ACCUMULATION and COMPETITIVENESS

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A look at some import share equations

An exercise useful for teaching econometrics

The import share equations in the INFORUM Bilateral Trade Model

The BTM in the present Inforum system has matrices showing Bilateral Trade among 14 countries (+ 2 groups of countries) for 120 commodities.

Each element of these matrices

$$S_{ijt}$$

is the share of country i in the country j imports of one of the 120 commodities at time t.

The analytical form of the import share equation

- The equation is

$$S_{ijt} = \beta_{ij0} * \left(\frac{P_{eit}}{P_{wit}}\right)^{\beta_{ij1}} * \left(\frac{K_{eit}}{K_{wit}}\right)^{\beta_{ij2}} * e^{\beta_{ij3} T_t}$$

- where

β_{ij0}, β_{ij1}, β_{ij2}, β_{ij3} are estimated parameters

Three explanatory variables

- Price term $\frac{P_{eit}}{P_{wit}}$
- Capital stock term $\frac{K_{eit}}{K_{wit}}$
- Trend T_t

About the foundations of the equation

They are well described in Ma's PhD thesis

furthermore…….

From the 2002 Broad Economic Policy Guidelines

"Developments in productivity are the result of many different factors, but depend largely on investment performance, which determines the structure and size of the capital stock and enables the penetration of new technologies in the economy. A higher rate of investment growth rises the capital available per worker and thereby – ceteris paribus – labour productivity."

2002 Broad Economic Policy Guidelines continued

"A high rate of innovation in a context of strong investment growth increases also the quality of the capital stock"

Back to theThree explanatory variables

- Prices come from country models
- Trend is the familiar Nyhus trend. It is computed using BTM import shares
- Capital stock is figured out from investments coming from country models

The role of the replacement rate

- Capital stock is used as a *proxy* for quality change of product
- Relative Capital stock is used as an index of non price competitiveness and the capacity to export
- In order to make Capital stock comparable among countries, a common replacement rate is applied.

In G7 notation

The capital stock indices are cumulated from investment data with replacement rate REP

$$cumk_j = @cum(cumk_j, inv_j, REP_j)$$

and adjusted by “Almon’s unit buckets”

$$REPbuck=@cum(REPbuck,1.,REP)$$

So that country Capital stock for sector j is

$$K_j = cumk_j/REPbuck$$

Replacement rates in BTM

The **replacement rate** used to compute capital stock from capital investment (applying the perpetual inventory criterion and used as explanatory variable in the import share equations in BTM) is

8 per cent.

The replacement rate benchmarks

The **8 per cent** replacement rate was considered much more ‘weighty’ than the one ‘behind’ the capital stock time series applied by National Statistical Offices

In fact, in the past the ‘average’ replacement rate obtained comparing investment and capital stock time series was in many cases much lower than 8 per cent

From Trujillo Conference

- In 2006, ISTAT (the Italian Statistical Office) published time series for investments and capital stock for 29 investors.
- These time series made possible a simple investigation about the ‘average’ replacement rates which relate capital stock and investments over the time interval 1980-2005.

The origin of the present exercise

Unexpectedly, 20 out of 29 replacement rates figured out from Capital stock time series computed according to EUROSTAT standards turned out to be greater than 8.00 per cent. This means that the decay of capital stock assumed within European countries Statistical Offices is higher than the one used in the BTM share equations.

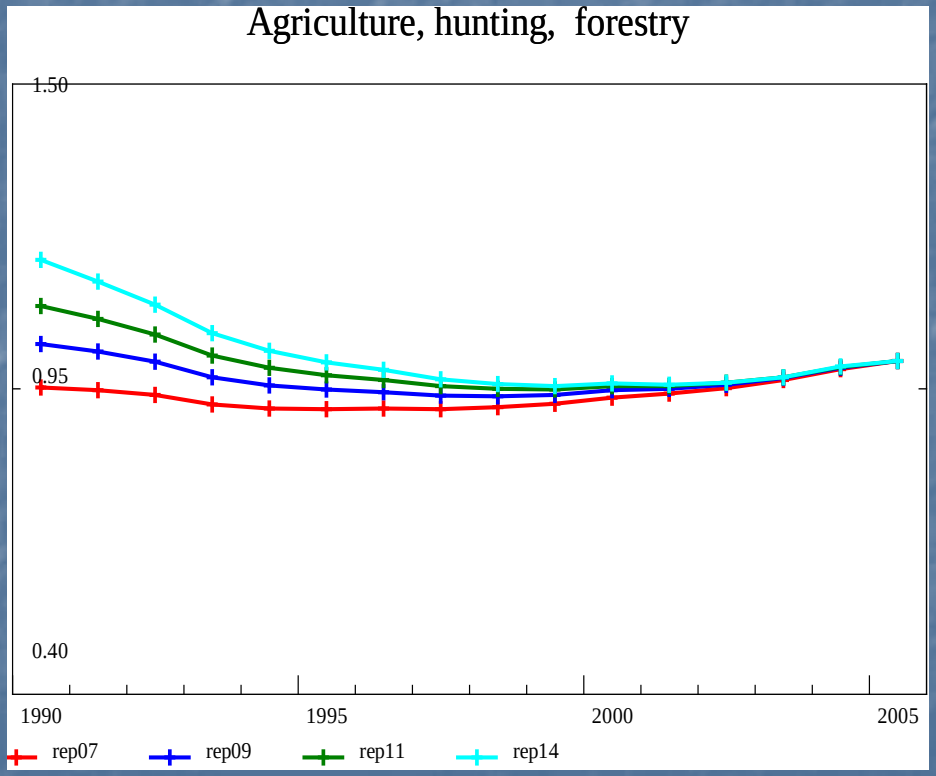
A Grid of Replacement Rates

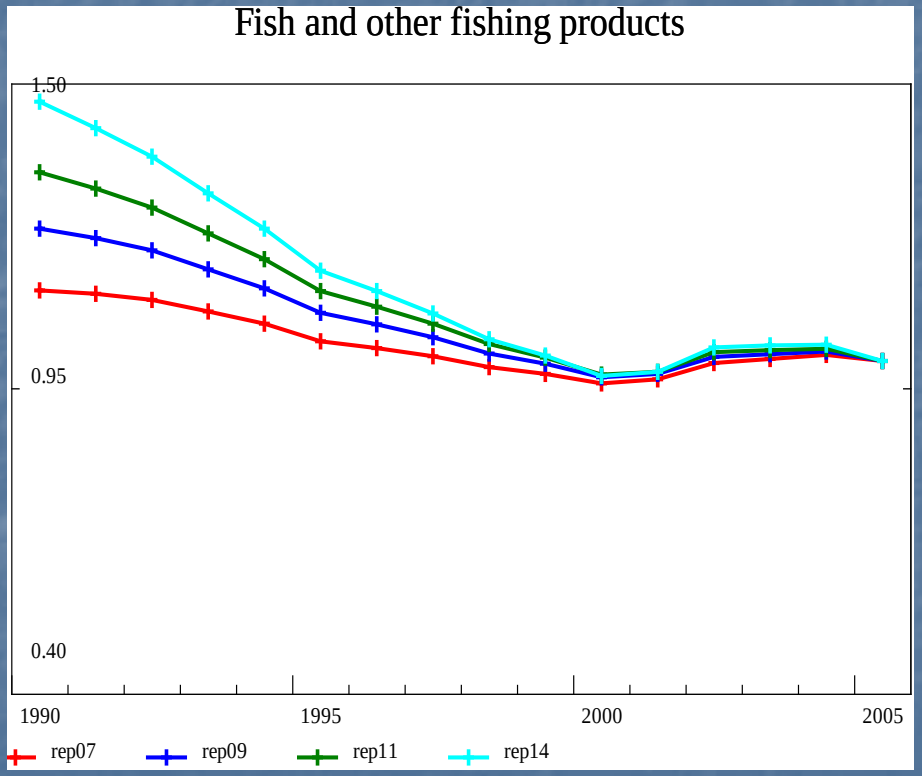
Hence, the idea to investigate the impact of different replacement rates on the Capital stock explanatory variable in the estimation of import share equations.

In the present exercise, the replacement rate spans from 7 to 14 per cent

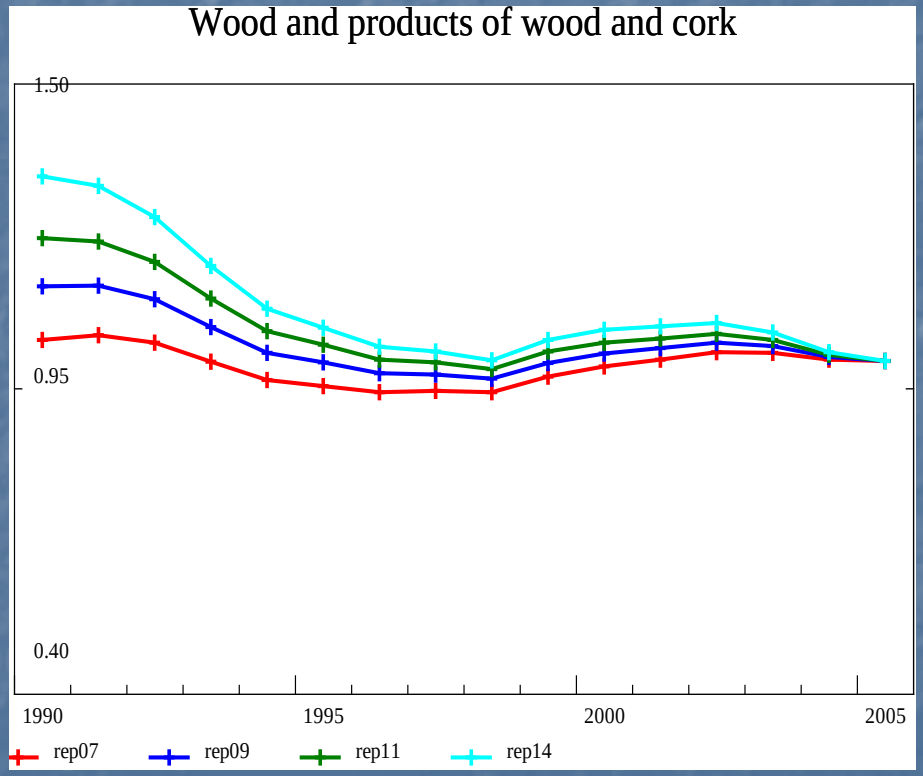
The effect of different Replacement rates on the Capital stock time series

