PADS for Russia:
Tentative Results and Embedding into Russian Interindustry Model

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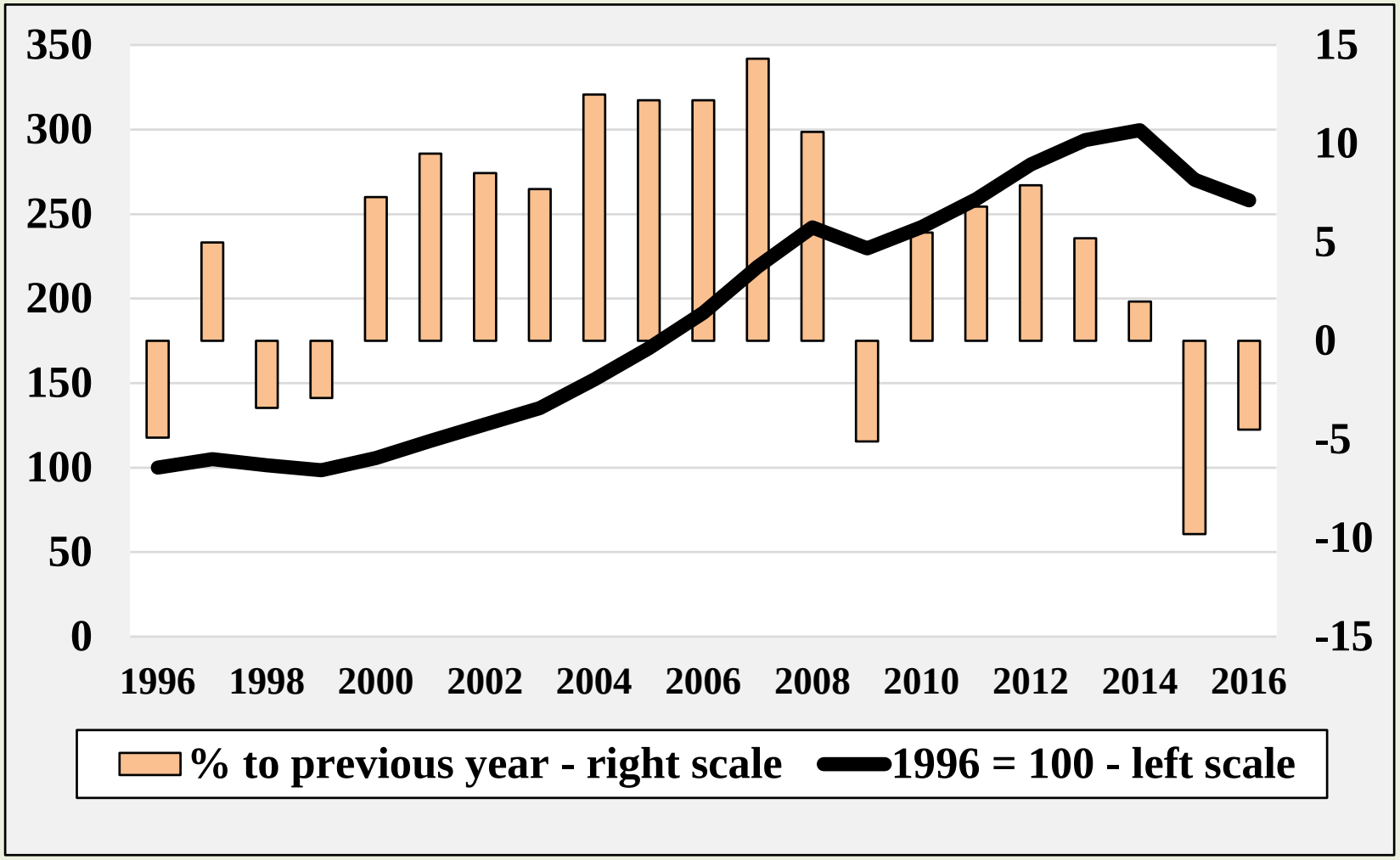
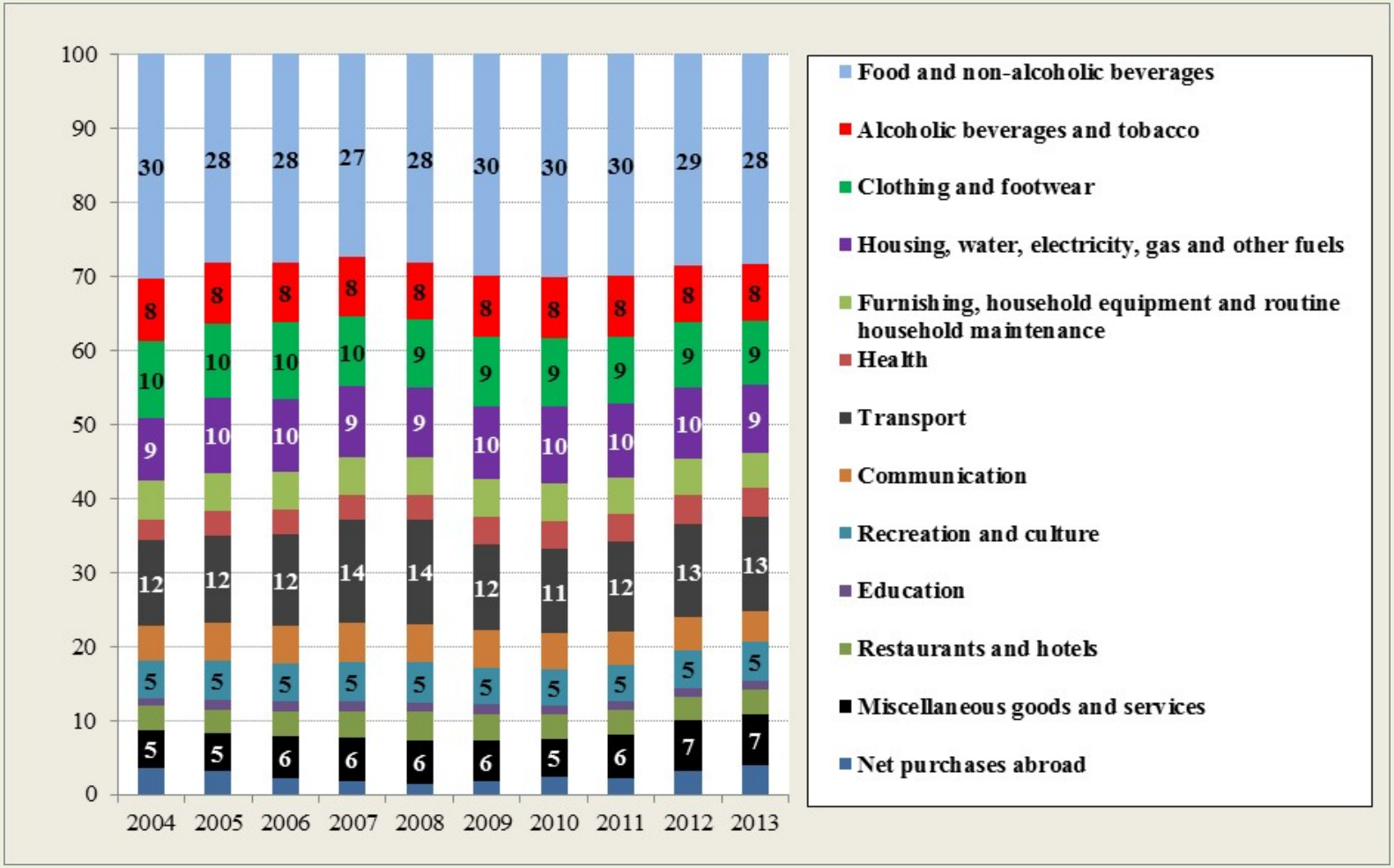
Household Consumption Expenditures: Long Run

Volume of Final Household Consumption Expenditures in Russia



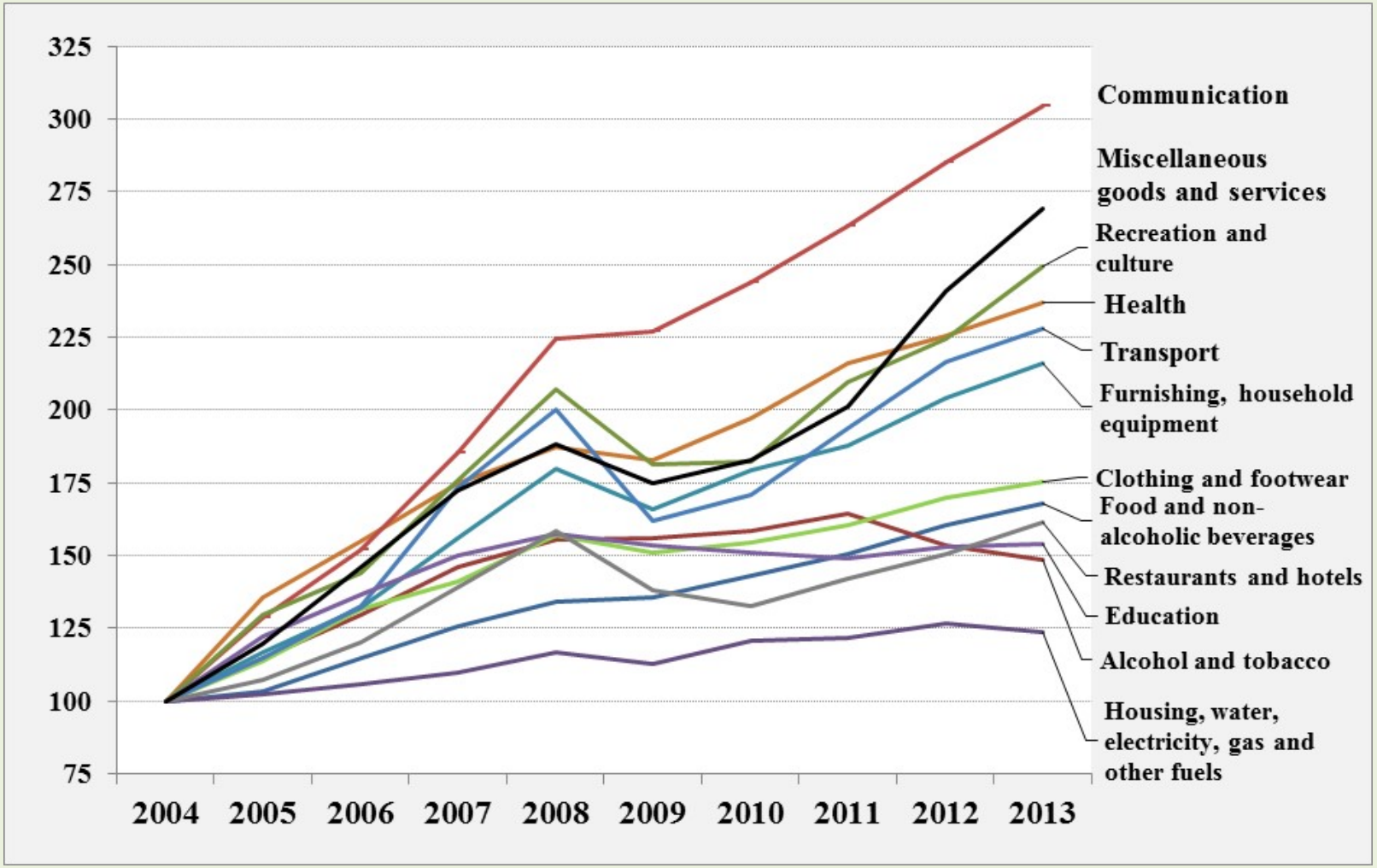
Structure of Household Consumption Expenditures

Structure of Household Consumption Expenditures by Top Level Items of COICOP classification, %



