ARE REGIONAL DIFFERENCES IN NOMINAL WAGES COMPENSATED BY A DIFFERENT COST OF LIVING IN THE SWISS REGIONS?

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1. THE IMPORTANCE OF THE REGIONAL COST OF LIVING

In Switzerland, large differences in average nominal wages between cantons and regions, for which statistical information is easily available, are often taken as a measure of spatial disparities and, therefore, become a matter of debate concerning regional policy. For example, average wages in Ticino are around 17% lower than in Zurich, a statistical fact that seems to indicate a much lower level of welfare, and thus becomes an argument in favor of compensatory policy measures. A regional price index, so far not existent in Switzerland, would permit to give a more realistic picture of regional disparities and, hence, correct a distorted perception of regional disparities, but also obviate inefficient migration and location decisions.

In order to shed light on cost of living differences, and thus supporting a more equilibrated discussion of disparities, on the one hand, and a better understanding of wage dynamics, migratory flows and location choices of companies on the other, we attempt here to build a synthetic index for the different cost of living in the 7 Swiss regions. Due to the lack of proper data, some simplifications and assumptions have been made. We have been able to cover about 50% of the different regional market basket of consumer goods, as reported in the Household Budget Survey (HBS) with direct or indirect estimation of the price; for the price of the residual goods, we propose three scenarios. Our results suggest that significant differences in the cost of living among the Swiss regions exist, and that in five of the six regions compared to the Zürich area, these differences are able to compensate wage differentials.

2. INDICES FOR THE REGIONAL COST OF LIVING

Cost of living differences have been a topic of great interest in literature. From a theoretical perspective, several economic theories have been developed in the past years to explain regional or national different levels of prices. Balassa (1964) and Samuelson (1964) developed a theoretical model to explain Purchasing Power Parity differences among nations; in the Balassa (1964) model, “the greater are productivity differentials in the production of tradable goods between countries, the larger will be differences in wages and in the prices of services and correspondingly the greater will be the gap between purchasing power parity and the equilibrium exchange rate”.
Roback (1982, 1988) explains almost all the differences in regional prices – reflected in both the wage and the rent gradient – with the value of local amenities. Roback (1982) showed empirically that the regional wage differences could be largely explained by local amenities and, in his theoretical framework, rent, traded and non-traded goods prices change with respect to a change in the level of amenities.

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More recently, Moretti (2013) found that the difference between the wage of skilled workers and of unskilled workers in US is significantly lower in real terms than in nominal terms, due to the different regional cost of living caused by a change (shock) in the demand of skilled (and more productive) workers[1].

From an empirical point of view, several indices have been developed in order to assess differences in national prices, to compare national account measure as GDP, consumption, wages, both in time and in cross-sectional analysis. Nowadays, Power Purchasing Parity (PPP) measures are widely available and currently used for country comparisons, in order to correct for the different purchasing power among nations. There exist also attempts to estimate regional purchasing power, the regional cost of living, especially in large countries as the US – as realized by Koo et al. (2000) – or in countries with big economic differences among regions, as in Italy – see Cannari and Iuzzolino (2009). Computations of the regional cost of living (COL) indices are usually based on the detailed price data collected for the Consumer Price Index (CPI) estimation as in Moulton (1995) or Kokoski et al.(1996), among others. The prices collected in these datasets are often corrected for the quality of goods and outlet characteristics applying a hedonic regression. When data are partially available, different techniques have been proposed. Moretti (2013) estimated the price for the component of non-housing goods regressing changes in the official CPI local index on changes in housing costs[2], then imputing the estimated systematic component of non-housing costs to all the regions where official data were lacking[3].

Prices are then aggregated in a COL index with the specific expenditure shares.

From a theoretical point of view, as reported by Koo et al. (2000), "the true regional COL index is the change in the cost of attaining some base level of utility *u**, between a base region *b* and a comparison region c:

$$\frac{e(p^c,u^*)}{e(p^b,u^*)} \qquad (1)$$

where p^c and p^b denote the prices faced by the representative individual in the respective regions, and e denotes the individual's expenditure function that gives the minimum cost of attaining base level of utility u* when faced with a set of prices, p, for the goods and services that enter the individual's utility function". Empirically, the main problem regards the estimation of the "same level of utility" between the areas *b* and *c*, as expenditure shares and marginal utility of goods vary across regions and are not easily computable or even feasible. Cost of living indices represent therefore only approximation of the true theoretical COL index.

Common approximations of this theoretical ratio are the Laspeyres index,

$$P^L = \frac{\sum_{i=1}^{n} p_i^c q_i^b}{\sum_{i=1}^{n} p_i^b q_i^b} \qquad (2)$$

and the Paasche index,

[1] Moretti (2013) proposed a theoretical model in which the wage differences could be generated by both a demand or supply shock on the labor market, proving then empirically that in US the shock was been on the demand side.

[2] The price of houses (rent or purchase) is widely available across almost all nations at a regional or municipal level.

[3] $CPI_r = w_r(HP_r) + (1-w_r)NHP_r$ and $NHP_r = \pi_r HP_r + v_r$ where CPI_r is the regional CPI index, w_r is the expenditure share on housing related goods (rent and other expenses) in region r, HP_r is the housing price in the r region, NHP is the price of non-housing goods and v_r is the component orthogonal to housing costs.

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$$P^P = \frac{\sum_{i=1}^{n} p_i^c q_i^c}{\sum_{i=1}^{n} p_i^b q_i^c} \qquad (3)$$

where *p* denotes the price, *q* the quantity, *i* is the good consumed and the superscripts *b* and *c* are respectively the base region and the comparison region.

These two indices are different approximations of the true COL. The Laspeyres index uses the utility in the base region as reference and is therefore a proxy for the true COL in the base region, whereas in the Paasche index the base utility is that of the compared region; Paasche index is therefore a proxy for the true COL of the compared region. Both indices assume a fixed market basket for each region; consequently, they are not able to consider the substitution effect (the ability of consumers to substitute between products based on the relative price of the goods, in order to increase their utility). The direction of this bias moves in the opposite direction for the two indexes[4], giving rise to the so-called Laspeyres-Paasche gap. This difference is usually small, especially in a time comparison where changes in the shares of goods consumed are small, but it increases in a cross-country comparison, specifically when the baskets of goods consumed are very different[5]. We refer to the weight of consumption goods applied in the COL index computation as the characteristicity of the index. In this sense, a COL index should satisfy the characteristicity property, i.e. the weights should be characteristic for the regions compared.