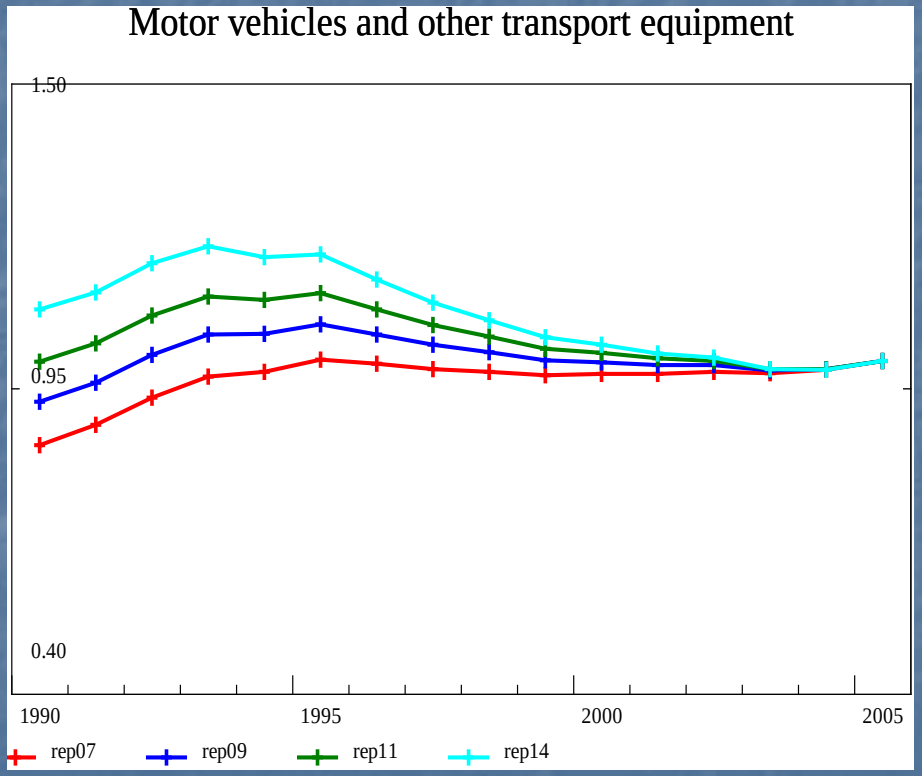
Italian Capital Stock



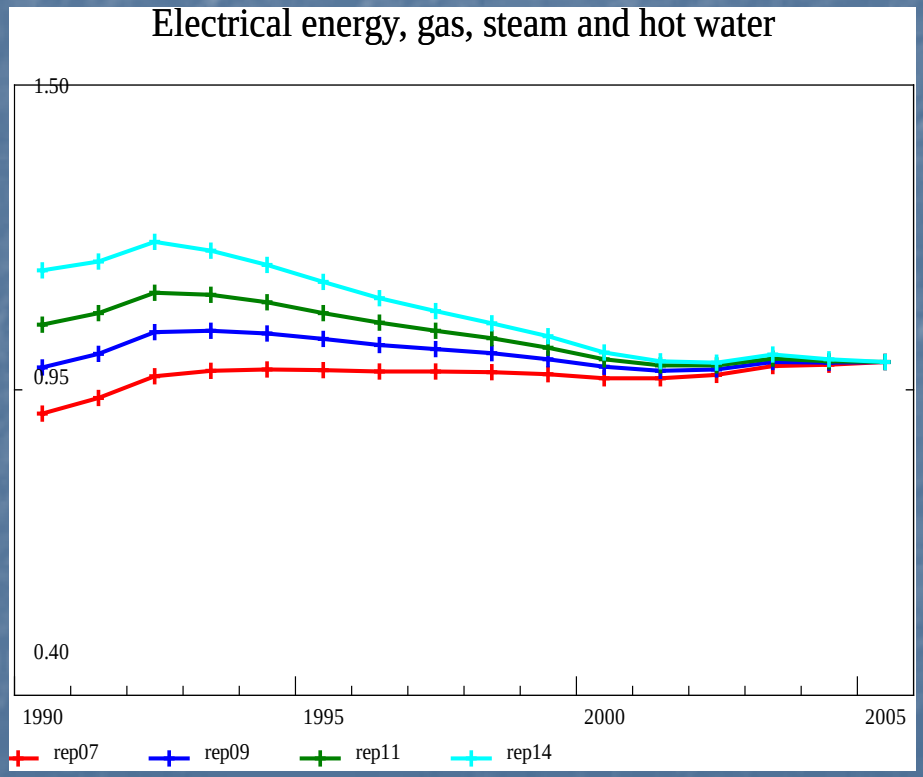


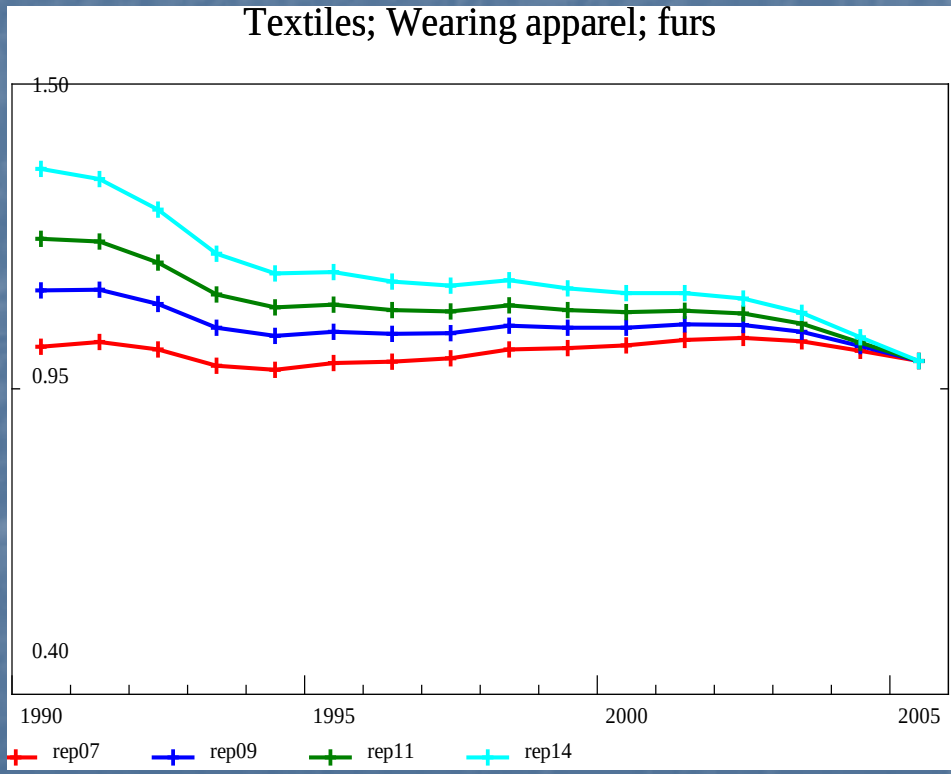
Italian Capital Stock





Italian Capital Stock



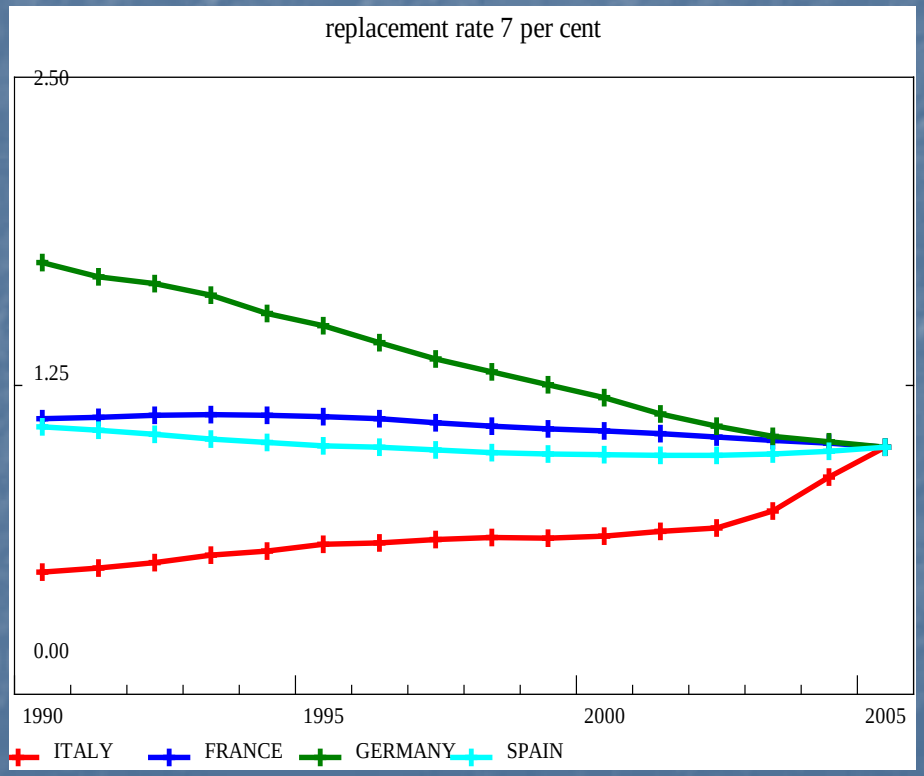


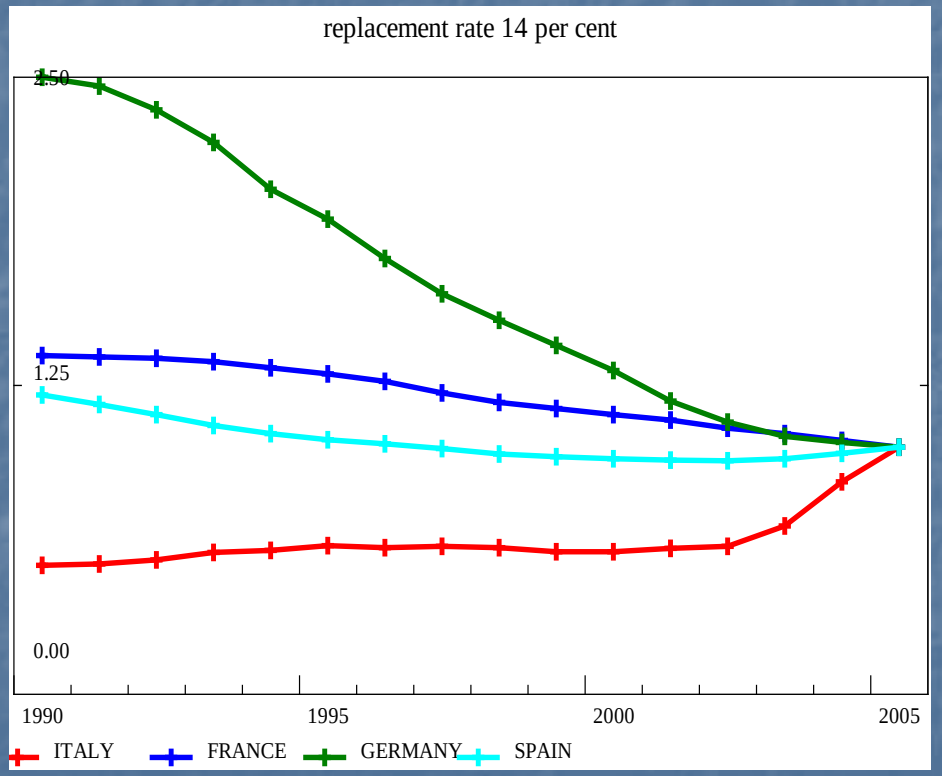
