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AGGREGATE DEMAND AND SUPPLY AND THE LABOUR MARKET WITHIN A REGIONAL ECONOMETRIC MODEL

by

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Abstract: In this paper we extend a previous model - in which the structure of a regional labour market for Lombardy was estimated – to take interactions with the goods market into account. We model this latter by introducing six new stochastic equations, which define respectively: aggregate consumption, total fixed investment, net imports, and sectoral production (Agriculture, Industry and Services value added). At this stage we have taken prices as exogenous, and we have dynamically simulated the whole model. We thus discuss the impact of demand and supply shocks, and interest and exchange rate shocks on both the labour and goods markets. This issue is particularly relevant for assessing the different impacts of fiscal and monetary policy within national and regional labour markets, thus providing important insights useful for policy analysis.

JEL Classification: E17, R23

Key words: Regional econometric models, Simulation

1. Introduction

In this paper we extend a previous regional macroeconometric model for Italy and Lombardy (Baussola 2003), in which both demand and supply for labour have been estimated. In this study we add to the previous model the demand and supply for goods and then simulate the whole model, which includes the two blocks. We add to the previous model six new stochastic equations, which define respectively: aggregate consumption, total fixed investment, net imports, and sectoral production (Agriculture, Industry and Services value added). At this stage we have taken prices as exogenous, and we have dynamically simulated the whole model. We thus discuss the impact of demand and supply shocks, and interest and exchange rates shocks on both the labour and goods markets at the regional and national level, thus providing important policy insights in the light of the discussion of the possible impact of monetary and fiscal policy. It is, therefore, worth recalling the main economic indicators which may throw light on the differences between the regional and national growth patterns over the last decades, and then analyse the structure of the model.

Table 1 Economic indicators: ratio of Lombardy to Italy

	GDP/POP	GDP/TE	TE/POP	VAIND/EEIND	VASER/EESER	VAAGR/EEAGR
1970	1.41	1.16	1.21	1.01	3.67	1.42
1975	1.36	1.15	1.19	1.02	3.33	1.47
1980	1.34	1.15	1.17	1.03	3.20	1.45
1985	1.34	1.17	1.15	1.05	2.61	1.36
1990	1.34	1.15	1.17	1.07	2.43	1.38
1995	1.33	1.13	1.17	1.10	2.21	1.38
2000	1.32	1.14	1.16	1.12	2.04	1.41

Source: Calculation based on ISTAT, National Accounts 1980-2000, and SVIMEZ, Regional Accounts for the period 1970-1980
Legend: POP=Population, TE=Total employment (labour units), VAIND=Value added in industry, VASER= Value added in services, EEIND Employees in industry, EESER =Employees in services; EEAGR=Employees in agriculture

Over the last 30 years convergence in per capita income between regional and national economies has been weak, as the gap between Lombardy and Italy still remains high with an income per head which is about 32% higher in the former area. This gap is smaller if one considers income per employee, but still remains high (about 16%). This suggests that the labour market and, particularly, the ratio of employment to population (employment rate) is crucial to determining the overall difference for income per capita, as one can break down per-capita income by using the following formula:

$$\frac{GDP}{POP} = \frac{GDP}{TE} x \frac{TE}{POP}$$

where POP is population and TE is total employment. The labour market and its interaction with the goods market are therefore crucial in determining the value of income per capita and its overall change over the entire period considered. In addition, sectoral differences still remain relevant, as productivity in private services, although declining during the entire period, remains twice as high in Lombardy as in Italy as a whole in 2000. In agriculture, value added per employee is more than 40% higher at the regional level than in the national economy, while the gap in manufacturing is significantly smaller, reaching 12% in 2000.

These facts do underline how important the link is between, on the one hand, the performance of each economic system, as measured by the aggregate and sectoral growth rate of per capita and per employee income and, on the other hand, the labour market. This justifies our choice to incorporate the goods market into our previous model in which sectoral value added has been taken as exogenous. Thus, in section two we describe the structure of the model including the goods markets, while in section 3 we analyse the estimated equations. Section 4 investigates the simulation results and section 5 concludes the paper.

2. The structure of the whole model: demand, supply and the labour market blocks

The model has eleven stochastic equations and 15 identities and it incorporates both the labour market and the goods market. Its structure is summarised as follows:

- Labour market

  Behavioural equations:

  (1) EEAGR(i) = g_1{VAGR(i), WAGR(i)/DEFAGR(i), TFPAGR(i)}

  (2) EEIND(i)) = g_2{VAIND(i), WIND(i), DEFIND(i), PRODIND(i)}

(3) EESER(i) = g_3{VASER(i), WSER(i), DEFSER(i), PRODSER(i)}

(4) SE(i) = g_4{PROFSE(i), UR(i), YU(i)}

(5) PR(i) = g_5{, SE/POP(i), EE/POP(i), IMMIG(i)}

Labour demand depends on value added, factor cost, and a proxy of technological factors. This specification implicitly derives from the usual Cobb-Douglas production function, in which output is proxied by value added. Labour demand is therefore obtained by the usual profit maximisation condition, which implies that labour productivity be equal to real wages. If one uses a log transformation of the condition for profit maximisation, one can break down the labour cost variable (product wage) into nominal wage and product prices.[1]

Labour supply is split into two components (equations 4) and 5)) .The first is a modified version of the discouraged worker hypothesis (Tella 1964). Following this hypothesis, fluctuations in labour supply, as described by fluctuations in the labour force participation rate, are crucially influenced by variations in employment, and thus reflect changes in the demand for labour. Thus a shrinking labour market may discourage labour force participation, while an expanding job market will have the opposite effect. This specification takes into account how different levels of economic activity may influence labour demand and supply, and therefore unemployment. In addition, we modify this original version of the discouraged worker by separating employment into two components: self-employment and employees (Baussola and Fiorito 1994). In our specification the participation rate depends on the ratio of employees to population and the ratio of self-employment to population. In addition we include a migration index to take the effect of migration flows from foreign countries into account, and a lagged dependent variable to capture the adjustment process.

The second component of labour supply is self-employment, and this represents the typical neo-classical version of the supply of labour. Thus we include profits (10) and structural variables (the unemployment rate and the ratio of young unemployed to total unemployed) as explanatory variables to capture the marginal component of workers who may decide to set up an independent activity in response to adverse job market opportunities.

[1] In the agriculture sector we did not use such a breakdown of the labour cost variable because of the problem of significance of factor costs and product prices; instead we decided to use the real wage specification, i.e., labour cost deflated by the corresponding product price.

Unemployment is endogenously determined (9) by the interaction of the labour force (8) and total employment (6). The former is obtained by applying the participation rate as determined in equation (5), and the latter is the sum of employees in industry, private services, employees in agriculture, other employees and self-employment.

Identities

(6) TE(i) ≡EEIND(i)+EESER(i)+EEAGR(i)+OEE(i)+SE(i)

(7) TEE(i) ≡ a*TE(i)

(8) LF(i) ≡PR(i)*POP(i)

(9) UR(i) ≡(LF(i)-TEE(i))/LF(i)*100

(10) PROF(i) ≡((VAIND(i)*DEFIND(i)+VASER(i)*DEFSER(i)+VAGR(i)*DEFAGR(i))-(WIND(i)*EEIND(i)+WSER(i)*EESER(i)+WAGR(i)*EEAGR(i))-INTAX(i))

(11) PROFSE(i) ≡PROF(i)/SE(i)

(12) EE(i) ≡EEIND(i)+EESER(i)+EEAGR(i)+OEE(i)

• Supply block

Behavioural equations

(13) VAAGR(i) = g_6{KAGR(i), EEAGR(i), TFPAGR(i)}

(14) VAIND(i) = g_7{KIND(i), EEIND(i), TFPIND(i), UTILT(i)}

(15) VASER(i) = g_8{KSER(i), EESER(i), TFPSER(i), UTILT(i)}

Aggregate supply is described by three sectoral production functions, respectively in industry, tradable services and agriculture. We use a Cobb-Douglas representation defined with respect to capital and labour inputs, total factor productivity and a term which proxies capacity utilisation. We thus expect that both the TFP index and the capacity utilisation index enter each equation positively and significantly. Capacity utilisation is proxied by the ratio of actual GDP to potential GDP, which in turn is defined as a linear trend of actual GDP.

Identities

(16) UTILT(i) ≡ (C(i)+G(i)+IFIX(i)+INV(i)-NIMP(i))/VA(i)

(17) VA(i) ≡ VAAGR(i)+VAIND(i)+VASER(i)+(VAPS(i)+VACONST(i))

- ## Demand block

Behavioural equations

(18) NIMP(i) = g_9{WD, RE, UTILT(i)}

(19) IFIX(i) = g_{10}{VA(i), IRATE}

(20) C(i) = g_{11}{VA(i)}

The aggregate demand side is described by aggregate private consumption, total fixed investment and net imports. At this stage we take inventories as exogenous. Consumption depends on income, a proxy of private wealth and an adjustment term. Income enters the equation without any lag, and it may be interpreted in the light of the permanent income hypothesis (Friedman (1957)). In particular, the coefficient on the income variable may be thought of as a discrete approximation of the coefficient of permanent income defined as:

$$Y_{pt} = (1-\lambda)\sum_{i=0}^{\infty} \lambda^i Y_{t-1} \qquad 0 < \lambda < 1$$

By applying the Koyck transformation we get the following empirical version:

$$C_t = \gamma(1-\lambda)Y_t + \lambda C_{t-1}$$

We have augmented this specification with a proxy of aggregate household wealth, and non-labour income (long-term Government bonds interest rate). However, neither

proxy has any significant impact on household consumption in either the national or regional specifications.

Investment is a typical Keynesian function, in that it is defined with respect to the interest rate and the level of economic activity, proxied by actual value added. A more accurate specification could have been used if for machinery and equipment and buildings investments we had had separate data, which at this stage is not available at the regional level.

We have encountered the same limitations in data availability with respect to imports and exports. At the regional level we can only use data on the net balance between imports and exports, and thus we cannot separately specify export and import equations.

In our specification, however, net imports depends on a proxy of world demand, real exchange rate and capacity utilisation

Identities

(21) $KAGR(i) \equiv IFIXAGR(i) + (1-\ddot{a}(i)_{AGR}) * KAGR(i)_{t-1}$

(22) $KIND(i) \equiv IFIXIND(i) + (1-\ddot{a}(i)_{IND}) * KIND(i)_{t-1}$

(23) $KSER(i) \equiv IFIXSER(i) + (1-\ddot{a}(i)_{SER}) * KSER(i)_{t-1}$

(24) $IFIXAGR(i) \equiv \hat{a}(i)_{AGR} * IFIX(i)$

(25) $IFIXIND(i) \equiv \hat{a}(i)_{IND} * IFIX(i)$

(26) $IFIXSER(i) \equiv \hat{a}(i)_{SER} * IFIX(i)$

Legend:

DEFAGR	**value added deflator in agriculture (1995=100)**
DEFIND	**value added deflator in industry (1995=100)**
DEFSER	**value added deflator in tradable services (1995=100)**
EE	**total employees**
EEAGR	**employees in agriculture**
EEIND	**employees in industry**
EESER	**employees in tradable services**
PRODIND	**industry productivity**
PRODSER	**services productivity**
IMMIG	**immigration flows from abroad**

INTAX	**net indirect taxes**
LF	**labour force**
OEE	**other employees**
PR	**participation rate**
PROF	**nominal total profits**
POP	**population**
SE	**self employment**
TE	**total employment (labour units)**
á	**coefficient linking total labour units to total employment**
TEE	**total employment adjusted for discrepancy (a) with total labour units**
TFPAGR	**total factor productivity in agriculture**
TFPIND	**total factor productivity in industry**
TFPSER	**total factor productivity in tradable services**
UR	**unemployment rate**
VA	**total value added at 1995 prices**
VA*	**full capacity value added at 1995 prices (linear trend of total value added at 1995 prices)**
VAAGR	**value added in agriculture at 1995 prices**
VAIND	**value added in industry at 1995 prices**
VASER	**value added in tradable services at 1995 prices**
VAPS	**value added in public sector at 1995 prices**
VACONST	**value added in constructions at 1995 prices**
VAAGR*	**full capacity value added in agriculture at 1995 prices (linear trend of actual value added in agriculture at 1995 prices)**
WAGR	**per capita nominal labour cost in agriculture**
WIND	**per capita nominal labour cost in industry**
WSER	**per capita nominal labour cost in tradable services**
YU	**ratio of persons searching for a job for the first time to total unemployed**
KAGR	**capital in agriculture at 1995 prices**
KIND	**capital in industry at 1995 prices**
KSER	**capital in services at 1995 prices**
UTILT	**capacity utilization (total economy)**
NIMP	**net imports at 1995 prices**
WD	**world demand**
RE	**real exchange rate**
IFIX	**total investments at 1995 prices**
IFIXAGR	**investments in agriculture at 1995 prices**
IFIXIND	**investments in industry at 1995 prices**
IFIXSER	**investments in services at 1995 prices**
IRATE	**interest rate**
C	**household consumption at 1995 prices**
ä$_{AGR}$	**depreciation rate (agriculture)**
ä$_{IND}$	**depreciation rate (industry)**
ä$_{SER}$	**depreciation rate (services)**
â$_{AGR}$	**ratio of fixed investments in agriculture to total fixed investments**
â$_{IND}$	**ratio of fixed investments in industry to total fixed investments**
â$_{SER}$	**ratio of fixed investments in services to total fixed investments**
INV	**inventories at 1995 prices**
i	**Lombardy, Italy**

3 Behavioural equations: the estimates

The model described in the previous section has been estimated by using data derived from the Regional Accounts data set available from the Italian National Institute of Statistics (ISTAT 2000). This data set covers only the period 1980-2000, and thus we have matched it with the Regional Accounts data set set up by SVIMEZ (SVIMEZ 1998), and covering the period 1970-1980, in order to have a longer time span for our estimates.
We present estimates based on an Error Correction Mechanism (ECM) specification in order to take short-term dynamics into account and to incorporate long-run relationships.
It is worthwhile noting that in our estimates, the values of variables for the Italian economy are net of Lombardy's value, in order to derive a more precise description of the effect of exogenous shocks on the rest of the national economy, which thus excludes Lombardy.

