Chapter 2
Data and Methods

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2.1 International EQ-5D Archive of Population Surveys

The international EQ-5D database archive consists of 27 EQ-5D population surveys collected in 24 countries. Countries with 1 or more population surveys include: Argentina, Armenia, Belgium, Canada, China, Denmark, England, Finland, France, Germany, Greece, Hungary, Italy, Japan, Korea, the Netherlands, New Zealand, Slovenia, Spain, Sweden, Thailand, United Kingdom, United States, and Zimbabwe. The datasets are structured in a standardized format to facilitate comparative research, although each survey also has its own characteristics and variables specific to the individual research context in which they were conducted. In addition, three datasets from Argentina, China, and Sweden (Stockholm area) were analyzed locally and results were added to the book, as the dataset transfer to the central archive was not possible from these countries. The datasets captured by this book currently include observations on 216,703 individuals. For a more detailed account of the data, see Table 2.1.

All of the surveys used a standardized version of EQ-5D-3L. The Dutch, Swedish and Finnish versions were translated in 1987 according to a 'simultaneous' process while the remaining versions were translated according to the EuroQol Group's translation protocol – based on international guidelines. However, some differences between sampling and data collection methods should be noted.

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A. Szende et al. (eds.), *Self-Reported Population Health: An International Perspective based on EQ-5D*, DOI 10.1007/978-94-007-7596-1_2, © The Author(s) 2014

Table 2.1 National and Regional EQ-5D Population Surveys

	Source	Sample size	Data collection	Survey method
National				
Argentina	Ministry of Health of Argentina 2005	41,392	2005	**Face-to-face interviews** on the 2005 Risk Factors Survey on a random selection of households representative also at regional level
Belgium	ESEMED, König et al. 2009	2,411	2001–2003	**Personal computer-based home interviews** on a national representative sample of the noninstitutionalized general adult population as part of the European Study of the Epidemiology of Mental Disorders (ESEMeD)
China	Household Health Survey 2010; Sun et al. 2011	8,031	2010	**Face-to-face interviews** on the representative 2010 Household Health Survey (HHS)
Denmark	Sorensen et al. 2009	16,861	2000–2001	**Face-to-face interviews** on three representative national surveys, including a national health interview survey undertaken by the National Institute of Public Health (SUSY-2000), a health survey undertaken in Funen County (Funen data set) and a national health survey undertaken by the University of Southern Denmark (SDU data set) with a total of 22,486 individuals
England	Health Survey for England 2010	14,763	2008	**Computer assisted interviews** on a randomly selected sample of households in England
Finland	Saarni et al. 2006	8,028	2000	**Face-to-face interviews** on the Health 2000 survey sample, which is a representative survey of the Finnish population aged 30 and over
France	ESEMED, König et al. 2009	2,892	2001–2003	**Personal computer-based home interviews** on a national representative sample of the noninstitutionalized general adult population as part of the European Study of the Epidemiology of Mental Disorders (ESEMeD)
Germany	ESEMED, König et al. 2009	3,552	2001–2003	**Personal computer-based home interviews** on a national representative sample of the noninstitutionalized general adult population as part of the European Study of the Epidemiology of Mental Disorders (ESEMeD)
Greece	Yfantopoulous 1999	464	1998	**Face-to-face interviews** on a sample of 500 individuals selected from the general population