The effect of different Replacement rates on the Capital stock time series

Capital stock of FRANCE, ITALY, GERMANY and SPAIN

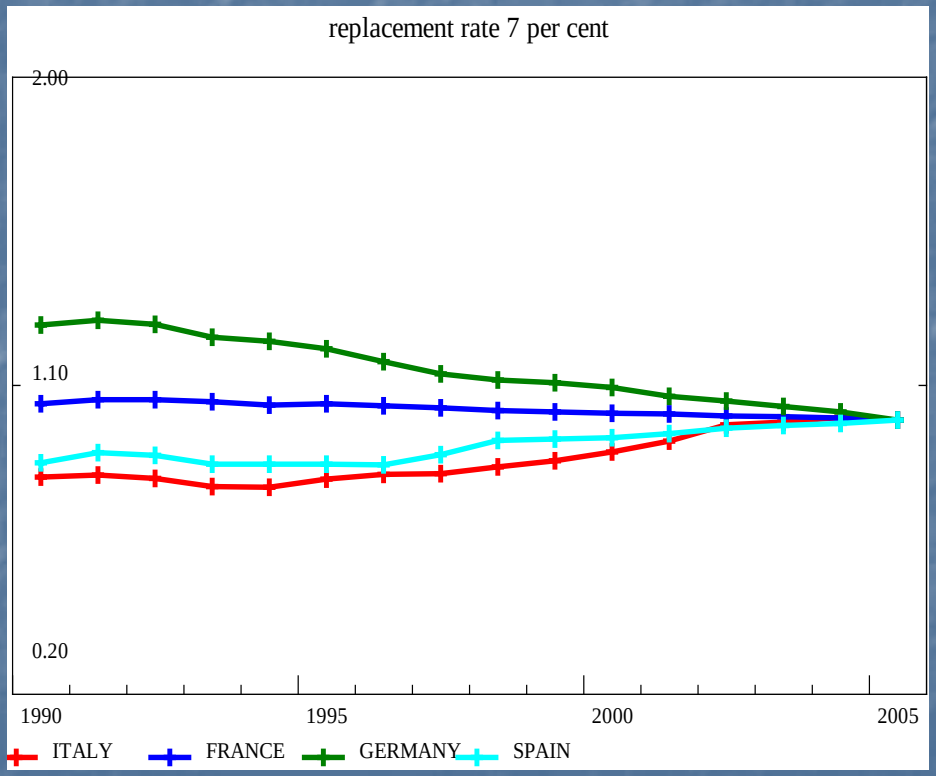
replacement rate for 7 and for 14 per cent

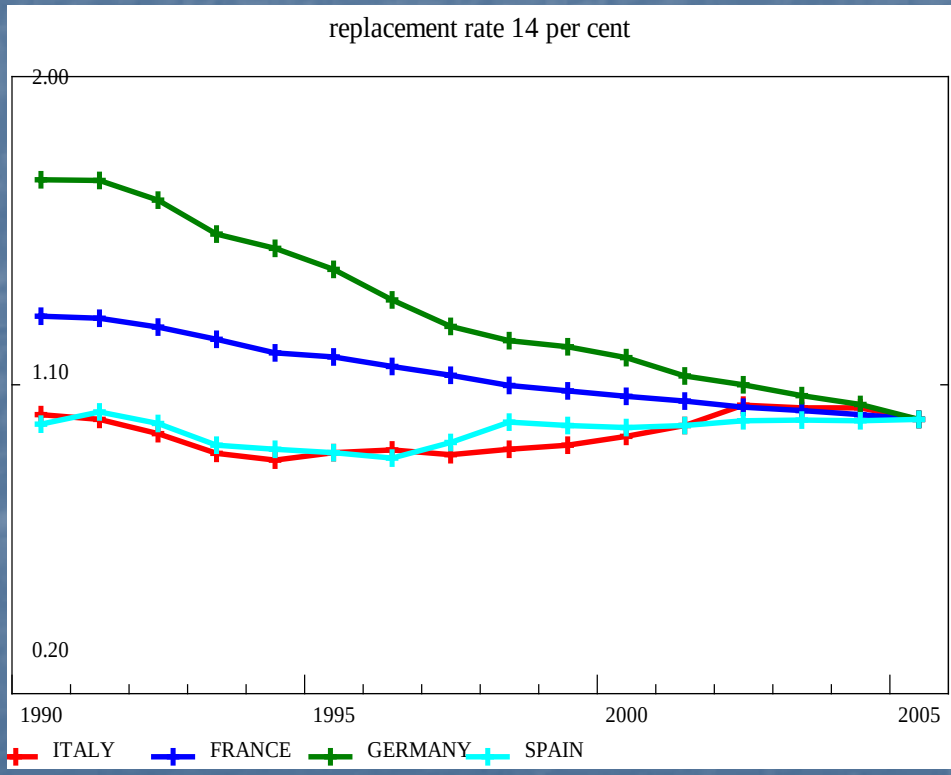
Coal, lignite, peat crude petroleum and natural gas