- **Labour demand**

Labour demand is described by using three sectoral specifications for employees, i.e., employees in agriculture, industry and services. Employment in each sector depends on the variables described in section 3. The equation of the demand for labour in agriculture shows coefficients which suggest, as expected, a negative relationship only in the long run between the demand for labour and its real unit cost. However, its coefficient is significant only for high significance levels both in Lombardy and in Italy, while the short-run adjustment mechanism is not significant in either specification. This fact underlines how difficult it is to model agriculture labour demand, affected as it is by the marginal labour force (mature female labour force, immigrants) and seasonal patterns which cannot easily be accounted for in our specification.

Labour demand in industry highlights an adjustment process which is affected by labour hoarding in both the regional and national specifications. Indeed, short-run dynamics of employment are mild if not insignificant as in the national specification, except for the short-run impact of the product price change. In the long run the national specification shows a higher elasticity of employment to value added, when compared to Lombardy. The effect of

labour cost is only significant at the national level, and product price in this specification, is significant at a higher significance level (0.23).

On the whole, labour hoarding does affect labour demand in industry in both frameworks; however, in our specification labour hoarding is also captured by the impact of the ratio of labour productivity to total factor productivity. This variable shows that any productivity shock has a grater impact at the regional level, as compared with the national level.

Labour demand in tradable services, as in the case of employees in industry, shows a differentiated response in the two territorial dimensions to fluctuations in output, factor cost and product price. The response of employment to value added change is significant and higher, in the short-run, at the national level than in Lombardy. This is confirmed in the long –run, as the elasticity of employment to value added is almost one (0.995) in the national specification, and 0.610 at the regional level. Labour cost is significant only in the long run in both specifications, although at the regional level the significance level is higher (0.204) than those conventionally used. This consideration also applies to the product price variable, which shows, as expected, a positive impact on employment.

These results may crucially depend on the characteristics of private services in Lombardy compared to those prevailing at the national level, influenced by the characteristics prevailing in services in the central and southern regions. Indeed, the size of such activities is particularly small in such areas, and thus labour cost becomes a constraint on expansion. This is less relevant in Lombardy, where businesses are on average bigger, thus contributing to absorbing labour cost variations. This argument may also be used to explain the long-run impact of labour productivity on employment, thus suggesting that labour hoarding is more relevant in Lombardy, and is brought about by a larger firm size.

Table 2 - Labour Demand - Employees in Agriculture – OLS Estimates
Dependent Variable: Dlog(EEAGR)

Regressors	Lombardy	Italy
$\Delta\log(EEAGR)_{t-1}$	-0.106	0.137
	(-0.535)	(0.676)
$\Delta\log(VAAGR)_{t-1}$	-0.147	-0.031
	(-0.472)	(-0.170)
$\Delta\log(WAGR/DEFAGR)_{t-1}$	0.207	-0.027
	(1.327)	(-0.197)
$\log(EEAGR)_{t-1}$	-0.557	-0.364
	(-2.478)	(-2.053)
$\log(VAAGR)_{t-1}$	0.305	0.0002
	(0.776)	(0.001)
$\log(WAGR/DEFAGR)_{t-1}$	-0.182	-0.064
	(-1.222)	(-1.325)
$\log(TFPAGR)_t$	-0.173	-0.213
	(-0.826)	(-2.255)
CONST.	0.075	-2.960
	(0.027)	(0.757)
Elasticity		
â (1)	-0.327	-0.175
ã (1)	-0.310	-0.584
Adj R^2	0.377	0.262
F-stat.	3.422	1.065
	(0.013)	(0.419)
LM_1*	0.254	0.073
	(0.620)	(0.790)
LM_4*	1.665	1.419
	(0.204)	(0.270)
LM_W*	0.695	0.652
	(0.747)	(0.778)

t-statistics in parenthesis.
(1) Long run elasticity with respect to: WAGR/DEFAGR, TFPAGR.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

Table 3 - Labour Demand - Employees in Industry - OLS Estimates
Dependent Variable: Dlog(EEIND)

Regressors	Lombardy	Italy
$\Delta\log(EEIND)_{t-1}$	0.244	0.055
	(1.754)	(0.466)
$\Delta\log(VAIND)_{t-1}$	-0.113	-0.029
	(-1.236)	(-0.461)
$\Delta\log(WIND)_t$	-0.189	-0.111
	(-1.244)	(-0.962)
$\Delta\log(DEFIND)_t$	0.326	0.218
	(2.356)	(2.433)
$\log(EEIND)_{t-1}$	-0.576	-0.439
	(-5.440)	(-0.627)
$\log(VAIND)_t$	0.315	0.411

	(3.979)	(7.295)
$\log(WIND)_t$	-0.075	-0.138
	(-0.715)	(-1.883)
$\log(DEFIND)_t$	0.055	0.086
	(0.530)	(1.236)
$PRODIND_t$	-0.308	-0.172
	(-3.442)	(-2.632)
CONST.	2.028	-0.200
	(1.848)	(-0.219)
Elasticity		
á (1)	0.546	0.937
â (1)	-------	-0.316
ã (1)	-------	0.196
ä (1)	-0.535	-0.392
Adj R^2	0.704	0.816
F-stat	8.390	14.793
	(0.000)	(0.000)
LM_1*	0.074	0.031
	(0.788)	(0.863)
LM_4*	1.371	1.515
	(0.291)	(0.248)
LM_W*	1.237	9.793
	(0.376)	(0.000)

t-statistics in parenthesis.
(1) Long run elasticity with respect to: VAIND, WIND, DEFIND, PRODIND.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

Table 4 - Labour Demand - Employees in Tradable Services - OLS Estimates
Dependent Variable: Dlog(EESER)

Regressors	Lombardy	Italy
$\Delta\log(EESER)_{t-1}$	0.182	0.336
	(0.966)	(2.934)
$\Delta\log(VASER)_t$	-0.197	-0.256
	(-1.115)	(-2.451)
$\log(EESER)_{t-1}$	-0.602	-0.471
	(-3.303)	(-5.758)
$\log(VASER)_{t-1}$	0.368	0.469
	2.280	(5.155)
$\log(WSER)_t$	-0.162	-0.142
	(-1.310)	(-2.477)
$\log(DEFSER)_t$	0.192	0.119
	(1.460)	(1.848)
$PRODSER_t$	-0.094	-0.086
	(-3.514)	(-3.572)
CONST.	1.492	-0.847
	(1.555)	(-1.119)

Elasticity		
á (1)	0.610	0.995
â (1)	-0.270	-0.301
ã (1)	0.318	0.254
ä (1)	-0.156	-0.183
Adj R^2	0.482	0.693
F-stat.	4.717	10.045
	(0.003)	(0.000)
LM_1*	0.028	1.183
	(0.869)	(0.290)
LM_4*	0.523	1.697
	(0.721)	(0.197)
LM_W*	3.948	0.505
	(0.007)	(0.893)

t-statistics in parenthesis.
(1) Long run elasticity with respect to : VASER, WSER, DEFSER, PROD.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

- **Labour supply**

Labour supply is described by means of the participation rate and self-employment. The estimation of the participation rate shows short-run and long-run relationships which underline how the discouragement effect in the regional equation, as measured by the link between employment and labour force participation, is milder than in the national equation. This result is coherent with the fact that the discouragement effect prevails in the national labour market and therefore the response of the labour force participation rate to changes in economic conditions, proxied by changes in employment, is higher in this context, and determines a quick adjustment in the participation rate. In addition, we include a migration variable to take the impact of inflows of immigrants on the participation rate into account. This impact is not significant, and it may depend on the fact that inflows from foreign countries have increased over the last ten years, therefore affecting only the last part of the sample period. However, it is worth including this variable as it will become ever more important in the future, as immigration, even though restricted at the national and regional level, is an important key to resolving differences between labour demand and supply in some industrial sectors of the Italian and regional economy.

The classical component of labour supply is modelled by using self-employment as a dependent variable. Therefore, we include per capita nominal earnings as a regressor to take

the effect of a change in earned income on individual labour supply into account, as in the typical neoclassical story. In addition, we include the unemployment rate and the ratio of young unemployed to total unemployed, to take the marginal component of self-employment into account, i.e., those individuals who react to failure in finding a job as employees. The earning variable is significant only in the long run and in the regional specification, whereas in the national specification it does not affect either the short-run adjustment or the long-run relationship.

The unemployment rate does not enter the regional equation significantly, while the proportion of young unemployed people is significant in the long-run relationship, and in the short-run is significant at a significance level of 0.281. In the national equation these variables do affect self-employment. In particular, the proportion of young unemployed people does affect both the short and long-run dynamics, while the whole unemployment rate is significant in the long-run relationship only. However, it is worthwhile to note that the long-run elasticity of the proportion of young unemployed people is almost three times as high as the elasticity calculated for Lombardy.

These results underline the different characteristics of self employment between Lombardy and the rest of the country, as in the former there is a consistent neo-classical component, which is therefore sensitive to changes in opportunity costs, i.e., earnings. In the latter, self-employment responds to bad labour market conditions, i.e., high unemployment, and this highlights the structural difference of labour supply between the two territorial areas.

Table 5 - Labour Supply - Participation Rate - OLS Estimates
Dependent Variable: Dlog(LF/POP)

Regressors	Lombardy	Italy
$\Delta\log(LF/POP)_{t-1}$	0.156	-0.049
	(1.005)	(-0.491)
$\Delta\log(SE/POP)_{t}$	0.228	0.300
	(3.180)	(2.672)
$\Delta\log(EE/POP)_{t}$	0.110	0.859
	(0.872)	(4.676)
$\Delta\log(IMMIG)_{t}$	0.004	0.008
	(0.444)	(0.950)
$\log(LF/POP)_{t-1}$	-0.655	-0.885
	(-2.842)	(-3.955)
$\log(SE/POP)_{t-1}$	0.171	0.424
	(2.354)	(4.255)
$\log(EE/POP)_{t-1}$	0.133	0.537
	(1.014)	(2.744)
$\log(IMMIG)_{t-1}$	0.006	0.009

	(0.737)	(0.841)
DUM93	-0.012	-0.015
	(-1.680)	(-2.327)
CONST.	-0.039	0.794
	(-0.245)	(3.727)
Elasticity		
á (1)	0.260	0.480
â (1)	0.203	0.607
ã (1)	0.009	0.010
Adj R^2	0.622	0.812
F-stat.	6.123	14.407
	(0.000)	(0.000)
LM_1*	0.459	0.019
	(0.507)	(0.893)
LM_4*	3.550	0.738
	(0.031)	(0.580)
LM_W*	1.643	1.788
	(0.203)	(0.165)

t-statistics in parenthesis.
(1) Long run elasticity with respect to : SE/POP, EE/POP, IMMIG.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

Table 6 - Labour Supply - Self-Employment - OLS Estimates
Dependent Variable: Dlog(SE)

Regressors	Lombardy	Italy
$\Delta\log(SE)_{t-1}$	0.150	0.237
	(1.004)	(1.272)
$\Delta\log(PROFSE)_t$	0.005	0.045
	(0.059)	(0.494)
$\Delta\log(UR)_t$	-0.035	0.060
	(-1.386)	(1.008)
$\Delta\log(YU)_t$	0.038	0.111
	(1.109)	(2.048)
$\log(SE)_{t-1}$	-0.424	-0.532
	(-3.540)	(-3.764)
$\log(PROFSE)_{t-1}$	0.063	0.001
	(3.018)	(0.048)
$\log(UR)_{t-1}$	-0.007	0.112
	(-0.304)	(1.669)
$\log(YU)_{t-1}$	-0.052	0.182
	(-2.145)	(3.261)
CONST.	2.825	4.474
	(3.604)	(3.834)

Elasticity		
á (1)	0.148	-------
â (1)	------	0.211
ã (1)	0.124	0.343
Adj R^2	0.450	0.395
F-stat.	3.863	3.282
	(0.007)	(0.015)
LM_1*	0.023	0.055
	(0.881)	(0.817)
LM_4*	0.553	0.081
	(0.700)	(0.987)
LM_W*	1.687	3.856
	(0.182)	(0.011)

t-statistics in parenthesis.
(1) Long run elasticity with respect to: PROFSE, UR, YU.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

- Production

In this version of the model we include sectoral production functions which define sectoral value added as a function of capital and labour inputs, total factor productivity and an index of capacity utilisation. This latter is included in order to close the model on the demand and supply side, as an increase of actual GDP brings about an increase in one of its components which may in turn affect production, and thus the supply side of the model. This index is defined as the ratio of actual to potential GDP, and this latter is obtained as a linear trend interpolating the GDP variable.

Value added in agriculture is crucially affected by technical progress, which in turn implies an intensive use of capital and a reduction in the use of labour. This is indeed summarised in the estimates, which show a significant effect of capital and TFP on agriculture value added in both the regional and national specifications. The labour input enters equations with a significant and positive impact only in the short run, while long-run dynamics imply a negative coefficient, which may be the result of the strong negative correlation between TFP and employment in agriculture.

The equations for value added in industry show coefficients on factor inputs which are significant and with expected signs. Short-run adjustments are driven by labour input variations, and this implies a higher short-run elasticity in the national specification. However, in the long run, capital and labour elasticities are higher in Lombardy, while the adjustment to capacity utilisation is milder than in the national equation.

This evidence is partially confirmed in the services equation, in that the short-run impact of employment is significant only in the regional equation, and capital input does show a higher elasticity compared with the national figure. However, in the long run the labour input and capacity utilisation have a stronger impact on services value added in Italy, in contrast with TFP which has a stronger impact at the regional level. This is coherent with the characteristics of private services in Lombardy and the rest of Italy, as we have previously underlined, in that services are characterised by a larger scale and higher capital to labour ratio in the regional context.