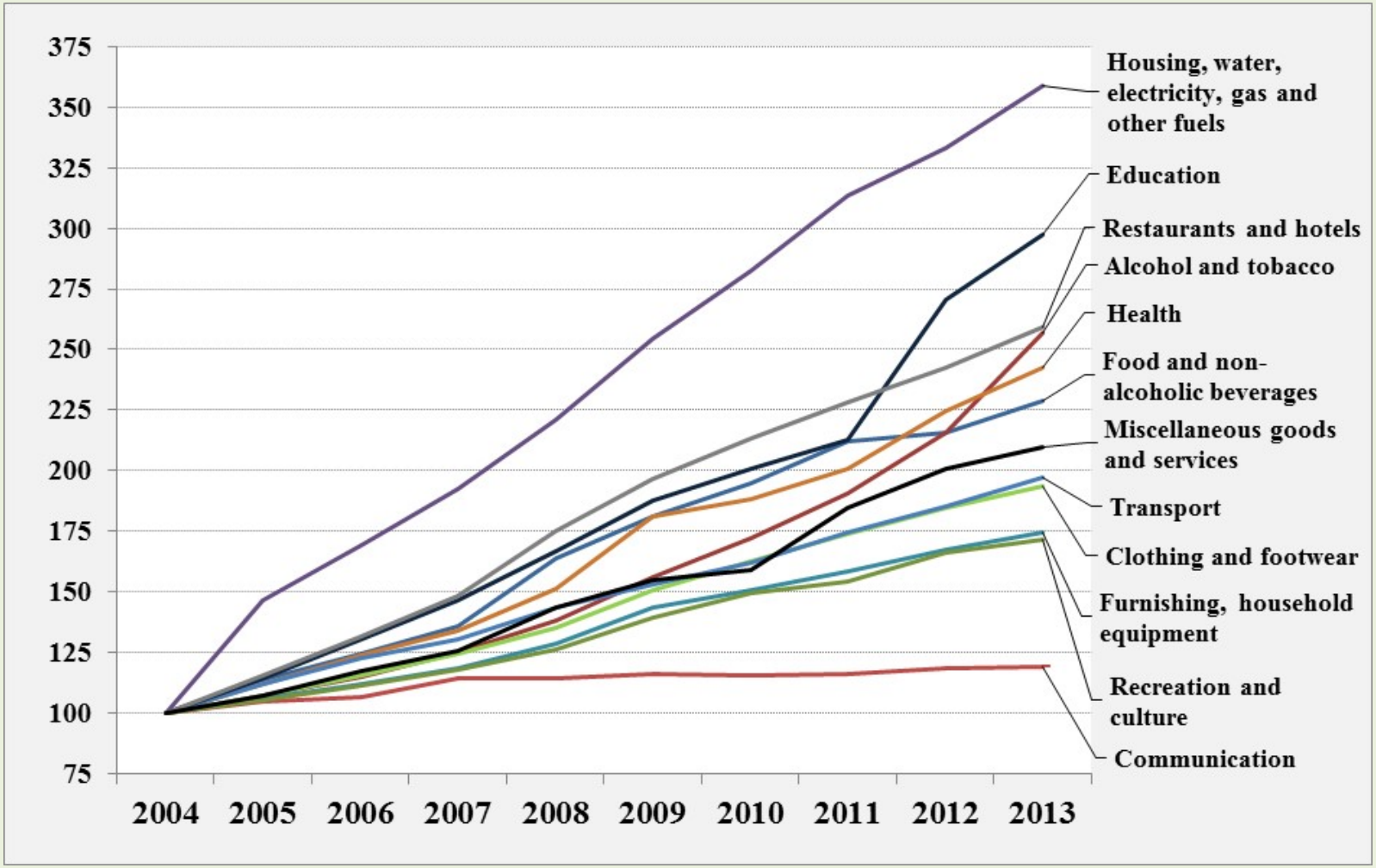
Volume of Household Consumption Expenditures

Volumes of Household Consumption Expenditures by Top Level Items of COICOP classification, 2004 = 100



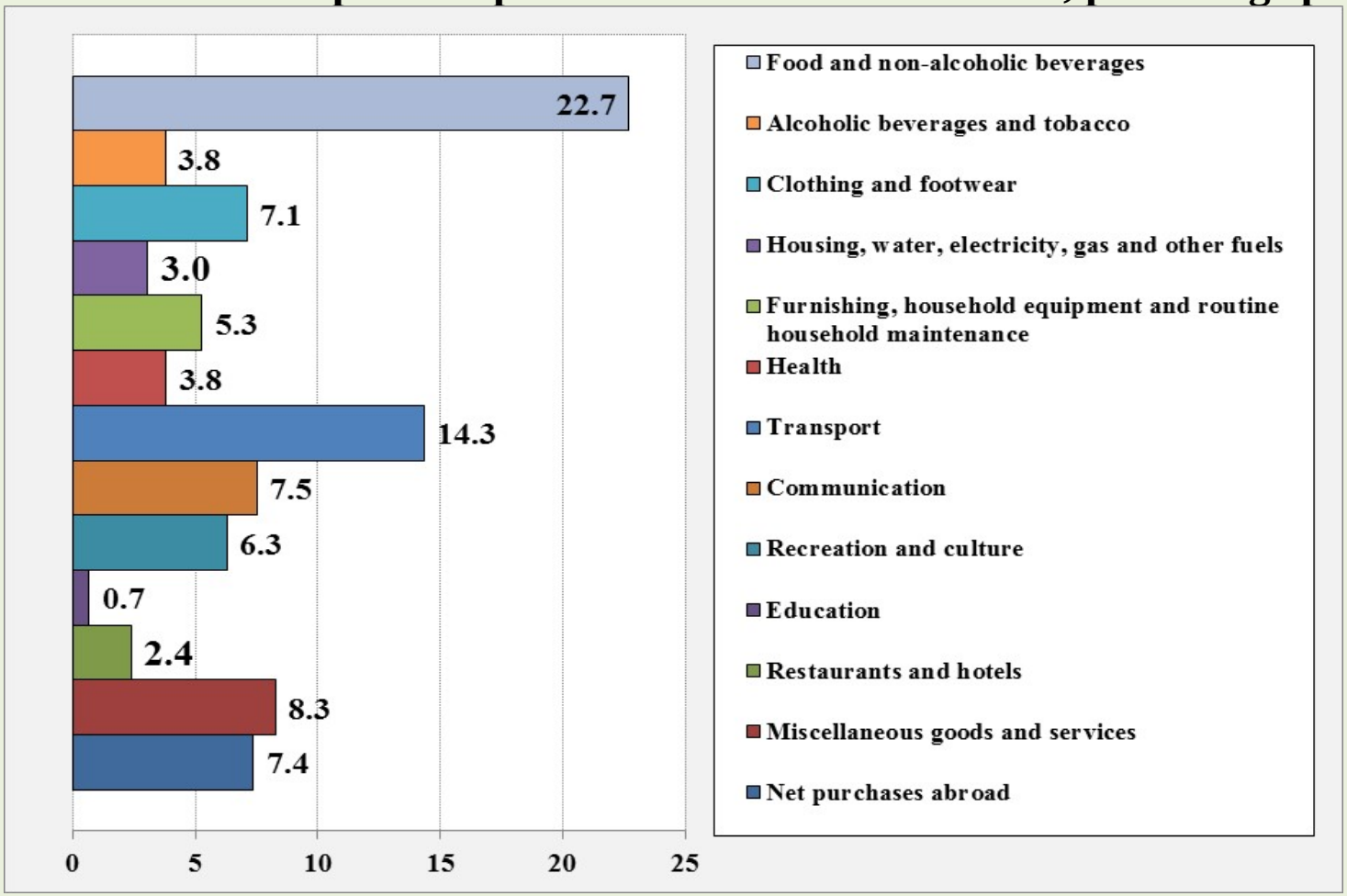
Prices of Household Consumption Expenditures

Price Deflators of Household Consumption Expenditures by Top Level Items of COICOP classification, 2004 = 100



Decomposition of Household Consumption Expenditures' Volume

Contribution of Top Level Items of COICOP classification to Increment of Total Household Consumption Expenditures' Volume in 2004-13, percentage points



Total household consumption expenditures' volume increased by 1.9 times in 2004-13

Perhaps Adequate Demand System

$$x_i = (ai + bi * t + ci * \left(\frac{y}{P}\right) + di * \Delta\left(\frac{y}{P}\right)) * \left(\frac{p_i}{P}\right)^{-\lambda_i} \prod_{k=1}^{n} \left(\frac{p_i}{p_k}\right)^{-\lambda_k * s_k} \left(\frac{p_i}{P_G}\right)^{-\mu_G} \left(\frac{p_i}{P_g}\right)^{-\vartheta_g}$$

x_i – consumption per capita of item i in constant prices
t – time
y – nominal total expenditures (or income) per capita
P, P_G, P_g – overall, group and subgroup price indexes, respectiveley
Δ - difference between t and t-1 values
p_k – price index for item i (in the base year p_k = 1)
s_k – share of item i in the expenditures of the base year
a_i, b_i, c_i, d_i, λ_k, μ_G , ϑ_g – parameters to be estimated

Features of Russian PADS' Estimation

- **Number of items estimated: 25**
- **Estimation period: 2004-13 (there is no COICOP data before 2004)**
- **Base year: 2010**
- **Specification:**
  real income, change of income, price deflators are used
  no time trend applied
- **Number of groups: 4**
- **Number of subgroups: 2**

A List of Goods and Services Estimated

№	Title	Groups	Subgroups
1	Bread and cereals	1	
2	Meat	1	1
3	Fish and seafood	1	1
4	Milk, cheese and eggs	1	1
5	Oils and fats	1	
6	Fruit and vegetables	1	
7	Food products n.e.c.	1	
8	Non-alcoholic beverages		
9	Alcoholic beverages		
10	Tobacco		
11	Clothing	2	
12	Footwear	2	
13	Housing, water, electricity, gas and other fuels		
14	Furnishing, household equipment and routine household maintenance		
15	Medical products, appliances and equipment	3	
16	Outpatient and hospital services	3	
17	Purchase of vehicles	4	2
18	Operation of personal transport equipment	4	2
19	Transport services	4	
20	Communication		
21	Recreation and culture		
22	Education		
23	Restaurants and hotels		
24	Miscellaneous goods and services		
25	Net purchases abroad		

Groups: 1. Food; 2. Clothing and footwear; 3. Health; 4. Transport
Subgroups: 1. Proteins; 2. Personal Transport

Estimation Results (No Constraints)

Weighted Lambda L = 0.141

Mu: Mu1 = 0.22 Mu2 = 4.89 Mu3 = 0.30 Mu4 = 2.13 Nu: Nu1 = -1.16 Nu2 = -0.29

№	Title	lamb	share	IncEl	Dinc	PrEl	Err%	Rho
1	Bread and cereals	0.00	4.1	1.12	0.16	-0.34	3.2	-0.07
2	Meat	0.22	8.5	1.21	0.23	-0.01	3.7	0.06
3	Fish and seafood	0.67	1.6	0.96	-0.03	0.03	1.6	0.75
4	Milk, cheese and eggs	0.99	4.3	1.07	0.12	-0.43	4.3	0.48
5	Oils and fats	0.08	1.2	1.15	0.22	-0.44	1.5	0.45
6	Fruit and vegetables	0.04	5.6	1.15	0.11	-0.35	7.2	0.36
7	Food products n.e.c.	-0.07	2.7	0.97	-0.01	-0.28	2.0	0.06
8	Non-alcoholic beverages	-1.74	2.2	-0.75	-1.74	1.31	6.2	0.51
9	Alcoholic beverages	1.34	6.2	1.08	0.17	-1.32	8.6	0.46
10	Tobacco	0.10	1.9	0.96	0.00	-0.23	1.6	-0.14
11	Clothing	0.66	7.1	0.96	-0.02	-1.85	3.7	-0.01
12	Footwear	-2.74	2.2	1.44	0.47	-1.27	2.6	0.19
13	Housing, water, electricity, gas and other fuels	0.32	10.4	1.77	0.91	-0.40	14.4	0.26
14	Furnishing, household equipment and routine household maintenance	0.46	5.1	0.70	-0.29	-0.55	2.7	-0.23
15	Medical products, appliances and equipment	1.94	2.0	0.11	-0.89	-2.14	3.1	0.19
16	Outpatient and hospital services	-0.13	1.6	1.70	0.70	-0.18	2.5	0.44
17	Purchase of vehicles	-0.52	4.9	1.48	0.32	-0.77	15.0	0.24
18	Operation of personal transport equipment	-1.78	3.3	0.31	-0.69	0.18	7.2	0.89
19	Transport services	-2.06	3.3	2.40	1.48	0.27	9.7	0.19
20	Communication	0.32	4.8	-0.32	-1.31	-0.43	6.6	-0.05
21	Recreation and culture	0.75	4.8	0.83	-0.23	-0.82	5.2	0.19
22	Education	0.39	1.2	1.40	0.46	-0.52	1.6	0.35
23	Restaurants and hotels	0.25	3.3	1.62	0.57	-0.38	4.9	0.50
24	Miscellaneous goods and services	-0.44	5.3	0.69	-0.37	0.25	12.6	0.79
25	Net purchases abroad	2.17	2.3	-0.65	-1.53	-2.21	15.7	0.53

lamb – lambda estimated**, share** – share of an item in 2010**, IncEl** - income elasticity in 2010**, Dinc** – ratio of coefficient on the change of income and income coefficient**, PrEl** – own price elasticity**, Err** – the standard error of estimate as % of 2010 value**, Rho** – residuals' autocorrelation coefficient

