reweighted estimators (Firpo, 2010). Regression-based and other flexible approaches—such as "recentered influence function" techniques (Firpo *et al*., 2009)—would require estimation of a large number of distinct statistical models for each of the functionals we are interested in. The price to pay—as discussed above—is the necessity to specify a particular

[4]The decision to reweight Luxembourg nationals to immigrant population characteristics is dictated by the data since the characteristics observed among Portuguese immigrants are only a subset of the characteristics observed among Luxembourg nationals: the fully non-parametrically reweighted indicators can therefore only be estimated by cumulatively shrinking the characteristics of the counterfactual (reweighted) sample of Luxembourg nationals towards the characteristics of Portuguese immigrants.

chain of conditional distributions and a sequence of "elimination" of the covariates (see Appendix A for details). In our application, the chain of conditional distributions appears, however, natural. In particular, we are interested in assessing the role of income differences after controlling for demographics and employment differences; see Altonji *et al*. (2012) for a similar argument.

The sampling variability of all estimates presented in the paper is estimated using a non-parametric block bootstrap resampling procedure, detailed in Appendix D. Resampling methods make it possible to assess the sampling variability of the relatively complex statistics considered here and to take into account the relatively complex dependence of the sample data (induced by the stratified PSELL survey design and our pooling of multiple waves of data described shortly).

4. Data and Descriptive Statistics

4.1. *Sample*

We use data from the Panel Socio-Economique *Liewen zu Lëtzebuerg* (PSELL-3), a general purpose panel survey carried out annually since 2003 with an initial sample of over 3,500 households representative of the population living in private dwellings in Luxembourg. Analysis is conducted on pooled data from waves 3, 4 and 5 (covering the 2005–2007 period) which contain comparable deprivation indicators related to the enforced lack of a combination of items depicting material living conditions.[5] "Enforced" is understood as lacking possession due to insufficient financial resources, not by choice (see Nolan and Whelan, 1996; McKay, 2004, for further discussion).

We restrict our sample to all Luxembourg nationals and Portuguese immigrant households whose reference person ("household head") is 16 years old or more. Our analysis relies on the (first) nationality of respondents to distinguish Luxembourg nationals from Portuguese immigrant households. We eliminate all "mixed households" so both partners are Luxembourg citizens in our sample of Luxembourg households, while both partners are Portuguese citizens in our sample of Portuguese households. After excluding all observations with missing values on any of the variables used in our empirical analysis (see Appendix E), our estimation sample includes 5110 Luxembourg and 1413 Portuguese household-year observations.

4.2. *Deprivation Indicators*

We exploit a total of 17 deprivation indicators of three broad categories: economic strain, non-possession of common durable goods, and housing conditions. Economic strain includes the capacity to face unexpected expenses; to eat meat or fish every second day (if the households wanted to); to pay for a week of annual holiday away from home; to keep their home (household's principal residence) adequately warm; the inability to meet scheduled payment such as mortgage payments, accommodation or hire purchase instalments. Non-possession of

[5]Earlier waves of data either did not contain all deprivation items considered or used a different wording of questions, which lead to slight inconsistencies.

durables is related to the lack of widely desired durable goods: a TV set, a phone, a computer, a dishwasher, a car or van for private use. Housing conditions capture both the absence of basic housing amenities and the existence of serious problems associated with the family home including having a leaky roof, having damp walls, windows or grounds, having rot in walls, windows or grounds, having non-hermetic windows and doors, not having double glazing windows, and not having an outdoor space.

All indicators are binary with a value of 1 indicative of deprivation and 0 otherwise. Sample means of all indicators are reported, separately for Luxembourg and Portuguese households, in Appendix Table C.1. Portuguese households are more frequently deprived than Luxembourg households for each item. The difference in the capacity to face unexpected expenses is particularly striking: 46 percent of all Portuguese households report difficulties to face unexpected expenses compared to only 12 percent of natives. Percentage point differences in the possession of durables is smaller than for economic strain indicators for all items but the possession of a computer. But the number of households lacking common durables is generally trivial (except for the possession of a computer). By contrast, we observe large differences between the two groups for all items within the "housing conditions" dimension with the lack of possession of an outdoor space being the most striking one—about 31 percent among Portuguese households versus only 5 percent among natives from Luxembourg.

Decision over the subset of items to consider for computing the aggregate index θ (and the related dimension deprivation curves) is a non trivial and largely unsettled issue. In the absence of consensus or compelling arguments about particular choices (see, e.g. Klasen, 2000; Guio *et al*., 2009; Nolan and Whelan, 2010) our application reports estimates based on four different subsets defined as follows (the list of items used in each of the four sets is in Appendix Table F).