Table 7 - Agriculture Production Function - OLS Estimates
Dependent Variable: Dlog(VAAGR)

Regressors	Lombardy	Italy
$\Delta\log(VAAGR)_{t-1}$	0.106	0.389
	(1.438)	(4.261)
$\Delta\log(EEAGR)_t$	0.082	0.201
	(1.537)	(1.801)
$\Delta\log(TFPAGR)_t$	0.511	0.868
	(4.060)	(8.627)
$\log(VAAGR)_{t-1}$	-0.683	-0.806
	(-4.661)	(-5.316)
$\log(KAGR)_{t-1}$	0.177	0.189
	(1.791)	(2.599)
$\log(EEAGR)_{t-1}$	-0.071	-0.111
	(-1.327)	(-2.861)
$\log(TFPAGR)_t$	0.364	--
	(3.859)	--
CONST.	3.548	6.668
	(4.194)	(4.242)
Elasticity		
á (1)	0.260	0.235
â (1)	-0.105	-0.138
ã (1)	0.534	--
Adj R^2	0.878	0.898
F-stat.	29.828	41.866
	(0.000)	(0.000)
LM_1*	0.764	0.0002
	(0.392)	(0.990)
LM_4*	0.815	0.418
	(0.533)	(0.794)
LM_W*	2.122	0.657
	(0.086)	(0.767)

t-statistics in parenthesis.
(1) Long run elasticity with respect to: KAGR, EEAGR, TFPAGR.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

Table 8 - Industry Production Function - OLS Estimates
Dependent Variable: Dlog(VAIND)

Regressors	Lombardy	Italy
$\Delta\log(VAIND)_{t-1}$	0.046	0.038
	(0.641)	(0.766)
$\Delta\log(EEIND)_t$	0.483	0.505
	(11.040)	(15.773)
$\Delta\log(UTILT)_{t-1}$	-0.108	-0.169
	(-0.856)	(-1.229)
$\log(VAIND)_{t-1}$	-0.950	-0.916
	(-29.116)	(-32.119)
$\log(KIND)_{t-1}$	0.308	0.288
	(8.437)	(6.188)
$\log(EEIND)_{t-1}$	0.571	0.460
	(16.937)	(13.311)
$\log(TFPIND)_t$	0.961	0.928
	(22.094)	(22.806)
$\log(UTILT)_t$	0.207	0.394
	(3.470)	(4.846)
CONST.	0.575	1.476
	(2.110)	(8.447)
Elasticity		
á (1)	0.325	0.314
â (1)	0.601	0.502
ã (1)	1.012	1.013
ä (1)	0.218	0.430
Adj R^2	0.989	0.996
F-stat.	311.1626	869.670
	(0.000)	(0.000)
LM_1*	2.101	0.1.425
	(0.163)	(0.247)
LM_4*	1.197	0.759
	(0.350)	(0.567)
LM_W*	0.396	1.225
	(0.957)	(0.367)

t-statistics in parenthesis.
(1) Long run elasticity with respect to: KIND, EEIND, TFPIND, UTILT.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

Table 9 - Services Production Function - OLS Estimates
Dependent Variable: Dlog(VASER)

Regressors	Lombardy	Italy
$\Delta log(VASER)_{t-1}$	-0.019	-0.094
	(-0.126)	(-0.769)
$\Delta log(EESER)_{t-1}$	0.310	0.120
	(2.044)	(0.964)
$log(VASER)_{t-1}$	-0.738	-0.818
	(-4.645)	(-6.363)
$log(KSER)_{t-1}$	0.421	0.438
	(3.967)	(3.519)
$log(EESER)_{t-1}$	0.260	0.342
	(2.123)	(4.789)
$log(UTILT)_t$	0.108	0.441
	(0.773)	(4.843)
$log(TFPSER)_t$	0.717	0.542
	(4.095)	(7.558)
CONST.	-0.103	0.458
	(-0.375)	(1.571)
Elasticity		
á (1)	0.572	0.536
â (1)	0.352	0.419
ã (1)	0.148	0.539
ä (1)	0.970	0.662
Adj R^2	0.677	0.805
F-stat.	9.373	17.512
	(0.000)	(0.000)
LM_1*	2.225	33.232
	(0.151)	(0.00001)
LM_4*	5.588	10.299
	(0.005)	(0.0002)
LM_W*	1.272	2.010
	(0.330)	(0.099)

t-statistic in parenthesis.
(1) Long run elasticity with respect to: KSER, EESER, UTILT, TFPSER..

* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

- **Demand**

The Demand side of the model considers private consumption, total fixed investment and net imports as endogenous components. At this stage we take government expenditure and the change in inventories as exogenous. We are aware of the fact that a complete model should endogenise at least inventories, to take account of the interactions between the demand side and the supply side, and thus closing the model more accurately from a methodological point

of view. However, given the actual availability of regional data, we are forced to simplify the model structure and thus we have decided to take the two latter demand side components as exogenous.

As discussed in Section 2, private consumption is modelled by using a simple representation, in that it depends on income, adjustment terms and the long-run relationship between consumption and income.

The elasticity of income is higher both in the short and in the long run in the national specification, and this is consistent with the income gap between the two areas.

The level of economic activity positively and significantly affects total fixed investment, and the interest rate enters the equation with the expected negative sign. The adjustment process responds more to value added and interest rate changes in the national equation, whereas the impact of such variables in the long run is stronger in the regional specification

At the regional level we can only estimate net imports and not both components of trade, i.e. exports and imports, separately. This may result in poor results in the estimates at the regional level, as one cannot single out the effect of each explanatory variable on each of the components of the trade balance.

Net imports are defined as the difference between imports and exports; however, one has to take account of the fact that for a regional economy this variable reflects movements with the rest of the world which includes the national economy, as goods may be exchanged between the national and regional economies. It has to be pointed out that Lombardy accounts for more than 20% of the Italian foreign trade account, and that the openness of the regional economy is testified by the ratio of exports and imports to GDP, which is more than 60%.

Net imports are crucially affected by changes in the real exchange rate both in the short-run and in the long run, while world demand is significant only in the national equation and in the long-run relationship. On the other hand, capacity utilisation is only significant at the 0.241 significance level in Lombardy, and this suggests that any positive increase, or negative reduction, in the gap between actual and potential output has a positive effect on exports, and through this route a negative impact on net imports.

Table 10 - Consumption Function - OLS Estimates
Dependent Variable: Dlog(C)

Regressors	Lombardy	Italy
$\Delta\log(C)_{t-1}$	0.113	0.207
	(1.031)	(2.300)
$\Delta\log(VA)_t$	0.668	0.816
	(7.240)	(9.111)
$\log(C)_{t-1}$	-0.388	-0.343
	(-3.029)	(-2.658)
$\log(VA)_{t-1}$	0.424	0.387
	(2.982)	(2.640)
CONST.	-0.655	-0.722
	(-2.443)	(-2.366)
Elasticity		
á (1)	1.093	1.127
Adj R^2	0.725	0.819
F-stat.	19.486	32.654
	(0.000)	(0.000)
LM_1*	0.023	0.076
	(0.880)	(0.786)
LM_4*	0.267	0.381
	(0.896)	(0.819)
LM_W*	0.344	0.291
	(0.938)	(0.950)

t-statistics in parenthesis.
(1) Long run elasticity with respect to VA.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

Table 11 - Investment Function - OLS Estimates
Dependent Variable: Dlog(IFIX)

Regressors	Lombardy	Italy
$\Delta\log(IFIX)_{t-1}$	0.378	0.350
	(1.950)	(1.645)
$\Delta\log(VA)_{t-1}$	0.191	0.678
	(0.303)	(1.164)
$\Delta(IRATE)_{t-1}$	-0.006	-0.006
	(-1.130)	(-1.873)
$\log(IFIX)_{t-1}$	-0.580	-0.455
	(-2.995)	(-2.691)
$\log(VA)_{t-1}$	0.332	-0.239
	(2.615)	(2.753)
$(IRATE)_{t-1}$	-0.009	-0.004
	(-3.411)	(-2.191)
CONST.	2.119	2.224
	(2.866)	(2.110)

Elasticity		
á (1)	0.572	0.526
â (1)	-0.016	-0.009
Adj R^2	0.659	0.567
F-stat.	10.028	7.110
	(0.000)	(0.000)
LM_1*	1.070	0.002
	(0.313)	(0.965)
LM_4*	1.512	1.492
	(0.241)	(0.246)
LM_W*	1.012	1.231
	(0.481)	(0.342)

t-statistics in parenthesis.
(1) Long run elasticity with respect to: VA, IRATE.
(2) Ratio of standard error of regression to mean value of dependent variable.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

Table 12 - Net Imports - OLS Estimates
Dependent Variable: D(NIMP)

Regressors	Lombardy	Italy
$\Delta(NIMP)_{t-1}$	0.085	0.277
	(0.352)	(1.716)
$\Delta(WD)_t$	56.398	57.946
	(0.567)	(0.301)
$\Delta(RE)_t$	196.412	591.459
	(1.860)	(3.554)
$(NIMP)_{t-1}$	-0.245	-0.554
	(-0.997)	(-3.414)
$(WD)_{t-1}$	-22.533	68.709
	(-0.452)	(2.261)
$(RE)_{t-1}$	199.857	654.883
	(2.067)	(3.193)
$(UTILT)_{t-1}$	-27041.95	-15930.10
	(-1.206)	(-0.376)
CONST.	397.654	-49410.35
	(0.022)	(-1.070)
R^2	0.318	0.653
F-stat.	1.399	4.777
	(0.257)	(0.002)
LM_1*	2.658	3.151
	(0.119)	(0.091)
LM_4*	1.198	1.416
	(0.348)	(0.271)
LM_W*	0.981	1.714
	(0.514)	(0.162)

t-statistic in parenthesis.
* Lagrange Multiplier Test for first and fourth order autocorrelation with associated p-value (small sample version) and White test for heteroskedasticity.

4. Simulated shocks

The model has been simulated from 1985 to 2000 by means of a dynamic deterministic simulation, and the baseline solution has been used for evaluating the response of the national and regional models to exogenous shocks. In what follows we consider labour cost, product price, total factor and labour productivity, interest rate and real exchange rate shocks, and evaluate their impact on the main endogenous variables of the model.

- ### Labour cost and product price shocks

We first consider a unit rise in money wages in industry, and then a corresponding increase in product price. Employment effects are higher in the regional economy, as the direct effect on employees in industry implies a positive net effect in Lombardy, contrary to the national net effect which is milder and then negative in the longer run. This result is the result of the stronger negative effect of the labour cost on labour demand in the national specification. In addition, one has to bear in mind that output is endogenous, and thus any increase in employees in industry also affects the production function. The impact on the participation rate is, therefore, higher in the regional labour market as employment response is larger. The net effect on unemployment is confined to the short-run in Lombardy, whereas in the rest of the country unemployment remain steady, as the response of the participation rate in Italy is positive only in the short-run, and negative in the long run.

The same argument may be applied to the analysis of a unit increase in labour cost and product price in services. In this case the negative effect on unemployment, although mild, does persist in Lombardy, and the same pattern, but with a positive sign, characterises the unemployment response in the rest of Italy.

- **Total factor and labour productivity shocks**

Total factor and labour productivity are used as a proxy of technological change and in our specifications are combined to take account of employment adjustment, and thus to capture labour hoarding in the regional and national labour market. A unit shock in labour and total factor productivity in industry determines a negative effect on employment on the whole in the regional and national labour market. In the long-run, the response in the two areas does converge towards a common negative value; however, in the short-run the negative effect is larger in Lombardy, where the direct (negative) effect on labour demand in industry is wider.
The net impact on unemployment suggests that the compensation effect is operating at both the national and regional levels, in that the positive impact on unemployment of a productivity shock is almost completely absorbed in the long run. In other words, an increase in productivity reduces employment as a pure substitution effect on the one hand and, on the other, it increases output in a later period and, as a consequence, employment. This is an old and controversial mechanism first estimated by Salter (1967), but it is however crucial if one thinks of the possible impact of ICT technologies on output and employment.
The same argument may be used for the corresponding productivity shock in services, although a mild positive impact on unemployment does persist more than in industry at the regional level.

- **Interest rate and exchange rate shocks**

A unit reduction in interest rate stimulates output through the typical Keynesian mechanism, and thus investment, value added and consumption increase. Employment and the participation rate increase at the same time, thus determining the unemployment rate response. The net result is a reduction in unemployment which is more relevant in Lombardy. This result crucially depends on the higher fluctuation of the participation rate in Italy, and is also consistent with our previous findings (Baussola 2003), in which the demand side of the model was taken as exogenous.
Similar results are obtained with respect to a decrease in the real exchange rate index, which in our case implies a currency devaluation. The overall impact on the goods market determines a stronger impact on employment in Italy as compared to Lombardy; however, the

impact on the participation rate is positive and stronger in the former area and this causes a decrease in the unemployment rate which is milder in the rest of Italy than in the regional economy.

5. Conclusion

We have investigated the characteristics of interactions between the labour and the goods markets by using a regional econometric model of Lombardy. We have compared the performance of such a model in the regional and national context by adopting a specification which allows for the endogeneity of both the demand and supply of labour. The labour force participation rate and self-employment are the two components of labour supply, whereas labour demand is determined by the equations that define employees in industry, in private services and in agriculture, as we take as given employees in construction and in the public sector.

Supply and demand for goods are derived by using sectoral production functions on the one hand, and consumption, investment and net imports equations on the other. This specification allows us to estimate and then solve the model, in order to highlight the specific characteristics of the regional labour market and, therefore, the different responses to various exogenous shocks. The regional labour market, in comparison with the national one, shows a higher responsiveness of unemployment to demand shocks. This result is mainly due to the low discouragement effect estimated for Lombardy in the participation rate equation. On the supply side, labour cost and price shocks affect the demand and supply for labour and therefore unemployment; this latter increases more in Italy than in Lombardy through the same kind of transmission mechanisms previously highlighted, i.e., the milder discouragement effect prevailing in Lombardy's labour supply. Productivity shocks may have mild effects on unemployment, both at the regional and the national level in the shorter run. In the longer run, a compensation effect prevails at both the regional and national levels, confirming, however, that in Lombardy the discouragement effect on the participation rate determines a lower impact on unemployment.