In 1992, Fisher (1992) proposed taking the geometric mean of the Laspeyres and Paasche index (the Fisher Index). Konus (1924) proved this index to be the exact COL index for the homogeneous quadratic utility function. Another perfect measure of COL – a "superlative index" as defined by Diewert in 1976 – of a specific utility function is the Törnqvist index for the translog utility function.

Another problem arise when the regions to compare are more than two: the index have to be transitive. Transitivity implies that comparing regions *a* and *c* indirectly through region *b* is identical with comparing *a* and *c* directly. However, the characteristicity property is incompatible with the transitivity property, due to the different basket of goods set as reference. During the past years, scholars developed several approaches to not completely sacrifice characteristicity for transitivity. The two best known methods are the central-country (region) solution (Drechsler, 1973) and the EKS (Eltetö-Köves-Szulc) method (Köves 1999).

In the central-country solution, one single region is used to carry out the multilateral comparisons. Transitivity can be achieved by keeping all other individual indexes fully characteristic and compiling other indexes as products or quotients of the appropriate central index, while EKS method achieves transitivity by minimizing the deviation of the EKS indexes from the Fisher indexes[6]. For the purpose of our analysis, we chose to consider a central-country Paasche index, since we are interested in comparing the 6 great Swiss statistical region with respect to the Zürich area.

[4] The Laspeyres index overestimates the real COL in each regions while the Paasche index underestimates it

[5] In our case, the difference between the two indexes are negligible, because of the small differences between our regional baskets of goods.

[6] $P_{i/j}^{EKS} = \left(\frac{\Pi_k P_{i/b}^F}{\Pi_k P_{j/b}^F}\right)^{1/n}$, where $P_{i/b}^F$ is the Fisher index with *b* as base region and *j* as comparison region.

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3. A COL INDEX FOR THE SWISS REGIONS

An attempt to capture the cost of living differences in the Swiss cantons has been made by Carnazzi-Weber and Rühl (2008). They compute the cantonal "freely disposable income" that is the amount available for consumption for a given type of taxpayer. The index was calculated by from the gross earnings taxes on income and assets, social security contributions (second pillar), social insurance contributions (AVS, AI, etc.), healthcare insurance, rental costs and utility expenses. Not accounting for regional price difference, their index does not express the purchasing power in the different Swiss regions, but rather their attractiveness in terms of taxation and fixed residential costs. What we propose here, is to estimate a regional cost of living index and use it to compare nominal regional wages on the one hand and regional disposable income on the other.

3.1 Methodological approach

The first aim of our analysis is to compare the differences in regional wages with the differences in the cost of living among the seven Swiss statistical regions. As we saw before, there are different ways to compute a regional cost of living index; we chose to use a Paasche index, the best COL index for the compared region, setting Zürich as central region. Since we will compare regional wages applying a Mincer equation in order to control for all the demographic characteristics of the employee and employer, regional wage differences will be estimated by six regional binary variables. These dummy variables estimate the relative value of region *i* wage with respect to the wage in the reference (base) category – the Zürich region. We chose therefore to proceed to compute the Paasche index because of its best characteristicity for the compared region and because this approach permits to compare directly the two measures (binary regional variables for wages and relative COL) and to assess the differences without further transformations. Our price index[7] will therefore be:

$$P^P = \frac{\sum_{i=1}^{n} p_i^c q_i^c}{\sum_{i=1}^{n} p_i^{ZH} q_i^c} \qquad (4)$$

where p_i^{ZH} is the price of good *i* in the region of Zürich, p_i^c is the price of good *i* in the compared region (Région Lémanique, Nordwest Schweiz, Zentral Schweiz, Espace Mittelland, Ostschweiz and Ticino) and q_i^c is the quantity of good *i* consumed in the compared region. It is easily shown that equation 4 can be rewritten as:

$$price\ index_c = \sum_{i=1}^{n} w_{ic} * \left(\frac{p_i^c}{p_i^{ZH}}\right) \qquad \Pi \qquad (5)$$

where w_{ic} is the share of the consumption of good *i* in the country *c* basket of consumption[8]. Since we cannot rely on detailed regional CPI data, we compute the price of the goods consumed as the ratio between the expenditure and the quantity consumed as reported on the Household Budget Survey (HBS), collected by the Swiss Federal Statistical Office. This computation relies on the assumption that the classes of consumed goods

[7] For a better reading comprehension, we will normalize to 100 the Zurich region.

[8] The regional baskets of consumer goods are computed from the Household Budget Survey (HBS); the weights applied are the ratios between the regional expenditure in the *i* goods and the total regional consumption expenditure.

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are homogeneous among the regions[9]. When official statistical surveys are not available, we proceed with some assumptions on the regional distribution of the goods' prices. We implement three scenarios, based on previous theoretical and empirical findings, where the first and third scenarios are limit cases. In the first scenario, the prices of the goods are equally distributed among all regions while in the third scenario prices have the same distribution as the house rental prices. These assumptions rely on the limit case of perfectly tradable goods, with uniform prices across regions, and non-tradable goods, which prices are a function of labor and capital. In the latter case, rental price is set as a proxy for the cost of capital and is assumed to be the only element to enter in the production function[10]. In the second scenario, we make some realistic assumptions on the price distribution.

3.2 Source and data

In order to compute our regional COL index, we rely on multiple data sources. The main source is the Household Budget Survey (HBS) for 2009-2011 years, collected by the Swiss Federal Statistical Office. With this source, we compute prices for the food and non-alcoholic beverages (12,1% of the national household consumption expenditure), alcoholic beverages and tobacco (2% of the national household consumption expenditure), fuel and lubricants (2,7%). Other important sources are: the Building and housing report collected by the Swiss Federal Statistical office, for the rental price of 3 and 4 room flats with reference year 2010 (20% of the national household consumption expenditure); Schleiniger (2014) for the healthcare expenditure price, with reference years 2004-2010 (4,9% national household consumption expenditure [11]) and Elcom for the price of electricity (1,4%, with reference year 2010). The prices for communications (3,3% of the national household consumption expenditure) are the same among all the regions. With these sources, we are able to observe about 46% of the national household consumption expenditure; this share is included in a range between 49% and 45%, when the 7 different regional household baskets expenditures are considered. We will refer to the aggregation of these goods as the directly detected goods[12]. In table 1, it is possible to observe the share of consumption for each good in each region.