The first set—which we refer to as "EU set"—includes the nine items that have been selected to construct the official EU indicator of material deprivation and now headline indicator in the EU Horizon 2020 strategy. This is a small set of basic deprivation items. It does not take any of our housing conditions items into account. The second set—which we refer to as our "minimal" set—also relies on just a few items, which we consider important and exhibit significant differences between natives and Portuguese immigrants. In contrast to the EU set, it includes one item on housing condition but excludes items related to the possession of a TV set and a phone. The latter two indicators are discarded because these deprivations are almost absent from our samples (e.g. only 0.1 percent of Portuguese households are deprived of a TV set). The third set—which we will refer to as our "maximal" set—includes all 17 available indicators. Fourth and finally, we chose an "intermediate" set as a middle range between the "minimal" and "maximal" sets. The "intermediate" set balances the number of items from the three broad dimensions, and only includes items which are frequently considered relevant in similar studies (see for example, Layte *et al*., 2001; Guio *et al*., 2009; Pi Alperin, 2010). Betti-Verma item weights (w_k) obtained with these four schemes are reported in Appendix Table F.

Because Portuguese immigrants fare worse than Luxembourg nationals in *all* items taken separately (Table C.1), the synthetic indicator (S) will obviously be

higher for the latter than for the former, irrespectively of the item sets considered. However, the magnitude of the difference and the extent to which differences are explained by socioeconomic characteristics and income will differ across item sets, as shown shortly.

4.3. *Demographic Characteristics*

Differences in deprivation level between Luxembourgish and Portuguese households are marked, but our sample composition with respect to basic socio-economic household characteristics also differs widely. Household characteristics in our sample are summarized in Appendix Table C.2.

Portuguese households are younger than Luxembourg nationals. Pensioner households are significantly more prevalent among Luxembourg nationals (18 percent v.s. 2 percent) while Portuguese are more likely to live in families with children (74 percent v.s. 47 percent). It is, therefore, natural to start our decomposition by accounting for differences in households' age (a) and family types (h). In addition, as Portuguese are younger than nationals and wages are expected to be an increasing function of labor market experience, identifying the independent effect of age on the deprivation gap is interesting in itself.

Portuguese exhibit significantly lower educational attainment than the Luxembourg nationals with only 19 percent of Portuguese households having at least completed secondary school compared to 68 percent of nationals. It is now well established that poor educational attainment has long-term negative consequences on individual well-being (Blanchflower and Oswald, 2004). Hence, we consider the role of human capital (e) as a third factor explaining the deprivation gap. We create three indicator variables capturing the highest level of education completed by the head of household, including primary education (or without any formal education), high-school education, and post-secondary education.

Respondents from Portuguese households also report higher labor market participation than their Luxembourg counterparts, with 63 percent of the latter having more than one active member participating in the labor market compared to less than 40 percent amongst nationals. Greater labor force participation of Portuguese households could reflect age differences and/or a behavioral response of immigrants to compensate for the significantly lower compensation level of their active members. As a result, we consider the role of labor market participation (l) as another potentially relevant explanatory factor. To this end, we create three indicator variables (i) households without any active respondents, (ii) households with one active respondent and (iii) households with two or more active respondents.

Finally, the degree of income polarization by nativity group is stunning. Over 89 percent of Portuguese households are found in the bottom half of the income distribution against only 42 percent of Luxembourg households when using a conventional measure of "annual single adult equivalent household income" derived by applying the modified-OECD equivalence scale to make household income levels comparable across household types. Given the contention—widely conveyed in the EU by the objectives set by the "Lisbon Treaty" to promote social inclusion (Cantillon *et al*., 2012)—that income based measures are unlikely to fully

capture all facets of poverty and deprivation, we consider the impact of income (y) on the nativity gap. We purposely consider income as our last factor in the sequence used to implement our decomposition exercise as it allows us to measure the impact of income purged of basic demographic differences in the populations.

5. The Deprivation Gap of Portuguese Immigrants in Luxembourg

As discussed *supra*, our analysis considers four different indices based on alternative item sets. Index values are reported in Table 1 along with estimates of the adjusted gap and marginal reduction of the gap when the various differences in population characteristics are accounted for.[6]

We find a large positive and significant raw gap for all of the four indices (compare the first and last columns or the second line of column 1 from Table 1). There are, however, variations in the levels of the aggregate deprivation indicators and in the magnitude of the differentials according to the index composition.

The deprivation index of Portuguese immigrants is 168 percent larger than that of Luxembourg nationals for the "maximal set" (0.056 v.s. 0.021), up to approximately 267 percent larger for the "EU set" (at 0.032 v.s. 0.009). Accounting for differences in household age, household type, educational attainment, and labor market participation (AHEL) explains between 10 percent and 30 percent of this deprivation gap. This reduction is largely explained by differences in educational attainment.