Hungary	Szende and Nemeth 2003	5,503	2000	**Self-administered questionnaire during a personal interview** on a random sample of 7000 people from the electoral registry
Italy	ESEMED, König et al. 2009	4,709	2001–2003	**Personal computer-based home interviews** on a national representative sample of the noninstitutionalized general adult population as part of the European Study of the Epidemiology of Mental Disorders (ESEMeD)
Korea	Lee et al. 2009	1,307	2007	**Face-to-face interviews** on a random sample of the South Korean residential registry
Netherlands	ESEMED, König et al. 2009	2,367	2001–2003	**Personal computer-based home interviews** on a national representative sample of the noninstitutionalized general adult population as part of the European Study of the Epidemiology of Mental Disorders (ESEMeD)
New Zealand	Devlin et al. 2000	1,327	1999	**Postal survey** on a random sample of 3000 New Zealanders selected from the electoral roll
Slovenia	Prevolnik Rupel and Rebolj 2001	742	2000	**Postal survey** on a randomized sample of 3000 people selected from the general population
Spain	ESEMED, König et al. 2009	5,473	2001–2003	**Personal computer-based home interviews** on a national representative sample of the noninstitutionalized general adult population as part of the European Study of the Epidemiology of Mental Disorders (ESEMeD)
Sweden	Björk et al. 1999	534	1994	**Postal survey** on a randomized sample of 1000 Swedish citizens selected from the general population from an address register
Thailand	Tongsiri et al. 2011	1,409	2007	**Face-to-face interviews** on a random national sample provided by the national statistical office
United Kingdom	Kind et al. 1998	3,395	1993	**Face-to-face interviews** on a random sample of 5324 individuals selected from the general population (based on the Postcode Address file) from England, Scotland and Wales
United States	MEPS, Sullivan et al. 2005	38,678	2000–2002	**Paper-and-pencil questionnaire among the Medical Expenditure Panel Survey participants,** a nationally representative survey of the US civilian noninstitutionalized population. The research pooled 2000, 2001, and 2002 MEPS data on 23,839, 32,122, and 37,418 individuals

(continued)

Table 2.1 (continued)

	Source	Sample size	Data collection	Survey method
Regional				
Armenia (5 regions)	Gharagebakyan 2003	2,217	2002	**Face-to-face interviews** on a random sample of 1300 households (2337 individuals) selected from the general population of 5 regions of Armenia (Yerevan city, Gegharkounik, Shirak, Lori, and Suinik)
Canada (Alberta)	HQCA 2010	5,010	2010	**Computer Assisted Telephone Interviewing** with a sample of 5010 adult Albertans
Japan (3 prefectures)	Tsuchiya et al. 2002	620	1998	**Face-to-face interviews** on a random sample of 972 individuals selected from the general population (over age 20) of 3 Prefectures in Japan – Saitama, Hiroshima and Hokkaido
Spain (Canary Islands)	Canary Health Survey 2009	4,468	2009	**Personal computer-based home interviews** on a district representative regional Canaries Health Survey to 4600 individuals
Spain (Catalonia)	Catalunya Health Survey 2011	5,603	2011	**Personal computer-based home interviews** on a district representative regional Catalonia Continuous Health Survey in semester waves of 2500 individuals
Sweden (Stockholm county)	Sun et al. 2012	32,597	2006	**Postal survey** on a representative sample of the Stockholm County population aged 20–88 years
Zimbabwe (Harare)	Jelsma 2003	2,350	2000	**Face-to-face interviews** with 2488 residents from Glenview (a high density suburb of Harare). As compared to the 1992 census Harare Profile, males were underrepresented and there were more young and better educated respondents than in the general population

Most importantly, while the majority of surveys were national representative surveys covering the whole of the country, some surveys covered a specific part (such as prefectures, regions or even city areas). Therefore, care should be exercised in generalizing data outside the geographic location captured by the data collection. Results in this book are reported separately for the national and the regional surveys.

Surveys also differed in sample sizes and in the method of data collection. The Argentinean dataset had the largest sample with over 41,000 respondents, while the Greek and the Swedish national surveys had the smallest sample of around 500 respondents. Some of the surveys were postal while others were performed as part of a face-to-face interview or administered by telephone. Since the questions asked in EQ-5D are very simple to answer, there is no reason to believe that there would be a significant impact on results other than differences in response rates.

While only the most recent national surveys were included in this book from each country, the date of data collection varied considerably across countries. Data collection for the majority of surveys took place during or after 2000, however some surveys were older with the United Kingdom and Swedish national datasets being the earliest from 1993 to 1994, respectively. These differences should be considered when interpreting results, given that health-related quality of life in general and specifically EQ-5D ratings and values could have changed over time.

Standardized variables across all datasets included reported problems by the five dimensions, self-reported EQ VAS ratings, and the EQ-5D index values. In addition, all analyses of EQ-5D data presented in this book focused on three main characteristics of the population: age, gender, and education level. Age in most surveys was measured as a continuous variable (life years), while gender was recorded as a categorical variable. Education level in each country was recoded to a three-level scale, distinguishing low (i.e. primary), medium (i.e. secondary), and high (i.e. university degree) education level.