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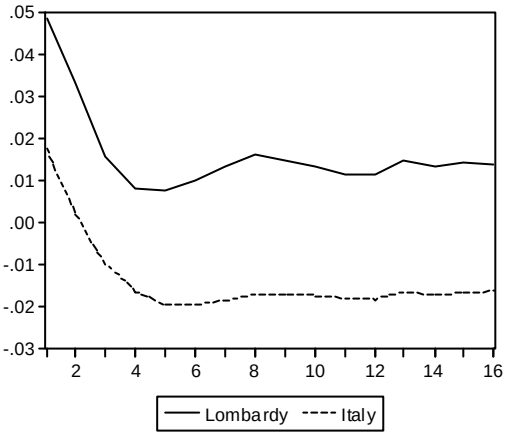
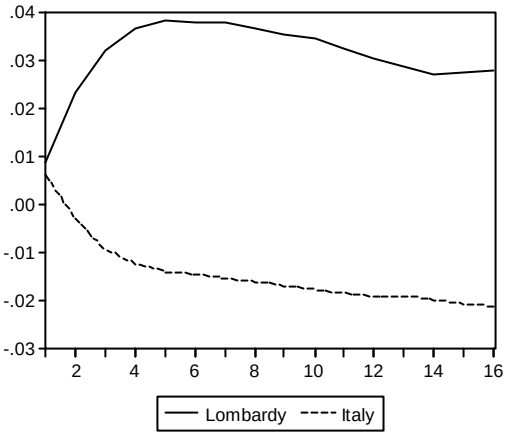
APPENDIX 1

Response to exogenous shocks. Lombardy

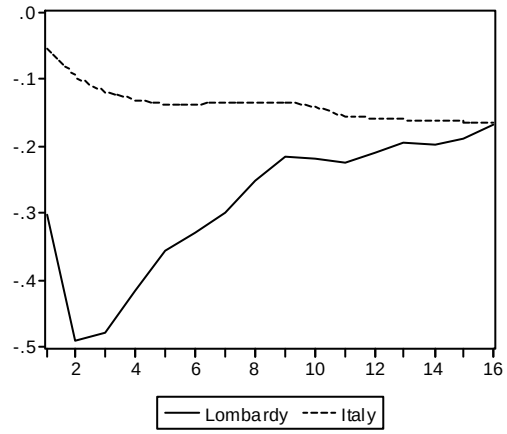
Total employment response to a unit increase in labour cost and product price in industry



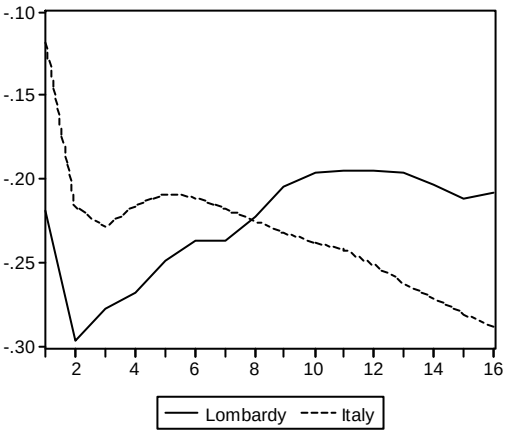
Total employment response to a unit increase in labour cost and product price in services



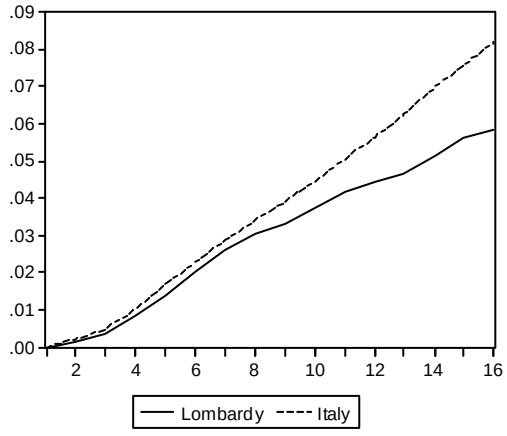
Total employment response to a unit productivity shock in industry



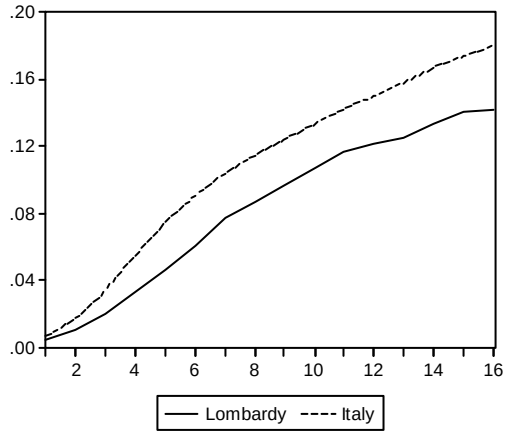
Total employment response to a unit productivity shock in services



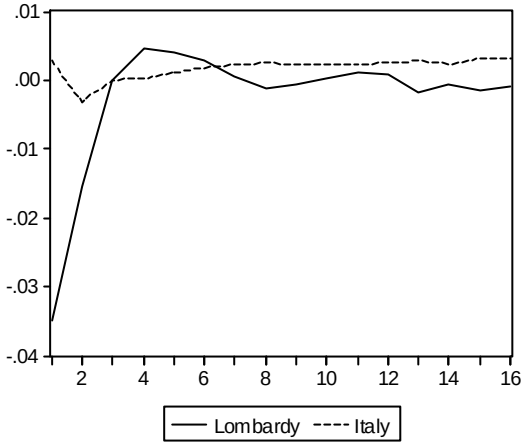
Total employment response to a unit decrease in interest rate



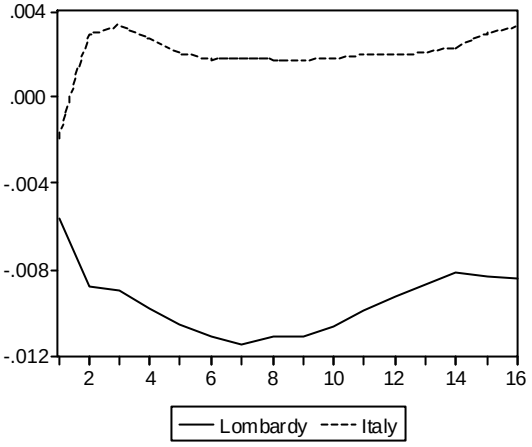
Total employment response to a unit decrease in real exchange rate



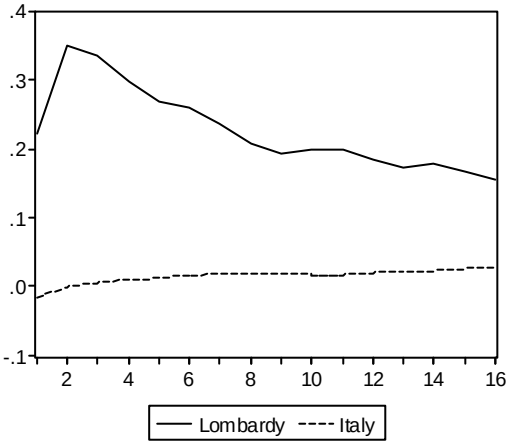
Unemployment response to a unit increase in labour cost and product price in industry



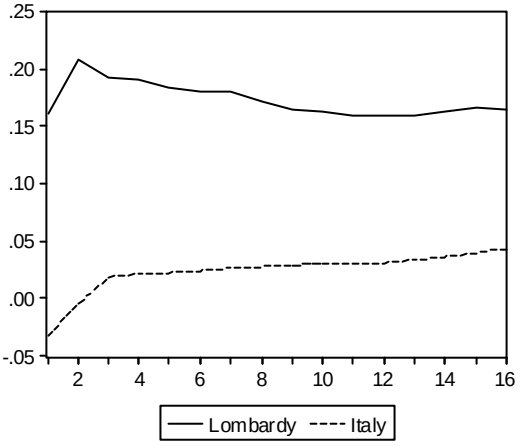
Unemployment response to a unit increase in labour cost and product price in services



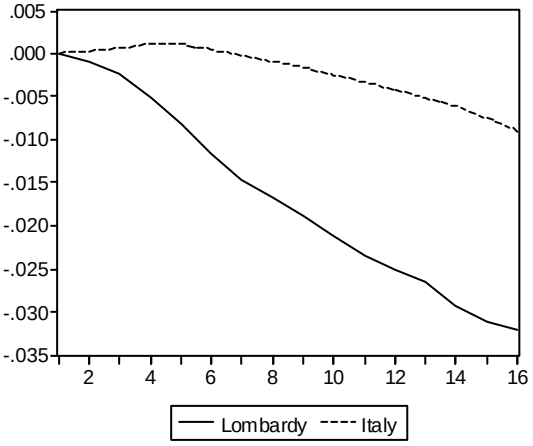
Unemployment response to a unit productivity shock in industry



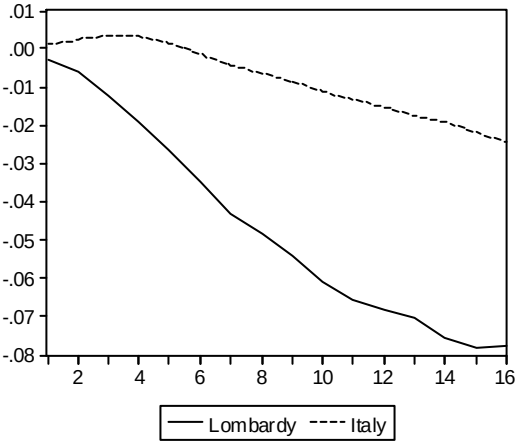
Unemployment response to a unit productivity shock in services



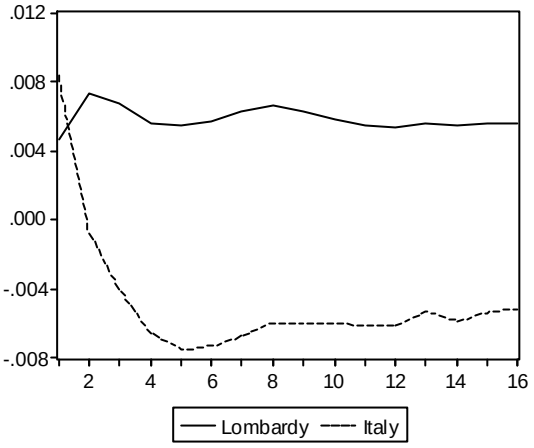
Unemployment response to a unit decrease in interest rate



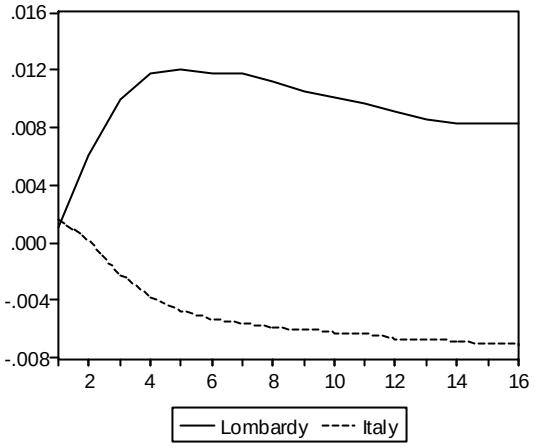
Unemployment response to a unit decrease in real exchange rate



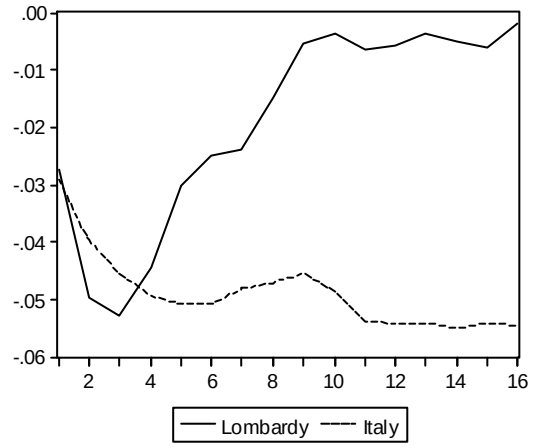
Participation rate response to a unit increase in labour cost and product price in industry



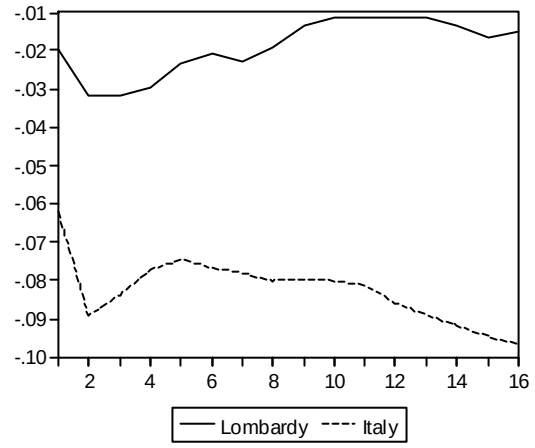
Participation rate response to a unit increase in labour cost and product price in services



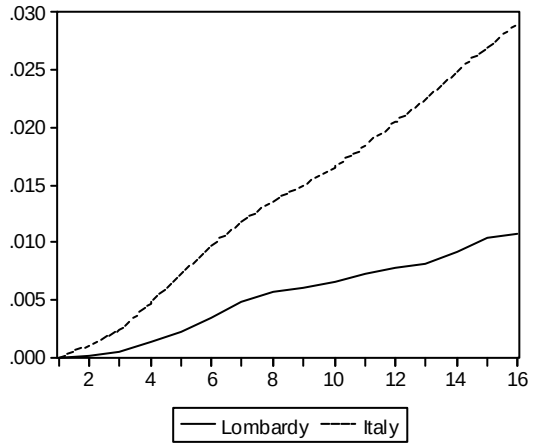
Participation rate response to a unit productivity shock in industry



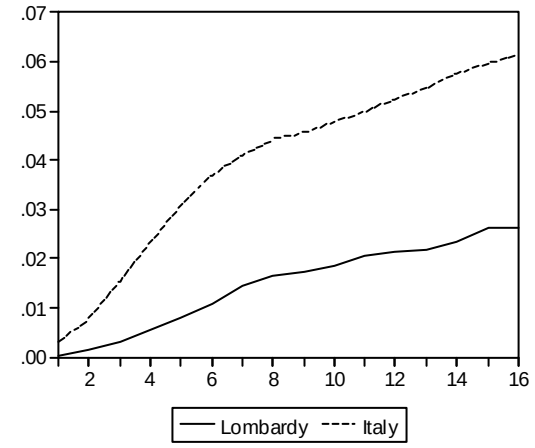
Participation rate response to a unit productivity shock in services



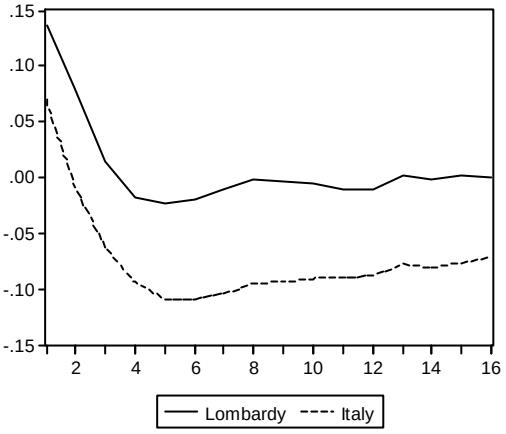
Participation rate response to a unit decrease in interest rate