[9] We are not concerned about this issue because of the high level of disaggregation of the goods reported (6 digit classifications).

[10] Rental prices are fully representative of the non-tradable class of goods, and have the most extreme distribution of price detected among regions.

[11] For the sake of clarity, we do not consider in this share the mandatory healthcare insurance, as it is not classified as consumption expenditure.

[12] The prices for these goods are drawn, directly or indirectly, from official statistic or are already computed in published empirical work.

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Table 1. Household national and regional expenditure (share on total consumption expenditure) and sources used to compute the regional cost of living index.

	Switzer-land	Région Lémani que	Espace Mittel-land	Nord-west schweiz	Zürich	Ostsch weiz	Zentral schweiz	Ticino	
Directetcly detected goods	***46%***	***49%***	***46%***	***45%***	***45%***	***45%***	***46%***	***48%***	***Sources:***
51: Food and non-alcoholic beverages	12.1%	12.9%	13.0%	11.7%	10.4%	12.6%	11.8%	12.7%	Household Budget Survey (HBS), 2009-2011
52: Alcoholic beverages and tobacco	2.0%	2.1%	2.0%	2.0%	1.9%	1.9%	2.0%	2.1%	Household Budget Survey (HBS), 2009-2011
6215: Fuels and lubricants	2.7%	3.0%	2.9%	2.4%	2.1%	3.0%	2.8%	3.7%	Household Budget Survey (HBS), 2009-2011
5711: Rent price or mortgage interest on primary residence	20.0%	20.4%	18.5%	20.0%	21.8%	18.7%	20.6%	18.9%	Federal Statistical Office (FSO), Press Release n. 0352-1302-70, 28.03.2013 (2010 data)
61: Health expenditures	4.9%	5.3%	5.1%	4.6%	4.8%	4.7%	4.5%	5.0%	Schleiniger (2014)
63: Communication	3.3%	3.7%	3.3%	3.1%	3.0%	3.2%	3.0%	4.0%	Federal Office of communication
5713.01 Energy for the primary residence	1.4%	1.6%	1.5%	1.3%	0.9%	1.4%	1.4%	1.7%	Elcom, Federal Electricity Commision, Cantonal Electricity
Not directetcly detected goods	***54%***	***51%***	***54%***	***55%***	***55%***	***55%***	***54%***	***52%***	***Hypothesis (Scenarios)***
53: Hotels and restaurants	10.0%	9.2%	9.9%	10.0%	10.7%	10.3%	10.7%	8.6%	3 Scenarios
56: Clothing and footwear	4.3%	3.9%	4.2%	4.5%	4.4%	4.6%	4.4%	4.6%	3 Scenarios
5712: other expenses for primary residence	3.4%	3.1%	3.4%	3.4%	3.6%	3.3%	3.4%	3.3%	3 Scenarios
5713.02 and 5713.03: gas, other fuels and central heating	0.9%	1.2%	1.0%	0.9%	0.6%	1.0%	0.6%	1.4%	3 Scenarios
572 and 573: rent price, maintenance, for secondary residence	1.9%	2.0%	2.1%	1.9%	1.7%	1.9%	1.4%	1.7%	3 Scenarios
58: Furnishings, household equipment and household maintenance	5.1%	4.6%	5.3%	5.7%	5.0%	5.2%	5.3%	4.9%	3 Scenarios
62: Transport (except 6215)	11.1%	10.5%	11.4%	11.2%	11.0%	11.1%	11.7%	11.3%	3 Scenarios
66: Entertainment, recreation and culture	11.5%	11.5%	11.4%	11.7%	11.6%	11.9%	11.2%	11.1%	3 Scenarios
67: Schooling and courses expenses	0.8%	0.5%	0.6%	0.8%	1.1%	0.9%	1.0%	0.3%	3 Scenarios
68: Other goods and services	4.7%	4.6%	4.2%	4.8%	5.5%	4.4%	4.2%	4.7%	3 Scenarios
Total Expenditure	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	

Percentages in the table represent the national and regional share of consumption for each good; the share of consumption is equal to the ratio between the specific good expenditure (as defined by the NOGA number classification) and the regional total consumption expenditure, as reported in the HBS. The last column shows the sources used to define prices.

3.3 Estimate of the Swiss regional COL index

The prices for Food, beverages, Fuels and Lubricants are computed as the ratio between the regional expenditure and regional quantity consumed for each good at a 6-digits level, as reported by the Federal Statistical Office in the Household Budget Survey, for the year 2009-2011. The prices are then weighted by the share in the regional consumption basket, at a 6-digit level. The housing rental prices are given by the Federal Statistical office: for the purpose of our analysis, we considered the 3 and 4 rooms flat rental price, as they are the most significant and

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representative housing units to compare. The data on rental price are available at a cantonal level; we therefore proceed to aggregate them at a regional level, weighting for the number of household in each canton. Communication expenditures include mainly the cost for fixed and mobile phones, whose prices are equal among all of the regions. The price of energy for the primary residence comes from the Federal Electricity commission that collects data at a cantonal level. Electricity prices are for a standard H3 class of consumer[13] and represent the final bill paid by families, including tax and others fares.

The price for health expenditures was set equal for all the regions. We analyzed the results of Schleiniger (2014), Crivelli et al. (2007) and the cantonal cost of a TarMed point[14] reported by CSS Assurance and New Index AG. The results of Schleiniger (2014) and Crivelli et al. (2007) suggest that the different cantonal cost for the healthcare insurance in Switzerland is mostly driven by the quantity of goods consumed[15].