Portuguese immigrants are much more concentrated towards the lowest deciles of the household income distribution than nationals (even after controlling for labor market participation and education) and this translates directly on the deprivation gap. Income differences (after controlling for the previous four factors) explain the largest portion of the deprivation gap, with the impact ranging broadly between 39 percent and 56 percent of the raw gap. While this result is not fully surprising, the magnitude of its effect is worth noticing.

Taken together, depending on the index, the deprivation gap is more than halved when the Luxembourg population is fully re-weighted to the characteristics of Portuguese immigrants. Interestingly, differences in characteristics explained the largest portion of the gap (86 percent) for the official "EU" set, the only index with a statistically insignificant unexplained part.

In what follows, we further examine graphically the extent to which our five factors account for the raw gap. As discussed earlier, the dimension deprivation curves allow us to provide a comprehensive representation of the deprivation gap over the entire distribution. For the sake of brevity, we restrict our focus to two item sets: the "EU set" and the "intermediate" set. The "EU set" does not include any of the housing quality indicators and focuses on items reflecting the strongest degree of deprivation. Accordingly, in a country like Luxembourg, the level of deprivation implied by this indicator is comparatively low, especially among nationals. The lion's share of the contribution to this aggregate indicator is due to the "ability to face unexpected expenses" and to a lesser extent the "capacity of paying bills".

Figure 1 displays (i) dimension deprivation curves from the raw samples (top left) and the difference between the two curves with bootstrap variability bands

[6]Stata programs for calculating all results reported in the paper are available in Appendix J.

TABLE 1

AGGREGATE DEPRIVATION INDICES ON RAW AND REWEIGHTED SAMPLES

	LU						PT
	Raw	A	AH	AHE	AHEL	AHELY	Raw
EU material deprivation set							
Index value:	0.009	0.010	0.009	0.016	0.016	0.029	0.032
Gap PT–LU:	0.023*	0.021*	0.023*	0.016*	0.016*	0.003	
Ratio PT/LU:	3.67	3.07	3.53	1.97	2.04	1.12	
Marginal impact:		0.002*	−0.001*	0.007*	−0.001	0.013*	
		[0.001; 0.003]	[−0.002; −0.001]	[0.004; 0.011]	[−0.002; 0.001]	[0.006; 0.020]	
Marg. impact over gap:		0.07	−0.06	0.31	−0.02	0.56	
Minimal item set							
Index value:	0.042	0.048	0.043	0.064	0.061	0.100	0.144
Gap PT–LU:	0.102*	0.096*	0.101*	0.080*	0.083*	0.043*	
Ratio PT/LU:	3.46	2.99	3.36	2.25	2.37	1.43	
Marginal impact:		0.007*	−0.005*	0.021*	−0.003	0.040*	
		[0.004; 0.010]	[−0.008;−0.003]	[0.012; 0.029]	[−0.008; 0.002]	[0.022; 0.053]	
Marg. impact over gap:		0.06	−0.05	0.21	−0.03	0.39	
Intermediate item set							
Index value:	0.047	0.048	0.043	0.060	0.056	0.094	0.140
Gap PT–LU:	0.093*	0.092*	0.096*	0.080*	0.084*	0.046*	
Ratio PT/LU:	2.98	2.92	3.23	2.34	2.50	1.49	
Marginal impact:		0.001	−0.005*	0.016*	−0.004	0.038*	
		[−0.002; 0.004]	[−0.007;−0.003]	[0.007; 0.023]	[−0.008; 0.001]	[0.020; 0.051]	
Marg. impact over gap:		0.01	−0.05	0.18	−0.04	0.41	
Maximal item set							
Index value:	0.021	0.021	0.019	0.026	0.025	0.041	0.056
Gap PT–LU:	0.035*	0.035*	0.036*	0.029*	0.031*	0.015*	
Ratio PT/LU:	2.68	2.64	2.86	2.13	2.25	1.35	
Marginal impact:		0.000	−0.002*	0.007*	−0.001	0.016*	
		[−0.001; 0.002]	[−0.003;−0.001]	[0.003; 0.011]	[−0.003; 0.001]	[0.009; 0.024]	
Marg. impact over gap:		0.01	−0.05	0.19	−0.04	0.47	

Notes: For each index, the first row gives the index value, the second row gives the difference between the index for Portuguese and the (reweighted) natives, the third row gives the ratio of the index for Portuguese over the (reweighted) natives, the fourth row shows the marginal reduction of the gap when the column component is introduced, and the fifth row in brackets gives 90% bootstrap variability bands for the latter. The sixth row expressed the marginal reduction as a fraction of the total unadjusted gap. Stars indicate that bootstrap variability bands for the deprivation gap or marginal effects do not include zero.