Values of Parameters to be Improved

Weighted Lambda L = 0.141

Mu: Mu1 = 0.22 Mu2 = 4.89 Mu3 = 0.30 Mu4 = 2.13 Nu: Nu1 = -1.16 Nu2 = -0.29

№	Title	lamb	share	IncEl	Dinc	PrEl	Err%	Rho
1	Bread and cereals	0.00	4.1	1.12	0.16	-0.34	3.2	-0.07
2	Meat	0.22	8.5	1.21	0.23	-0.01	3.7	0.06
3	Fish and seafood	0.67	1.6	0.96	-0.03	0.03	1.6	0.75
4	Milk, cheese and eggs	0.99	4.3	1.07	0.12	-0.43	4.3	0.48
5	Oils and fats	0.08	1.2	1.15	0.22	-0.44	1.5	0.45
6	Fruit and vegetables	0.04	5.6	1.15	0.11	-0.35	7.2	0.36
7	Food products n.e.c.	-0.07	2.7	0.97	-0.01	-0.28	2.0	0.06
8	Non-alcoholic beverages	-1.74	2.2	-0.75	-1.74	1.31	6.2	0.51
9	Alcoholic beverages	1.34	6.2	1.08	0.17	-1.32	8.6	0.46
10	Tobacco	0.10	1.9	0.96	0.00	-0.23	1.6	-0.14
11	Clothing	0.66	7.1	0.96	-0.02	-1.85	3.7	-0.01
12	Footwear	-2.74	2.2	1.44	0.47	-1.27	2.6	0.19
13	Housing, water, electricity, gas and other fuels	0.32	10.4	1.77	0.91	-0.40	14.4	0.26
14	Furnishing, household equipment and routine household maintenance	0.46	5.1	0.70	-0.29	-0.55	2.7	-0.23
15	Medical products, appliances and equipment	1.94	2.0	0.11	-0.89	-2.14	3.1	0.19
16	Outpatient and hospital services	-0.13	1.6	1.70	0.70	-0.18	2.5	0.44
17	Purchase of vehicles	-0.52	4.9	1.48	0.32	-0.77	15.0	0.24
18	Operation of personal transport equipment	-1.78	3.3	0.31	-0.69	0.18	7.2	0.89
19	Transport services	-2.06	3.3	2.40	1.48	0.27	9.7	0.19
20	Communication	0.32	4.8	-0.32	-1.31	-0.43	6.6	-0.05
21	Recreation and culture	0.75	4.8	0.83	-0.23	-0.82	5.2	0.19
22	Education	0.39	1.2	1.40	0.46	-0.52	1.6	0.35
23	Restaurants and hotels	0.25	3.3	1.62	0.57	-0.38	4.9	0.50
24	Miscellaneous goods and services	-0.44	5.3	0.69	-0.37	0.25	12.6	0.79
25	Net purchases abroad	2.17	2.3	-0.65	-1.53	-2.21	15.7	0.53

Note. Highlights **Red in Yellow** mean logically incorrect values that must be changed, highlights **Blue** mean correct values hardly explainable

Constraints Imposed

i. Mu2 to be < 2.0

ii. Coefficients on the change of income to be removed for:

Non-alcoholic beverages
Transport services
Communication
Net purchases abroad

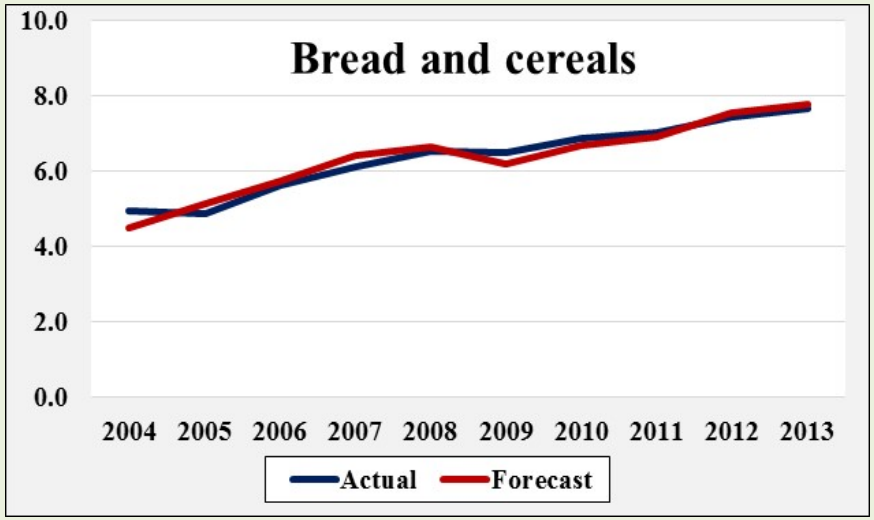
iii. Price elasticities to be negative for:

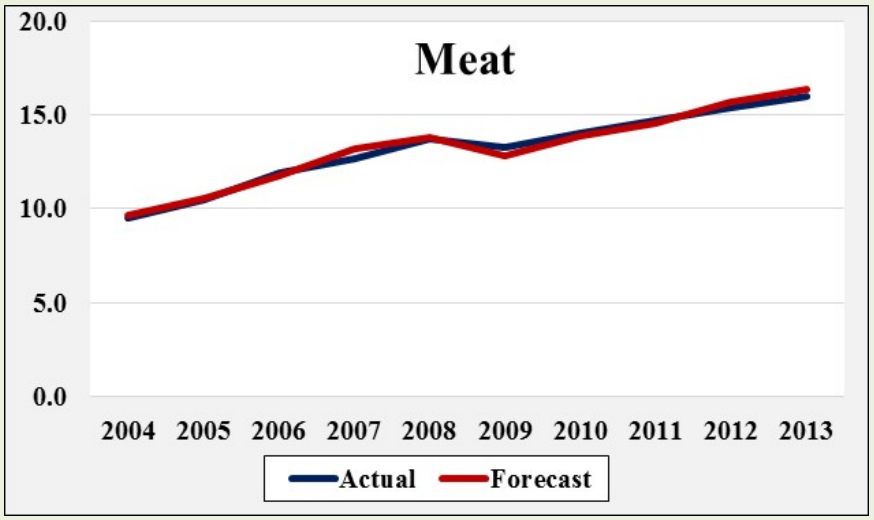
Fish and seafood
Non-alcoholic beverages
Operation of personal transport equipment
Transport services
Miscellaneous goods and services

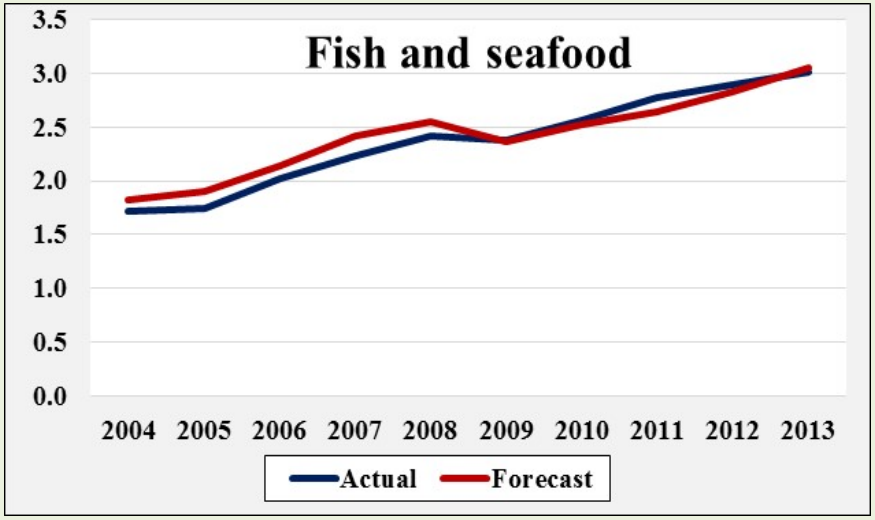
iv. Price elasticity to be in interval (-1.0, 0.0) for:

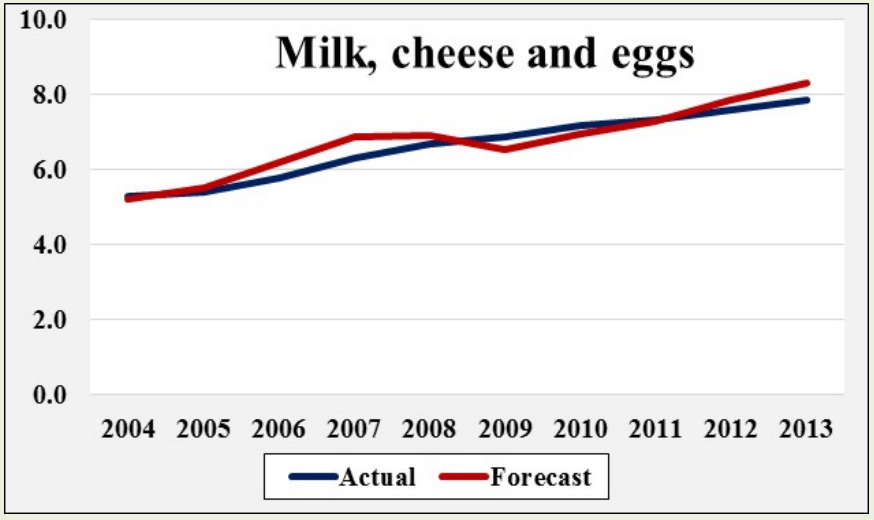
Medical products, appliances and equipment