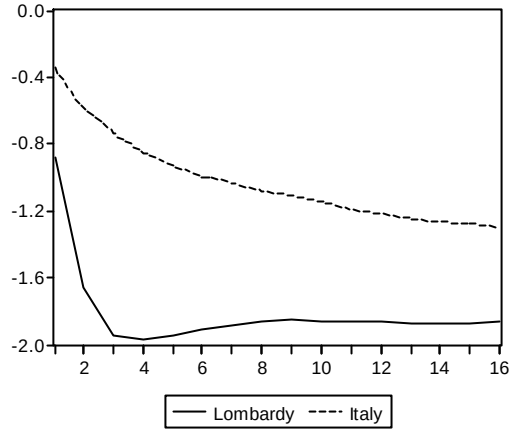
Participation rate response to a unit decrease in real exchange rate



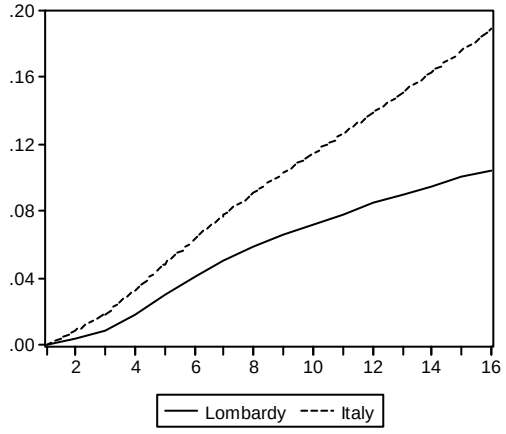
Response of employees in industry to a unit increase in labour cost and product price in industry



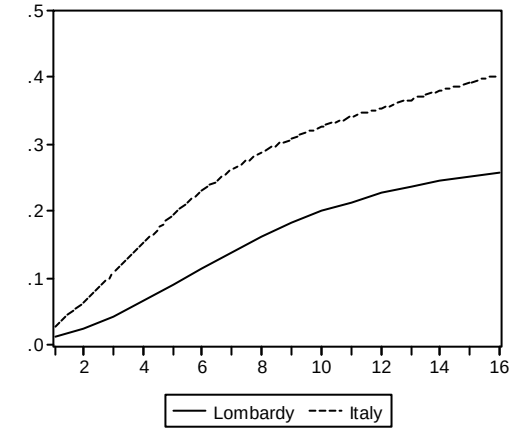
Response of employees in industry to a unit productivity shock in industry



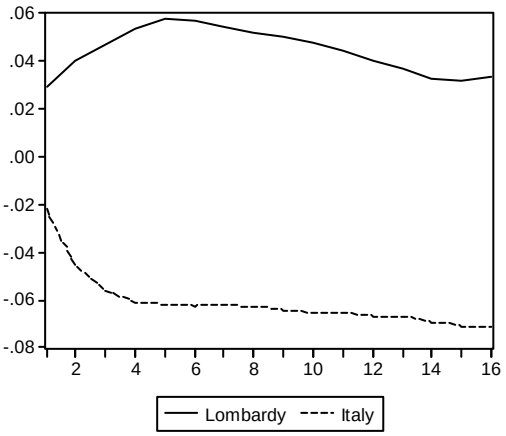
Response of employees in industry to a unit decrease in interest rate



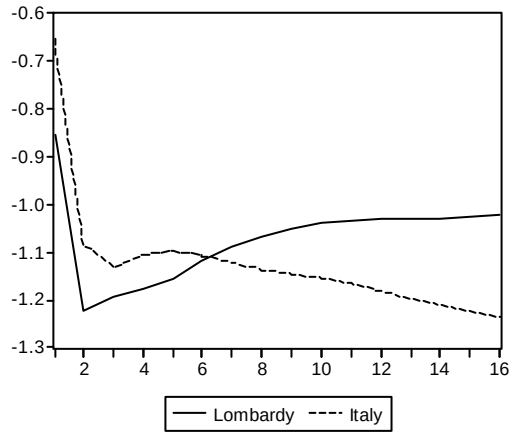
Response of employees in industry to a unit decrease in real exchange rate



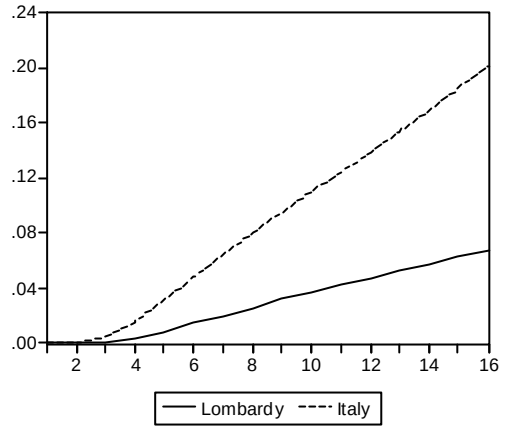
Response of employees in services to a unit increase in labour cost and product price in services



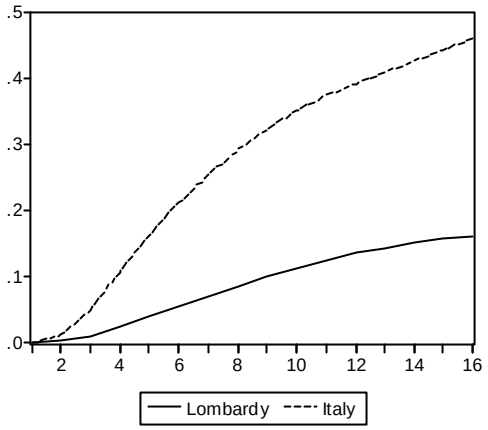
Response of employees in services to a unit productivity shock in services



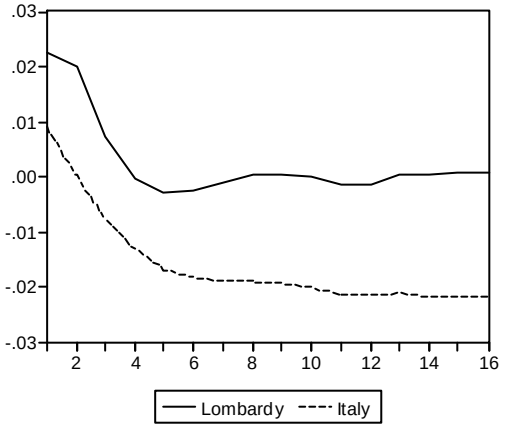
Response of employees in services to a unit decrease in interest rate



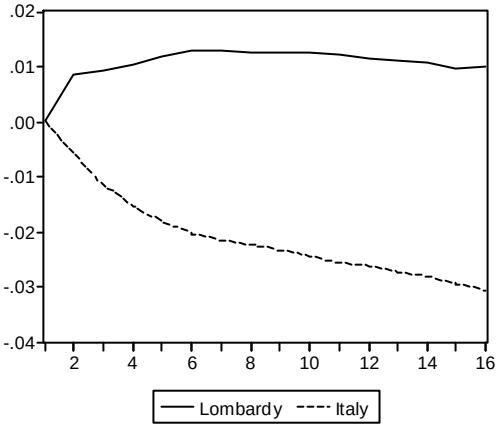
Response of employees in services to a unit decrease in real exchange rate



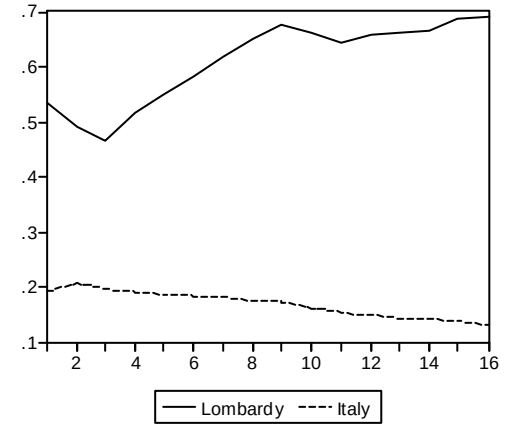
Total value added response to a unit increase
in labour cost and product price in industry



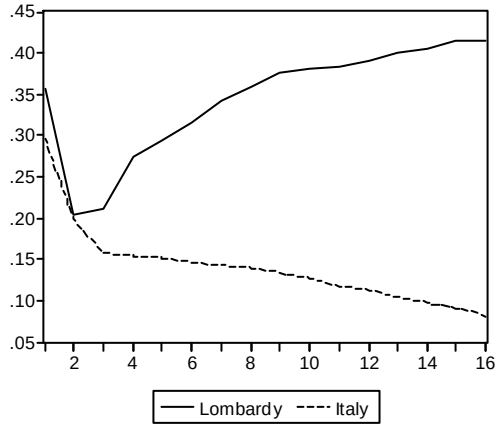
Total value added response to a unit increase
in labour cost and product price in services



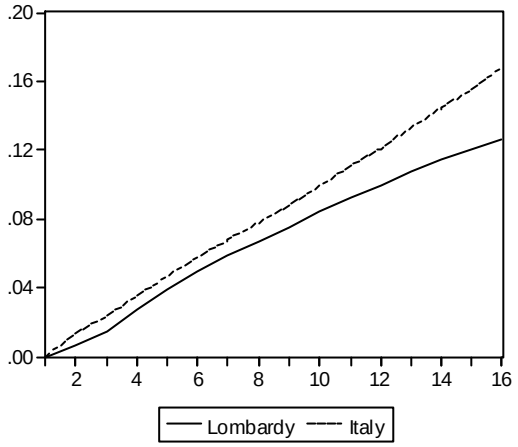
Total value added response to a unit productivity shock in industry



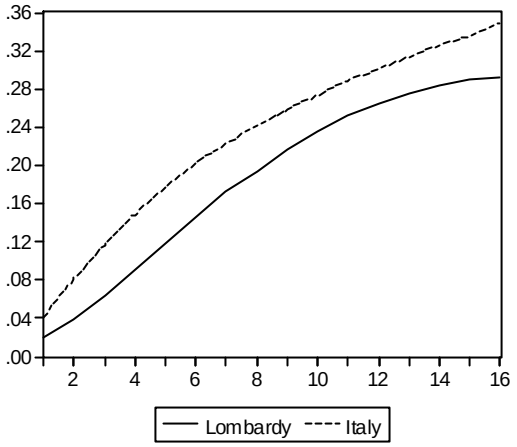
Total value added response to a unit productivity shock in services



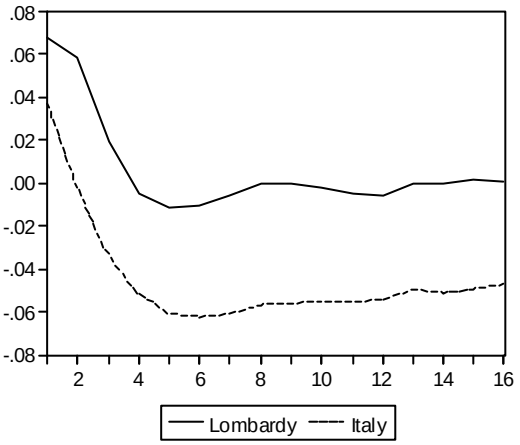
Total value added response to a unit decrease in interest rate



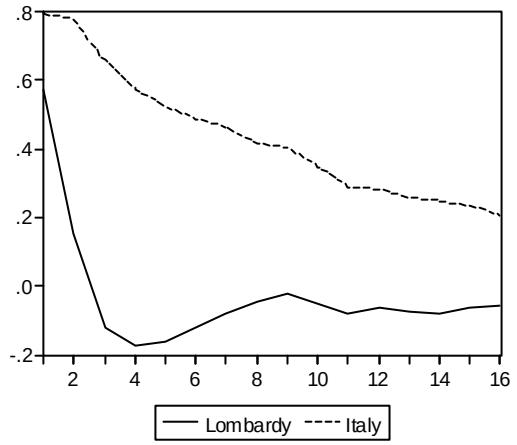
Total value added response to a unit decrease in real exchange rate



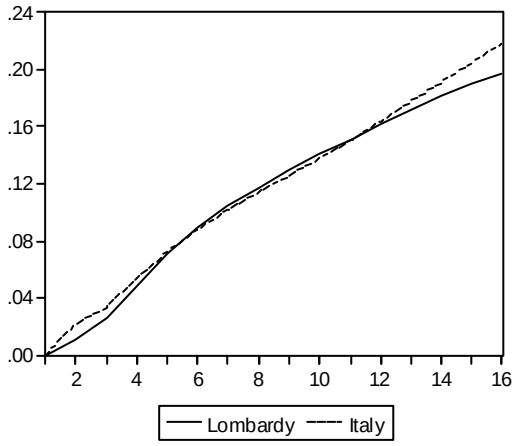
Industry value added response to a unit increase in labour cost and product price in industry



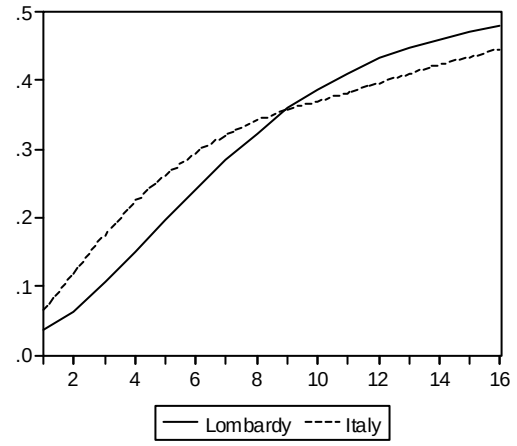
Industry value added response to a unit productivity shock in industry



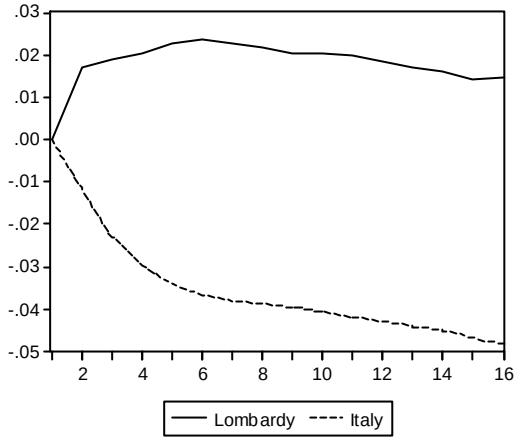
Industry value added response to a unit decrease in interest rate



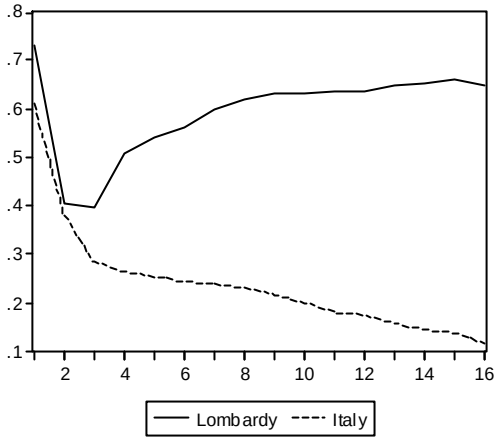
Industry value added response to a unit decrease in real exchange rate