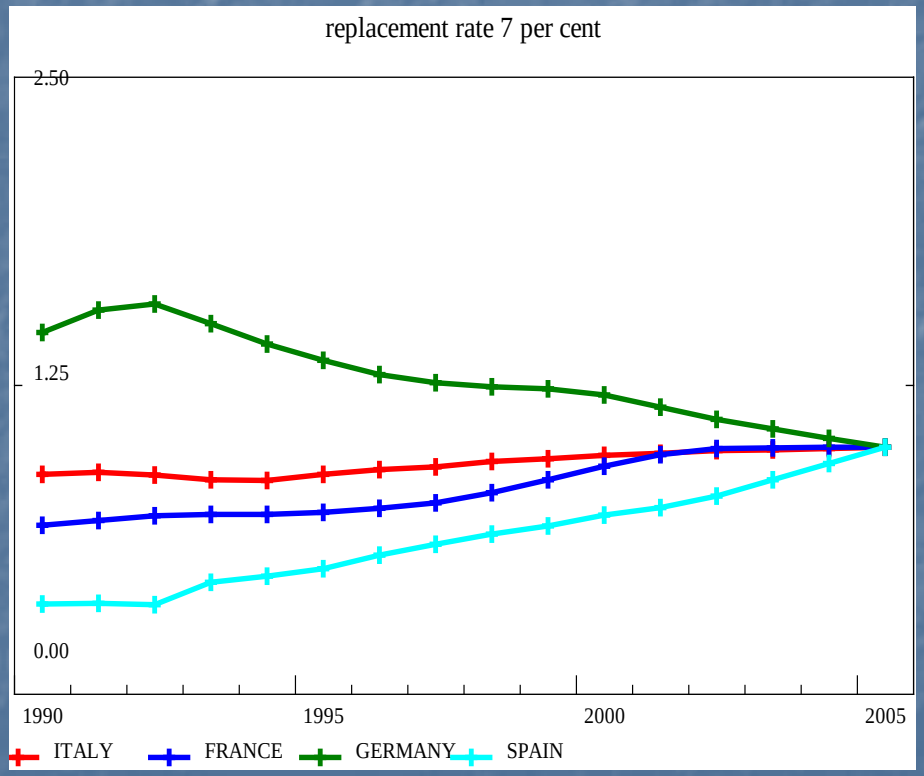


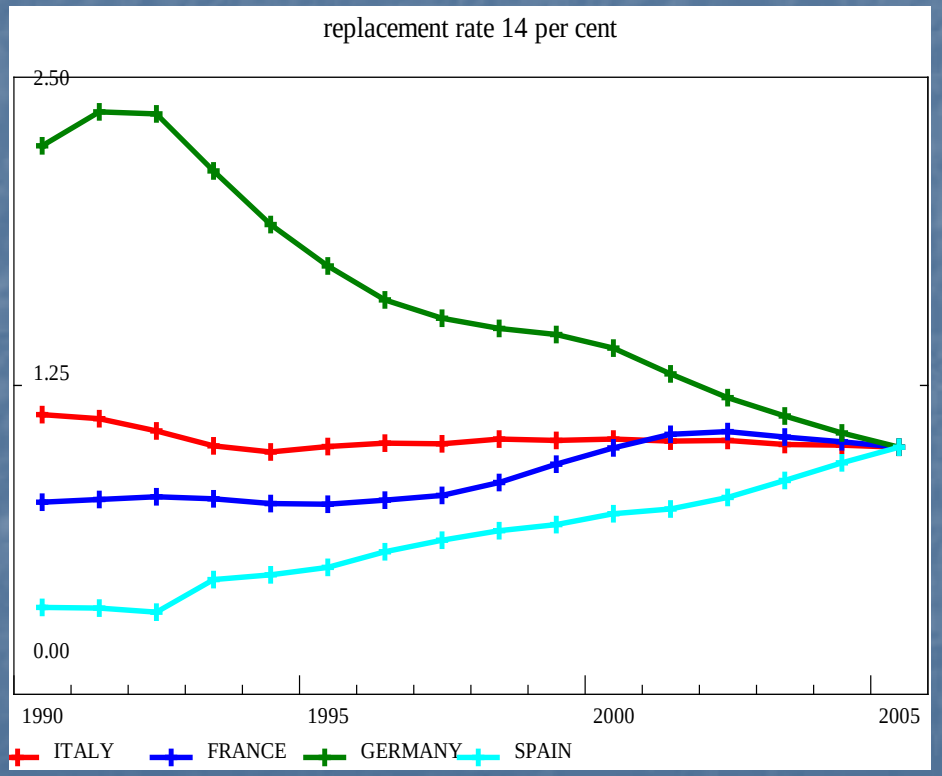
Leather and leather products



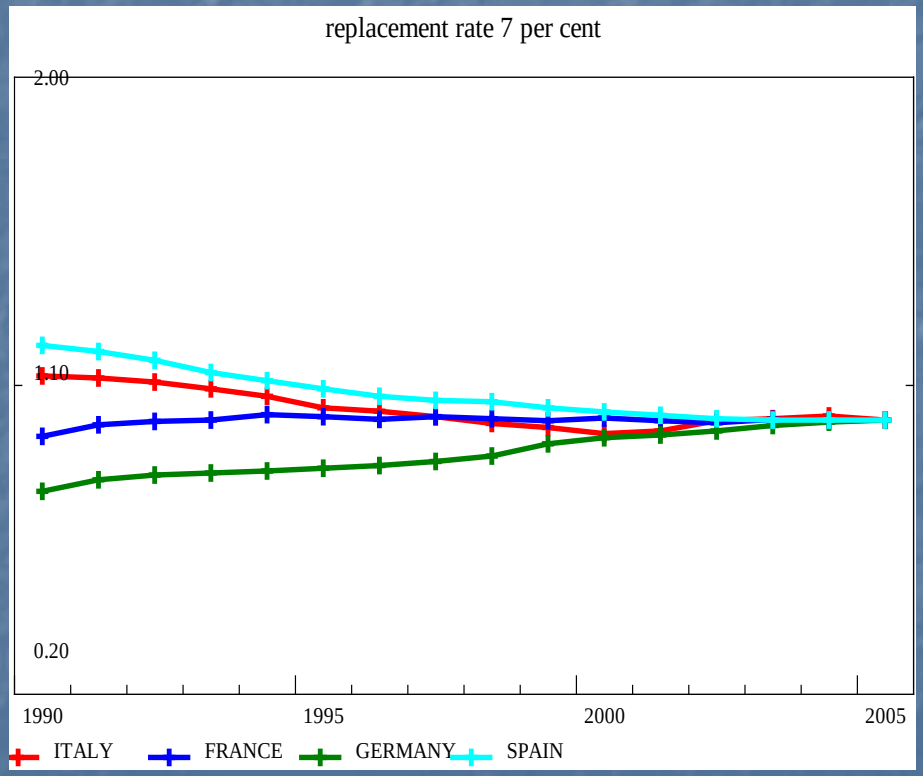


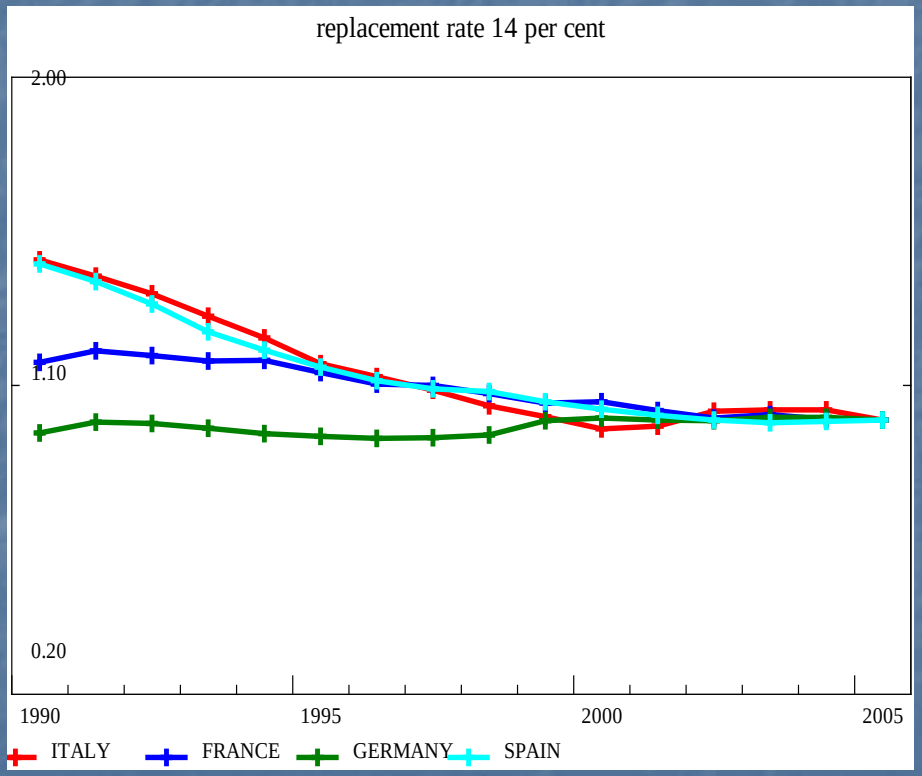
Computers, Radio, Medical and Optical instruments





Basic Metals, Fabricated Metal products





The Ma's research plan and estimation procedure

- Price and Capital term elasticities are located in two feasible sets.
- Respectively (-4.0, 0.0) and (0.0,4.0)
- Explanatory variables with wrong sign are excluded

Equation structure in BTM according to the explanatory variables included

- A) price, capital, trend
- B) price, capital
- C) price ,trend
- D) capital, trend
- E) price
- F) capital
- C) trend

- The research has been limited to the Italian import shares
- Among them to those in the markets where Italy has a relatively large share

Impact of replacement rates on Capital stock elasticities

Some results

92 – Other non-electrical Machinery

Replacement %	7	8	9	10	11	12	13	14
Canada	2,90	2,84	2,79	2,76	2,74	2,73	2,81	2,76
United States	2,09	2,06	2,03	2,00	1,96	1,93	1,97	1,85
Mexico	0,06	0,06	0,06	0,06	0,06	0,06	0,07	0,06
Austria	1,33	1,24	1,15	1,08	1,01	0,96	0,88	0,85
Belgium	1,21	1,11	1,03	0,95	0,88	0,82	0,74	0,71
France	1,13	1,05	0,98	0,92	0,86	0,81	0,75	0,72
Germany	2,12	2,00	1,89	1,78	1,69	1,61	1,42	1,44
UK	0,20	0,19	0,18	0,17	0,17	0,16	0,14	0,15
Japan	0,37	0,36	0,35	0,34	0,34	0,33	0,31	0,32
China	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Korea	0,24	0,21	0,18	0,15	0,12	0,09	0,07	0,03
ROECD	0,00	0,34	0,61	0,76	0,83	0,85	0,83	0,84
ROW	0,78	0,80	0,82	0,84	0,85	0,86	0,81	0,88

80 - Agricultural Machinery

Replacement %	7	8	9	10	11	12	13	14
United States	2,34	2,21	2,09	1,98	1,88	1,79	1,84	1,61
Mexico	0,00	0,00	0,00	0,00	0,00	0,00	3,84	3,72
Austria	3,14	2,94	2,76	2,60	2,45	2,32	2,17	2,07
Belgium	1,41	1,29	1,18	1,09	1,01	0,95	0,80	0,83
France	0,10	0,08	0,06	0,05	0,03	0,02	0,04	0,00
Germany	0,50	0,48	0,47	0,45	0,44	0,42	0,44	0,40
Spain	1,32	1,21	1,11	1,02	0,94	0,88	0,82	0,75
Japan	3,17	2,99	2,83	2,69	2,57	2,47	2,62	2,28
China	3,90	3,06	2,23	1,42	0,61	0,00	0,00	0,00
Korea	4,00	4,00	4,00	4,00	4,00	4,00	2,91	3,68
Taiwan	3,58	3,33	3,13	2,95	2,80	2,69	2,40	2,46
ROECD	0,73	0,76	0,78	0,81	0,83	0,85	0,83	0,88
ROW	0,07	0,07	0,06	0,05	0,04	0,03	0,03	0,02

96 – Computers

Replacement %	7	8	9	10	11	12	13	14
Canada	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
United States	2,25	2,21	2,17	2,14	2,10	2,08	1,98	2,02
Mexico	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Belgium	0,00	0,00	0,00	4,00	4,00	4,00	4,00	4,00
France	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Germany	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Spain	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
UK	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
China	4,00	4,00	4,00	4,00	4,00	3,96	3,75	3,87
Korea	3,86	3,62	3,41	3,20	3,01	2,85	2,53	2,50
Taiwan	0,65	0,64	0,63	0,62	0,61	0,61	0,60	0,60
ROECD	0,00	2,63	2,78	2,85	3,11	3,46	3,98	3,85

24 - Bakery

Replacement %	7	8	9	10	11	12	13	14
Canada	3,37	3,04	2,74	2,47	2,22	2,01	1,59	1,60
United States	4,00	4,00	3,96	3,78	3,62	3,50	3,04	3,25
Mexico	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Germany	0,46	0,44	0,42	0,40	0,39	0,38	0,36	0,36
Spain	4,00	4,00	4,00	4,00	4,00	3,48	1,18	3,26
UK	0,00	0,00	0,00	0,00	0,00	0,00	0,82	0,00
Japan	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
China	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Taiwan	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
ROECD	0,09	0,08	0,07	0,06	0,05	0,05	0,03	0,03
ROW	1,48	1,33	1,19	1,05	0,92	0,80	0,63	0,56

27 - Food products n.e.c.