Equations' Fitting: Items 1-4

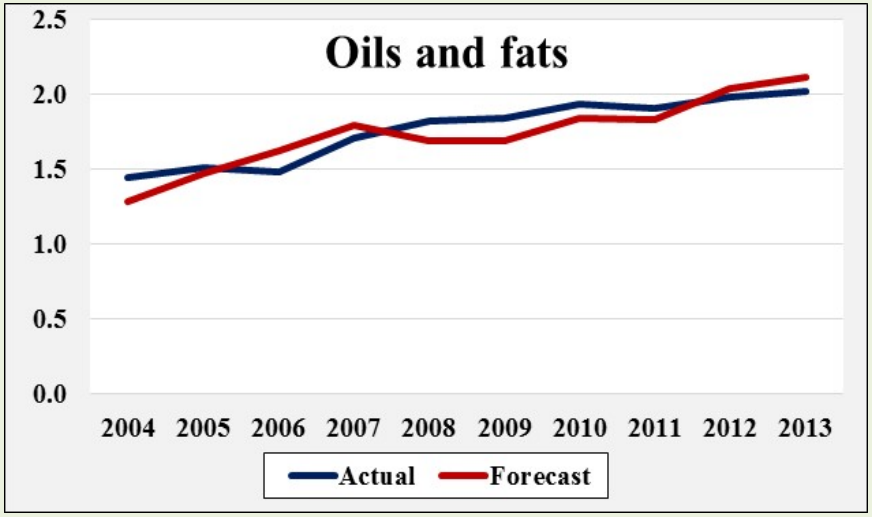


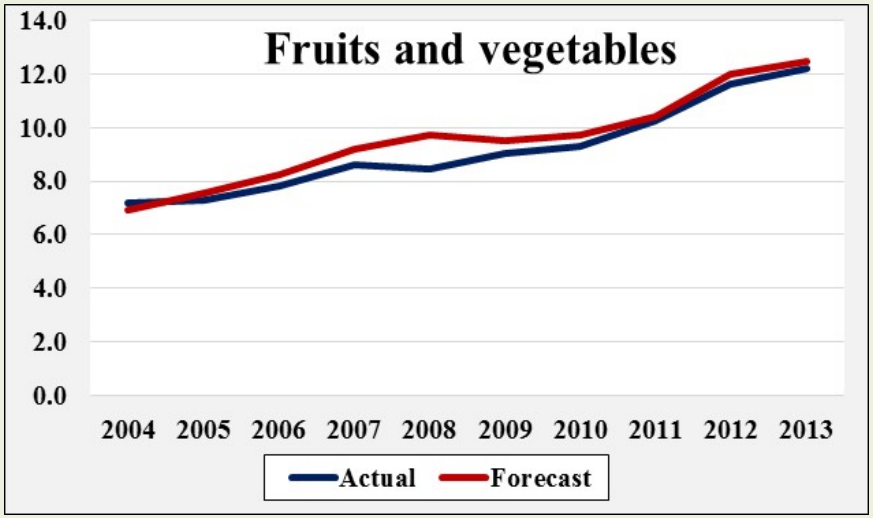


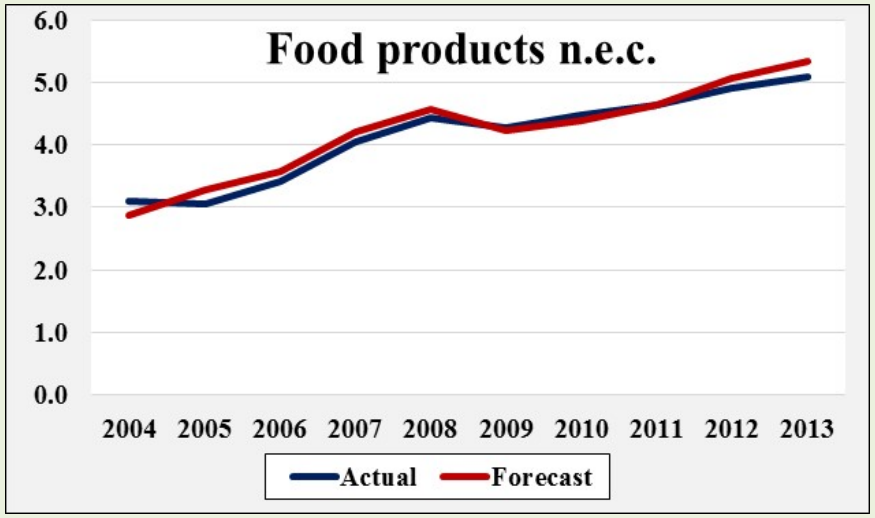


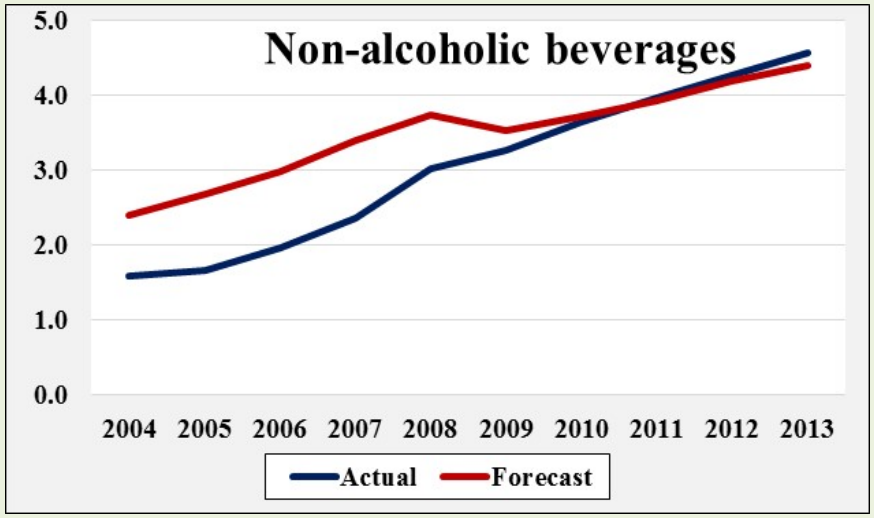


Equations' Fitting: Items 5-8

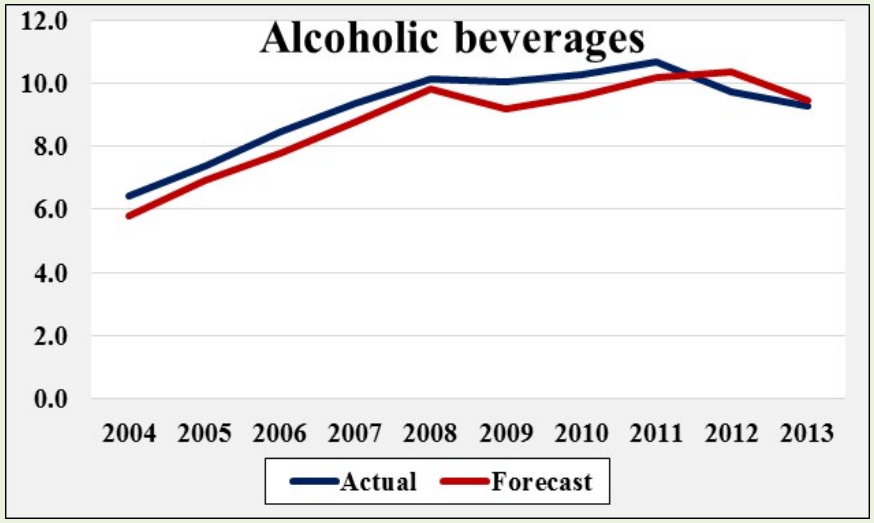


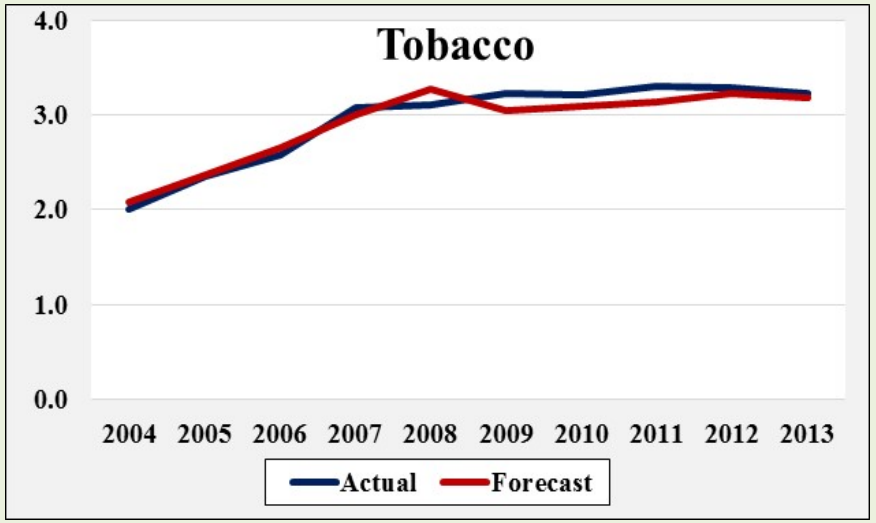


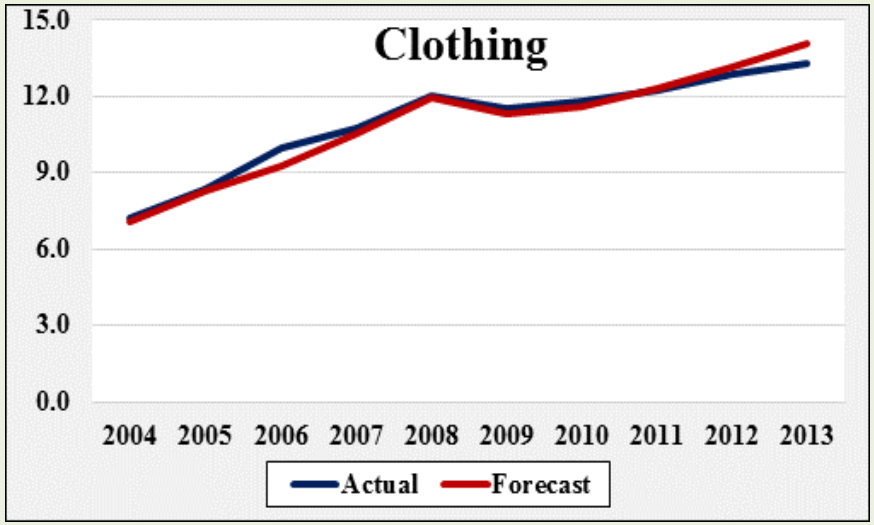


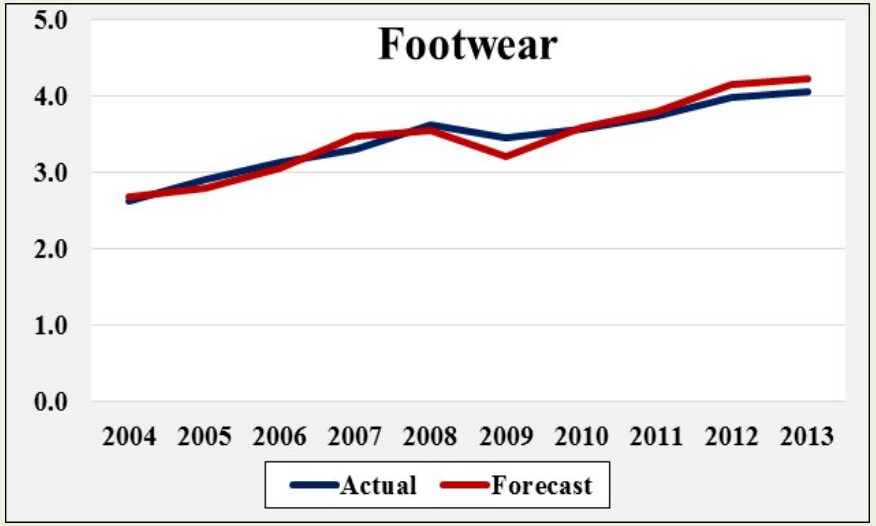


Equations' Fitting: Items 9-12

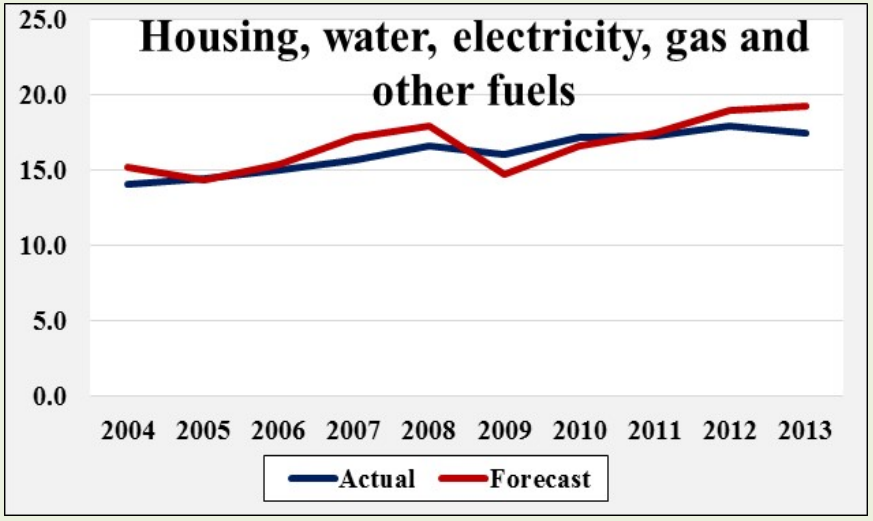


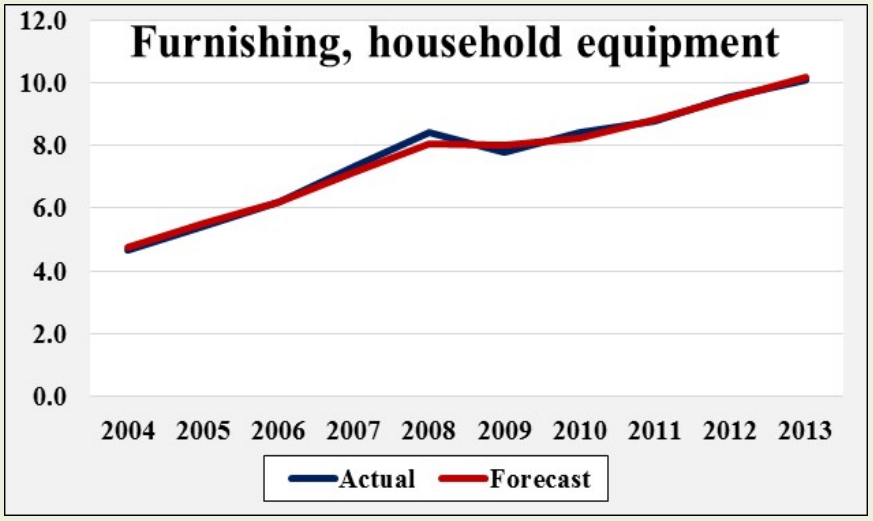


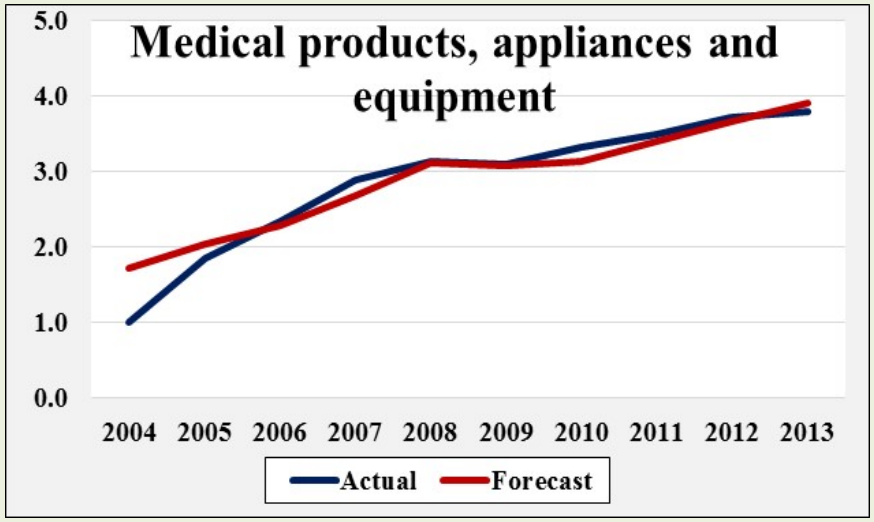