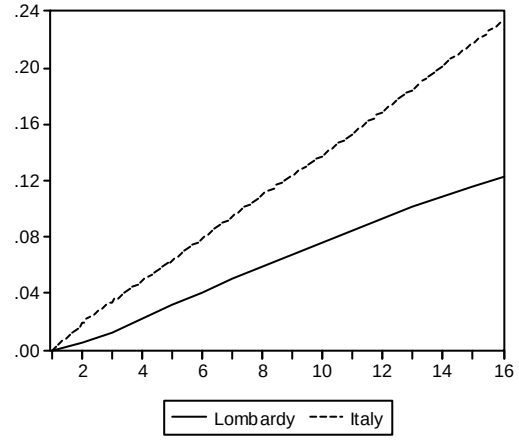
Services value added response to a unit increase
in labour cost and product price in services



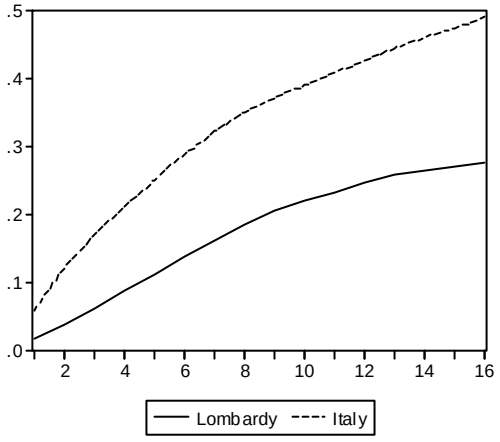
Services value added response to a unit productivity shock in services



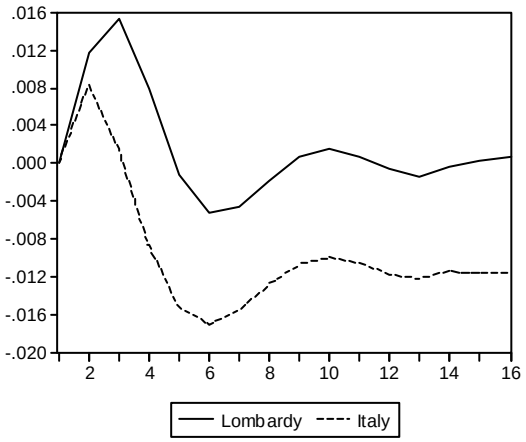
Services value added response to a unit decrease in interest rate



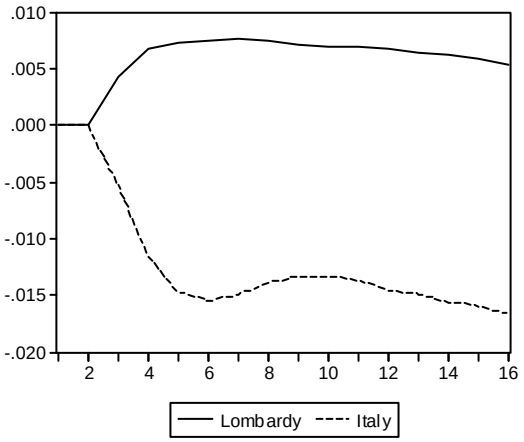
Services value added response to a unit decrease in real exchange rate



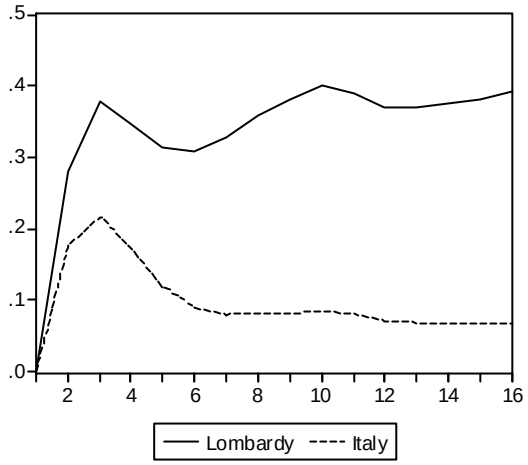
Investment response to a unit increase
in labour cost and product price in industry



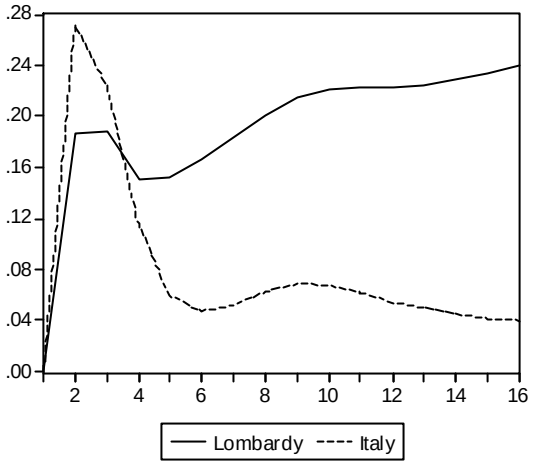
Investment response to a unit increase
in labour cost and product price in services



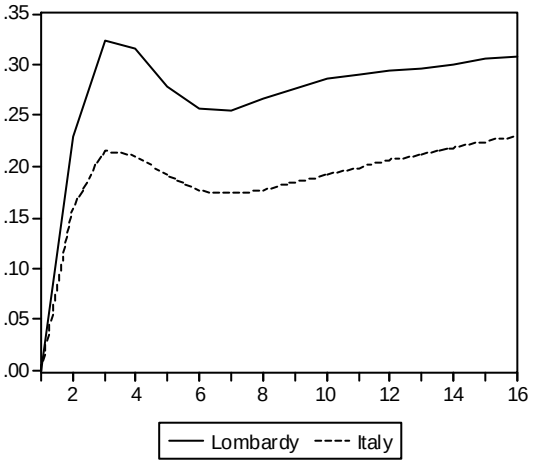
Investment response to a unit productivity shock in industry



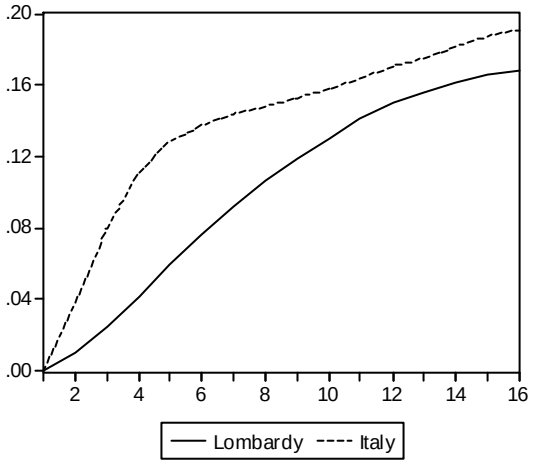
Investment response to a unit productivity shock in services



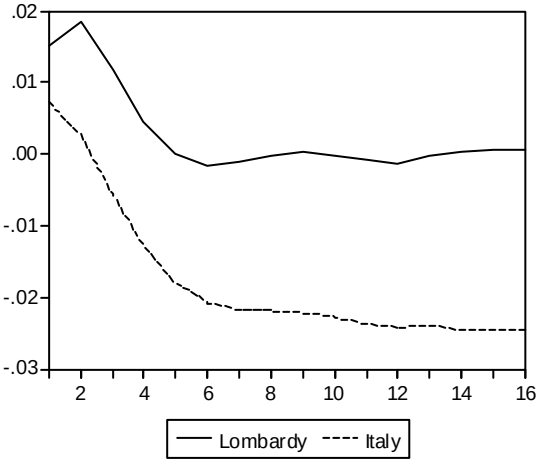
Investment response to a unit decrease in interest rate



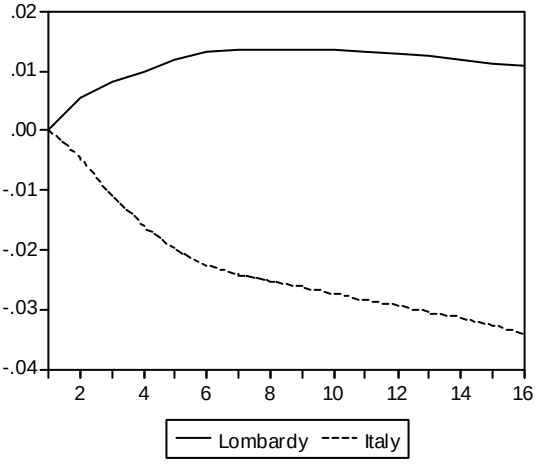
Investment response to a unit decrease in real exchange rate



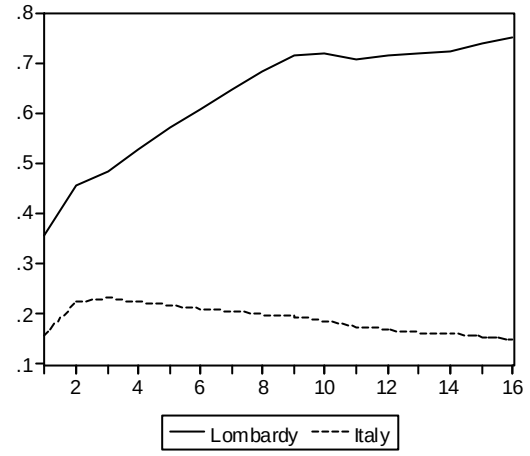
Consumption response to a unit increase
in labour cost and product price in industry



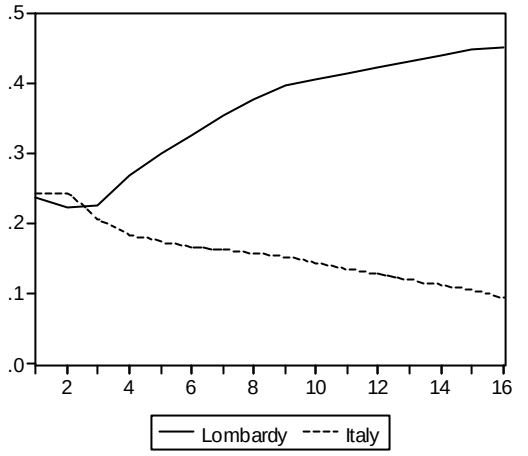
Consumption response to a unit increase
in labour cost and product price in services



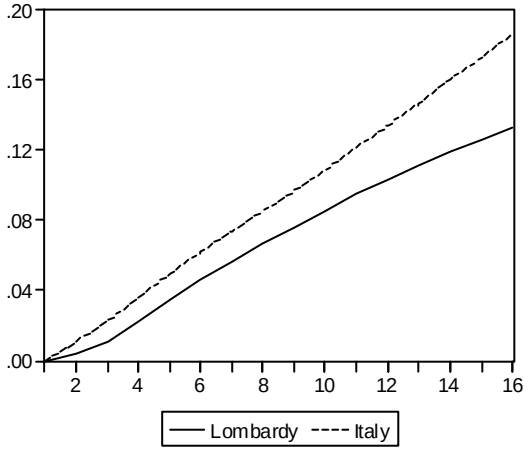
Consumption response to a unit productivity shock in industry



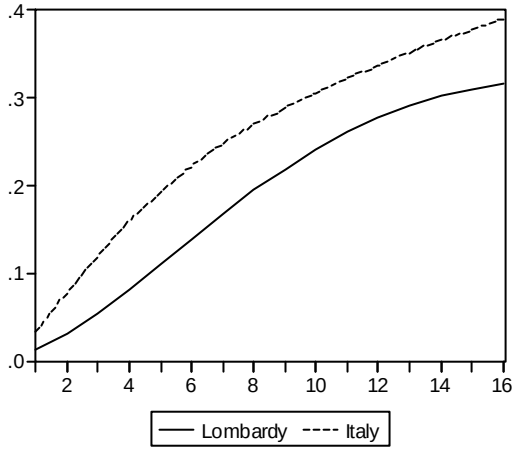
Consumption response to a unit productivity shock in services



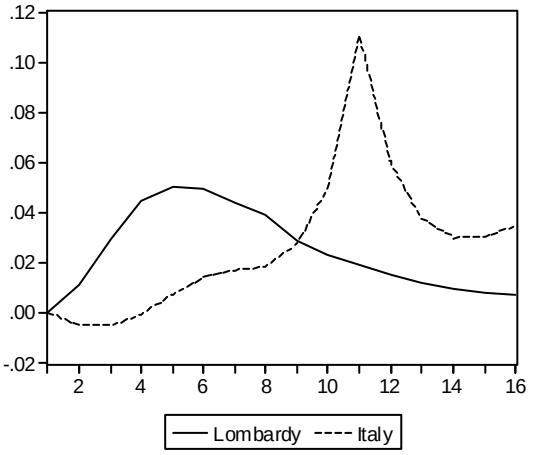
Consumption response to a unit decrease in interest rate shock



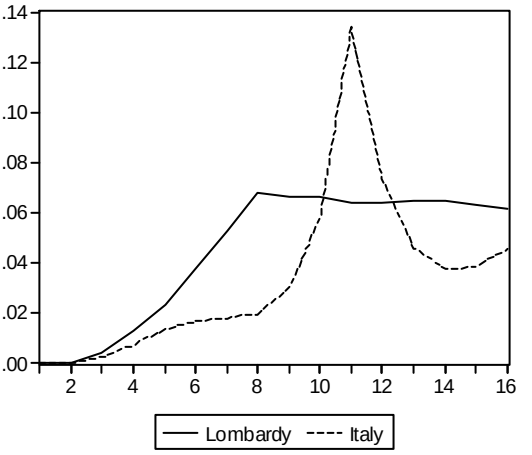
Consumption response to a unit decrease in real exchange rate



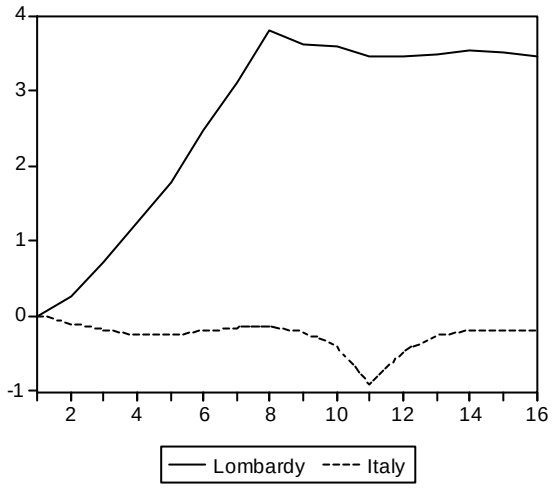
Net import response to a unit increase
in labour cost and product price in industry