Replacement %	7	8	9	10	11	12	13	14
Canada	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
United States	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Mexico	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Austria	1,88	1,80	1,72	1,65	1,59	1,54	1,45	1,44
Belgium	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
France	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Germany	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Spain	4,00	4,00	4,00	4,00	4,00	3,89	3,51	3,53
UK	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Japan	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
China	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Korea	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Taiwan	0,52	0,51	0,49	0,44	0,37	0,31	0,16	0,14
ROECD	3,61	3,64	3,67	3,69	3,69	3,68	3,63	3,64
ROW	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00

Improving the goodness of fit

Some Results

Two equations with 3 explanatory variables

Home Apparel - German Imports from Italy

	Regression Coefficients				Mexval			RSQ
REP%	intercept	price	capital	NyhTrend	price	capital	NyhTrend	
7	-1.72	-2.15	1.82	0.024	48.7	4.6	0.9	0.92
8	-1.72	-2.09	1.75	0.018	49.6	4.0	0.6	0.91
9	-1.70	-2.05	1.26	0.009	45.7	3.0	0.1	0.91
10	-1.69	-2.01	1.05	0.003	44.7	2.5	0.0	0.91
11	-1.68	-1.96	1.00	-0.001	45.3	2.1	0.0	0.91
12	-1.67	-1.94	0.75	-0.006	43.4	1.7	0.0	0.91
13	-1.66	-1.91	0.62	-0.010	43.0	1.4	0.3	0.91
14	-1.66	-1.88	0.53	-0.013	42.8	1.1	0.6	0.91

Other Textile - Spanish Imports from Italy

	Regression Coefficients				Mexval			RSQ
REP%	intercept	price	capital	NyhTrend	price	capital	NyhTrend	
7	-1.71	-1.88	0.99	-0.0021	23.6	0.8	0.1	0.77
8	-1.71	-1.85	0.83	-0.0027	25.0	0.6	3.9	0.77
9	-1.70	-1.82	0.70	-0.0032	23.8	0.5	0.4	0.77
10	-1.70	-1.79	0.58	-0.0036	24.0	0.4	0.5	0.77
11	-1.69	-1.77	0.49	-0.0040	26.0	0.3	2.7	0.77
12	-1.69	-1.75	0.41	-0.0044	24.4	0.3	0.8	0.76
13	-1.68	-1.72	0.33	-0.0047	24.7	0.2	1.0	0.76
14	-1.68	-1.70	0.27	-0.0050	25.0	0.2	1.2	0.76

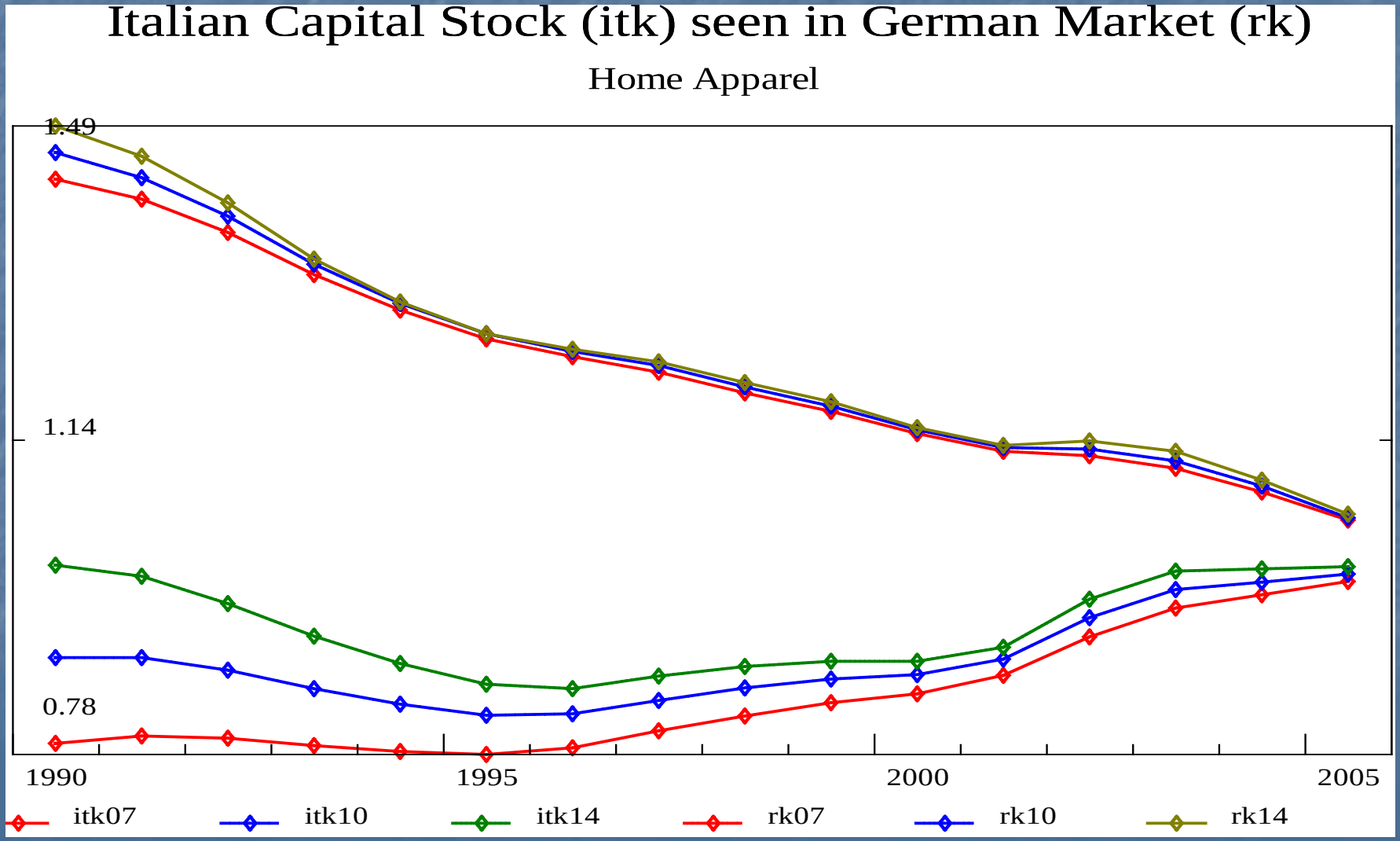
Useless exchange between Capital and Nyhus trend

Construction Equipment - Spanish Import from Italy

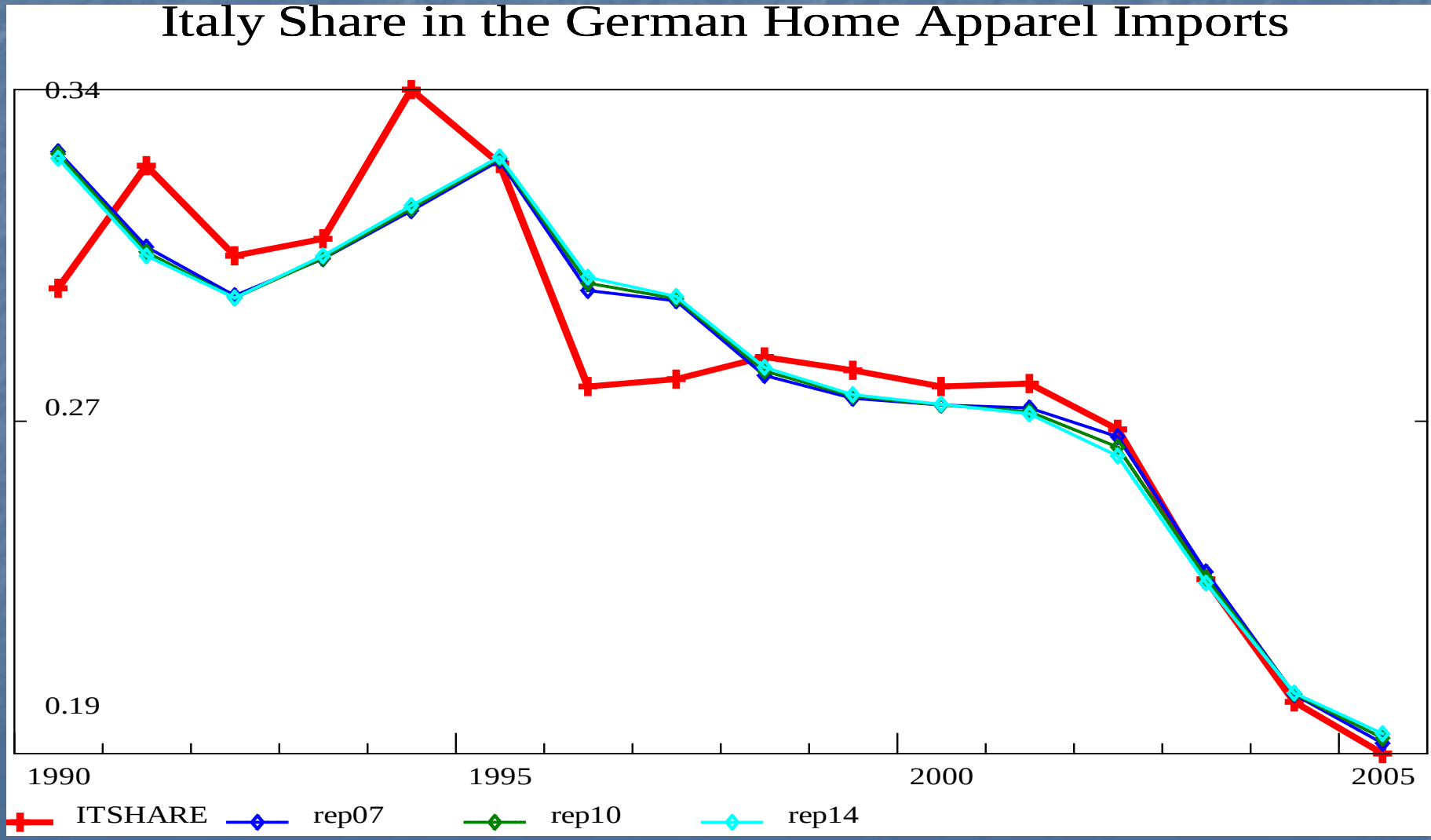
	Regression Coefficients				Mexval			RSQ
REP%	intercept	price	capital	NyhTrend	price	capital	NyhTrend	
7	-1.74	-3.55	0.80	0.0049	82.4	0.7	0.2	0.72
8	-1.74	-3.54	0.72	0.0048	81.6	0.7	0.1	0.72
9	-1.74	-3.54	0.65	0.0046	82.2	0.6	0.2	0.72
10	-1.74	-3.54	0.59	0.0043	82.1	0.6	0.2	0.72
11	-1.73	-3.54	0.53	0.0040	81.4	0.5	0.1	0.72
12	-1.73	-3.54	0.48	0.0036	81.9	0.4	0.1	0.72
13	-1.73	-3.54	0.42	0.0031	81.8	0.4	0.1	0.72
14	-1.73	-3.54	0.37	0.0027	81.7	0.3	0.1	0.72

