Long-term forecast of Russian Economy (using Russian Interindustry Model RIM)

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- Data and statistical base
- Current progress in RIM
- General structure of Model
    1. Budget and fiscal block
    2. Investments and capital stock
    3. Employment
- Some forecast results

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Russian Interindustry Model

- 44 sectors
- I-O data are available for 1980-2010
- Real and nominal sides
- Using G7 and PortableDyme
- Model construction hasn’t been finished yet

Data base - 1

Data base prepared by Marat Uzyakov and researches from the Institute of Economic Forecasting:

- Input-Output Tables: 1980-2010 (constant and current prices)
- Matrixes of trade and transport margins
- Tax matrix
- Import matrix
- Production capacity balances and sector investment

Data base - 2

Data from Russian Statistics Service, Ministry of Finances, the Central Bank etc.:

- National accounts (2002-2012)
- Institutional accounts (2002-2009)
- Consolidated budget data (including Pension fund)
- Demography and employment indicators
- Balance of payments
- Energy resources production data
- Prices data
- Exchange rates and money statistics

Current progress in RIM

Present version:

Real side:

- personal consumption
- government consumption
- investment and capital stock
- exports and imports
- energy block
- employment

Nominal side:

- budget and fiscal block
- value-added by sectors
- prices by sectors

Under construction:

- financial block
- balance of payments
- modeling of demography indicators

What's new from the last INFORUM Conference?

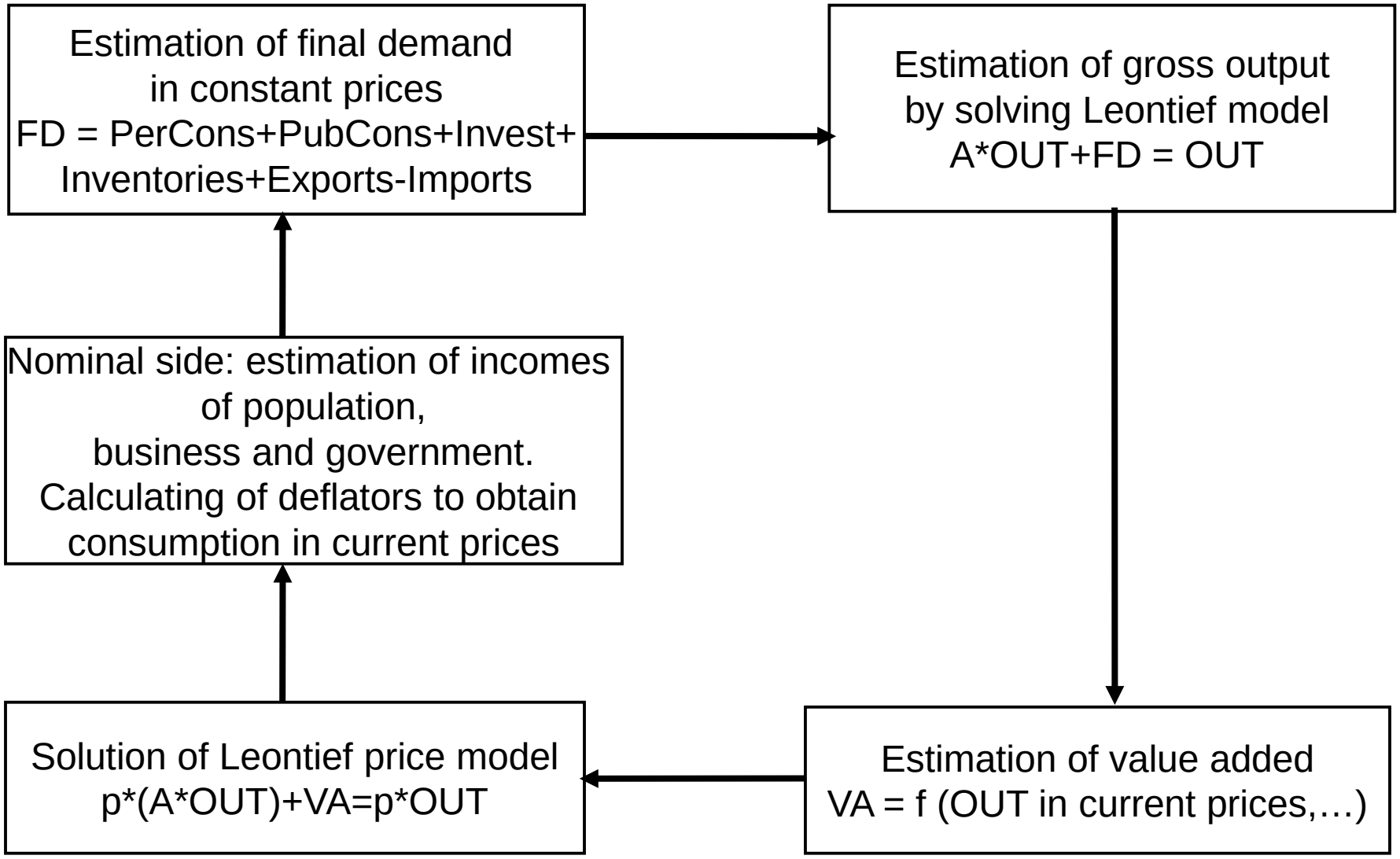
Real side of Model:

- ✓ Personal consumption estimates with use of saturation level
- ✓ Elaborated investment regressions
- ✓ Two-bucket system for calculation of capital stock
- ✓ New estimates for sector employment with use of production functions

Nominal side of Model:

- ✓ Calculations of net taxes on production and taxes on products used by sector

General structure of Model



Budget and fiscal block - 1

Main identity:

net taxes on products used = taxes paid - subsidies

Regression:

$$\text{net taxes}_i = a * (A_{7i} + A_{11i} + A_{24i}) + b * \text{export}_i + c * (\text{import used}_i) + d * VAT_i + e * \text{BudgetExpenses}$$

i – sector number

$(A_{7i} + A_{11i} + A_{24i})$ – intermediate consumption of excise goods by sector i