In table 2, we report the regional distribution of prices for the directly detected goods. Prices are centered at 100 in the Zürich region and weighted for the share of regional consumption. Most of the categories observed exhibit a similar pattern: the region of Zürich is the most expensive for consuming food and non-alcoholic drinks (other regions have lower prices in a range between -8% and -4%) and especially for renting a house (from -25% in Espace Mitteland to -10% in Zentral Schweiz); as expected, prices of fuels and lubricants are quite the same in all the regions (prices are in range between -2% and -0.3% than the Zürich region). Alcoholic beverages and tobacco are cheapest in Ticino (17% lower than Zürich) and most expensive in Zentral Schweiz (7% higher than Zürich), due to the high level of expenditure for imported wines. The prices for healthcare services or goods as well as communication prices are set equal across all regions. Electricity prices (energy) are the only ones to exhibit a different pattern. Due to the different cost of production (nuclear and hydroelectric), distribution (scale economy) and tax charge, Zürich has the cheapest tariffs across Switzerland while households living in Région Lemanique and Espace Mitteland pay 46% more than households in Zürich. Weighting all these different prices for the regional basket of consumption, we observe a high variance in the aggregate price of this partial regional basket of consumer goods (the price level for the goods directly detected). Households living in Ticino, Espace Mitteland and Ostschweiz pay about 10% less than families in Zürich to purchase these baskets of goods, while price differences in Zentral Schweiz, Nordwest Schweiz and Région Lemanique are between -7% and -5% lower than in Zürich.

[13] 4500 kwh consumed in a year. Standard consumption for a 4 rooms flat with boiler

[14] TarMed is the name of the tariff system for all doctors throughout Switzerland. The pricing of medical services with TarMed is calculated consistently throughout Switzerland with so-called tax points. However, the amount of remuneration per tax point varies from canton to canton.

[15] Further detail in Appendix, Figure A.1.

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Table 2. Level of price and share on total consumption, in brackets, in the seven Swiss regions.

	Région Lémanique	Espace Mittel-land	Nord-west schweiz	Zürich	Ostschweiz	Zentral schweiz	Ticino
Directly detected goods							
51: Food and non-alcoholic beverages	95.9 (12.9%)	92.8 (13%)	94.1 (11.7%)	100 (10.4%)	91.6 (12.6%)	93.8 (11.8%)	93 (12.7%)
52: Alcoholic beverages and tobacco	97.8 (2.1%)	89.6 (2%)	91.9 (2%)	100 (1.9%)	92.7 (1.9%)	106.7 (2%)	82.8 (2.1%)
6215: Fuels and lubricants	99.7 (3%)	98.2 (2.9%)	99.2 (2.4%)	100 (2.1%)	98.8 (3%)	99.7 (2.8%)	99.2 (3.7%)
5711: Rent price or mortgage interest on primary residence	86 (20.4%)	75.2 (18.5%)	86.8 (20%)	100 (21.8%)	76.8 (18.7%)	89.4 (20.6%)	77.8 (18.9%)
61: Health expenditures	100 (5.3%)	100 (5.1%)	100 (4.6%)	100 (4.8%)	100 (4.7%)	100 (4.5%)	100 (5%)
63: Communication	100 (3.7%)	100 (3.3%)	100 (3.1%)	100 (3%)	100 (3.2%)	100 (3%)	100 (4%)
5713.01 Energy for the primary residence	146.3 (1.6%)	147.5 (1.5%)	127.7 (1.3%)	100 (0.9%)	130 (1.4%)	142.3 (1.4%)	136.6 (1.7%)
Price Level (weighted average)	**94.6**	**89.1**	**93.0**	**100.0**	**88.6**	**95.2**	**90.0**

For each good, the table reports the price level with respect to the region of Zürich. Percentages in round brackets represent the share of consumption for the household living in the region. Price level for the directly detected goods are computed as a weighted average (for the regional basket of consumption) of the price calculated by the source reported in table 1.

A different approach is used for the goods where no direct observations are available. Two extreme scenarios are proposed. The first scenario sets the prices of all remaining goods equal for all regions (perfectly tradable goods) while in the third scenario the price distribution of the residual goods is equal to the rental price distribution for a primary residence (entirely not-tradable goods). In the second scenario, more specific and realistic assumptions are made (see table 3): for hotels and restaurant, others expenses for primary residence, rental price and maintenance for secondary residence, we assumed the same price distribution of the rental price on primary residence. For clothing and footwear, furnishings, transport and schooling we set the price equal across all the regions. Gas and central heating have the same distribution of the electricity price while entertainment, recreation and culture has the same price distribution of the directly detected goods.

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Table 3. Price distribution hypothesis for the not observable goods.

<table>
<tr><th></th><th>Scenario 1</th><th>Scenario 2</th><th>Scenario 3</th></tr>
<tr><td>53: Hotels and restaurants
5712: other expenses for primary residence
572 and 573: rent price, maintenance, for secondary residence</td><td rowspan="5">Same price in all the regions</td><td>Same price distribution as the rental price of primary residence</td><td rowspan="5">Same price distribution as the rental price of primary residence</td></tr>
<tr><td>56: Clothing and footwear
58: Furnishings, household equipment and household maintenance
62: Transport (except 6215)
67: Schooling and courses expenses</td><td>Same price in all the regions</td></tr>
<tr><td>5713.02 and 5713.03: gas, other fuels and central heating</td><td>Same price distribution as the electricity price</td></tr>
<tr><td>66: Entertainment, recreation and culture
68: Other goods and services</td><td>Same price distribution as the directly detected goods</td></tr>
</table>

The table reports the assumptions made to estimate the level of price for the not directly detected goods.

With these assumptions[16], we proceed to compute the Swiss regional COL index for the three scenarios, weighting the prices for the different regional baskets of consumption. Results are in figure 1. According to the second scenario, Ticino, Espace Mitteland and Ostschweiz exhibit a cost of living about 10% lower than Zürich while the differences are smaller for the others regions; the cost of living in Zentral Schweiz, Région Lémanique and Nordwest Schweiz is respectively 4%, 5% and 6% lower. The differences in the cost of living continue to be significant even in the first scenario, where the price of not directly observable goods was set equal across all the regions.

[16] We obtain similar results replicating the Local CPI 2 developed by Moretti (2013), setting $\pi = 0.35$. See figure A.3 in appendix.