A look at the variables behind these results

The case of Italian Capital stock and Capital term in German market



No changes in fitting



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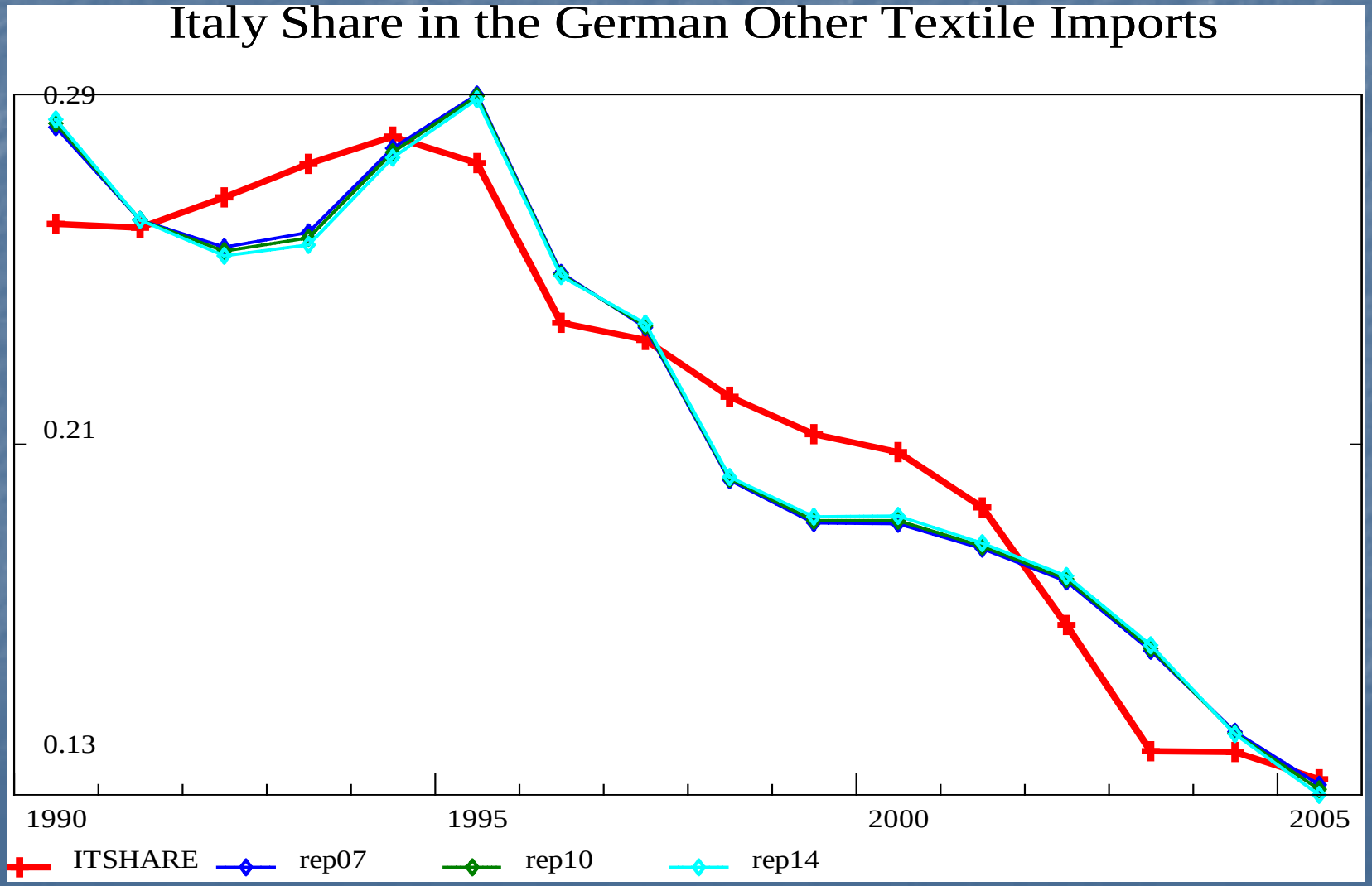

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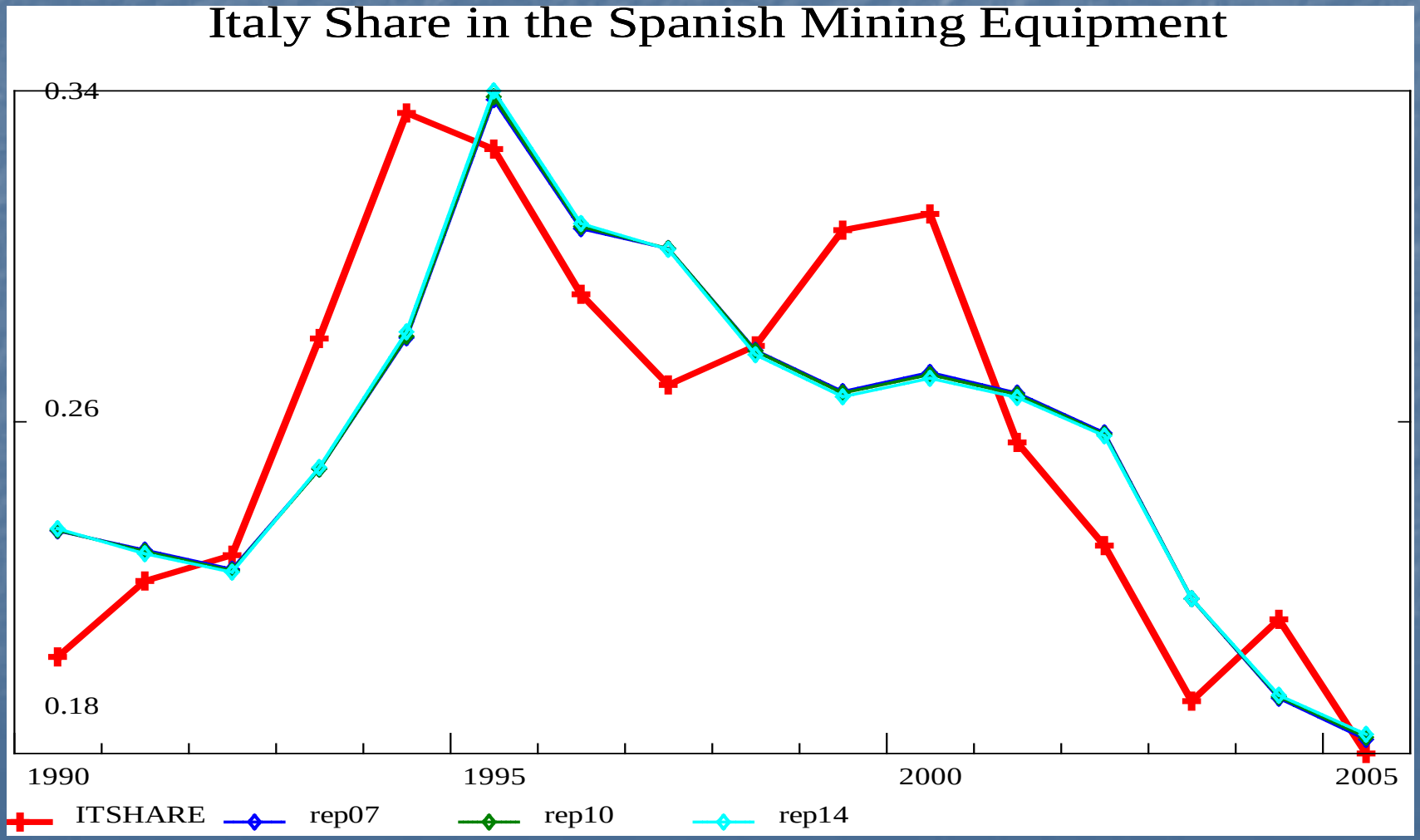