$$\text{import used}_i = \Sigma_k \, \text{ImportMatrix}_{ki}$$

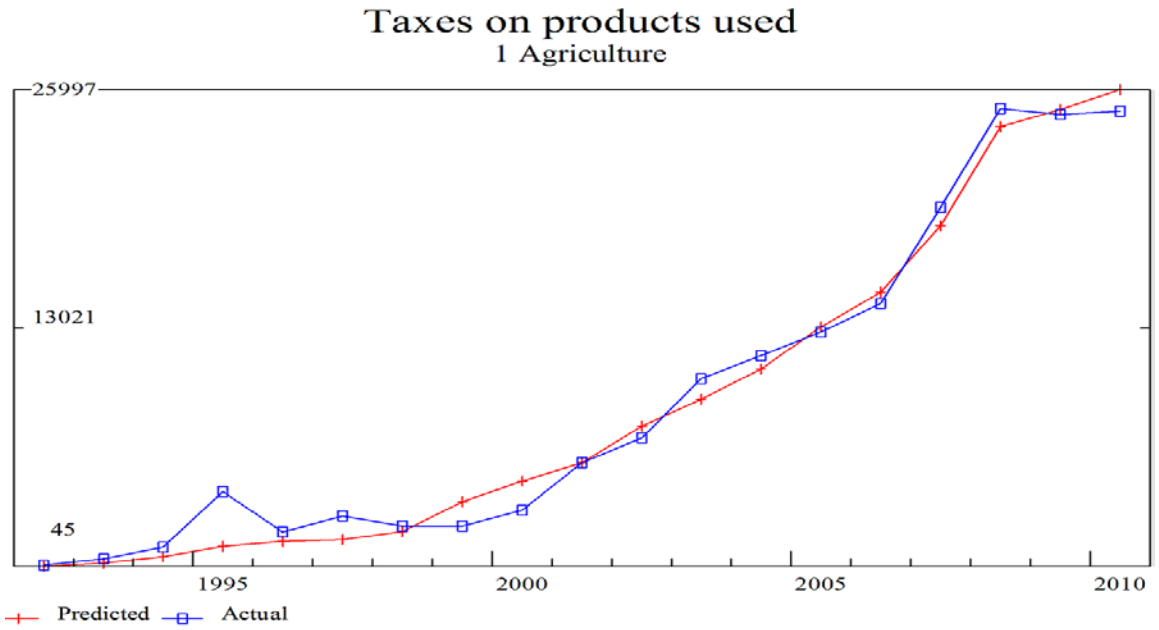
$$VAT_i = \text{VATreceived}_i - \text{VATpaid}_i = \text{VATrate}_i * OUT_i - (\Sigma_k \, \text{VATrate}_k * OUT_{ki}) - \text{VATrate}_i * \text{Export}_i$$

Budget and fiscal block - 2

1 Agriculture – Net taxes on products used

SEE = 1059.17 RSQ = 0.9846 RHO = 0.32 Obser = 19 from 1992.000
SEE+1 = 1009.62 RBSQ = 0.9802 DW = 1.35 DoFree = 14 to 2010.000
MAPE = 24.54

	Variable name	Reg-Coef	Mexval	Elas	NorRes	Mean	Beta
0	tax1	- - - - - - - - - - - - - - - - - - -				9128.57	- - -
1	$A_{7,1}+ A_{11,1}+ A_{24,1}$	0.02656	2.3	0.29	2.18	100341.76	
2	export1	0.02816	18.3	0.27	1.99	87846.87	0.349
3	VAT1	0.02543	12.9	0.26	1.03	93461.33	0.202
4	GovExpenses	-0.01348	1.5	-0.12	1.02	84048.67	-0.133
5	import used1	0.04425	1.0	0.28	1.00	57565.08	0.289



Budget and fiscal block - 3

Main identity:

net taxes on production = taxes paid – subsidies

Regression:

$$\text{net taxes}_i = a * \text{OUT}_i + b * \text{capstock}_i * \text{GDP deflator} + c * \text{BudgetExpenses}$$

i – sector number (except i = 2, 3)

For i=2 (Petroleum extraction):

$$\text{taxes}_2 = a * \text{tax rate}_2 * \text{oil extraction}$$

tax rate_2 = 493*(Urals Crude Oil price -15)*rateusd/261

For i=3 (Natural gas extraction):

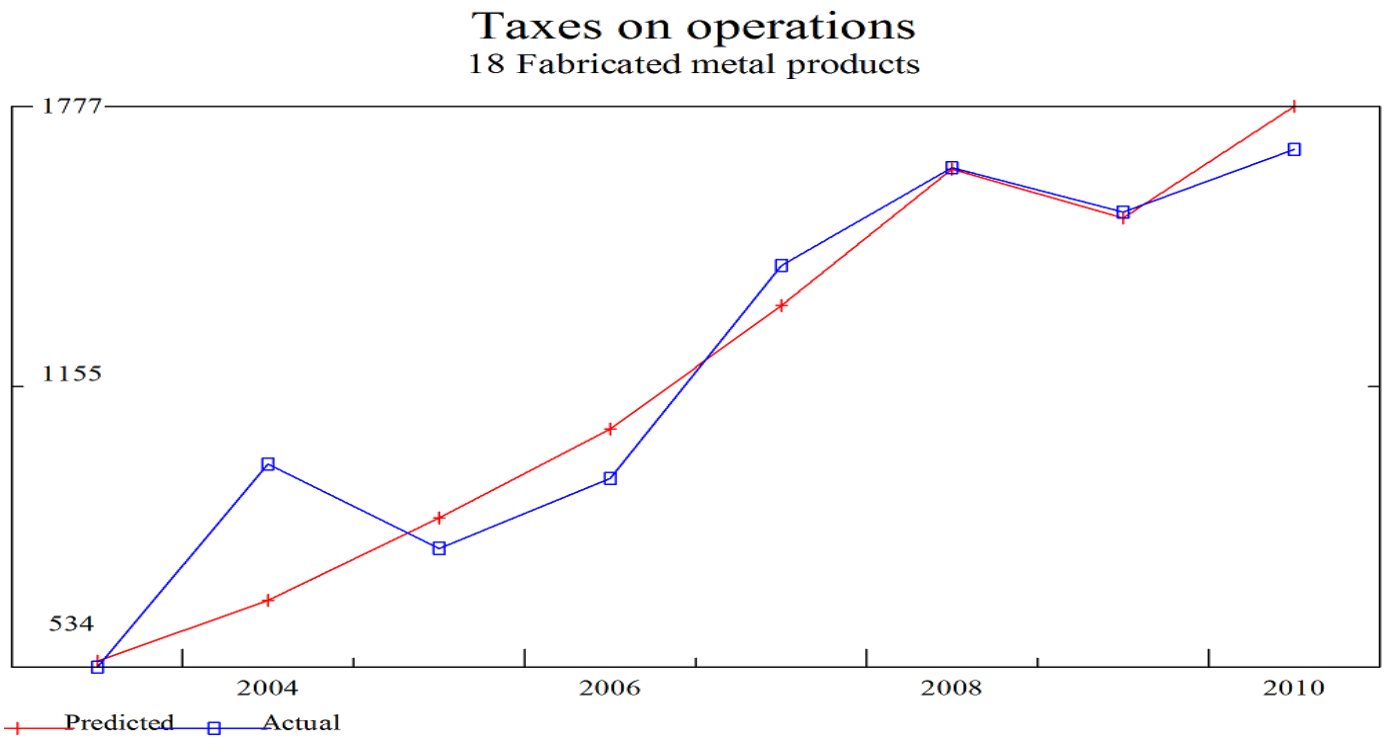
$$\text{taxes}_3 = a * \text{tax rate}_3 * \text{gas extraction}$$

tax rate_3 = 700 rubles/1 billion m^3

Budget and fiscal block - 4

19 Machinery – Net taxes on production

```
SEE    =     109.43 RSQ   = 0.9682 RHO =  -0.57 Obser  =    6 from 2003.000
SEE+1  =      88.83 RBSQ  = 0.9470 DW  =   3.13 DoFree =    3 to   2010.000
MAPE   =       2.95
  Variable name          Reg-Coef  Mexval  Elas   NorRes     Mean   Beta
0 b.taxop19            - - - - - - - - - - - - - - - - -  2746.53 - - -
1 intercept             242.29373    12.1   0.09   31.42      1.00
2 out19                   0.00235   176.0   0.74    1.35 861058.38  0.821
3 capstock19*def          0.52040    16.3   0.17    1.00    922.50  0.190
```