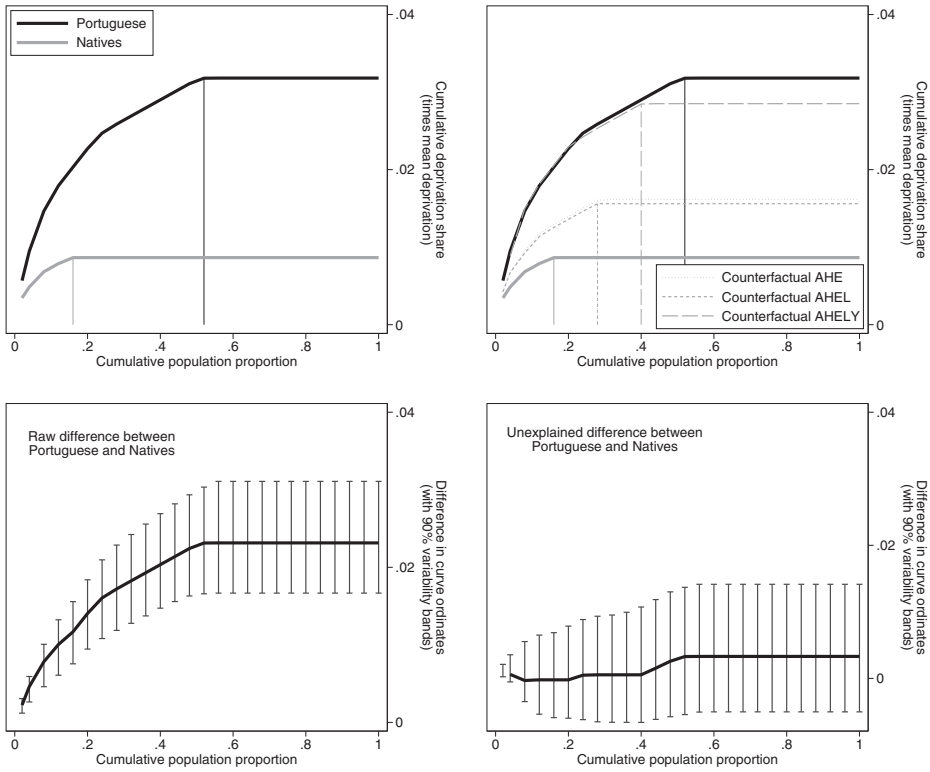

Figure 1. Dimension deprivation curves (top) and curve differences (bottom) for the EU set

(bottom left) and (ii) counterfactual dimension deprivation curves from the reweighted Luxembourg national sample at the AHE (the conditional distribution of education), the AHEL (the conditional distribution of employment) and the AHELY (the conditional distribution of income) steps (top right) with the bottom right panel showing the remaining, "unexplained" difference between the Portuguese dimension deprivation curve and the AHELY curve (also with bootstrap variability bands). The vertical bars indicate the proportion of the populations with non-zero deprivation (that is, deprived on at least one item) while the end-value of the curves give mean deprivation levels.

Figure 2 shows the marginal reduction of the difference between dimension deprivation curves at each of three steps of the sequence of introduction of our control factors. The top left quadrant gives the reduction in the gap after controlling for age, household structure and education; the top right quadrant gives the additional reduction of the gap observed after controlling for (conditional) employment differences; the bottom left quadrant gives the partial effect of income differences; netted out of differences in conditional education and employment; the bottom right quadrant gives the remaining, unexplained deprivation gap.

The raw deprivation gap is large and significant. More than 50 percent of Portuguese immigrants experience deprivation in (at least) one of the nine items,