Two equations with 2 explanatory variables

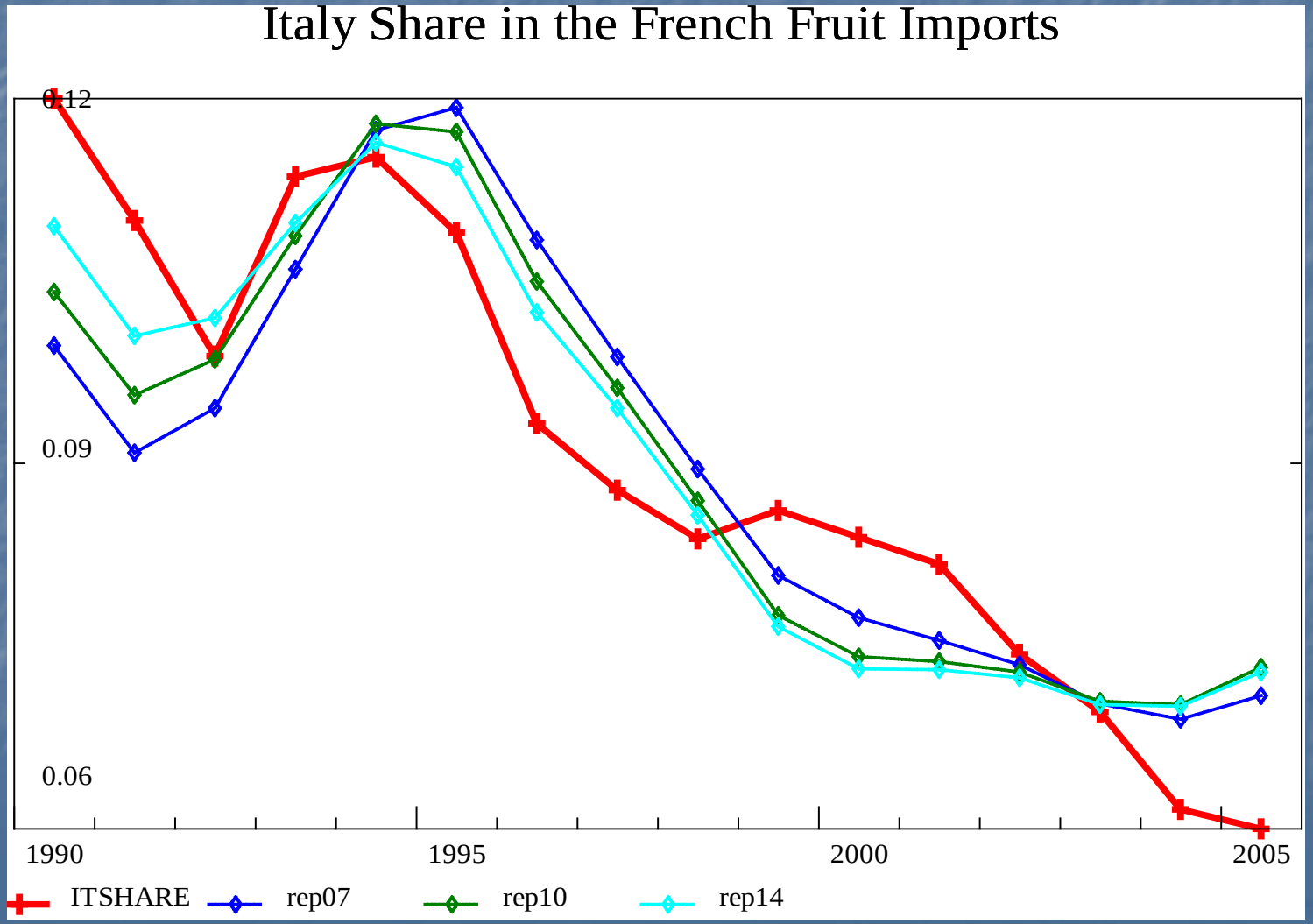
Fruits - Italian Import Share in the UK Market

	Regression coefficients			Mexval		RSQ
REP%	intercept	price	capital	price	capital	
7	-3,17	-1,38	3,20	109,4	21,8	0,82
8	-3,17	-1,35	2,90	105,5	23,3	0,83
9	-3,18	-1,32	2,62	101,8	24,5	0,83
10	-3,18	-1,30	2,37	98,6	21,6	0,83
11	-3,19	-1,28	2,15	96,6	26,5	0,83
12	-3,19	-1,27	1,98	94,1	27,2	0,84
13	-3,19	-1,25	1,80	92,4	27,9	0,84
14	-3,20	-1,24	1,66	91,5	28,4	0,84

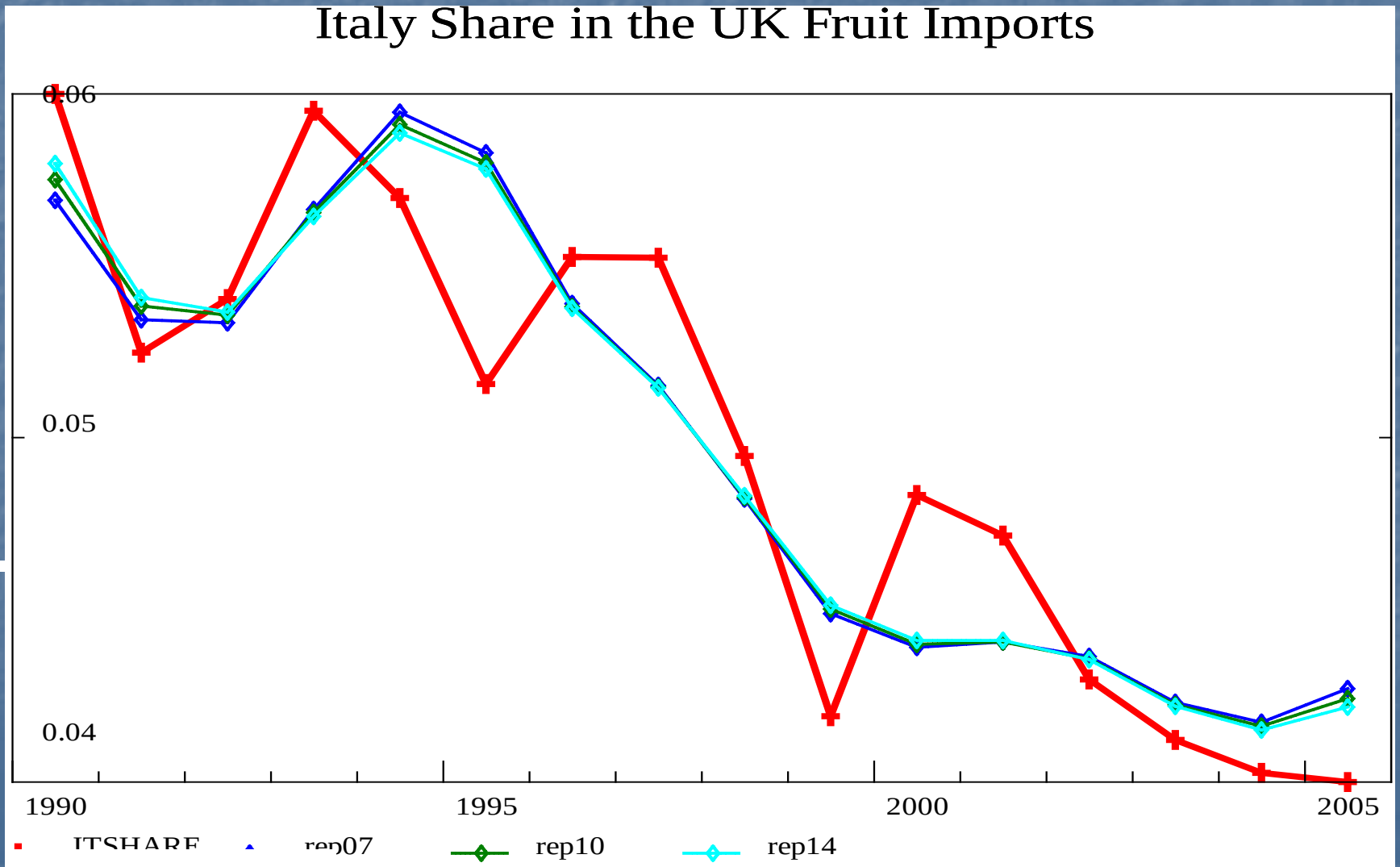
Fruits - Italian Import Share in the French Market

	Regression coefficients			Mexval		RSQ
REP%	intercept	price	capital	price	capital	
7	-2,58	-1,81	0,55	62,9	0,1	0,74
8	-2,56	-1,88	1,49	78,9	1,3	0,75
9	-2,54	-1,90	2,12	94,0	3,4	0,76
10	-2,54	-1,89	2,45	105,9	6,1	0,77
11	-2,54	-1,85	2,58	113,4	9,1	0,78
12	-2,54	-1,82	2,58	116,8	11,8	0,79
13	-2,54	-1,77	2,49	118,1	14,9	0,80
14	-2,55	-1,73	2,37	117,7	17,4	0,81