Investment and capital stock - 1

$$capinv_i = a * (output_i / capstock_i) +$$
$$+ b * profit_i + c * credits_i +$$
$$+ d * capinv_i [t-1] +$$
$$+ e * @pos (OUT_i – peakOUT_i)$$

output/capstock – ratio of usage of capital stock

credits – cumulative credits received divided by GDP deflator (level of debt load)

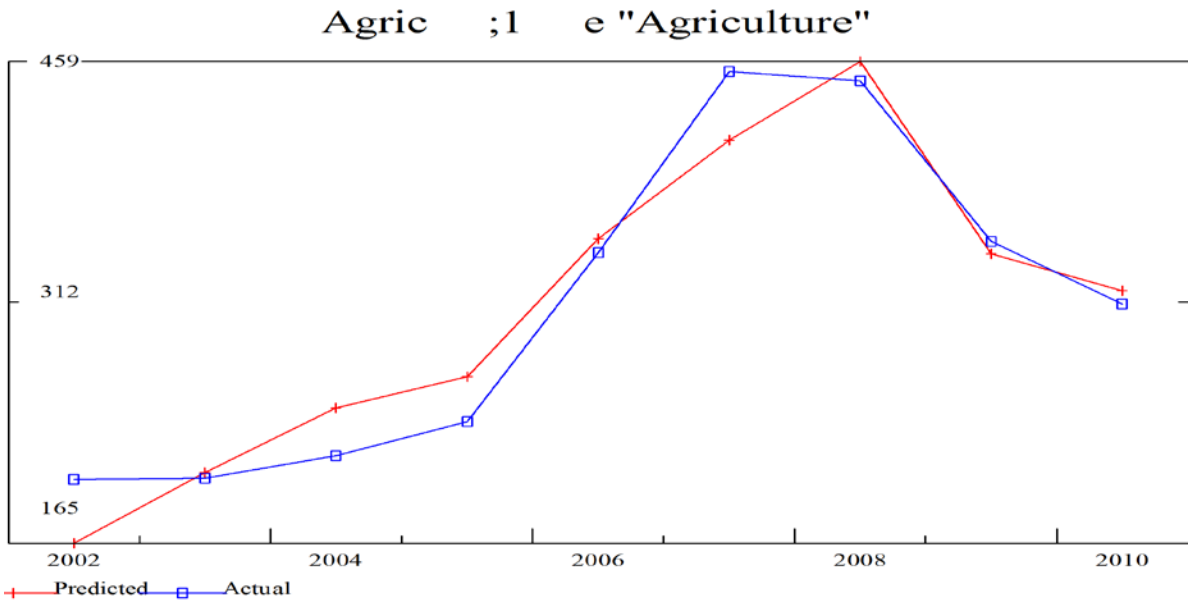
peakOUT – maximum sector output for years 1,…,t-1

Investment and capital stock - 2

1 Agriculture – Investments in capital stock

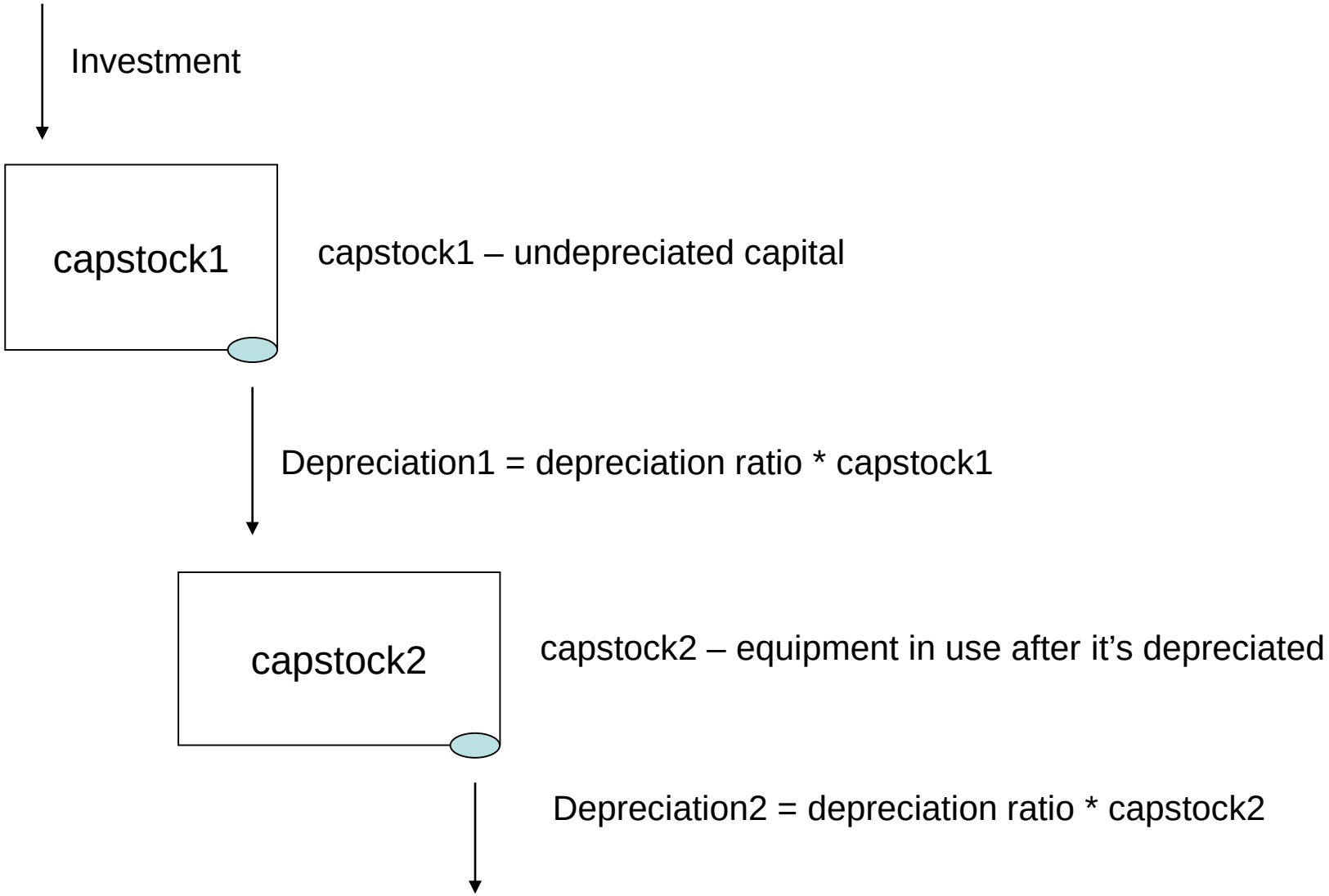
```
SEE    =      23.96 RSQ   = 0.9330 RHO =   0.15 Obser  =    9 from 2002.000
SEE+1  =      24.22 RBSQ  = 0.8928 DW  =   1.70 DoFree =    5 to   2010.000
MAPE   =       7.15
```