All data analyses were performed using SPSS version 19 and Stata version 12 statistical software packages. All codes were checked and analyses were reproduced by a second analyst. The exact methodologies are described in the remainder of this chapter.

2.2 Methods of Describing EQ-5D Population Norms

The EuroQol Group is frequently asked to provide EQ-5D population reference data (sometimes called normative data) for a specific country or international region. Such data can be used as reference data to compare profiles for patients with specific conditions with data for the average person in the general population in a similar age and/or gender group. This comparison helps to identify the burden of disease in a particular patient population.

Descriptive statistics are provided for EQ VAS, the five dimensions, and EQ-5D-3L index values for the total population and by gender and the following age groups: 18–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75+ years.

EQ-5D index value calculations are provided using the following value sets (Szende et al. 2007):

- **European VAS value set for all countries**. Note that the European VAS value set was constructed using data from 11 valuation studies in 6 countries: Finland (1), Germany (3), The Netherlands (1), Spain (3), Sweden (1) and the UK (2). This survey included enough data from different European regions to make the European VAS dataset moderately representative for Europe. (Greiner et al. 2003; Weijnen et al. 2003).
- **Country-specific time trade-off (TTO) value set if available**. Note that the time trade-off (TTO) method has played an important role in generating value sets for the EQ-5D as one of the most widely accepted preference elicitation methods for health states (Torrance 1986) for economic evaluation and the method of choice in the first large-scale EQ-5D valuation study (Dolan 1997). Table 2.2 summarizes those 13 countries that have their own TTO value sets and describes the value sets.
- **Country-specific VAS value set if available**. Note that the Visual Analogue Scale (VAS) has become the other widely used method to elicit preferences for the EQ-5D, including nine countries. Table 2.3 summarizes countries that have their own VAS based value sets and describes the value sets, including the European value set.

This means that for countries with no available value set from their own general population, only the European VAS value set based EQ-5D index values are summarised. However, for countries with available TTO and/or VAS value sets, additional population norms of EQ-5D index values are calculated.

To summarize key results on reported problems, EQ VAS, and EQ-5D index values, countries are tabulated in alphabetic order and are not ranked. Detailed country-by-country results are provided in the appendices. Because the population norms data are presented by age and gender, there is no need for the sample to have the same age distribution as the general population in each country. Therefore the data that are presented in the tables have not been standardized for age or gender. This means that international comparisons across several age groups should be made with caution as the demographic build-up by age and gender varies between countries, and that the samples of the general population used to create the tables do not necessarily follow that same distribution. However, international comparisons of data contained in a single cell (i.e. 1 age and gender group) are valid. The following section describes the methodology used to analyse cross-country differences in EQ-5D population data.

Table 2.2 Coefficients for the estimation of the EQ-5D index values based on TTO valuation studies

Country	Source	Model	MAD	Constant	MO2	MO3	SC2	SC3	UA2	UA3	PD2	PD3	AD2	AD3	N3	Other
Argentina	Augustovski 2009	OLS	0.039		−0.189	−0.272	−0.128	−0.209	−0.111	−0.067	−0.130	−0.209	−0.082	−0.135		O2: 0.003 O3: –0.355 Z2:–0.413 Z3: 0.117 $C2^2$: 0.010 $C3^2$: –0.005
Denmark	Wittrup-Jensen 2002	RE	0.089	−0.114	−0.053	−0.411	−0.063	−0.192	−0.048	−0.144	−0.062	−0.396	−0.068	−0.367		
France	Chevalier 2011	RE	0.043		−0.155	−0.372	−0.212	−0.326	−0.156	−0.189	−0.112	−0.265	−0.090	−0.204	−0.174	
Germany	Greiner 2005	RE	0.047	−0.001	−0.099	−0.327	−0.087	−0.174			−0.112	−0.315		−0.065	−0.323	
Italy	Scalone 2013	RE	0.030		−0.076	−0.518	−0.100	−0.289	−0.085	−0.198	−0.098	−0.334	−0.095	−0.213		D1: 0.043
Japan	Tsuchiya 2002	OLS	0.015	−0.152	−0.075	−0.418	−0.054	−0.102	−0.044	−0.133	−0.080	−0.194	−0.063	−0.112		
Korea	Lee 2009	OLS	0.029	−0.050	−0.418	−0.046	−0.136	−0.051	−0.208	−0.037	−0.151	−0.043	−0.158		−0.050	
Netherlands	Lamers 2006	RE	0.030	−0.071	−0.036	−0.161	−0.082	−0.152	−0.032	−0.057	−0.086	−0.329	−0.124	−0.325	−0.234	
Spain	Badia 2001	RE	NR	−0.024	−0.106	−0.430	−0.134	−0.309	−0.071	−0.195	−0.089	−0.261	−0.062	−0.144	−0.291	
Thailand	Tongsiri 2011	RE	0.080	−0.202	−0.121	−0.432	−0.121	−0.242	−0.059	−0.118	−0.072	−0.209	−0.032	−0.110	−0.139	
United Kingdom	MVH Group 1995	RE	0.039	−0.081	−0.069	−0.314	−0.104	−0.214	−0.036	−0.094	−0.123	−0.386	−0.071	−0.236	−0.269	
United States	Shaw 2005	RE	0.025		−0.146	−0.558	−0.175	−0.471	−0.140	−0.374	−0.173	−0.537	−0.156	−0.450		D1: 0.140 $I2^2$: –0.011 I3: 0.122 $I3^2$: 0.015
Zimbabwe	Jelsma 2003	RE	0.049	−0.100	−0.056	−0.204	−0.092	−0.231	−0.043	−0.135	−0.067	−0.302	−0.046	−0.173		