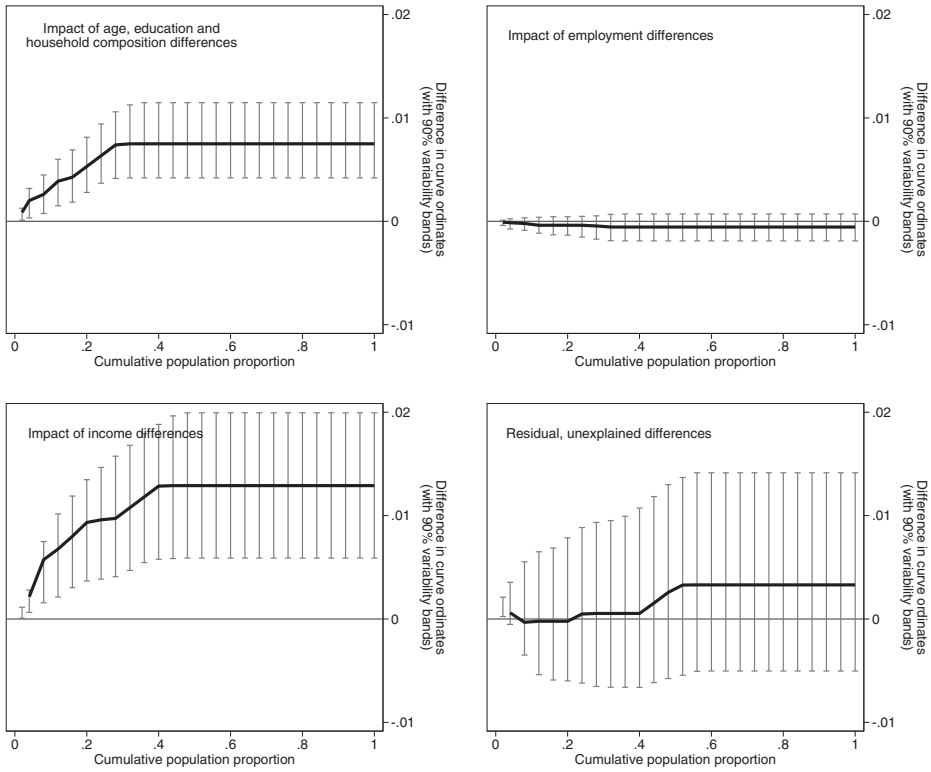

Figure 2. Marginal effects of components

compared to less than 20 percent of nationals. The expected deprivation score is above 0.032 for Portuguese against just above 0.009 for Luxembourg households. Note that the implied gap is largely accounted for by the explanatory factors over the entire distribution, yielding an unexplained portion never significantly different from zero. Income accounts for the largest part of the reduction in the deprivation gap. This should come as no surprise given the definition of items included in the EU indicator; most items refer to elements that "money can buy". This finding questions the value-added of common "income-based" indicators over the official indicator of material deprivation in general, and in a country like Luxembourg in particular.

Figures 3 and 4 show results for the aggregation based on the "intermediate" set of items. The "intermediate" set reflects our preferred choice of items, in which we grouped some items and excluded others that most households possess, making the information of enforced lack irrelevant (such as the possession of a TV set or phone, or the capacity to eat meat/fish).

In the raw samples, the dimension deprivation curve for Portuguese lies everywhere above the curve for Luxembourgers. The deprivation gap is again unambiguous and significant. More than 70 percent of Portuguese immigrants experience at least one of the deprivations considered, against less than 40 percent of nationals. The mean deprivation score is 0.140 for immigrants against 0.047 for

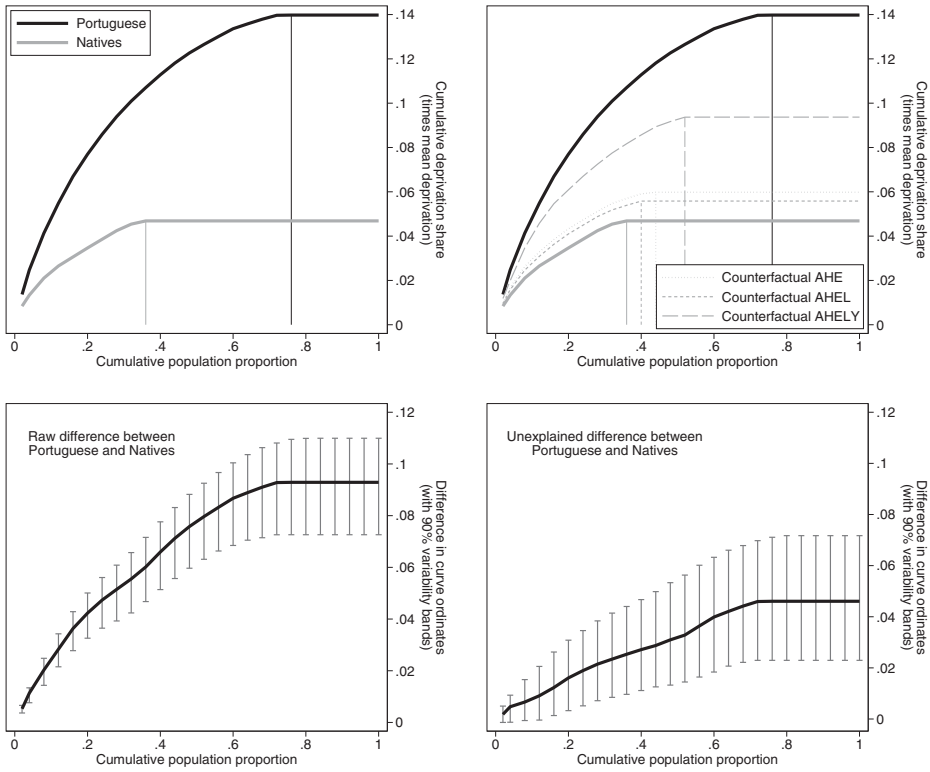

Figure 3. Dimension deprivation curves (top) and curve differences (bottom) for the intermediate item set

nationals (see Table 1). Since the curves do not cross, the ranking would remain unchanged for generalized means of the deprivation of any positive power (Jenkins and Lambert, 1997; Aaberge and Peluso, 2011).