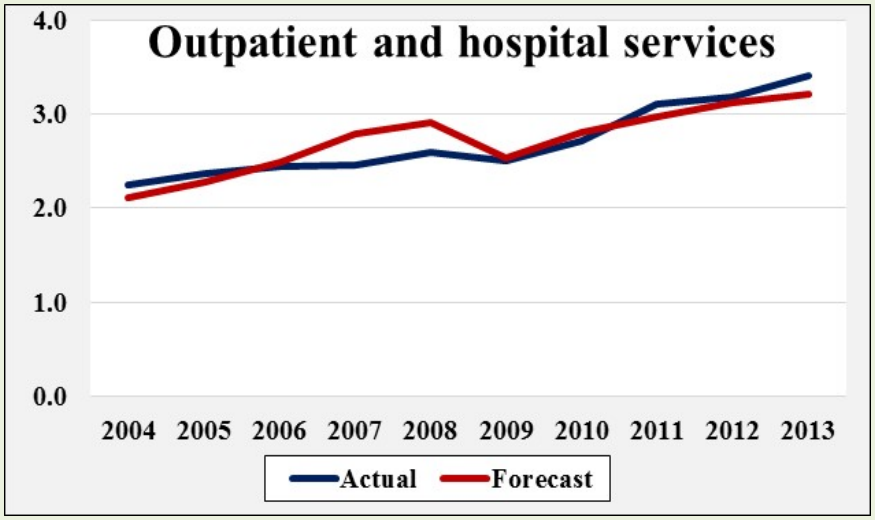


Equations' Fitting: Items 13-16

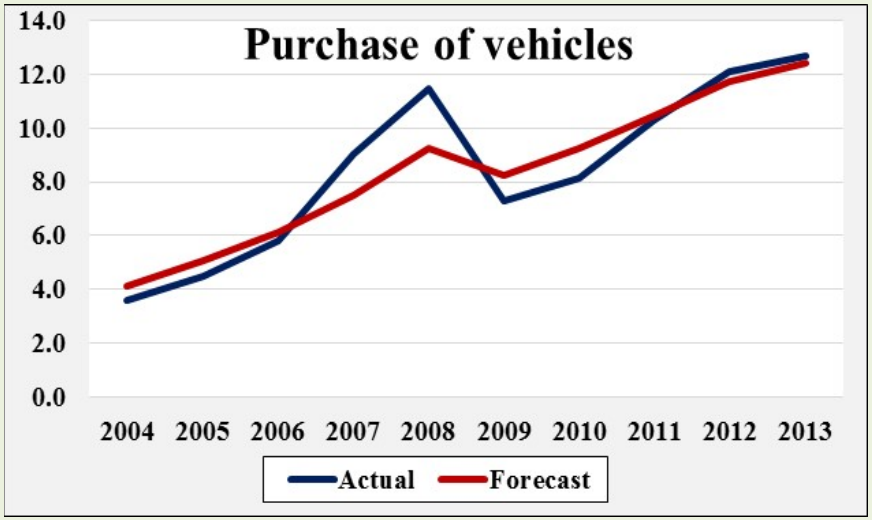


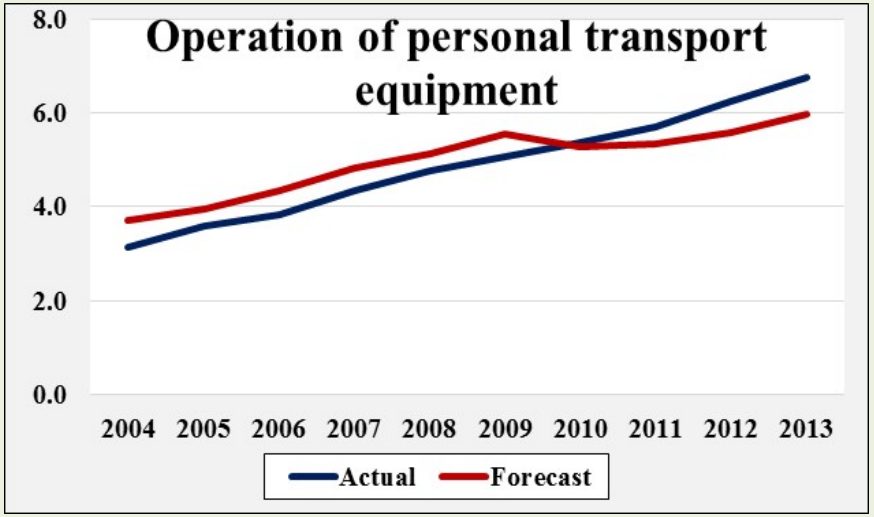


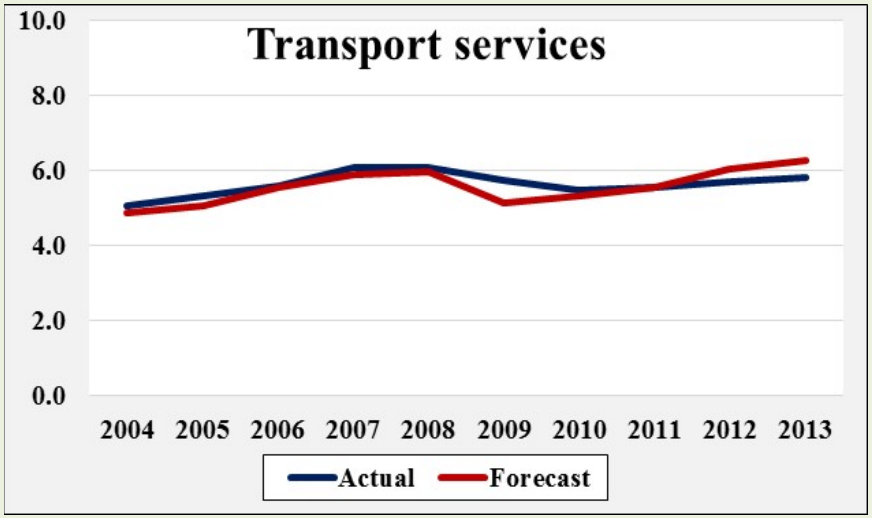


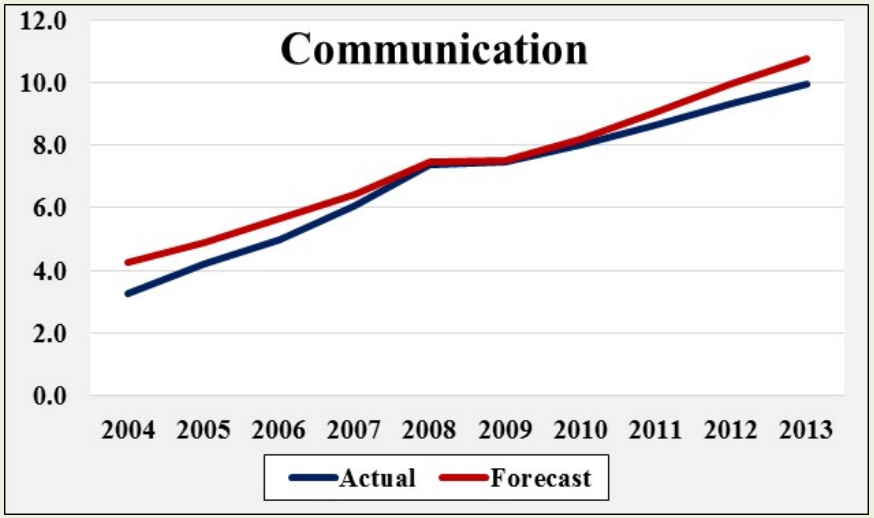


Equations' Fitting: Items 17-20

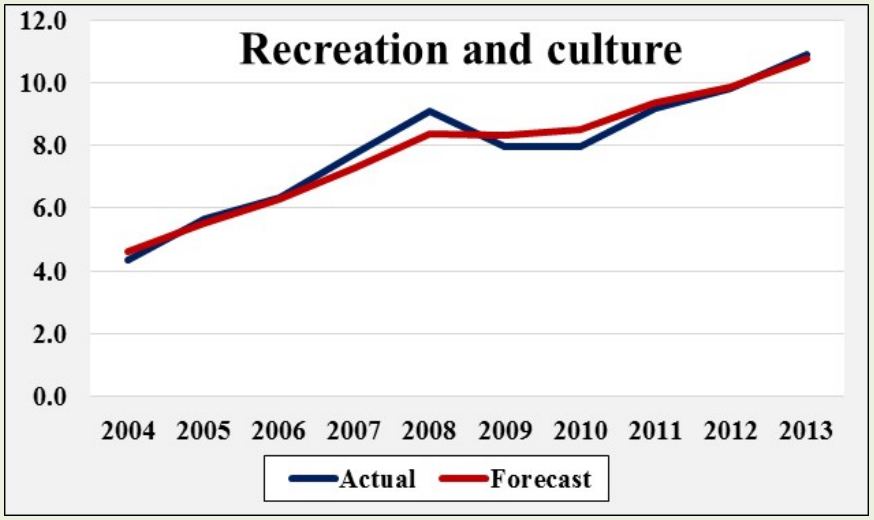


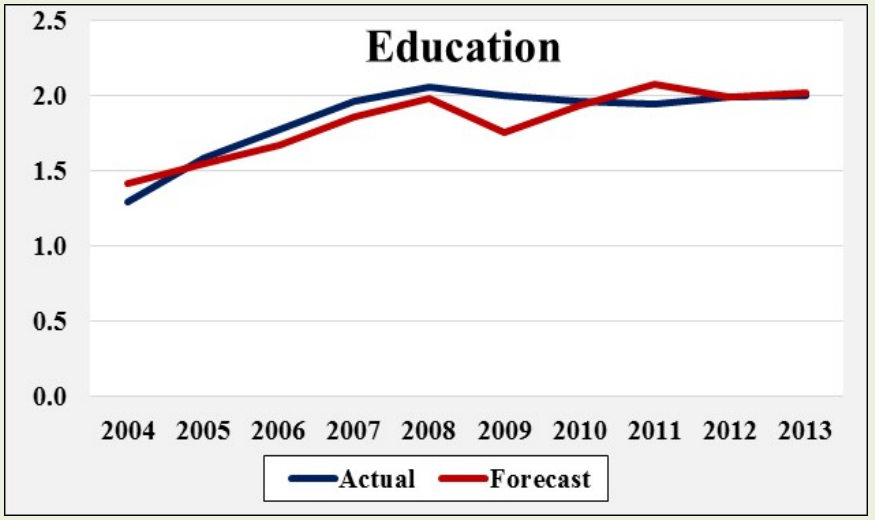


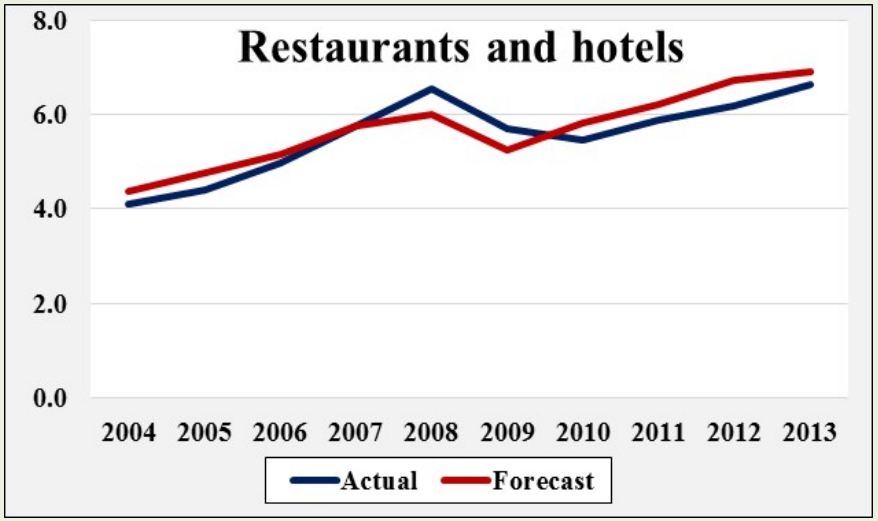


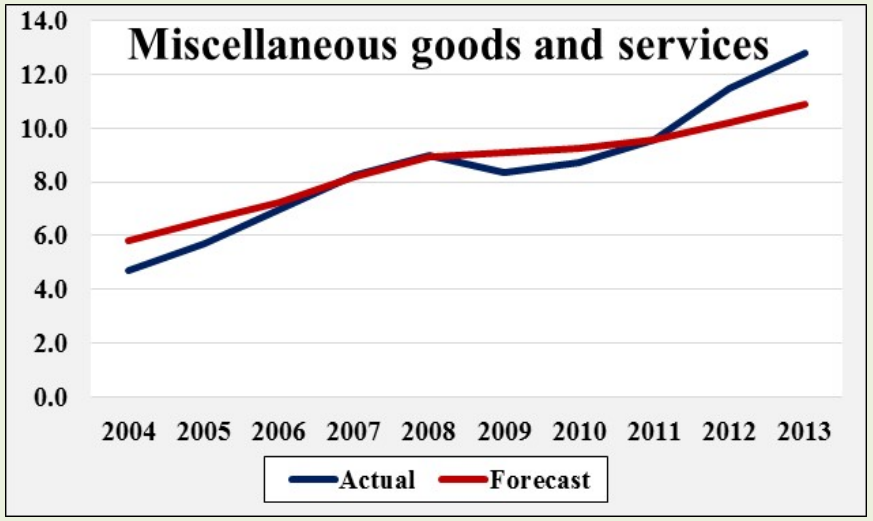


Equations' Fitting: Items 20-24









Estimation Results (with Constraints)