	Variable name	Reg-Coef	Mexval	Elas	NorRes	Mean	Beta
0	capinv1	- - - - - - - - - - - - - - - - - - - -				307.42	- - -
1	OUT1 – peakOUT1	0.00038	59.0	0.12	58.50	97090.67	
2	profit	1.78771	109.2	0.77	3.56	133.18	1.071
3	OUT1 / capstock1	0.01457	38.0	0.20	1.15	4160.60	0.103
4	(credits)/def	-42.88828	7.4	-0.09	1.00	0.65	-0.248



Investment and capital stock - 3

Расчет объема используемого основного капитала будем производить на основе системы “cascading two-bucket system”:



Investment and capital stock - 4

Two-bucket system for estimating capital stock by sector:

$ub1 = @cum(ub1,1,R_i)$

$a = @exp(embTech_i*(t))$

$capstock1_i = @cum(cuminv1_i, a*capinv_i, R_i) / ub1$

$capstock2_i = @cum(cuminv2_i, capstock1_i, R_i)/ub1$

$capstock_i = capstock1_i + capstock2_i$

R – depreciation ratio

embTech – rate of growth productivity embodied in capital

Investment and capital stock - 5

R – depreciation ratio (the 3rd column)

embTech – rate of growth productivity embodied in capital (the 2nd column)

```
1  .05 .15   "Agriculture"
2  .05 .15   "Petroleum extraction"
3  .00 .15   "Natural gas extraction"
4  .05 .15   "Coal mining"
5  .05 .15   "Other Fuels, incl. nuclear"
6  .00 .15   "Ores and other mining"
7  .05 .15   "Food, beverages, tobacco"
8  .05 .15   "Textiles, apparel, leather"
9  .05 .15   "Wood and wood products"
10 .00 .15   "Paper and printing"
11 .00 .15   "Petroleum refining"

  ...
```

developed by Clopper Almon

based on results of Ph.D. thesis by Daniel J.Wilson

Employment - 1

Estimation of sector employment by means of production functions with use of **embodied technical change** (for taking into consideration growth of labor productivity due to appearance of new equipment):

$$Q(t) = f(L(t), K(t), t)$$

The Cobb-Douglas production function

$$Q_t = Ae^{rt} L_t^{\alpha} K_t^{1-\alpha}$$

α = 2/3 (typical value)

e^{rt}- disembodied technical change

Regressions are estimated for the following identity:

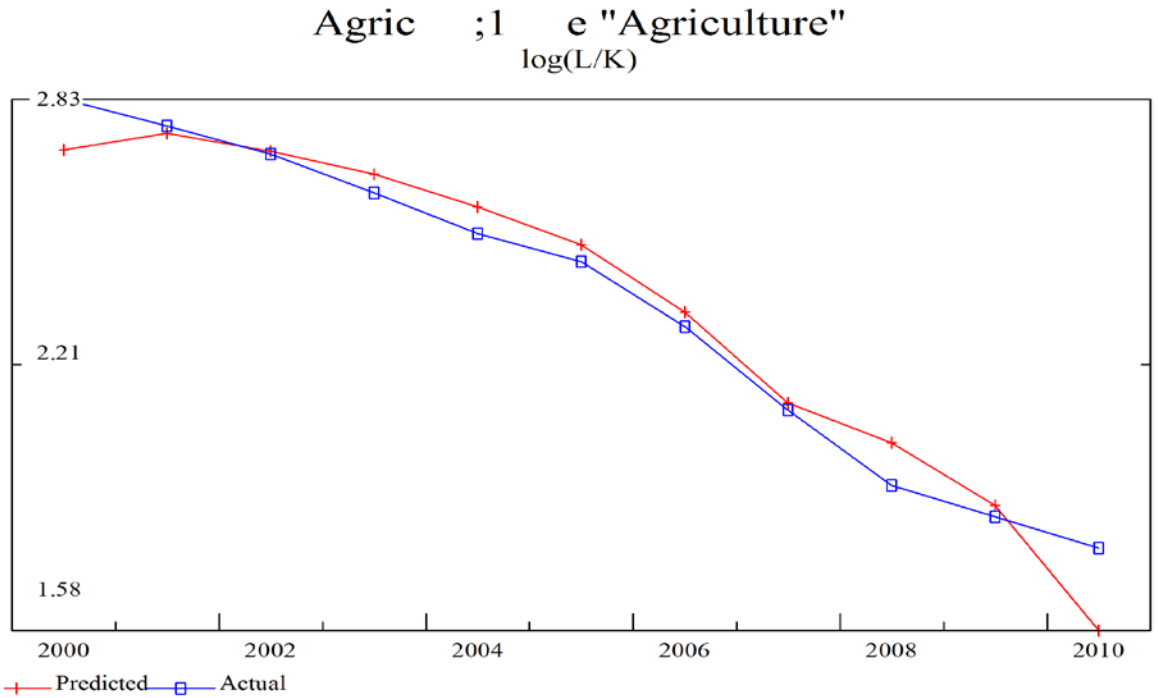
$$\log(L/K) = -\frac{\log A}{\alpha} - \frac{r}{\alpha} t + \frac{1}{\alpha} \log(Q/K).$$