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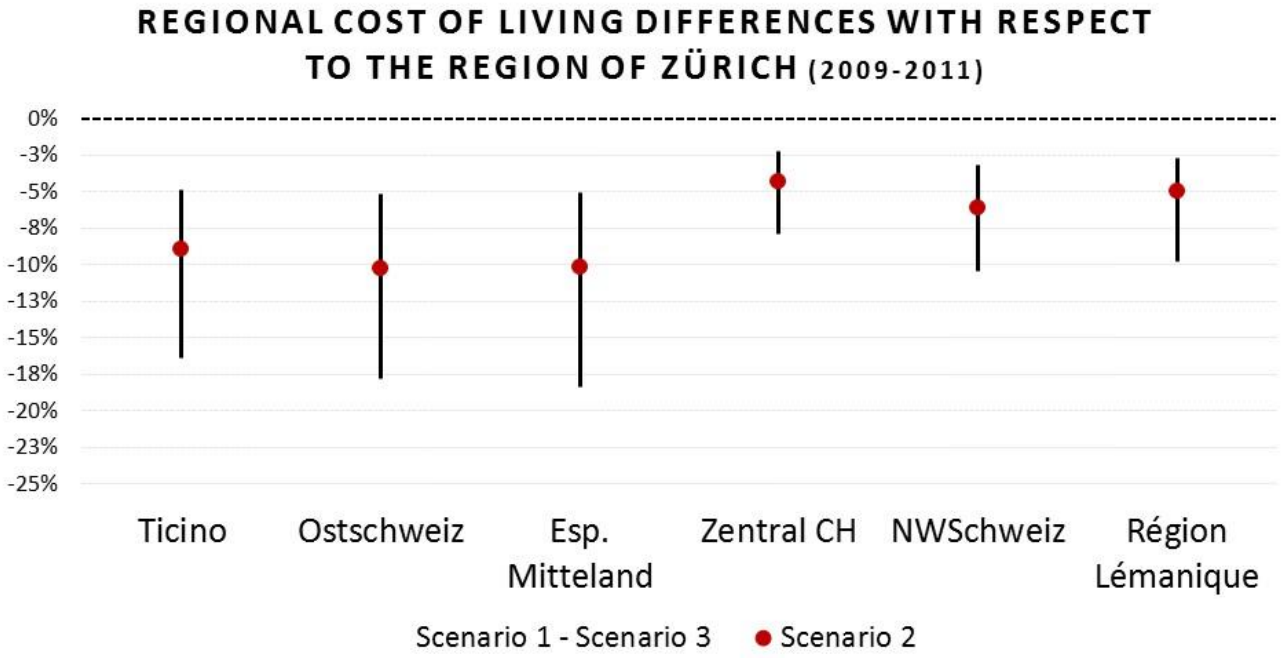
Figure 1. The Swiss regional Cost of Living Index, including scenarios for the prices not directly observable.



	Zürich	Zentral Schweiz	Région Lémanique	Nordwest Schweiz	Ticino	Espace Mittelland	Ostschweiz
Scenario 1	100	97.8	97.3	96.8	95.2	94.9	94.8
Scenario 2	100	95.7	95	93.9	91.1	89.9	89.7
Scenario 3	100	92.1	90.2	89.6	83.7	81.6	82.2

In figure 1, we observe the Cost of Living differences with respect to the region of Zürich. The round red points represent the differences in COL for the second scenario hypothesis while the black lines underline the range of value between the first (minimum probable price differences) and third scenario (maximum possible price differences). Scenarios are needed for the not directly detected goods.

4. WAGE DIFFERENCES AMONG THE SWISS REGIONS

The aim of our analysis is to assess if the differences in the cost of living are able to compensate the potential differences in the regional level of wages. Io order to answer this question, we need to evaluate regional differences in wages, keeping constant, across all the regions, others factors affecting the wage level. This means to evaluate the impact on earnings of being employed in one of the seven regions while controlling for all the characteristics of the employee and employer. We will therefore refer to the Mincer equation as our toolkit to solve this task. The Mincer earnings equation (Mincer, 1974) is one of the most widely used models in empirical economics[17]. It has been developed to evaluate the impact of education on earnings, but its field of applications has significantly extended over the years. It has been used to study inequality, as in Machin and Puhani (2003)

[17]See Heckman (2003) and Lemieux (2006).

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or wage exporter premium, Munch (2008), to mention a few. Mincer (1974) models the log of earnings as a function of education, experience (linear and quadratic term) and a constant equal to the earnings of someone with no education and no experience. Other explanatory variables have been added, such as demographic characteristic of employer and employee, as gender, nationality, age, dimension and sector of firms, to name but a few. We therefore proceed to estimate the regional wage differential trough this equation, adding a set of six binary variables for the seven Swiss regions (Zurich is set as the base category).

Our equation takes the following form:

$$\ln(w_{ijt}) = \beta X_{it} + \gamma Z_{jt} + \phi_r + \alpha_s + \mu_t + \varepsilon_{ijt} \quad (6)$$

where w_{ijt} is the standardized gross monthly wage of worker *i* in the firm *j* at time *t*, X_{it} is a vector of worker specific variables, Z_{jt} is a vector of firm specific variables, ϕ_r is a vector with our six regional binary variables, α_s and μ_t are sector and year fixed effects.

Data are taken from the Schweizerische Lohnstrukturerhebung (LSE)[18] for the year 2008, 2010 and 2012 and aggregated in a pooled cross sectional structure. Panel techniques are not applicable as workers and firms are anonymized. We exclude from this sample all workers with a G permit (trans-border commuters) as they are not resident on the national territory. Control variables for the worker include education, experience, experience squared, year in the same firm, year in the same firm squared, gender, marital status, if part-time worker, if he agreed to a collective contract, type of work permit (Swiss worker, Perm. B, Perm. L, Perm. C, Other Perm.), level of qualification (managerial activity); Z_{jt} represents the size of the firm, α_s is a set of binary variable for the 2-digit NOGA sectors and μ_t is a set of binary variables for the years fixed effects. ϕ_r is the set of 6 binary variables for the Swiss regions, where Zürich is set as the reference category. Control variables are in logarithm except for binary variables while standard errors are clustered at sectoral level[19]. Figure 3 displays the results for our regional binary variables.

[18] Swiss Earnings Structure Survey

[19] Robustness tests are conducted with tri-clustered standard errors (years, regions and sector); the significance of the regional coefficient does not change except for the Nordwestschweiz, for which the difference with Zürich becomes not significant.