Some changes in fitting



Negligible changes in fitting

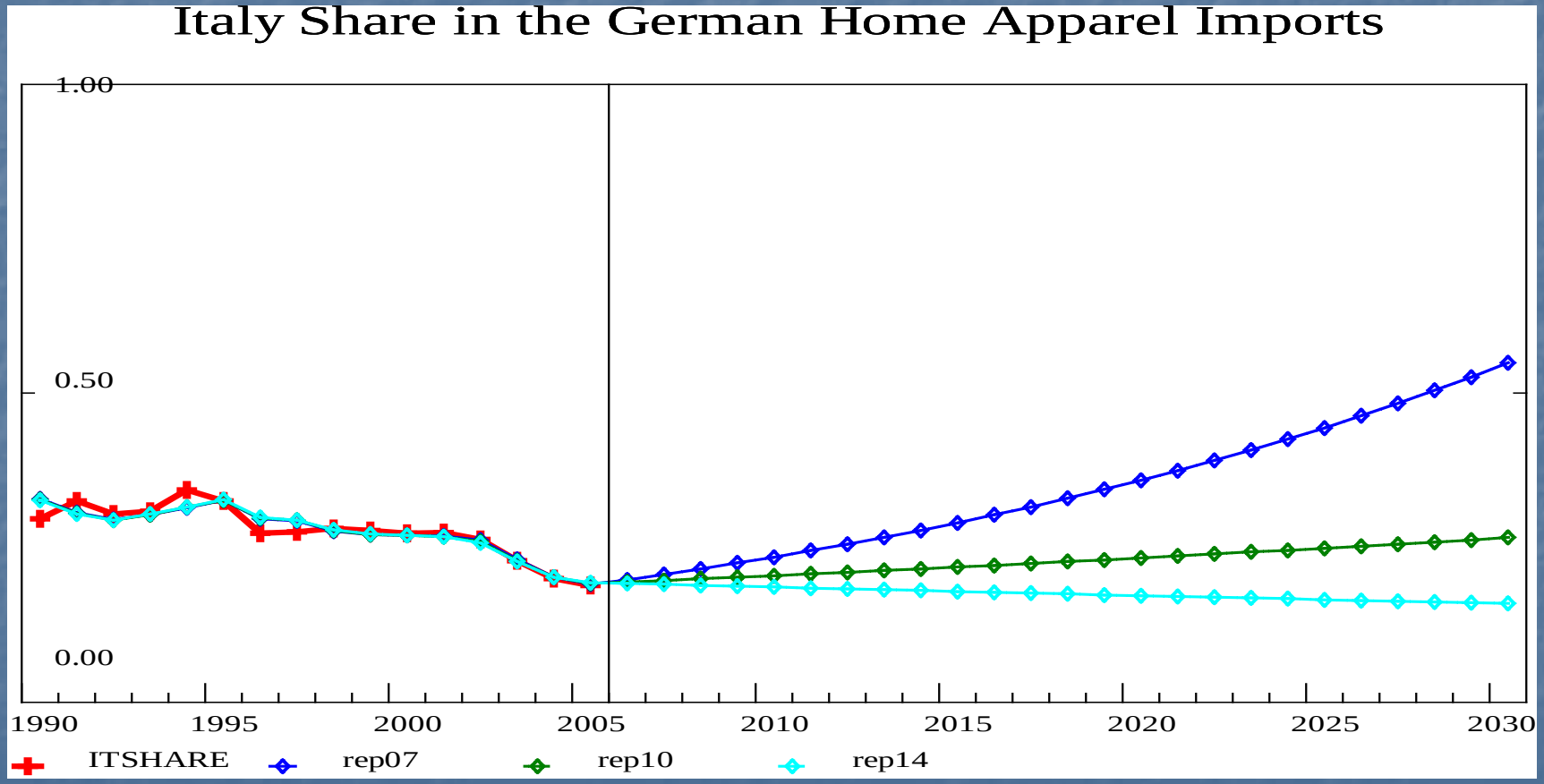


Behaviour of the Estimated equations in BTM

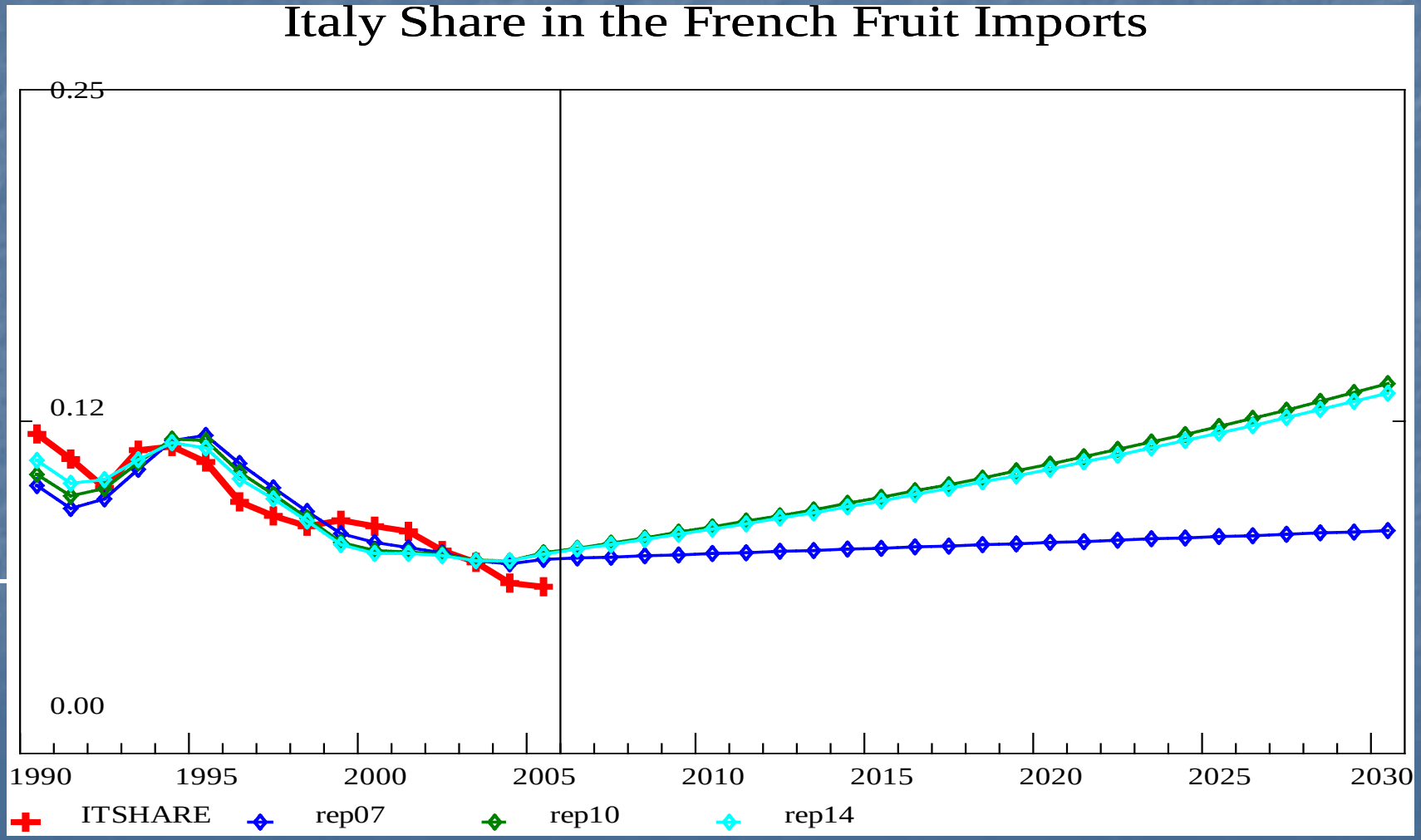
The scenario for the 2005 2030

- Price term remains constant and equal to one
- Trend is computed using import shares from the INFORUM December 2008 Outlook
- Capital term grows 1 per cent per year

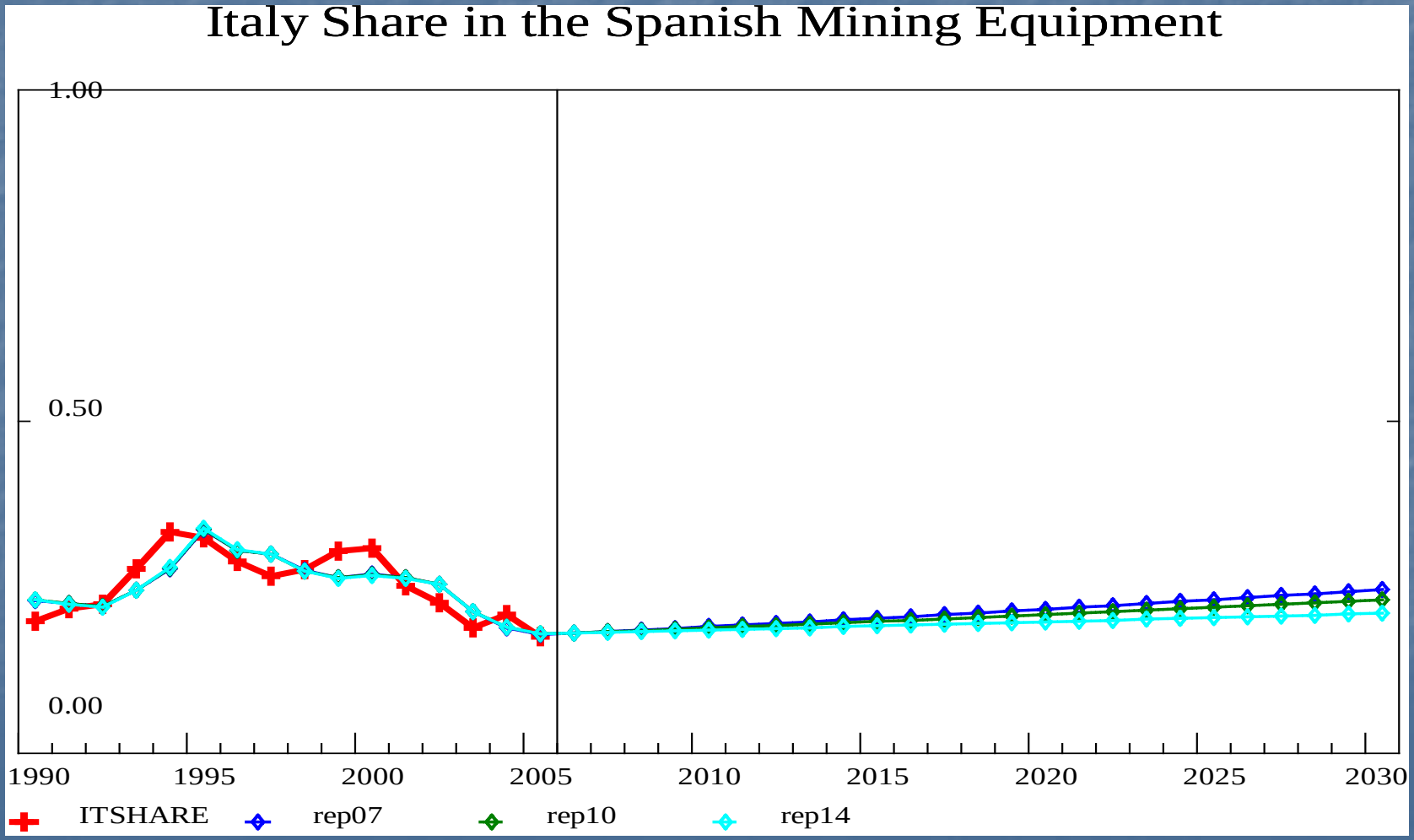
From fitting to forecasting



From fitting to forecasting



From fitting to forecasting



Where do changes in forecasting come from?

- Simply fitting criteria may be misleading
- Hypotesys testing and/or descriptive indexes (such as RSQ and Mexval) do not give any hint about the forecast performances
- Once inserted in BTM, an estimated import share equation does not preserve any memory of each independent variable explanatory power

The Ma's estimation procedure

- Price and Capital term elasticities are located in two feasible sets.
- Respectively (-4.0, 0.0) and (0.0,4.0)

The choice

- If the sign is wrong, the elasticity is put equal to zero
- If the sign is right and out of the feasible set, the elasticity is put equal to -4.0 for the Price term and equal to 4.0 for the Capital stock term

Capital term impact on import share with respect to the elasticity

From the scenario:

Capital term grows 1 per cent per year

ELASTICITY	IMPACT
1.0	28%
2.0	64%
4.0	171%

Capital term impact on import share with respect to the elasicity

From a scenario more conservative :

Capital term grows 0.5 per cent per year

ELASTICITY	IMPACT
1.0	13%
2.0	28%
4.0	64%