Just over half of the deprivation gap is accounted for by the five control factors (51 percent). Age, household structure, education and employment differences only account for about 10 percent of the gap. Controlling for differences in income also leads to a marked reduction of the "unexplained" part. Nevertheless, even after controlling for differences in income, the deprivation gaps remain positive and significant, leaving a significant part unexplained, unlike what is observed with the "EU set". A similar pattern is found with the alternative "minimal" and "maximal" item sets (see Appendix H).

To understand these results, we look back at single items. The latter provide additional clues on the significance and relative importance of single items in our aggregated results. Table 2 shows the proportion of the population experiencing specific deprivations in the national and the Portuguese samples, as well as in the reweighted national sample. Numbers in brackets show the item-level deprivation gaps of Portuguese at each stage of the reweighting sequence. Stars indicate that the deprivation gap is statistically significant at the 90 percent confidence level. For instance, the first row repeats the results of Appendix Table C.1 that 12 percent of

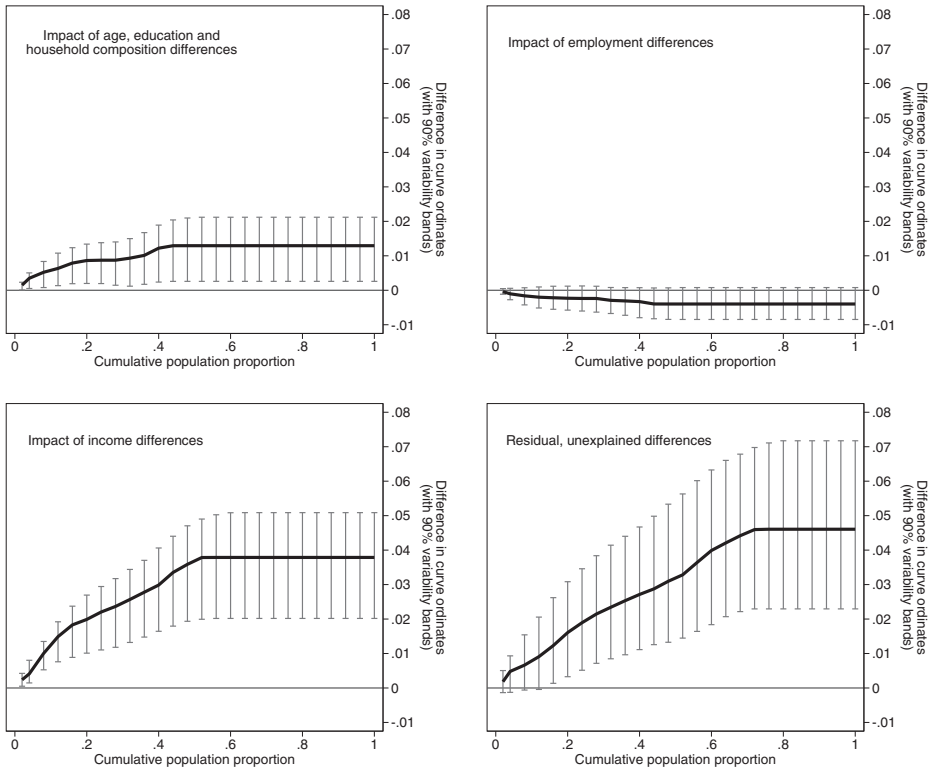

Figure 4. Marginal effects of components

Luxembourg nationals and 46 percent of Portuguese lack the "*capacity to face unexpected expenses*", resulting in a large and statistically significant deprivation gap of 34 percentage points. Columns in between these results show the expected deprivation at each stage of the five reweighting stages.

In line with our aggregated results, the size of the gap for each item is reduced when population characteristics of Luxembourg nationals are substituted for those of Portuguese i.e. when the Luxembourg sample is reweighted to reflect Portuguese characteristics.

For all items within the economic strain dimension, before conditioning on income, differences in education explain most of the reduction in the item-level gap. Once income differences are accounted for (AHELY), we no longer find sizeable systematic differences between nationals and Portuguese on these items. Differences in item means become small and none remain statistically significant (except perhaps for the "capacity to face unexpected expenses"). This finding is rather intuitive and validates the critical importance of the association between income and financial distress.