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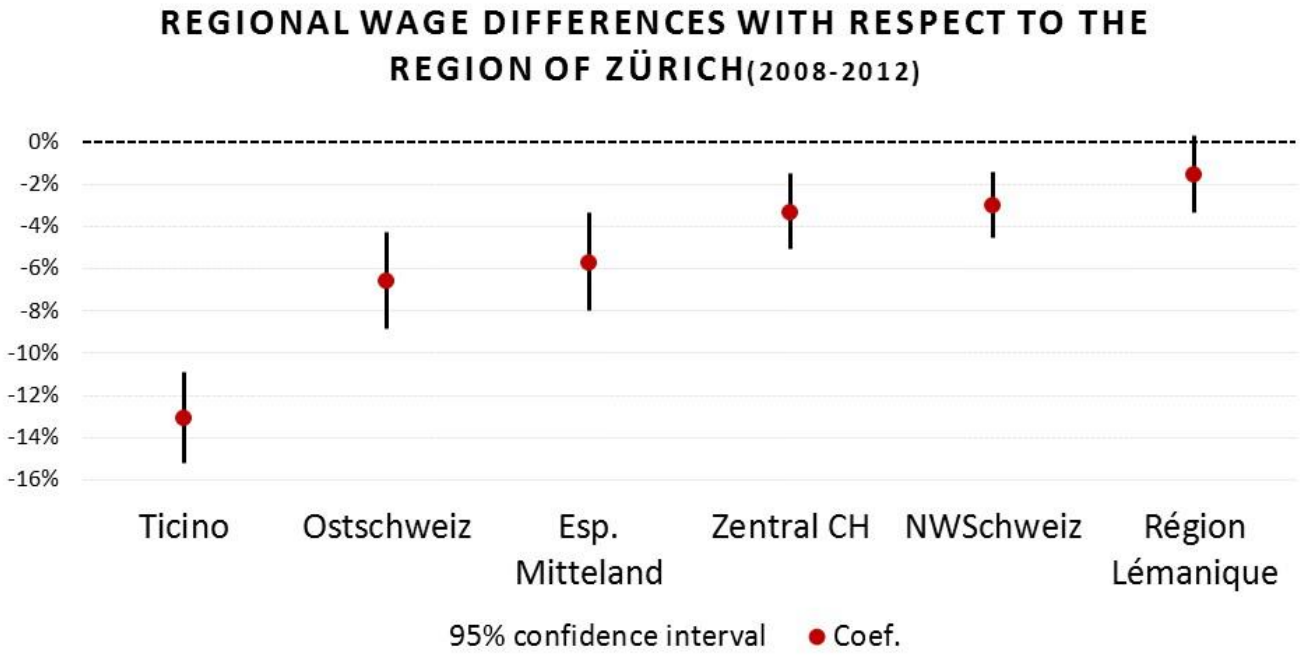
Figure 2. Regional wage differential with respect to the Zürich region, for the years 2008 – 2012.



In figure 2, regional wage differences are reported. Regional differences are estimated through a Mincer equation on LSE 2008, 2010 and 2012 data; standard error are clustered at a sectoral levels. We exclude from the sample the trans-border commuters, as, typically, they do not live in the compared region.

Differences in wages are significant at a 5% level for all the regions but Région Lémanique. Ticino exhibits the biggest gap with the region of Zürich; ceteris paribus, Ticino's wages are 13% lower than Zürich's; in Zentralschweiz and Nordwestschweiz the wage difference with the region of Zürich is about -3% while in Espace Mitteland and Ostschweiz it is -6% and -7% respectively.

5. RESULTS

Comparing in figure 3 the wage and COL regional differences, we observe that for five regions out of six, the wage difference is at least compensated by the difference in the cost of living. Ticino is the only region where the difference in wages is higher than the cost of living difference (real wages are 4% lower than in Zürich, considering the cost of living is in the second scenario). In Ostschweiz, Espace Mittland and Nortwest Schweiz, the lower level of wages is more than compensated by the lower cost of living while in Zentral Schweiz the difference between wages and cost of living is almost equal. Also in the Règion Lémanique, we observe a cost of living lower than the difference in wages.

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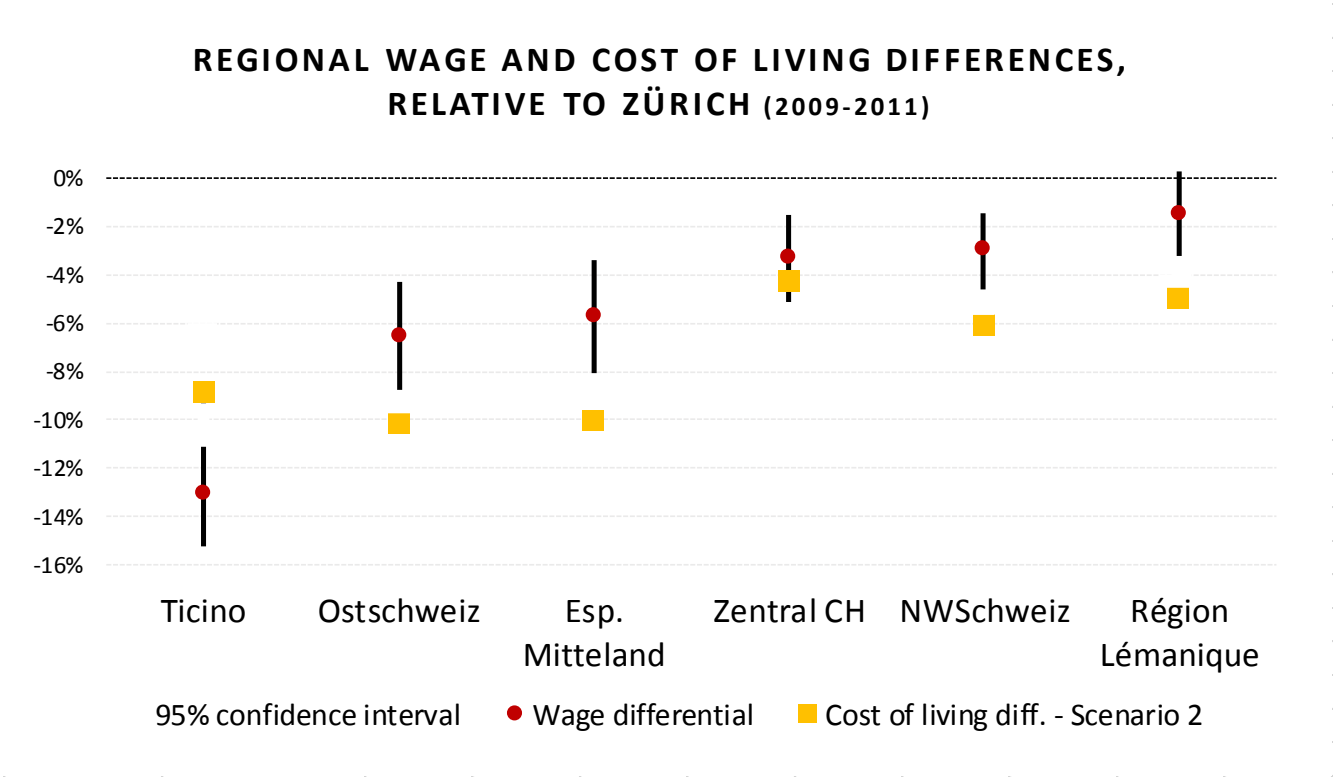
Figure 3. Wage and Cost of Living differences, relative to the Zürich region. Wage differential for the year 2008-2012; Cost of living (second scenario) for the year 2009-2011.