Employment - 2

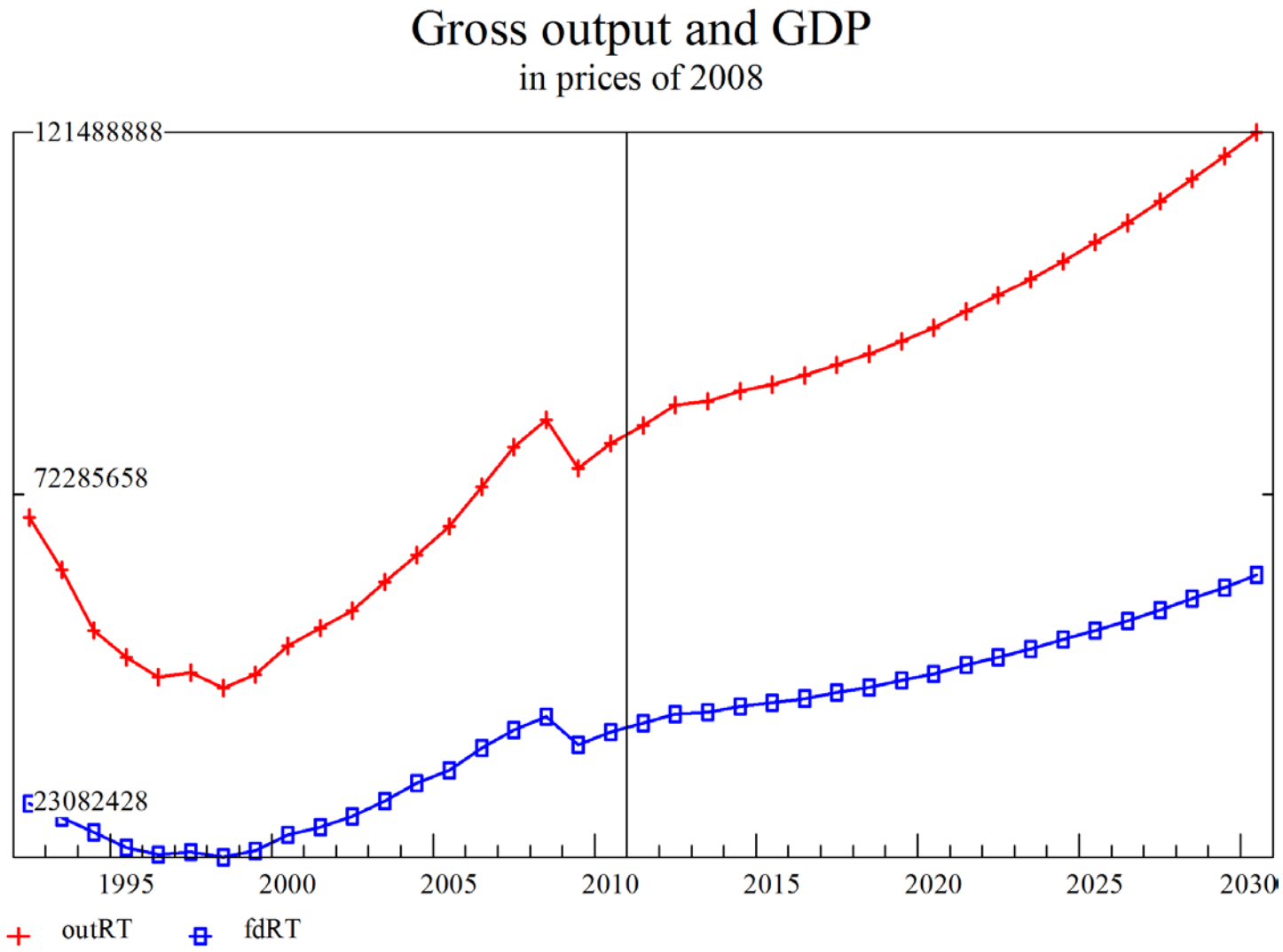
1 Agriculture – LOG (L/K)

SEE = 0.08 RSQ = 0.9509 RHO = 0.48 Obser = 11 from 2000.000
SEE+1 = 0.08 RBSQ = 0.9386 DW = 1.04 DoFree = 8 to 2010.000
MAPE = 2.82

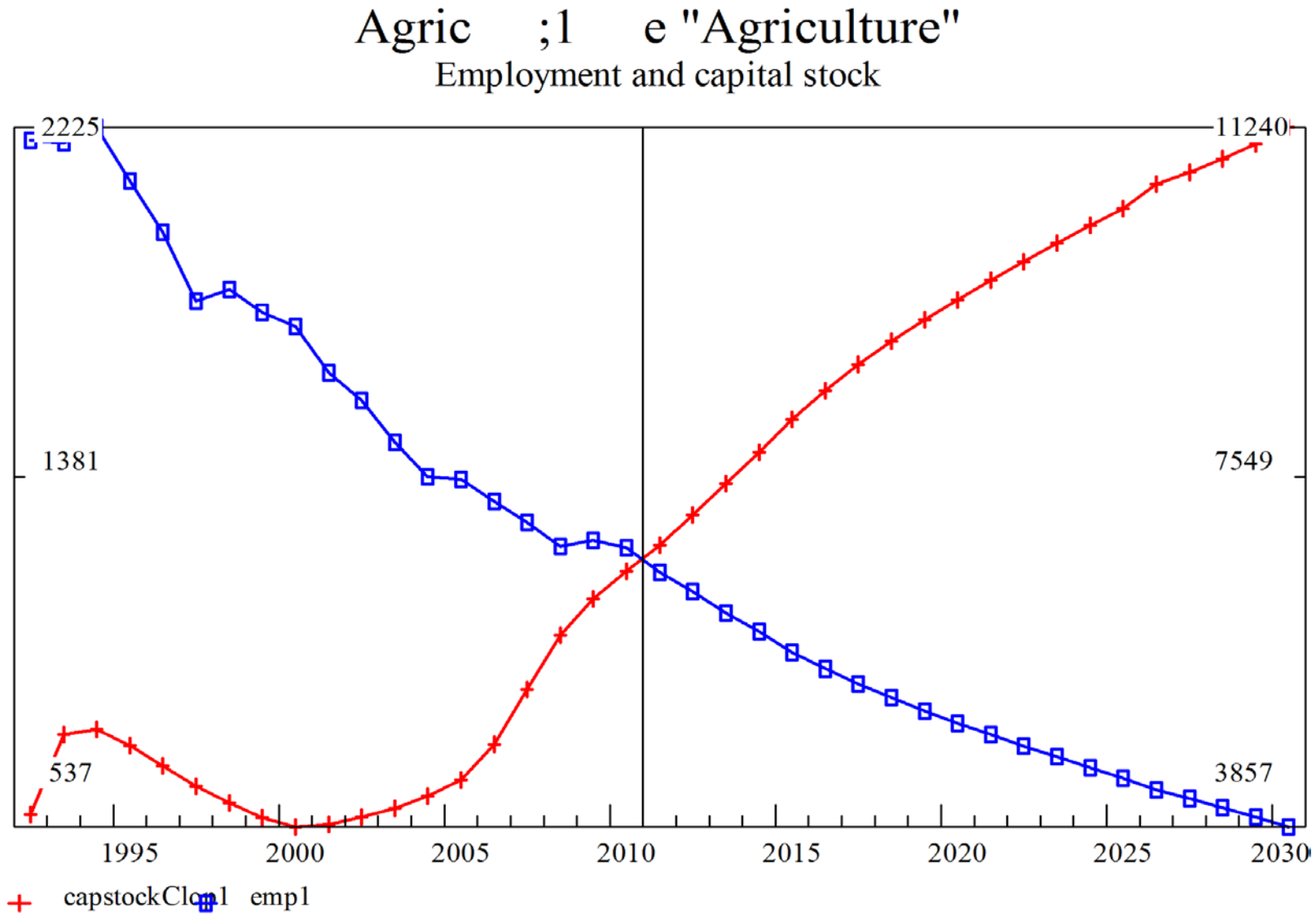
	Variable name	Reg-Coef	Mexval	Elas	NorRes	Mean	Beta
0	LOG(L/K)	- - - - - - - - - - - - - - - - - - -				2.35	- - -
1	intercept	66.54471	49.1	28.35	52.15	1.00	
2	time	-0.03798	63.0	-32.45	33.14	2005.00	-0.328
3	LOG (Q/K)	1.44628	475.6	5.09	1.00	8.27	0.726