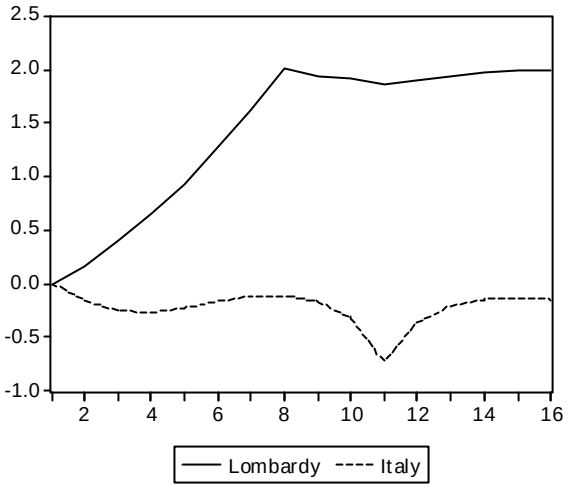
Net import response to a unit increase
in labour cost and product price in services



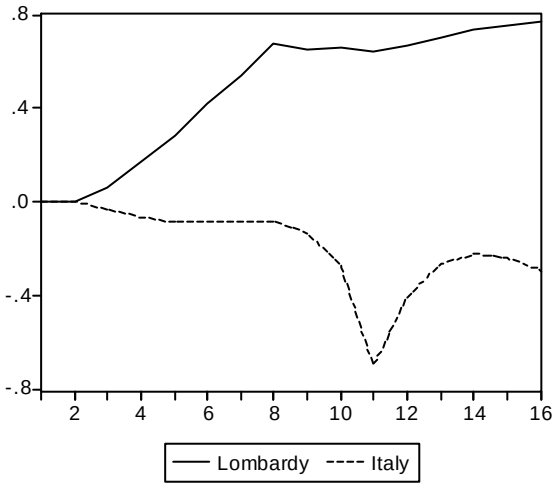
Net import response to a unit productivity shock in industry



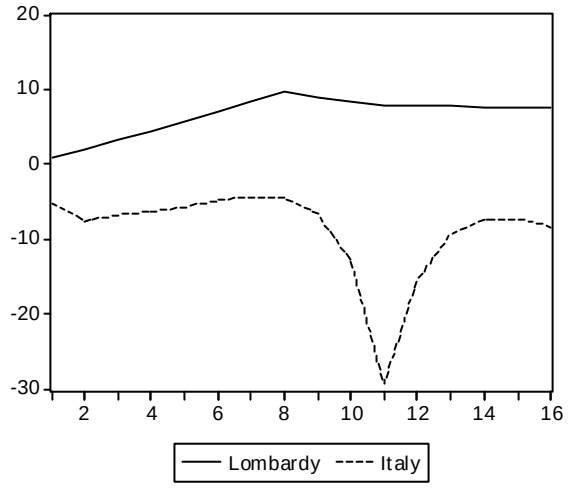
Net import response to a unit productivity shock in services



Net import response to a unit decrease in interest rate



Net import response to a unit decrease in real exchange rate

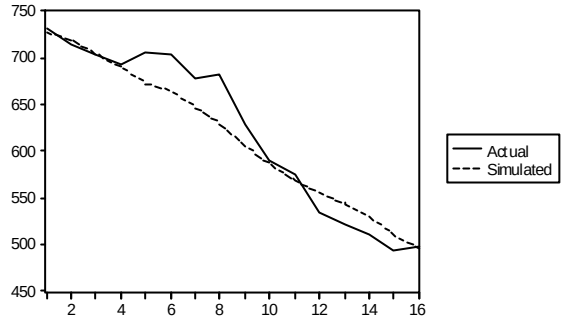


APPENDIX

ITALY

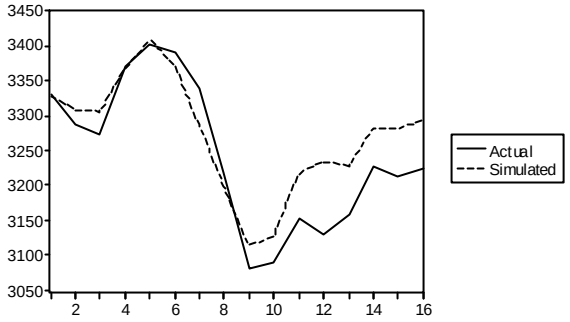
Dynamic-deterministic simulation

Employees in agriculture



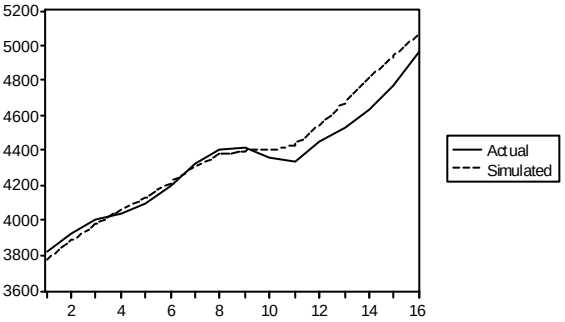
Mincer-Zarnowitz's Test = 1.126 (1.744)
Theil's Inequality Coeff. = 0.019
Root Mean Square Error = 0.037

Employees in industry



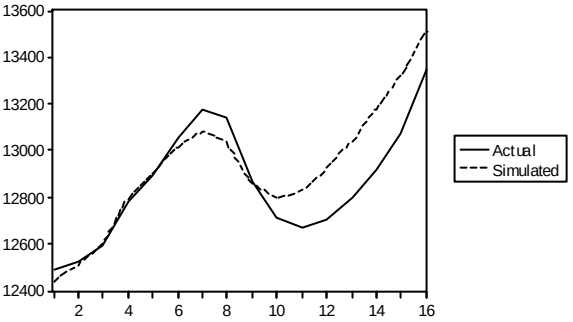
Mincer-Zarnowitz's Test = 1.174 (1.363)
Theil's Inequality Coeff. = 0.008
Root Mean Square Error = 0.016

Employees in tradable services



Mincer-Zarnowitz's Test = 0.832 (-5.403)
Theil's Inequality Coeff. = 0.010
Root Mean Square Error = 0.019

Total employees



Mincer-Zarnowitz's Test = 0.784 (-2.034)
Theil's Inequality Coeff. = 0.005
Root Mean Square Error = 0.011

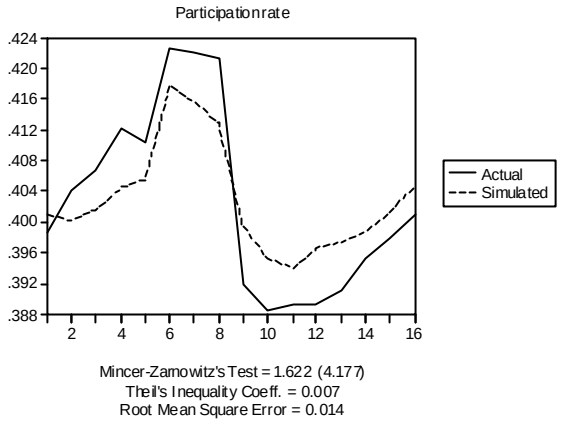
Total employment (Labour Units)

Mincer-Zarnowitz's Test = 1.042 (0.167)
Theil's Inequality Coeff. = 0.005
Root Mean Square Error = 0.011

Total employment **

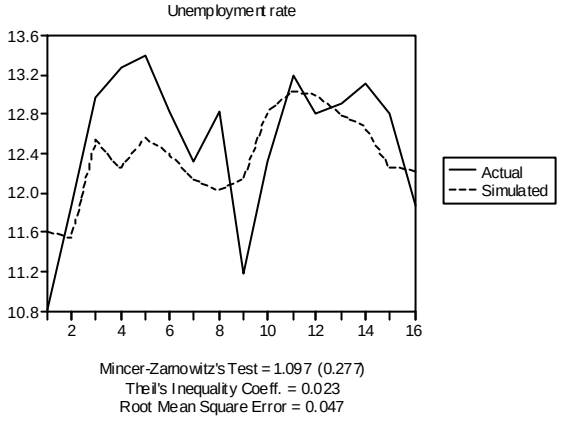
Mincer-Zarnowitz's Test = 1.497 (5.571)
Theil's Inequality Coeff. = 0.005
Root Mean Square Error = 0.011

Mincer-Zarnowitz's Test = 1.764 (4.446)
Theil's Inequality Coeff. = 0.002
Root Mean Square Error = 0.014

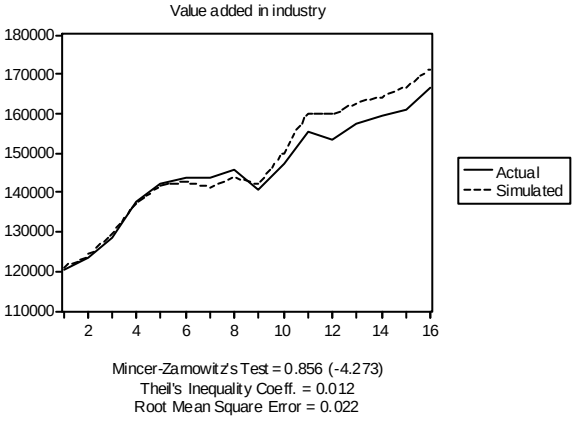


Mincer-Zarnowitz's Test = 1.622 (4.177)
Theil's Inequality Coeff. = 0.007
Root Mean Square Error = 0.014

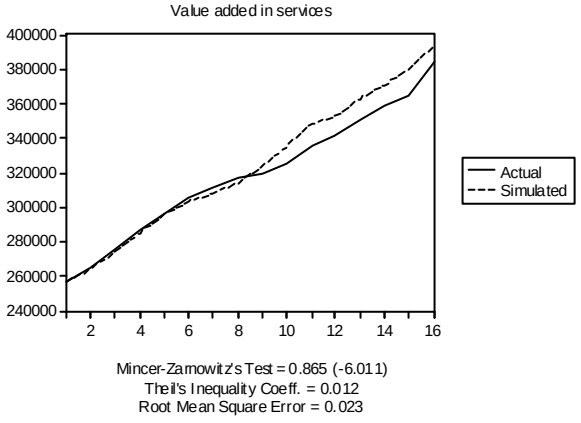
Mincer-Zarnowitz's Test = 1.488 (2.231)
Theil's Inequality Coeff. = 0.009
Root Mean Square Error = 0.018



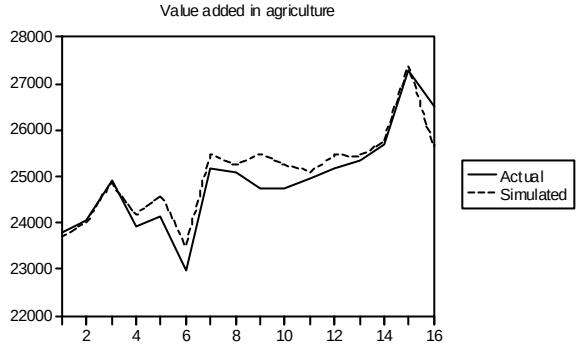
Mincer-Zarnowitz's Test = 1.097 (0.277)
Theil's Inequality Coeff. = 0.023
Root Mean Square Error = 0.047



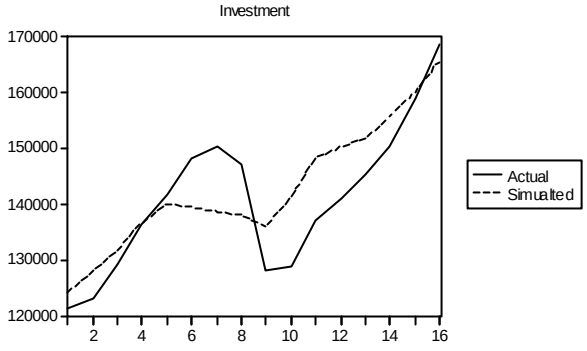
Mincer-Zarnowitz's Test = 0.856 (-4.273)
Theil's Inequality Coeff. = 0.012
Root Mean Square Error = 0.022



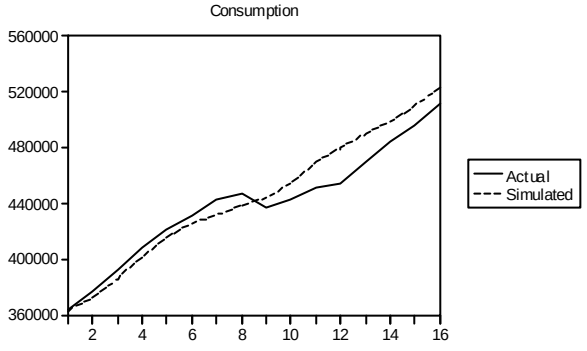
Mincer-Zarnowitz's Test = 0.865 (-6.011)
Theil's Inequality Coeff. = 0.012
Root Mean Square Error = 0.023



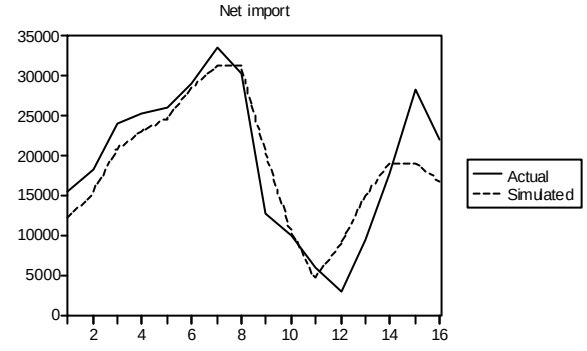
Mincer-Zarnowitz's Test= 1.050 (0.487)
Theil's Inequality Coeff. = 0.008
Root Mean Square Error = 0.015



Mincer-Zarnowitz's Test = 0.950 (-0.294)
Theil's Inequality Coeff. = 0.026
Root Mean Square Error = 0.052