We observe comparable results on items reflecting possession of common durable goods. Observed differences between the two groups disappear once income differences are controlled for, with the exception of the possession of a dishwasher and, most notably, of a computer. Interestingly, the gap of the latter is

TABLE 2

Deprivation Item Means in Raw and Reweighted Samples and Item-Level Deprivation Gaps of Portuguese Immigrants

	LU						PT
	Raw	A	AH	AHE	AHEL	AHELY	Raw
1. Capacity to face unexpected expenses	0.12 [0.34]*	0.15 [0.31]*	0.14 [0.33]*	0.26 [0.21]*	0.25 [0.21]*	0.37 [0.10]*	0.46
2. Capacity to eat meat/fish	0.01 [0.02]*	0.01 [0.02]*	0.01 [0.02]*	0.02 [0.01]	0.02 [0.01]	0.05 [–0.02]	0.03
3. Capacity to pay a week's holiday	0.06 [0.15]*	0.08 [0.13]*	0.07 [0.14]*	0.12 [0.10]*	0.11 [0.10]*	0.19 [0.02]	0.21
5. Difficulty paying bills	0.01 [0.03]*	0.02 [0.03]*	0.02 [0.03]*	0.03 [0.02]*	0.02 [0.02]*	0.07 [–0.02]	0.05
4. Capacity to keep house warm	0.00 [0.01]*	0.00 [0.01]*	0.00 [0.01]*	0.00 [0.01]*	0.00 [0.01]*	0.00 [0.01]	0.02
6. Inability to pay rent/mortgage	0.01 [0.03]*	0.01 [0.03]*	0.01 [0.03]*	0.02 [0.02]*	0.02 [0.03]*	0.05 [–0.01]	0.04
5.+6. Inability to pay rent/mortgage or bills (combined)	0.02 [0.04]*	0.02 [0.04]*	0.02 [0.04]*	0.03 [0.03]*	0.03 [0.03]*	0.08 [–0.02]	0.06
7. Possession of TV set	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]*	0.00
8. Possession of phone	0.00 [0.00]	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]	0.00
9. Possession of dishwasher	0.00 [0.00]	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]*	0.00 [0.00]*	0.00
10. Possession of computer	0.01 [0.09]*	0.01 [0.09]*	0.01 [0.09]*	0.01 [0.08]*	0.01 [0.09]*	0.02 [0.08]*	0.10
11. Possession of car	0.01 [0.02]*	0.01 [0.02]*	0.00 [0.02]*	0.01 [0.02]*	0.01 [0.02]*	0.02 [0.01]	0.03
12. Leaky roof	0.04 [0.01]	0.04 [0.01]	0.05 [0.01]	0.04 [0.01]	0.04 [0.01]	0.06 [–0.00]	0.05
13. Rot in house	0.06 [0.07]*	0.07 [0.07]*	0.07 [0.07]*	0.07 [0.06]*	0.07 [0.07]*	0.11 [0.02]	0.13
14. Damp in house	0.10 [0.04]*	0.11 [0.03]	0.11 [0.03]	0.12 [0.02]	0.12 [0.02]	0.17 [–0.03]	0.14
12.+13.+14. Leaky roof/damp/rot (combined)	0.12 [0.06]*	0.14 [0.05]*	0.14 [0.05]*	0.14 [0.05]	0.14 [0.05]	0.20 [–0.01]	0.19
15. Double glazing	0.13 [0.09]*	0.09 [0.13]*	0.09 [0.14]*	0.08 [0.15]*	0.07 [0.16]*	0.10 [0.12]*	0.23
16. Hermetic doors/windows	0.10 [0.05]*	0.10 [0.05]*	0.10 [0.05]*	0.13 [0.02]	0.13 [0.03]	0.19 [–0.04]	0.15
17. Outdoor space	0.05 [0.26]*	0.06 [0.25]*	0.04 [0.27]*	0.08 [0.23]*	0.07 [0.24]*	0.10 [0.21]*	0.31

Notes: Figures in square brackets are differences between raw item means for target sample (Portuguese) and item means for (reweighted) reference sample (Luxembourgers). Stars indicate that these differences are statistically significant at 90% confidence levels. Combined items are equal to 1 if any of the deprivation items combined equal to 1.

largely unexplained—our factors only explain one of the eight percentage point differences between the two groups. Other factors, perhaps cultural, appear to be at play on this particular item. Note that the gap in all items included in the official "EU set" fully disappears once differences in income are accounted for.