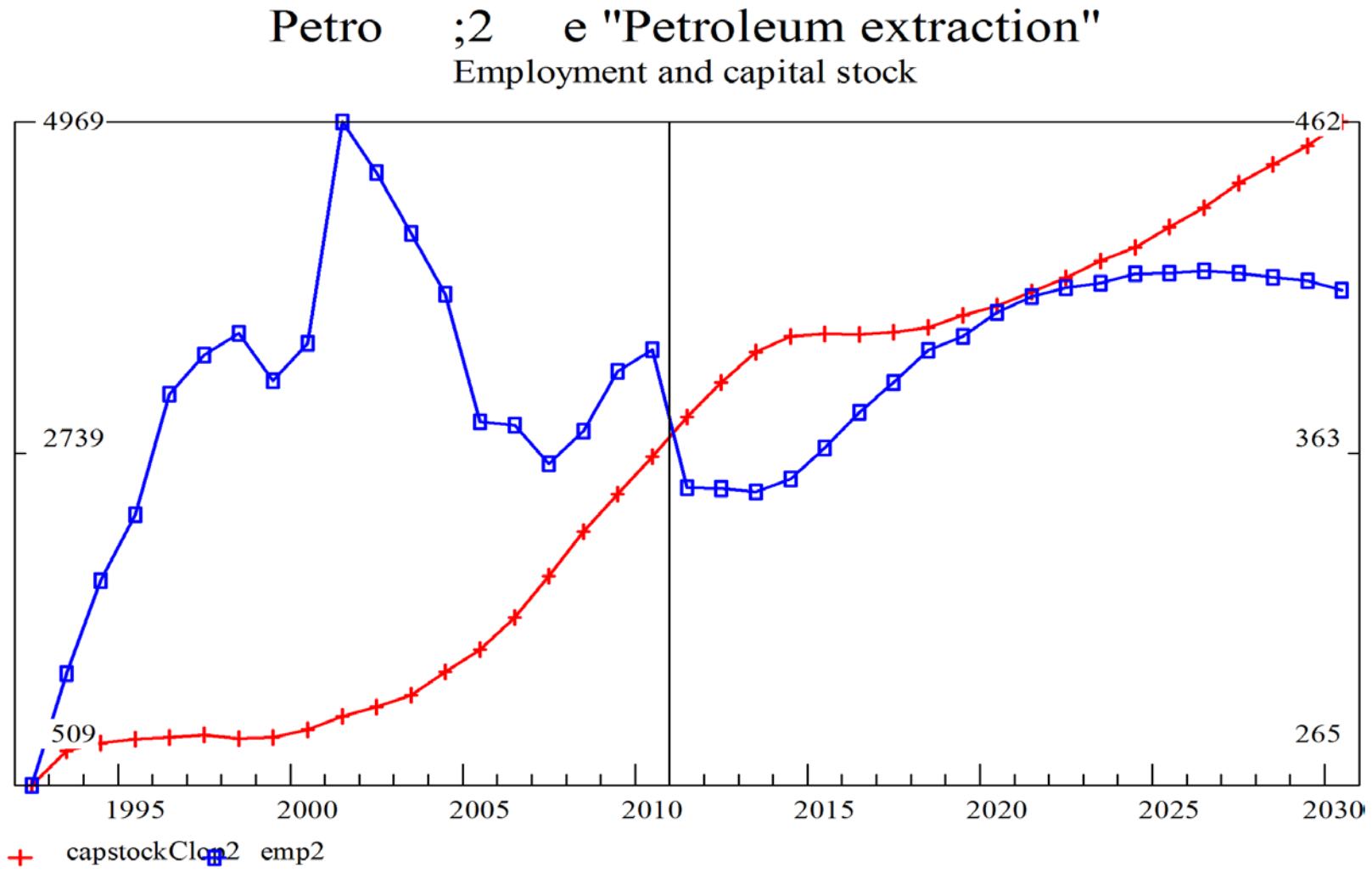
Forecast results - 1



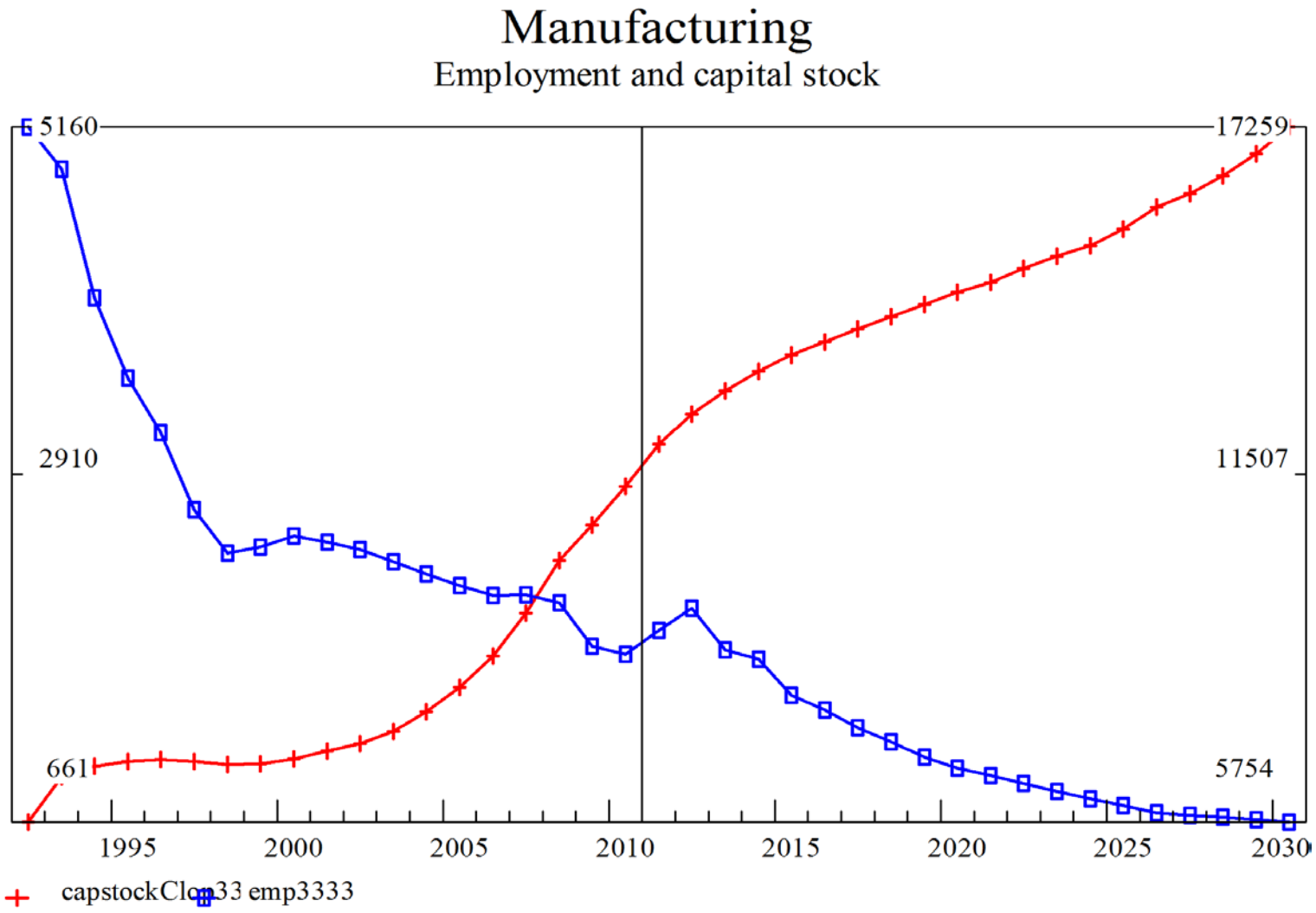
Forecast results - 2