MO2 = 1 if mobility is at level 2; MO3 = 1 if mobility is at level 3. SC2 = 1 if self-care is at level 2; SC3 = 1 if self-care is at level 3. UA2 = 1 if usual activities is at level 2; UA3 = 1 if usual activities is at level 3. PD2 = 1 if pain/discomfort is at level 2; PD3 = if pain/discomfort is at level 3. AD2 = 1 if anxiety/depression is at level 2; AD3 = 1 if anxiety/depression is at level 3. N3 = 1 if any dimension is at level 3, D1 = additional number of dimensions at either level 2 or level 3; I2 = number of dimensions at level 2 beyond the first; I3 = number of dimensions at level 3 beyond the first; O2 = 1 if all dimensions at level 1 and level 2; O3 = 1 if all dimensions at level 1 and level 3; Z2 = 1 if at least one dimension at level 2 and one dimension at level 3; Z3 = number of dimensions at level 2 given at least one dimension at level 3; C2 = number of dimensions at level 2; C3 = number of dimensions at level 3; MAD= mean absolute difference; OLS = ordinary least squares; RE = random

Table 2.3 Coefficients for the estimation of the EQ-5D index values based on VAS valuation studies

Country	Source	Model	MAD	Constant	MO2	MO3	SC2	SC3	UA2	UA3	PD2	PD3	AD2	AD3	N3	Other
Argentina	Augustovski 2009	OLS	0.020		−0.248	−0.247	−0.184	−0.178	−0.209	−0.148	−0.185	−0.157	−0.150	−0.116		O2: −0.028 O3: −0.388 Z2: −0.232 Z3: 0.086 $C2^2$: 0.020 $C3^2$: 0.008
Belgium	Cleemput 2004	RE	0.036	−0.152	−0.074	−0.148	−0.083	−0.166	−0.031	−0.062	−0.084	−0.168	−0.103	−0.206	−0.256	
Denmark	Wittrup-Jensen 2002	RE	NR	−0.225	−0.126	−0.252	−0.112	−0.224	−0.064	−0.128	−0.078	−0.156	−0.091	−0.182		
Europe[a]	Greiner 2003	RE	0.030	−0.128	−0.066	−0.183	−0.117	−0.156	−0.026	−0.086	−0.093	−0.164	−0.089	−0.129	−0.229	
Finland	Ohinmaa 1995	OLS	NR	−0.158	−0.058	−0.230	−0.098	−0.143	−0.047	−0.131	−0.111	−0.153	−0.160	−0.196		
Germany[b]	Claes 1999	RE	0.036	0.926	0.945	0.393	0.808	0.470	0.880	0.554	0.975	0.467	0.817	0.468		
New Zealand	Devlin 2000	RE	0.041	−0.204	−0.075	−0.150	−0.071	−0.142	−0.014	−0.028	−0.080	−0.160	−0.092	−0.184	−0.217	
Slovenia	Prevolnik Rupel 2000	OLS	NR	−0.128	−0.206	−0.412	−0.093	−0.186	−0.054	−0.108	−0.111	−0.222	−0.093	−0.186		
Spain	Badia 1998	OLS	NR	−0.150	−0.090	−0.179	−0.101	−0.202	−0.055	−0.110	−0.060	−0.119	−0.051	−0.102	−0.212	
United Kingdom	MVH Group 1995	RE	NR	−0.155	−0.071	−0.182	−0.093	−0.145	−0.031	−0.081	−0.084	−0.171	−0.063	−0.124	−0.215	