Results for items reflecting housing conditions are more contrasted. While raw differences on all items are to the disadvantage of the Portuguese, the gap

turns to their advantage on four of the seven items including having a leaky roof, damp and rot in the house or lacking hermetic doors and windows. This finding suggests that the Portuguese appear to have better housing conditions than nationals with similar characteristics. This could be potentially explained by the large contingent of Portuguese workers in the construction sector. Differences are not significantly different from zero however. Notable exceptions are the "availability of outdoor space" and "double glazing", which remain significantly to the disadvantage of the Portuguese. The former can allegedly be related to the time-invariant character of the presence of outdoor space in an accommodation, as this cannot be "fixed" by repair or transformation work but is tied to the initial investment. Both are also consistent with the housing investment choice of diaspora migrants (and/or transmigrants), who view their migration decision as a temporary sacrifice to "achieve a better life" upon their return to their native land (Constant *et al.*, 2009). This notion of temporary migration is largely shared by all Portuguese communities in Northern Europe (Afonso, 2010; Borges, 2011).

Despite its high housing costs, Luxembourg is considered a successful model of residential integration as foreign-born are not more likely to reside in subsidized public housing than nationals (Fetzer, 2010). While Portuguese are much less likely to own their principal residence than nationals, this housing gap is reduced by half once including their housing owned overseas—about 20 percent of Portuguese households who do not own their residence in Luxembourg own one abroad, most likely in their country of origin (Berger, 2004).

At the same time, given the high private ownership of land in Luxembourg (Cahill and McMahon, 2010), it is likely that in-vivo transfers and inheritance ease Luxembourg nationals' access to housing including properties with an outdoor space (which is likely to proxy some of the aforementioned factors). Overall, these considerations are likely to loosen the link to education and income. Material deprivation indicators that include housing indicators are therefore less closely determined by income.

6. Concluding Remarks

The socioeconomic integration of immigrants to their host destination has been the object of numerous studies on income, earnings, or employment differentials. Our study examines the degree of material deprivation of Portuguese migrants measured by the distance between Luxembourg nationals and immigrants in terms of several non-monetary dimensions. We find that material deprivation among Portuguese is non-negligible and the nationality gap is large. This finding corroborates Haisken-DeNew and Sinning (2010) who show that immigrants in Germany are more severely deprived than nationals. It is also consistent with the few studies reporting that Portuguese in Luxembourg lag behind Luxembourg nationals in income, employment and educational attainments (see Langers, 2006; Hartmann-Hirsch, 2007; Alieva, 2010; Van Kerm and Villeret, 2007). To the extent that the poor performance of Portuguese immigrants does not appear to be limited to Luxembourg, as suggested by Kalter and Granato (2002), Bauer *et al.* (2002), Brinbaum and Kieffer (2009) or Afonso (2010), our application provides

an assessment of potentially broader relevance for all European countries which also share an important population of Portuguese residents.

With the exception of our so-called "EU set" which exclusively focuses on the most basic deprivation items following the practice of the European Commission, we find compelling evidence that material deprivation is not entirely accounted for by income differentials (conditional on population composition), in particular when housing conditions are taken into account. This observation gives further support to the use of a multidimensional approach encompassing income to examine well-being. At the same time, it casts doubt on the value added by the official EU indicator—in its current format—over the simple use of an income based indicator in a country like Luxembourg.

Throughout the analysis, we impose a common weighting of items for both nationals and Portuguese immigrants and implicitly assumed common "preferences" over deprivation items in the two groups. We believe that our results could be altered if national and immigrant households assess their well-being differently, with respect, e.g., to idiosyncratic norms or reference groups (Haisken-DeNew and Sinning, 2010; Dickes *et al*., 2010; Bellani and D'Ambrosio, 2011; Bellani, 2013). Adjusting the structure of the deprivation index to subgroup deprivation levels in subgroup comparisons within a country is however normatively debatable and—we believe—best avoided in this context.

We note finally that the methods employed in the paper have potential application more generally. There is a large consensus supporting the view that deprivation (or poverty) is an inherently multidimensional concept which encompasses a broad spectrum of dimensions, implying that the sole use of income-based indicators would likely fail to capture important elements of human well-being; see, e.g., Sen (1992) or Bourguignon and Chakravarty (2003). As a result, multidimensional and non-monetary deprivation indicators are gaining popularity in Europe and elsewhere to better understand and identify poverty, the feeling of poverty, and social exclusion; see OECD (2011) or Nolan and Whelan (2010) for a recent discussion. Our methodological framework could be adapted to compare such multidimensional outcomes across population groups—substituting the material deprivation indicators we focus on by broader, multidimensional socioeconomic outcome indicators. In particular, given evidence of variations in the degree of socioeconomic performance according to alternative dimensions (Aleksynska and Algan, 2010), integrated, multidimensional analysis of immigrants socioeconomic integration along these lines is an avenue for future research.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

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