	Zentral schweiz	Région Lémanique	Nordwest schweiz	Ticino	Espace Mittelland	Ostschweiz
Wage differences	-3.3%	-1.5%	-3.0%	-13.1%	-5.7%	-6.6%
COL Index (2nd Scenario)	-4.30%	-5.0%	-6.10%	-8.9%	-10.1%	-10.2%
Difference	1.0%	3.5%	3.1%	-4.2%	4.4%	3.6%

In figure 3, we report the regional wage differences from figure 2 and the COL differences (for the second scenario hypothesis) of figure 1.

6. CONCLUSION

According to the previous literature, we demonstrated that regional price differences are significant, also in a relative small country like Switzerland. Theoretically, differences in regional prices could arise from different levels of productivity, as shown by Balassa (1964)[20], and by the different amenities in the regions. As shown in Moretti (2013), cost of living differences reduce the real wage gap among regions. For five regions out of the six compared, regional COL differences are able at least to compensate the lower nominal wages. Migration and location decisions based on nominal wages might therefore be inefficient and present biased results for regional policy conclusions. From a tax policy perspective, we observed that while the regional gross wage difference is

[20] See figure A.2 in Appendix.

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over-compensated by the different cost of living, the difference in the real disposable income persists due to the different tax policies among regions. Future tax policies should try to enhance rather than compensate the regional advantages in term of real wages. Finally, since this study is based on a rough estimation of the regional cost of living, it seems desirable to collect regional and cantonal prices, in order to develop an official local cost of living index, eventually on a cantonal basis. Further work should investigate if, in Switzerland as in the US, price differentials are generated by a shock on labor demand rather than by a labor supply shock. Further research might also try to clear up why Ticino is the only region where the lower wages are not completely compensated by the lower cost of living.

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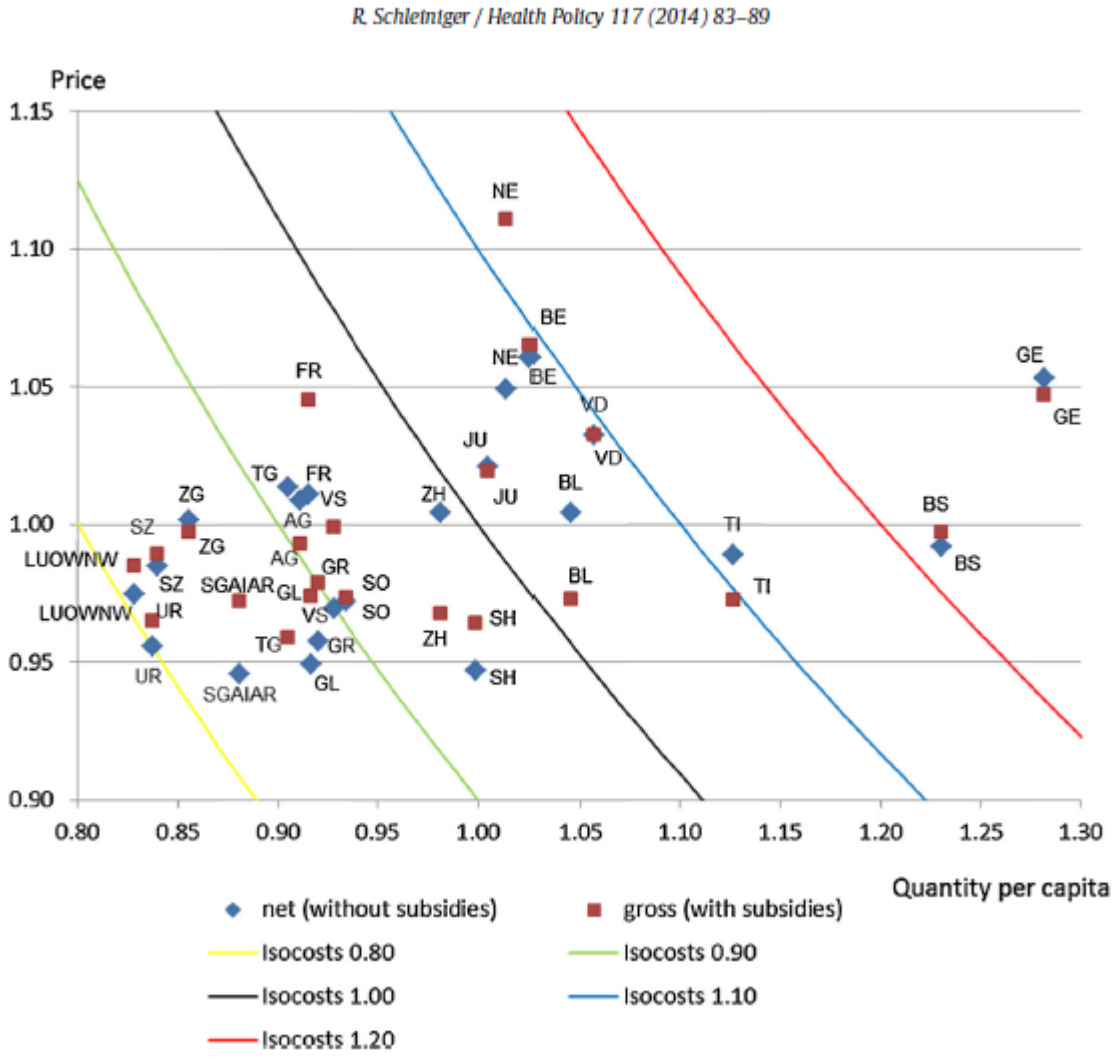
APPENDIX

A.1 Prices for healthcare services.