[a] These values have been rescaled with the mean value of dead

[b] The German model is a multiplicative model. This implies that when any of the dimensions is at level 1 the appropriate coefficient for that dimension is 1

MO2 = 1 if mobility is at level 2, 0 otherwise; MO3 = 1 if mobility is at level 3, 0 otherwise. SC2 = 1 if self-care is at level 2, 0 otherwise; SC3 = 1 if self-care is at level 3, 0 otherwise. UA2 = 1 if usual activities is at level 2, 0 otherwise; UA3 = 1 if usual activities is at level 3, 0 otherwise. PD2 = 1 if pain/discomfort is at level 2, 0 otherwise; PD3 = if pain/discomfort is at level 3, 0 otherwise. AD2 = 1 if anxiety/depression is at level 2, 0 otherwise; AD3 = 1 if anxiety/depression is at level 3, 0 otherwise. N1 = 1 if any dimension is at either level 2 or level 3, 0 otherwise; N3 = 1 if any dimension is at level 3, 0 otherwise; O2 = 1 if all dimensions at level 1 and level 2, 0 otherwise; O3 = 1 if all dimensions at level 1 and level 3, 0 otherwise; Z2 = 1 if at least one dimension at level 2 and one dimension at level 3, 0 otherwise; Z3 = number of dimensions at level 2 given at least one dimension at level 3; C2 = number of dimensions at level 2; C3 = number of dimensions at level 3. GLIM = generalized linear model; MAD = mean absolute difference; NR = not reported; OLS = ordinary least squares; RE = random effects model

2.3 Methods of Cross-Country Analysis of EQ-5D Data

Cross-country summary data for reported problems by five dimensions and EQ VAS were estimated using a standardized population structure for all countries with national EQ-5D surveys. Countries were tabulated in alphabetic order. Standardization for age was performed to avoid bias due to the fact that some populations have a relatively higher proportion of elderly people. Age standardization of reported problems by dimension and EQ VAS was based on the European population structure using Eurostat data from 2010 (Table 2.4).

To explore reasons for cross-country differences in EQ-5D data, correlations between country-specific EQ-5D data (EQ VAS and five dimensions) and country-specific economic and health system macro indicators were calculated.

Living standards were estimated by means of Gross Domestic Product (GDP) per capita and unemployment rate. Indicators for health care system performance were health expenditure per capita and health expenditure as a % of GDP, number of hospital beds per 1,000 people and number of physicians per 1,000 people. The indicators were selected on the basis of a presumed or possible relationship with self-reported health. Data were obtained from the World Health Organization Statistical Information System and the World Bank. The data were from 2010 or the closest year with available data (Table 2.5). An alternative set of macro data was also used to see how results might change when using macro data from the same year as the EQ-5D data collection, including variables on gross national income on purchasing power parity, unemployment rate, and health expenditure data.

For all correlation analyses, non-parametric Spearman rank correlations were calculated. For this calculation, countries were ranked based on mean self-assessed health results, and their living standards and health care system performance characteristics. A high rank correlation means that the ranking of countries on one variable (e.g. prevalence of self-reported health problems) is similar to the ranking of another variable (e.g. GDP per capita).