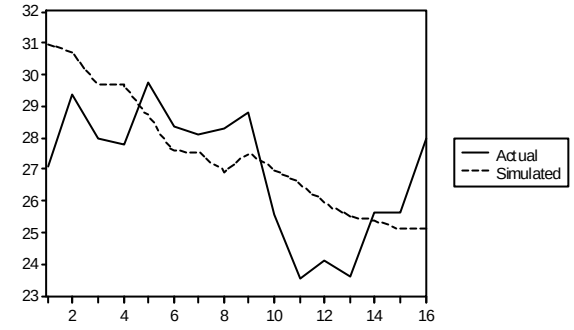
Mincer-Zarnowitz's Test = 0.819 (-4.074)
Theil's Inequality Coeff. = 0.014
Root Mean Square Error = 0.027



Mincer-Zarnowitz's Test = 1.070 (0.482)
Theil's Inequality Coeff. = 0.100
Root Mean Square Error = 0.548

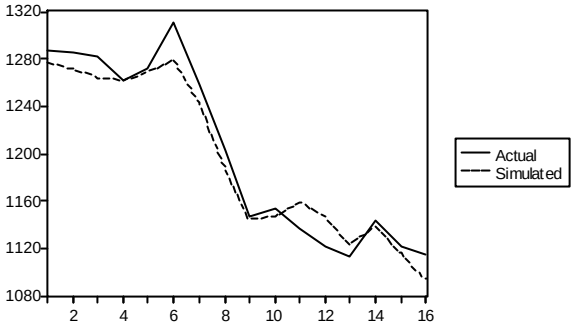
LOMBARDY
Dynamic-deterministic simulation

Employees in agriculture



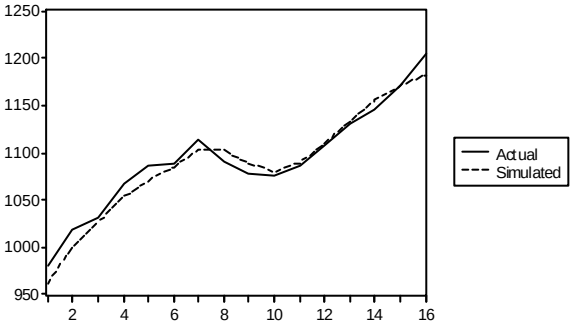
Mincer-Zarnowitz's Test = 0.590 (-1.810)
Theil's Inequality Coeff. = 0.034
Root Mean Square Error = 0.071

Employees in industry



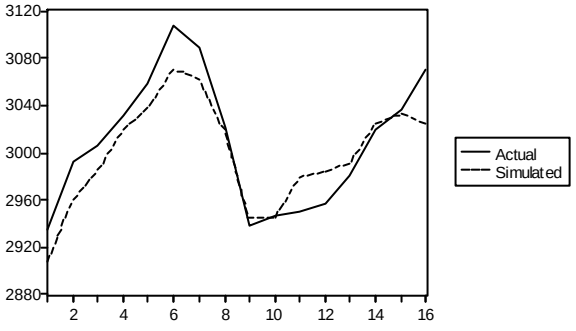
Mincer-Zarnowitz's Test = 1.088 (1.686)
Theil's Inequality Coeff. = 0.006
Root Mean Square Error = 0.013

Employees in services



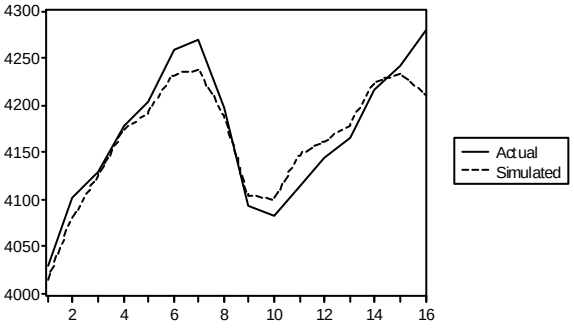
Mincer-Zarnowitz's Test = 0.924 (-1.603)
Theil's Inequality Coeff. = 0.005
Root Mean Square Error = 0.011

Total employees



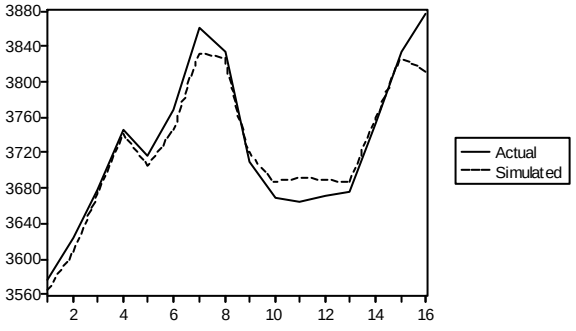
Mincer-Zarnowitz's Test = 1.127 (-7.020)
Theil's Inequality Coeff. = 0.004
Root Mean Square Error = 0.008

Total employment (Labour Units)



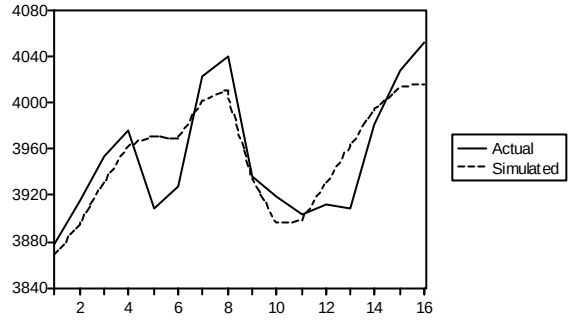
Mincer-Zarnowitz's Test = 1.105 (1.059)
Theil's Inequality Coeff. = 0.003
Root Mean Square Error = 0.006

Total employment **



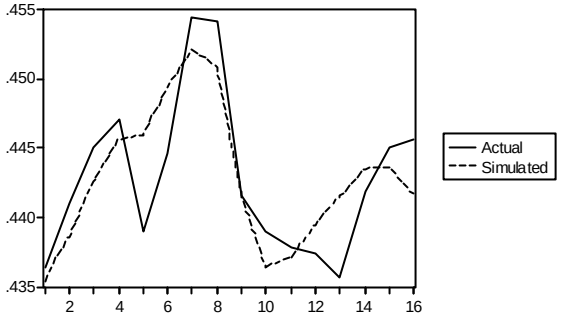
Mincer-Zarnowitz's Test = 1.097 (1.350)
Theil's Inequality Coeff. = 0.003
Root Mean Square Error = 0.006

Labour force



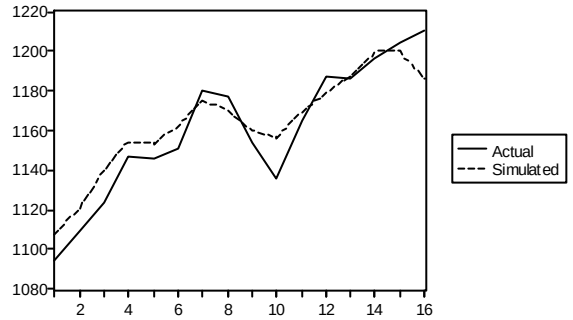
Mincer-Zarnowitz's Test = 0.985 (-0.091)
Theil's Inequality Coeff. = 0.004
Root Mean Square Error = 0.007

Participation rate



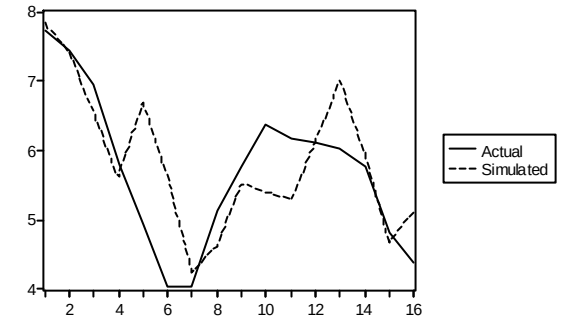
Mincer-Zarnowitz's Test = 0.929 (-0.396)
Theil's Inequality Coeff. = 0.004
Root Mean Square Error = 0.007

Self employment



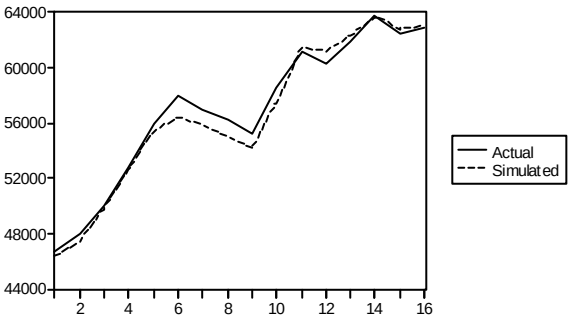
Mincer-Zarnowitz's Test = 1.267 (3.040)
Theil's Inequality Coeff. = 0.005
Root Mean Square Error = 0.010

Unemployment rate



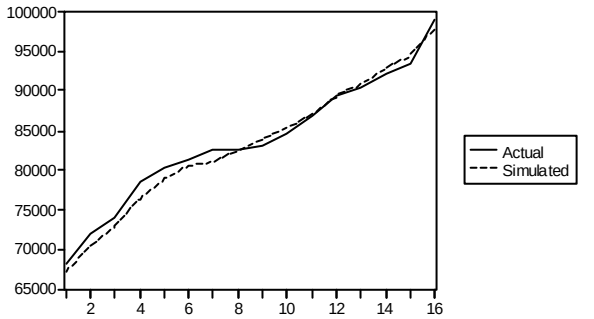
Mincer-Zarnowitz's Test = 0.797 (-1.038)
Theil's Inequality Coeff. = 0.065
Root Mean Square Error = 0.158

Value added in industry

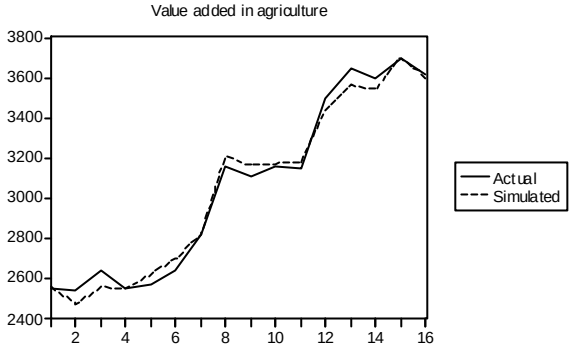


Mincer-Zarnowitz's Test = 0.942 (-1.934)
Theil's Inequality Coeff. = 0.007
Root Mean Square Error = 0.014

Value added in services



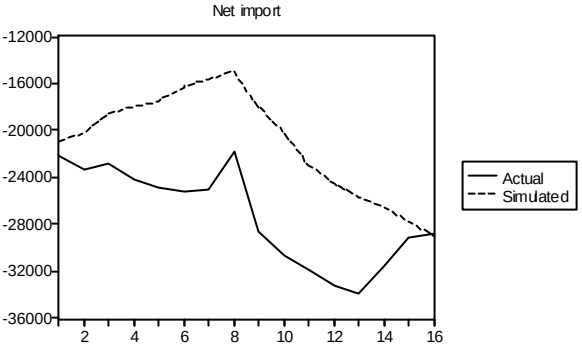
Mincer-Zarnowitz's Test = 0.930 (-2.970)
Theil's Inequality Coeff. = 0.006
Root Mean Square Error = 0.013



Mincer-Zarnowitz's Test = 1.020 (0.660)
Theil's Inequality Coeff. = 0.008
Root Mean Square Error = 0.017

Mincer-Zarnowitz's Test = 1.013 (0.109)
Theil's Inequality Coeff. = 0.025
Root Mean Square Error = 0.051

Mincer-Zarnowitz's Test = 0.895 (-2.893)
Theil's Inequality Coeff. = 0.009
Root Mean Square Error = 0.018



Mincer-Zarnowitz's Test = 0.613 (-2.163)
Theil's Inequality Coeff. = 0.145
Root Mean Square Error = 0.257

APPENDIX 2 – DATA SOURCES

DEFAGR	**value added deflator in agriculture (1995=100)**		
DEFIND	**value-added deflator in industry (1995=100)**		
DEFSER	**value added deflator in tradable services (1995=100)**		
EE	**total employees**		**(NA)**
EEAGR	**employees in agriculture**		**(NA)**
EEIND	**employees in industry**		**(NA)**
EESER	**employees in tradable services**		**(NA)**
IMMIG	**immigration flows from abroad**		**(ID)**
INTAX	**net indirect taxes**		**(NA)**
LF	**labour force**		**(ILF)**
OEE	**other employees**		**(NA)**
PR	**participation rate**		**(ILF)**
PROF	**nominal total profits**		**(NA)**
POP	**population**		**(NA)**
SE	**self employment**		**(ILF)**
TE	**total employment**		**(ILF)**
TEE	**total employment adjusted for discrepancy with total labour units**	**(NA)**	**(ILF)**
TFPAGR	**total factor productivity in agriculture**		**(NA)**
TFPIND	**total factor productivity in industry**		**(NA)**
TFPSER	**total factor productivity in tradable services**		**(NA)**
UR	**unemployment rate**		**(ILF)**
VA	**total value added at 1995 prices**		**(NA)**
VAAGR	**value added in agriculture at 1995 prices**		**(NA)**
VAIND	**value added in industry at 1995 prices**		**(NA)**
VASER	**value added in tradable services at 1995 prices**		**(NA)**
WAGR	**per capita nominal labor cost in agriculture**		**(NA)**
WIND	**per capita nominal labor cost in industry**		**(NA)**
WSER	**per capita nominal labor cost in tradable services**		**(NA)**
YU	**ratio of persons searching a job for the first time to total unemployed**		**(ILF)**
KAGR	**capital in agriculture at 1995 prices**		**(NA)**
KIND	**capital in industry at 1995 prices**		**(NA)**
KSER	**capital in services at 1995 prices**		**(NA)**
NIMP	**net imports at 1995 prices**		**(NA)**
WD	**world demand**		**(IMF)**
RE	**real exchange rate**		**(BI)**
IFIX	**total investments at 1995 prices**		**(NA)**
IFIXAGR	**investments in agriculture at 1995 prices**		**(NA)**
IFIXIND	**investments in industry at 1995 prices**		**(NA)**
IFIXSER	**investments in services at 1995 prices**		**(NA)**
IRATE	**interest rate**		**(IMF)**
C	**household consumption at 1995 prices**		**(NA)**
INV	**inventories at 1995 prices**		**(NA)**

ID = ISTAT, National Demographic Statistics
ILF = ISTAT (Labor Force Survey)
IMF = International Monetary Found
NA = National Accounts (1970-1980, SVIMEZ (1998); 1980-2000 ISTAT (2000))

TFP is defined as: $A = \frac{Y}{K^{a} L^{1-a}}$ **where Y is output and K and L are capital and labour inputs. Labour and income shares are derived from the regional and national accounts, and are taken as long-run average values over the entire sample period.**