The price for healthcare services in the cantons are quite similar. Otherwise, comparing their result (figure 1) with the cost of a TarMed point (recorded in a different year) we observe a different pattern in the price distribution. TarMed price distribution is more similar to the price distribution of house rental. We decide therefore, as a prudential approach, to set the price for the healthcare goods equal in all the regions.

Figure A.1 - Result of cross-section analysis: mean of quantity and price index from 2004 to 2010 (average national price and consumption equal to 1), from Health care cost in Switzerland: Quantity- or price-driven? By Reto Schleiniger



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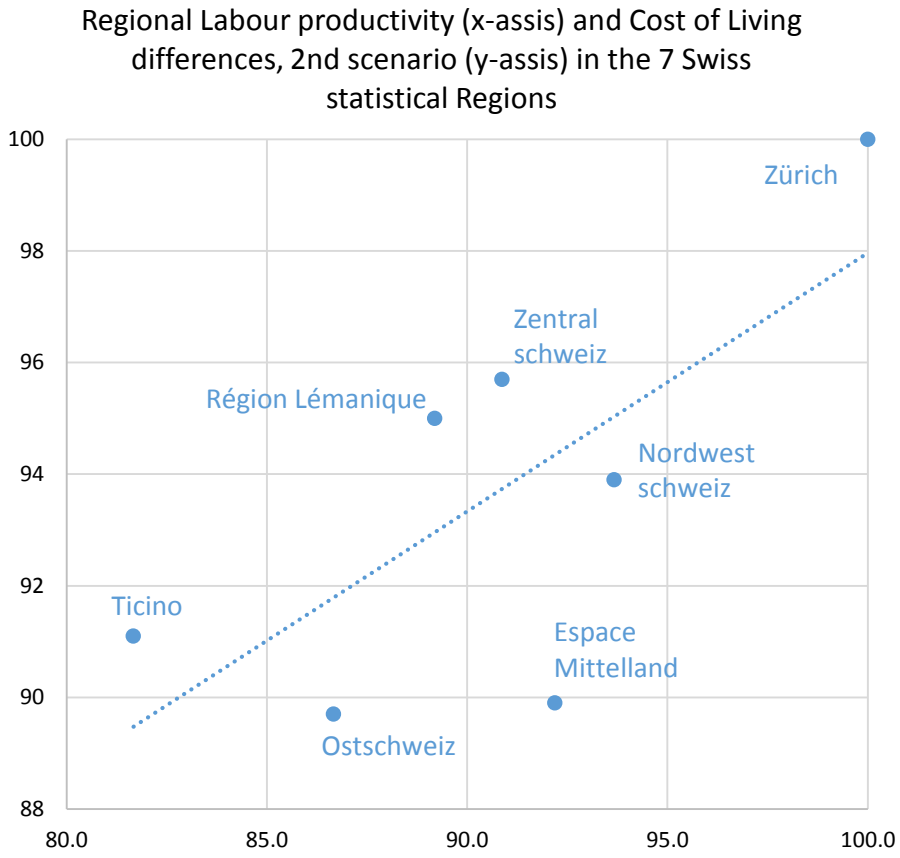
A.2 Regional labor productivity (full time equivalent) and cost of living differences (2nd scenario) among the 7 Swiss statistical regions, in 2010.

Figure A.2 - Regional labor productivity and cost of living differences (all value are normalized with the Zürich region, set at 100 for both productivity and cost of living).



Regional labor productivities are computed from the regional GDP and full time employment statistic provided by the Swiss Federal Statistical Office, with reference year 2010.

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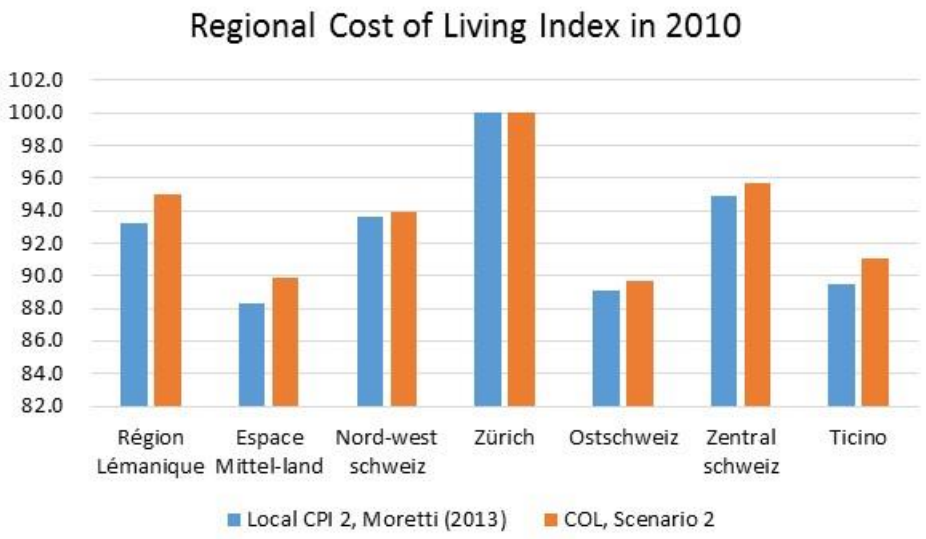
A.3 Regional Cost of living differences among the 7Swiss statistical regions, in 2010.

Figure A.3 – Regional Cost of Living differences, in 2010.



Results for the Local CPI are computed replicating the Local CPI 2 methodology developed by Moretti (2013), setting π equal to 0.35, as in his American Economic Review paper. Since the value of π is calibrated on American data, we do not consider this methodology in our study.

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