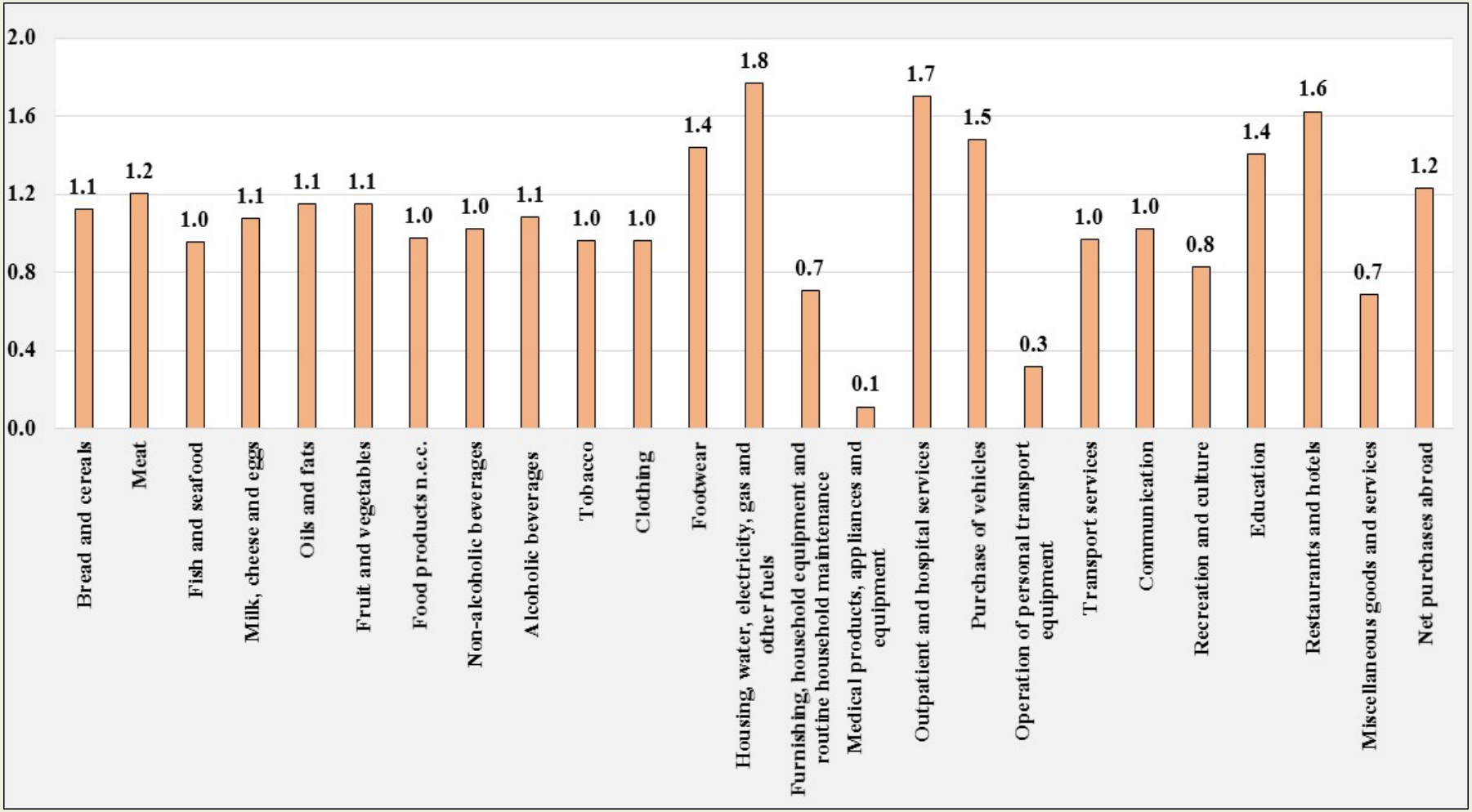
Weighted Lambda L = 0.256

Mu: Mu1 = 0.22 Mu2 = 2.00 Mu3 = 0.30 Mu4 = 2.13 Nu: Nu1 = -1.16 Nu2 = -0.29

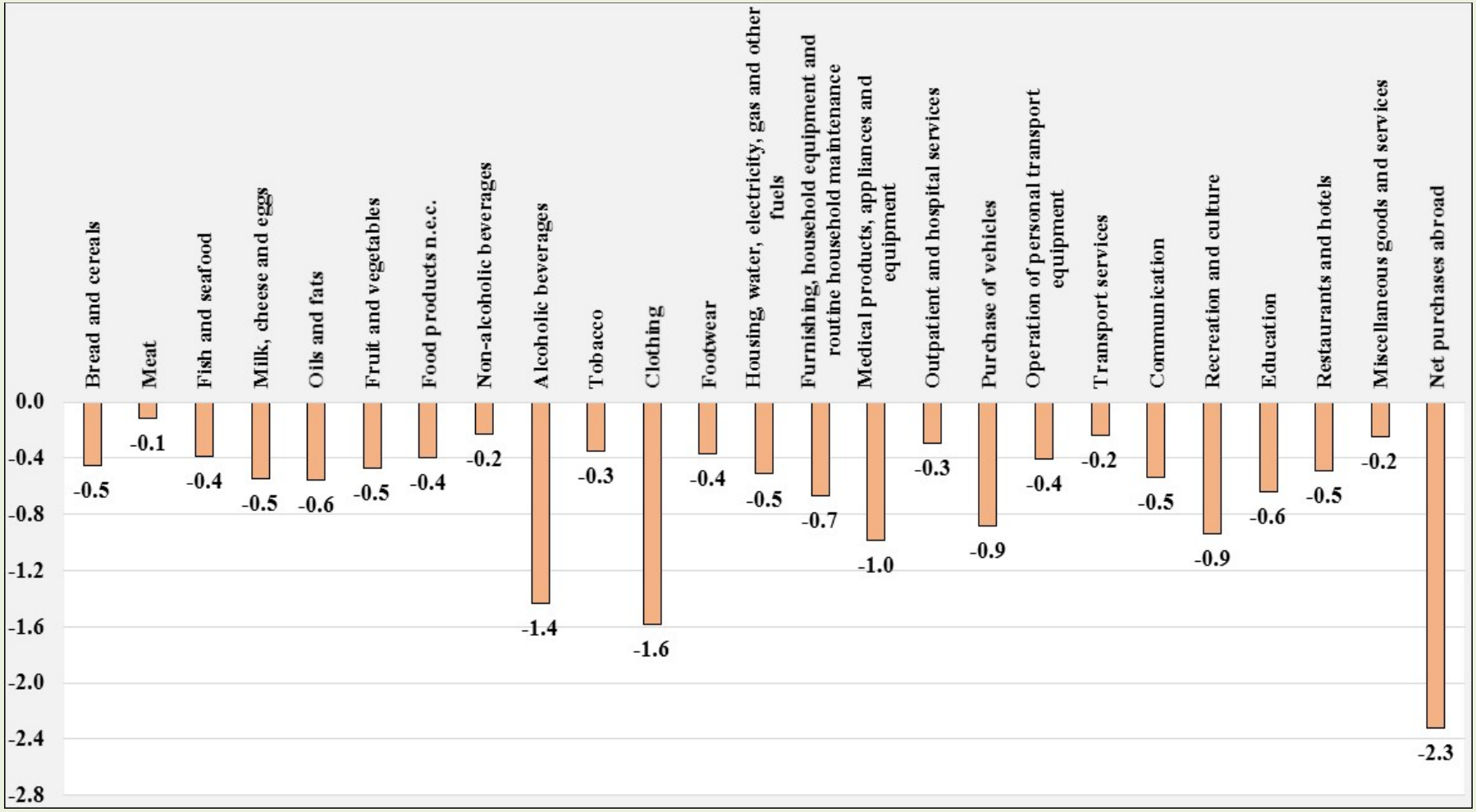
№	Title	lamb	share	IncEl	Dinc	PrEl	Err%	Rho
1	Bread and cereals	0.00	4.1	1.12	0.16	-0.45	3.4	0.04
2	Meat	0.22	8.5	1.21	0.23	-0.12	4.3	0.13
3	Fish and seafood	0.99	1.6	0.96	-0.03	-0.39	1.6	0.73
4	Milk, cheese and eggs	0.99	4.3	1.07	0.12	-0.54	4.6	0.52
5	Oils and fats	0.08	1.2	1.15	0.22	-0.55	1.6	0.40
6	Fruit and vegetables	0.04	5.6	1.15	0.11	-0.47	7.9	0.30
7	Food products n.e.c.	-0.07	2.7	0.97	-0.01	-0.40	2.4	0.13
8	Non-alcoholic beverages	-0.25	2.2	1.02		-0.23	9.7	0.92
9	Alcoholic beverages	1.34	6.2	1.08	0.17	-1.43	8.6	0.41
10	Tobacco	0.10	1.9	0.96	0.00	-0.35	1.7	0.03
11	Clothing	1.00	7.1	0.96	-0.02	-1.58	5.3	0.49
12	Footwear	-1.48	2.2	1.44	0.47	-0.37	2.0	0.21
13	Housing, water, electricity, gas and other fuels	0.32	10.4	1.77	0.91	-0.51	15.7	0.20
14	Furnishing, household equipment and routine household maintenance	0.46	5.1	0.70	-0.29	-0.66	2.5	-0.31
15	Medical products, appliances and equipment	0.61	2.0	0.11	-0.89	-0.98	3.7	0.59
16	Outpatient and hospital services	-0.13	1.6	1.70	0.70	-0.30	2.6	0.48
17	Purchase of vehicles	-0.52	4.9	1.48	0.32	-0.88	14.9	0.25
18	Operation of personal transport equipment	-1.28	3.3	0.31	-0.69	-0.41	7.3	0.90
19	Transport services	-1.64	3.3	0.97		-0.24	4.4	0.56
20	Communication	0.32	4.8	1.02		-0.54	8.4	0.72
21	Recreation and culture	0.75	4.8	0.83	-0.23	-0.94	5.1	0.24
22	Education	0.39	1.2	1.40	0.46	-0.64	1.6	0.25
23	Restaurants and hotels	0.25	3.3	1.62	0.57	-0.49	5.2	0.50
24	Miscellaneous goods and services	-0.01	5.3	0.69	-0.37	-0.25	13.0	0.80
25	Net purchases abroad	2.17	2.3	1.23		-2.33	17.3	0.49

lamb – lambda estimated**, share** – share of an item in 2010**, IncEl** - income elasticity in 2010**, Dinc** – ratio of coefficient on the change of income and income coefficient**, PrEl** – own price elasticity**, Err** – the standard error of estimate as % of 2010 value**, Rho** – residuals' autocorrelation coefficient