Table 2.4 European population age structure

Age group	EU population (%)
18–24	11
25–34	17
35–44	18
45–54	18
55–64	15
65–74	11
75+	10
ALL	*100*

Source: Eurostat 2010, EU 27

Table 2.5 Country-specific economic and health system macro indicators

	GDP per capita $ 2010	Unemployment rate % 2010[a]	Health expenditure (% of GDP) 2010[a]	Health expenditure per capita $ 2010[a]	Physicians per 1,000 people 2004–2009[a]
Argentina	9,124	8.6	8.1	742	3.2
Belgium	43,006	8.3	10.7	4,618	3.0
China	4,433	4.3	5.1	221	1.4
Denmark	56,486	7.4	11.4	6,422	3.4
France	39,170	9.3	11.9	4,691	3.5
Germany	40,164	7.1	11.6	4,668	3.5
Greece	25,832	12.5	10.2	2,729	6.0
Hungary	12,863	11.2	7.3	942	3.1
Italy	33,787	8.4	9.5	3,248	4.2
Korea	20,540	3.7	6.9	1,439	2.0
Netherlands	46,623	4.5	11.9	5,593	3.9
New Zealand	32,407	6.5	10.1	3,279	2.4
Slovenia	22,898	7.2	9.4	2,154	2.5
Spain	29,956	20.1	9.5	2,883	3.7
Sweden	49,360	8.4	9.6	4,710	3.8
Thailand	4,614	1.2	3.9	179	0.3
United Kingdom	36,256	7.8	9.6	3,503	2.7
United States	46,612	9.6	17.9	8,362	2.4

Source: Macro indicators for each country were obtained from the World Bank (www.worldbank.org) Physician per 1,000 population data were obtained from the World Health Organization Statistical Information System (www.who.int)

[a]Data availability for last year varies in some countries

2.4 Methods of Sociodemographic Analysis of EQ-5D Data

Two main approaches were used to derive socio-demographic indicators based on EQ-5D, based on odds ratios and concentration indices.

Logistic regression age-adjusted odds ratios for reporting problems on each EQ-5D dimension were calculated by age groups, gender, and education. An odds ratio higher than 1 indicates that the examined group reported more health problems than the reference group. The reference group was males, 18–24 years, with medium/high education.

Secondly, the analysis used the concentration index method, which is a single index measure of relative inequalities (Wagstaff et al. 1991; Kakwani et al. 1997). The overall health concentration index measures the mean difference in health between individuals as a proportion of the average health of the total population. This index can also be interpreted as a measure of how unequal the distribution of health is in the population. Health inequality is measured on a scale between 0 (meaning complete equality in health) and 1 (meaning complete inequality in health). Researchers also showed that the concentration index value also corresponds to 75 % of the Schutz index, and as such, it can also be interpreted as the proportion of health that should be redistributed from those above the average level to those below the average in order to equalize the distribution of health. (Koolman and Doorslaer 2004).

The overall concentration index can be decomposed to identify the impact of various factors, such as socio-demographic or quality of life characteristics, in order to determine how much each factor contributes to inequalities (Wagstaff and Doorslaer 2004; Clarke et al. 2010). In the current analysis, overall self-reported health was measured by the EQ VAS. Decomposition analysis was performed to determine inequalities by socio-demographic factors and by the EQ-5D dimensions, as well as in a combined model in which both socio-demographic and EQ-5D dimension variables were included.

The health concentration index for overall self-reported health, as measured by the EQ VAS, was computed by the convenient regression model as proposed by Kakwani et al. (1997):

$$\frac{2\sigma_R^2}{\overline{EQVAS}} EQVAS_i = \alpha_i + \gamma_k R_i + \varepsilon_i$$

where R_i is the relative fractional rank of the ith individual (ranked by the individual's EQ VAS health), and γ_k is the estimated concentration index.

For the purposes of the decomposition analysis, the same estimation is used for all explanatory variables (by replacing EQ VAS with the explanatory variable in the equation and also using this variable for ranking purposes).

The total health concentration index can be written as the weighted sum of the concentration indices of the explanatory variables and the generalized concentration index of ε:

$$\hat{C} = \sum_k \hat{\eta}_k \hat{C}_{xk} + G\hat{C}_\varepsilon$$

where the weights are equal to the elasticities of EQ VAS score with respect to each explanatory variable in the model:

$$\hat{\eta}_k = \hat{\gamma}_k \overline{x}_k / \overline{EQVAS}$$

where $\overline{x}_k$ (the mean of x_k explanatory variables: age, gender, education, EQ-5D problems) is multiplied by the coefficients for each explanatory variable that are taken from the linear regression model to explain EQ VAS:

$$EQ - VAS = \alpha + \sum_k \gamma_k \chi_{ik} + \varepsilon_i.$$

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