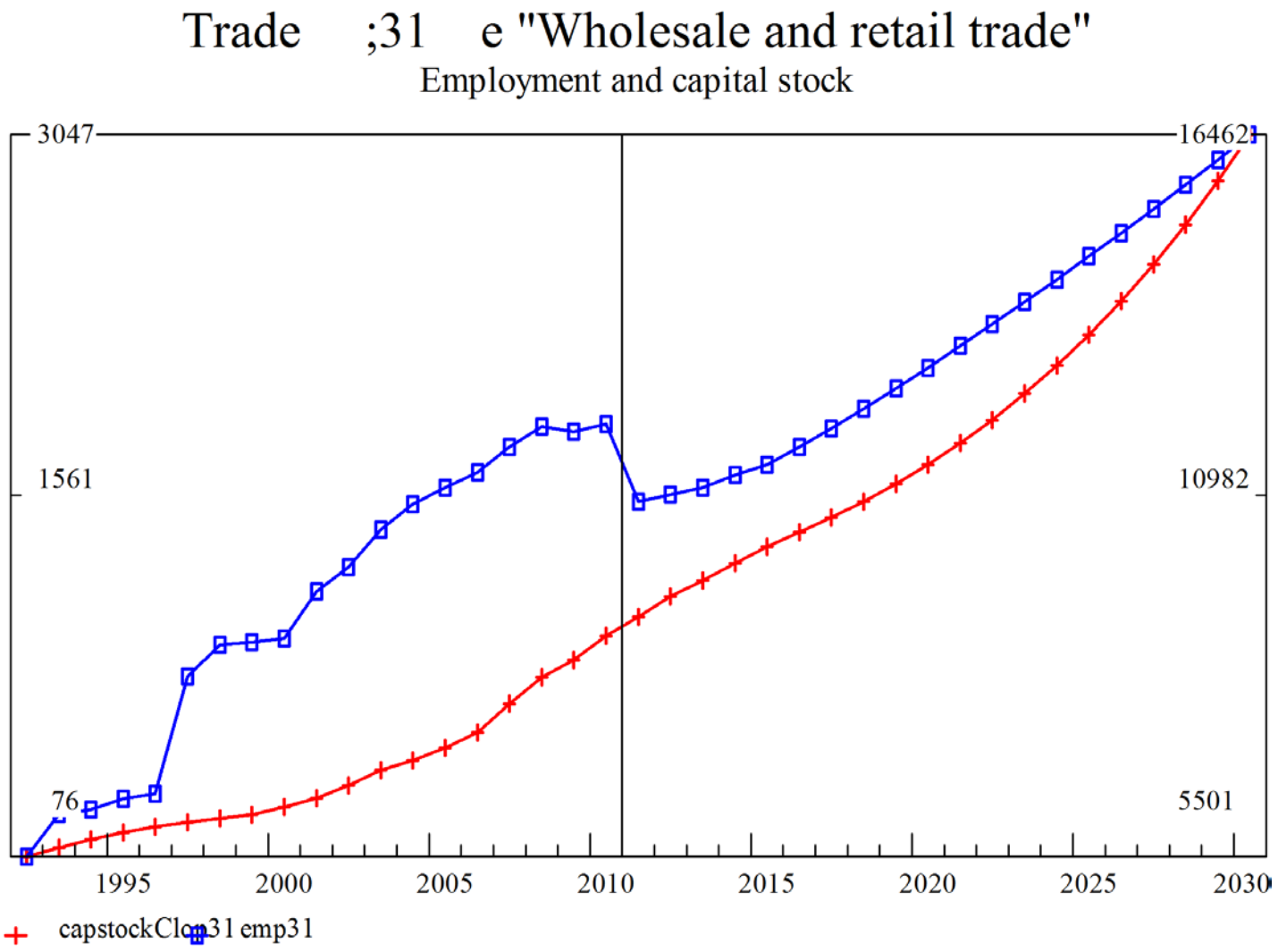
Forecast results - 3



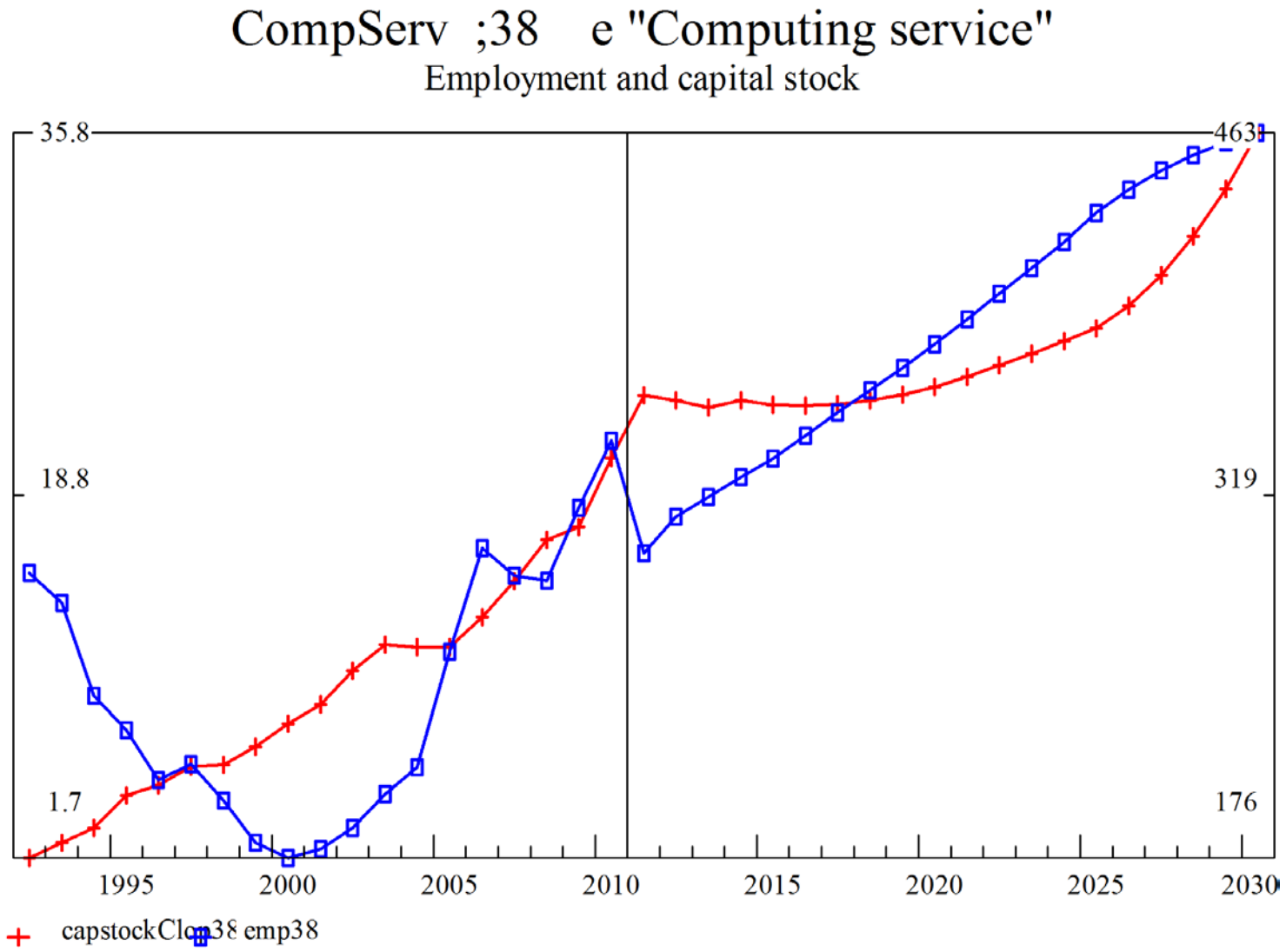
Forecast results - 4



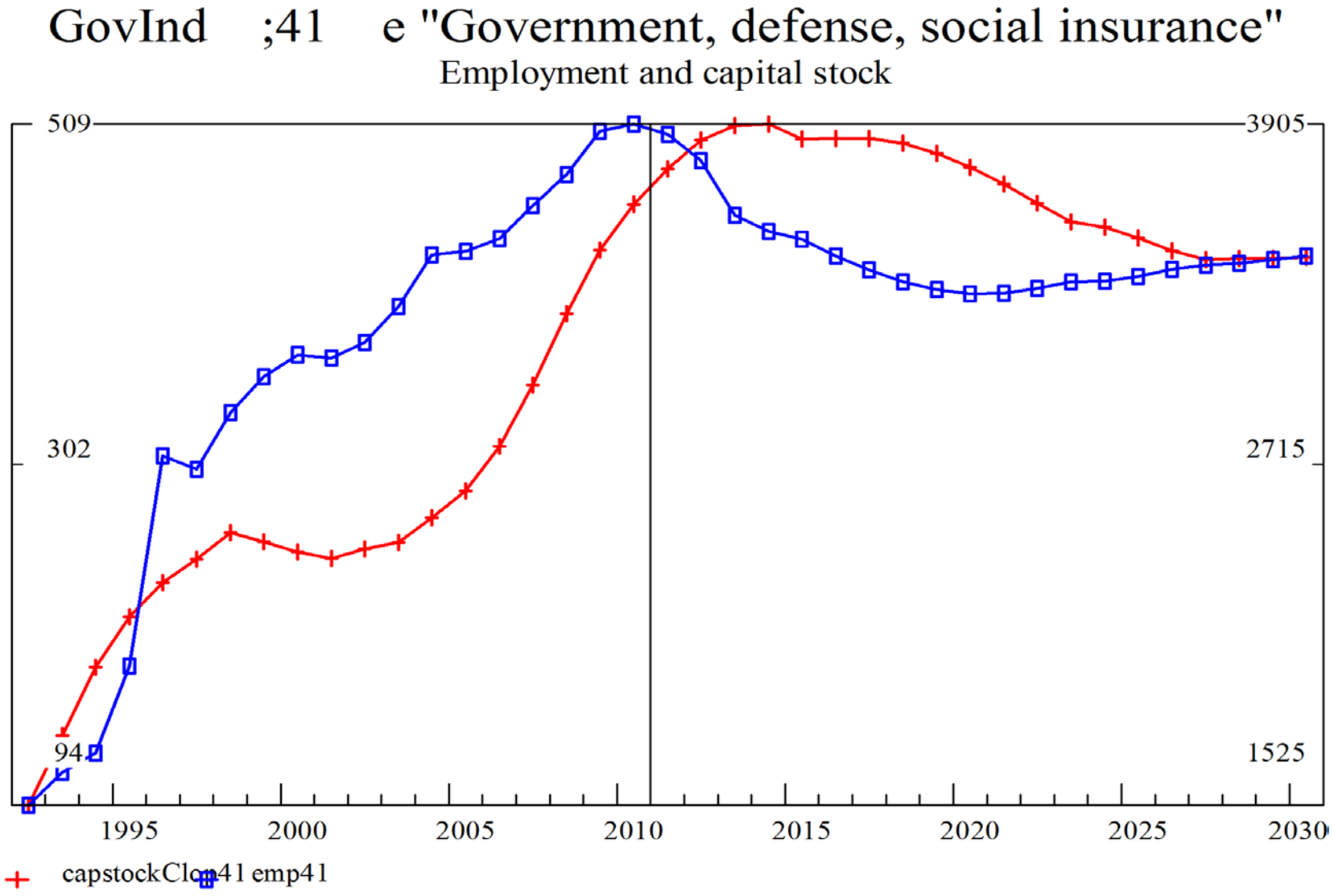
Forecast results - 4



Forecast results - 5



Forecast results - 6



Thank you!

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