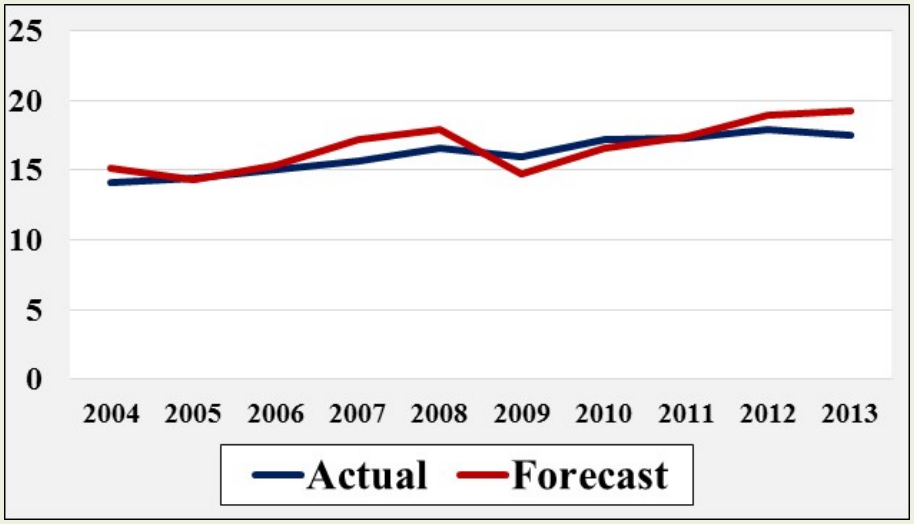
Estimated Income Elasticities



Estimated Own Price Elasticities

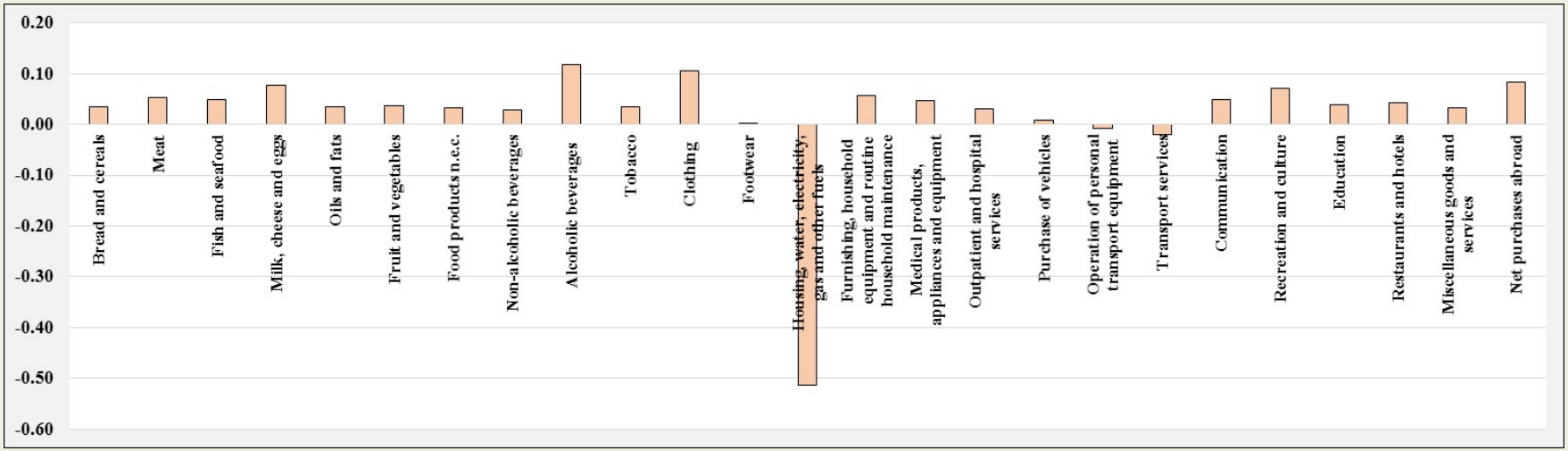


Examples: Housing, Water, Electricity, Gas and Other Fuels

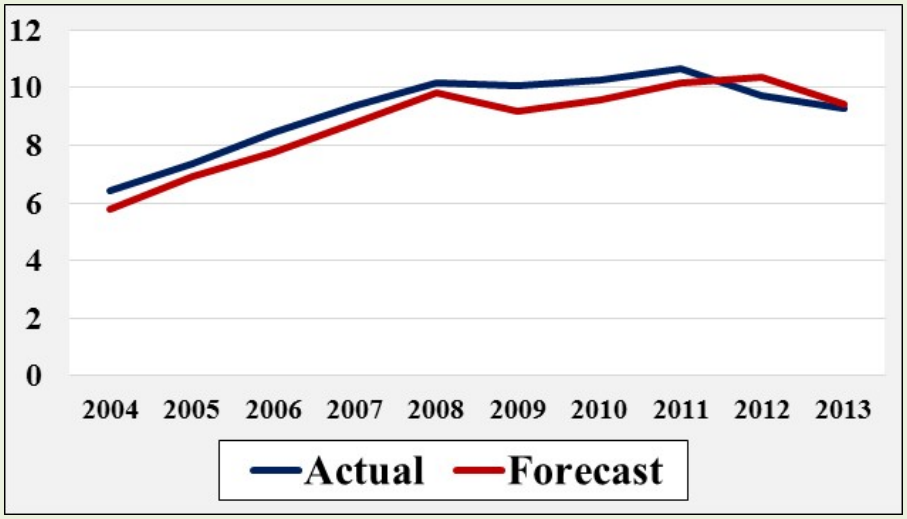


Share in 2010 = 10.4%
Lambda = 0.32
Income elasticity = 1.77
Own price elasticity = -0.51

Cross Price Elasticities

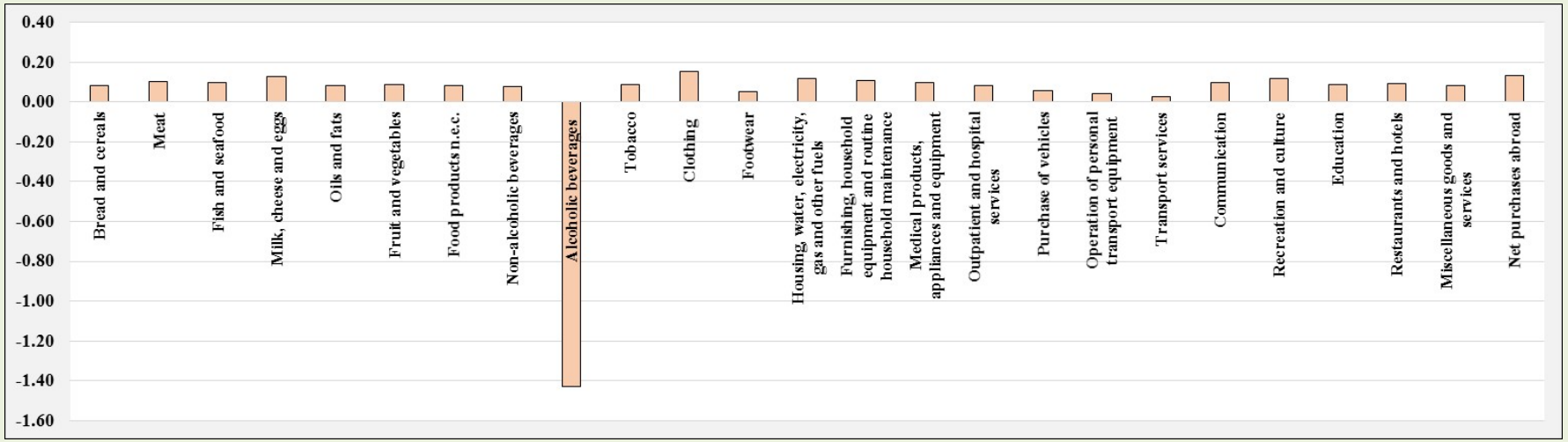


Examples: Alcoholic Beverages

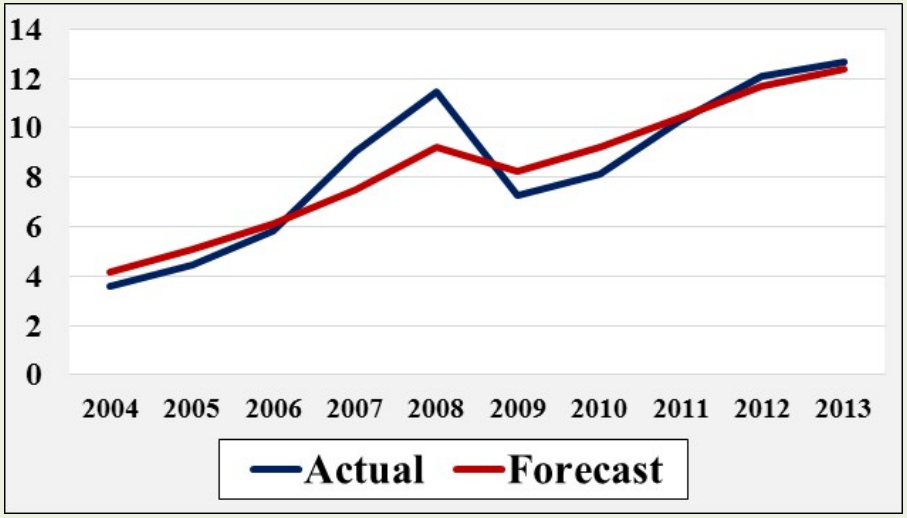


Share in 2010 = 6.2%
Lambda = 1.34
Income elasticity = 1.08
Own price elasticity = -1.43

Cross Price Elasticities

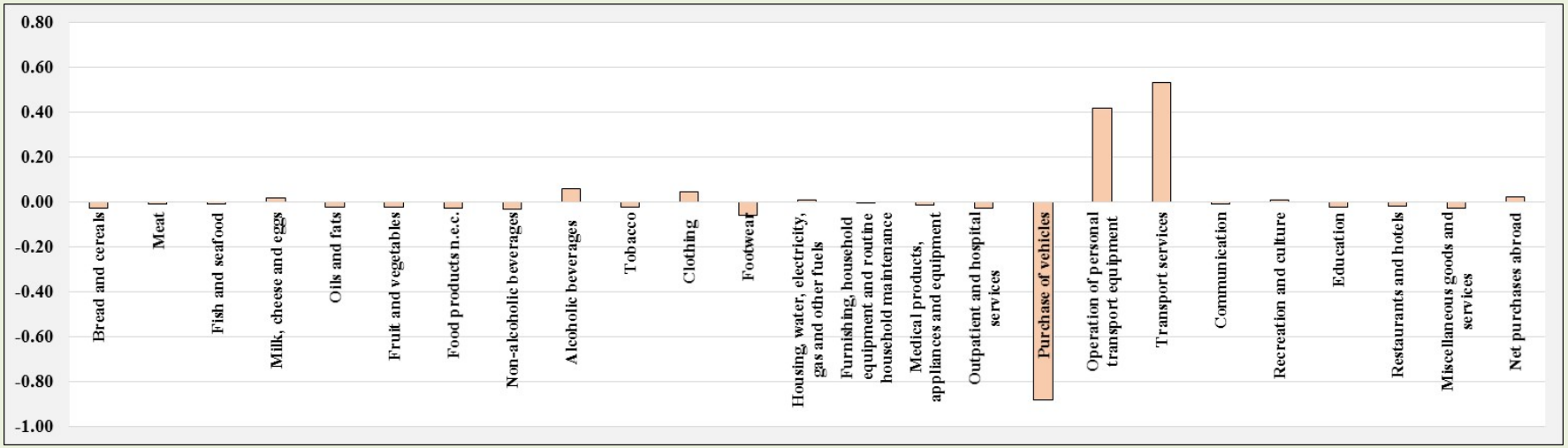


Examples: Purchase of Vehicles



Share in 2010 = 4.9%
Lambda = -0.52
Mu = -0.30
Nu = -0.29
Income elasticity = 1.48
Own price elasticity = -0.88

Cross Price Elasticities



Bridge Matrix

To proceed to forecasting with RIM (Russian Inforum-Type model), a bridge matrix should be used

The matrix allows to transform parameters estimated on COICOP classification (25 items) into forecast based on NACE Rev. 1.1 classification 45 items)

RIM Personal Consumption Block - PADS

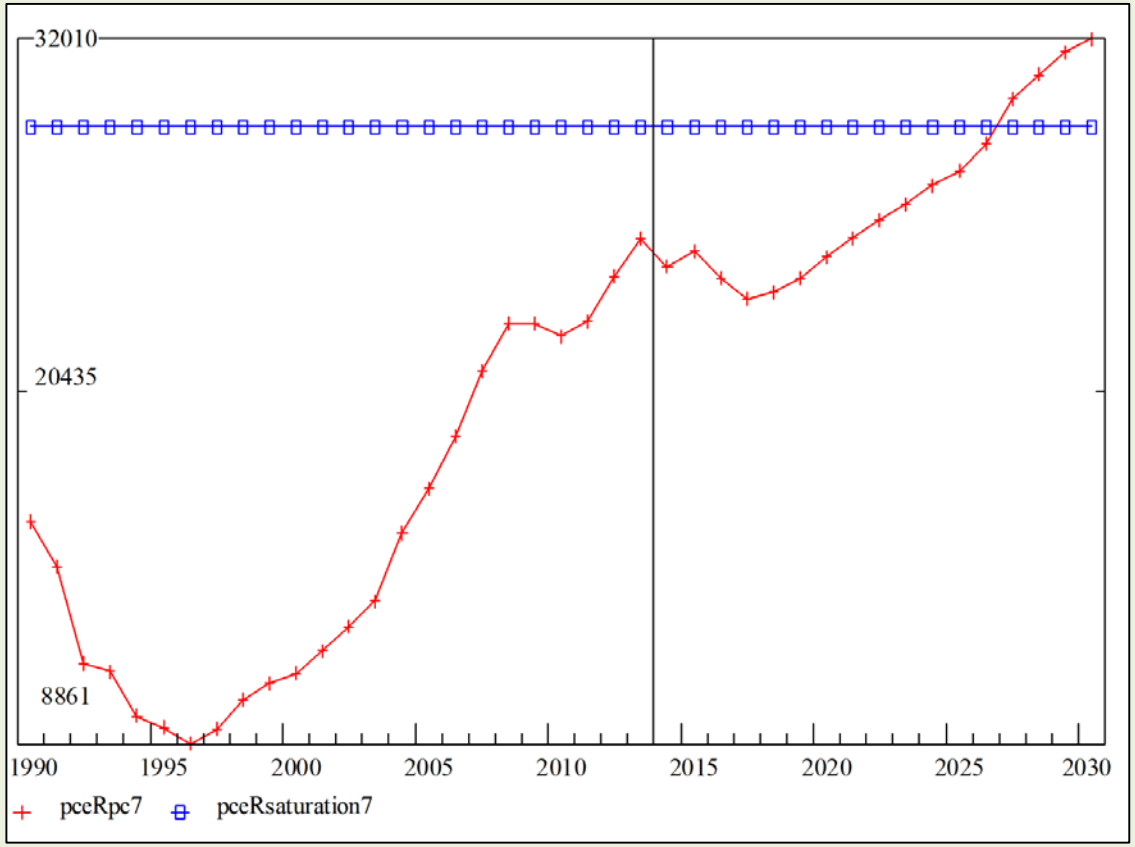
$$x_i = (b_i * \left(\frac{y}{P}\right) + ci * \Delta\left(\frac{y}{P}\right)) * \left(\frac{p_i}{P}\right)^{-\lambda_i} \prod_{k=1}^{n} \left(\frac{p_i}{p_k}\right)^{-\lambda_k * s_k} \left(\frac{p_i}{P_G}\right)^{-\mu_G} \left(\frac{p_i}{P_g}\right)^{-\vartheta_g}$$

$$P = \prod_{k=1}^{n} {p_k}^{s_k}$$

$$P_G = \left(\prod_{k=1}^{n} {p_k}^{s_k}\right)^{1/\sum_{k\in G} s_k}$$

$$P_g = \left(\prod_{k=1}^{n} {p_k}^{s_k}\right)^{1/\sum_{k\in g} s_k}$$

Food, beverages, tobacco



RIM Personal Consumption Block – Previous Variant

Logistic function

$C_i(y, z) = L_i / (1 + e^{(ai - bi*y)})$

where

y is expenditures for goods and services per capita in constant prices

C_i is consumption per capita of item i in constant prices

L_i is the saturation level

a_i, b_i are positive constants to be estimated with non-linear regression

Agriculture

Food, beverages, tobacco

Automobiles, highway transport equipment

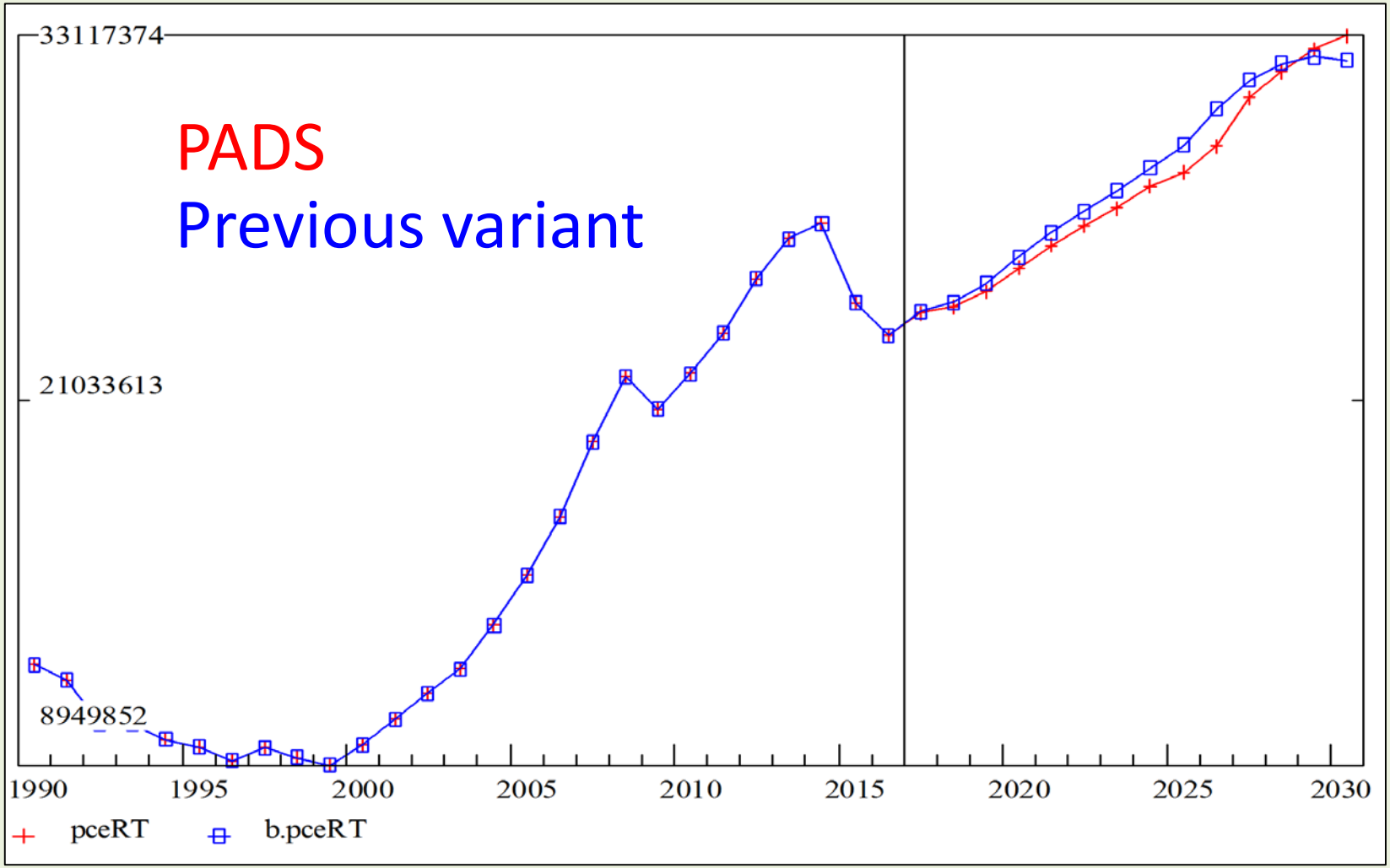
Transport and storage

Others sectors depend on

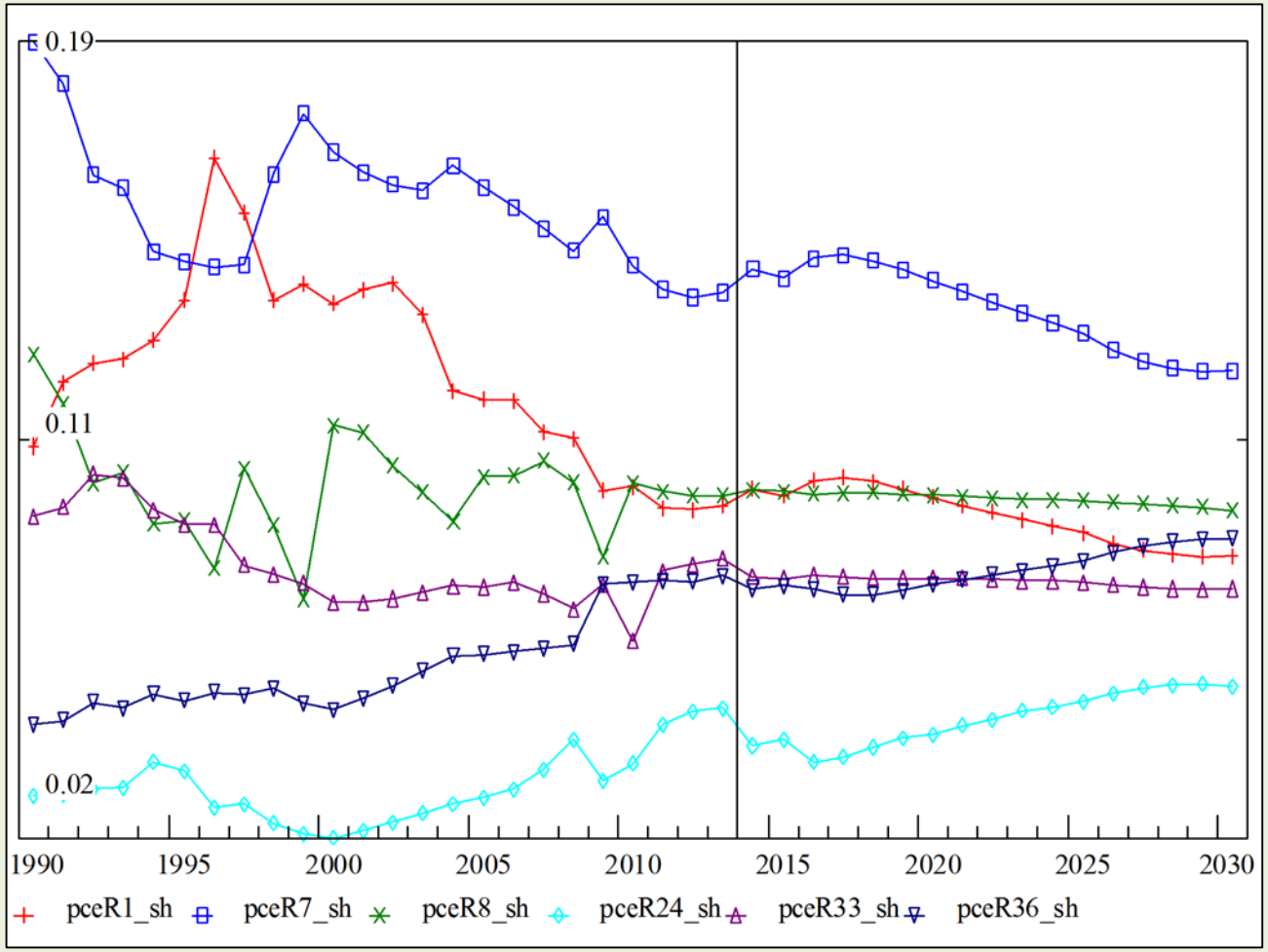
expenditures for goods and services per capita in constant prices

sector prices relative to PCE deflator

RIM Forecast 2030 – Volume of Personal Consumption



Personal Consumption by Main Sectors, shares in total – Previous Variant



Food, beverages, tobacco

Agriculture

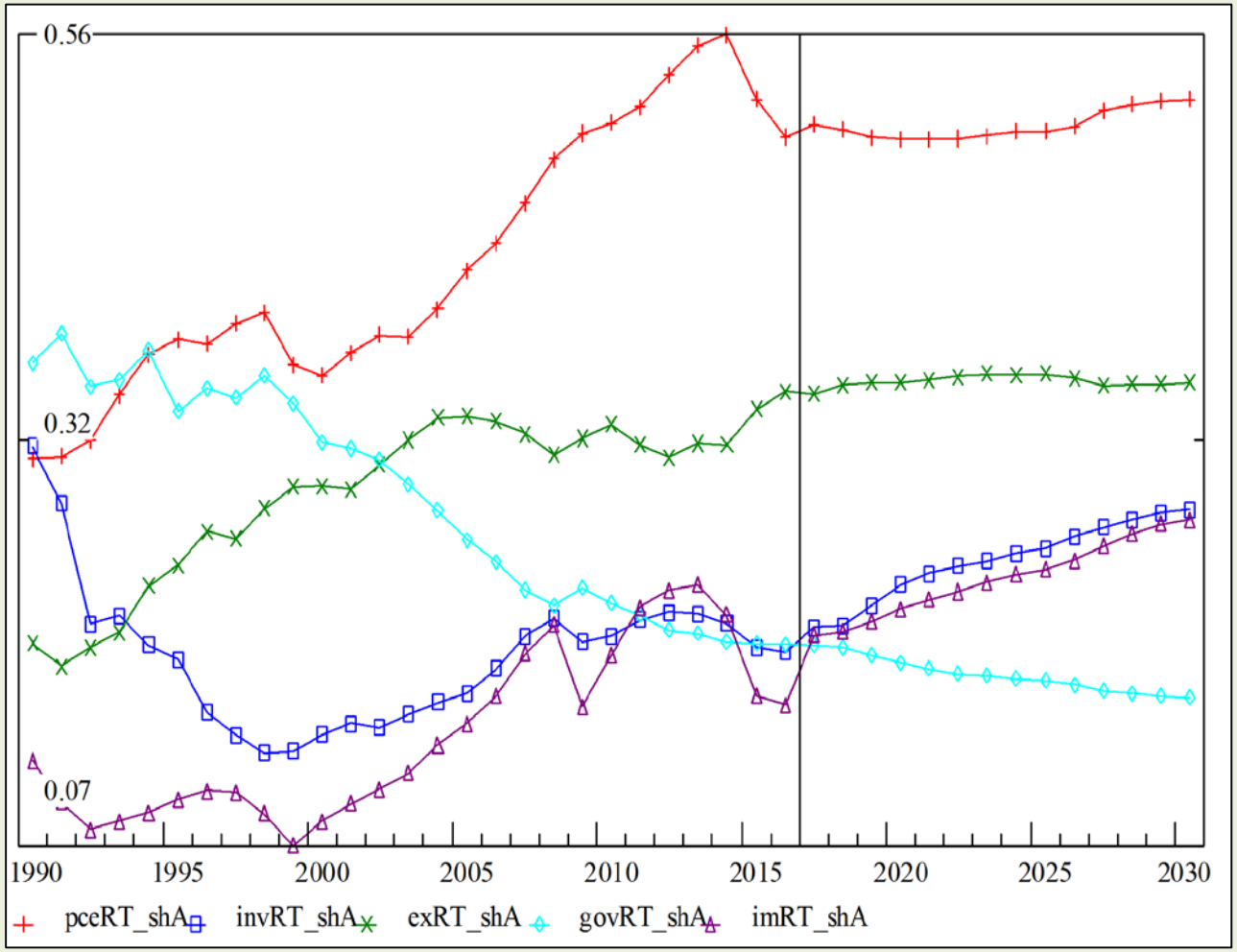
Textiles, apparel, leather

Transport and storage

Real estate

Automobiles, highway transport equipment

GDP Structure - PADS



Personal consumption

Exports

Investments in fixed capital

Imports

Government consumption

Economic aggregates, Real Quantities, Average Annual Growth Rates, %

	13-17	17-20	20-25	25-30
GDP	-0.1	2.6	2.1	2.2
Gross investments in fixed capital	-1.1	6.5	4.0	4.0
Personal consumption	-2.4	2.0	2.3	3.0
Government consumption	-1.1	0.6	0.9	1.0
Imports	-3.7	5.1	4.3	4.6
Exports	2.1	3.3	2.4	1.9
Personal disposable income per capita	-2.8	2.8	2.4	3.0
GDP deflator	5.0	3.1	3.3	3.9

Next Steps

- **Adjusting, cleaning and improving the current estimation results**
- **Cross-section approach's realization. Analysis of age and income distribution's influence on consumption patterns**
- **Adjusting, cleaning and improving forecast of household consumption expenditures within RIM model**

THANK YOU FOR ATTENTION!