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1 Introduction

The problem of economic dualism has been much studied in works on developing countries, and much attention has also been dedicated to the phenomenon of backward areas within developed economies. But careful studies of advanced dualistic economies are rare. In fact, such a dualism is often analyzed on the basis of the findings of the theory of economic underdevelopment or studies on backward areas, which inevitably neglect some central peculiarities of advanced dualistic economies. The situation is highly unsatisfactory, since advanced sectors are now achieving significant dimensions in an increasing number of developing countries.
Italy constitutes one of the best instances of an advanced dualistic economy and thus offers ideal material for investigating this case.

The macrodynamic model explored here focuses mainly on the impact of the dualistic character of the Italian economy on the labor market, inflation, the process of capital formation and its cyclical behavior. The model probably goes beyond the Italian experience and describes the supply and demand for goods, the distribution of income, the balance of payments on current accounts and the current account budget of the public sector. It refers to a historic period (30 years ago) during which dualism operated strongly.

Quantitative and qualitative analyses have been carried out on the model. This has been estimated as a continuous time model, using the full information maxi-mum likelihood method (FIML). We have also analyzed its stability properties and its predictive performance and performed some experiments of sensitivity analysis.

Keywords: Economic dualism; Modelling; Econometric estimations; FIML and continuos time estimation; Simulation results.

2 Formulation of the model[2]

The dynamic behavior of the model that will follow is significantly influenced by the sharp sectoral and territorial segmentation of the Italian economy.[3] This segmentation can be described as follows:

- An advanced sector (consisting mostly of manufacturing) characterized by high and rapidly rising productivity, consistent gains in employment, high export capacity, oligopolistic market conditions and the absence of competition in the labor market
- A backward sector (consisting mostly of agriculture) characterized by low productivity, the rate of change of which can be quite volatile, and a competitive product market
- A refuge sector (more or less covering retail trade, public administration and other services, and in some periods construction as well) characterized by low and above all nearly stagnant productivity. It should be noted that this sector is able to pass all cost increases along in higher prices.[4]

There is also a definite geographical segmentation corresponding to these sectors. The backward sector is mostly made up of agricultural zones, the advanced sector of industrial zones and the refuge sector of the large urban areas of central-southern Italy.

The role of the refuge sector remains implicit in the model; its impact is measured through the effects of the labor surplus (which it has absorbed in a more and more evident manner over time) on the cost of living, on the distribution of income, on the costs of the public administration and finally on investment.

The model is made up of 22 interdependent equations describing the supply and demand for goods, the distribution of income, the balance of payments on current account and the current account budget of the public sector.

Among the supply equations, the industrial productivity equation is of paramount importance. It is specified to be a function of the sectoral capital/employee ratio, the rate of growth in industrial investment (a summary indicator of the effects on productivity of embodied technical progress), total exports of goods and services (which affects productivity through economies of scale and the need for competitiveness dictated by foreign trade) and, with a minus sign, the share of profits (the assumption being that pressure on profits will spur innovation to boost productivity). The endogenous level of productivity (i.e. value added per employee) in industry makes it possible to calculate total industrial value added (multiplying productivity by the number of employees). Then, knowing the value added (VA) in industry, the GDP is calculated assuming a relationship of proportionality between the two variables.

The demand side is explained by three equations: an equation for industrial investment, depending on the share of profit in industry, the money supply and, with a minus sign, government's current account flow (to take into account crowding-in and crowding-out effects); an equation for total consumption, depending on GDP, the money supply (which influences liquidity conditions) and, with a minus sign, the cost of living; an equation for exports, depending on the ratio of international to domestic price for manufactures, world demand and, with a minus sign, internal demand (the assumption being that there is substitution between the latter and exports).

The equations for income distribution concern industrial wages, salaries in the remaining sectors and the share of profits.

The equation for nominal industrial wages plays a central role here. It is a func-tion of sectoral productivity, of the ratio between currency flow and real GDP flow, and the cost of living; it is assumed, however, that the level of employment – or, more precisely, the level of the excess labor force – does not affect wage increases.[5] Through wage leadership, industrial wages determine wages in the rest of the economy. The share of profits in industry is given by an identity: the difference between one and the share of wages in value added.

In this model, the variables describing employment assume a different meaning from the one usually ascribed to them. Given marked sectoral dualism and extensive backward areas, the exodus from traditional sectors (mainly agriculture) could not avoid exceeding the needs of the other sectors of the economy. This surplus of labor force has represented a powerful cause of inflation.[6] A variety of mechanisms are at work here. First, it has stimulated early retirements and other forms of income transfer by government. Second, refuge employment (which aggravates the exist-ing productivity gap between the refuge and the dynamic sectors) has strengthened inflationary pressures.[7] Third, there are the costs connected with the exodus from backward sectors and areas (the cost of urbanization, for one) and the bottlenecks (shortages of housing, services, etc.) created where these costs were not sustained. Finally, there was intensifying wage pressure from the employed labor force to preserve family incomes undermined by the fall in the employment rate. The previously mentioned influences have mainly concerned the cost of living.

These developments have given a vigorous impulse not only to inflation but also to public expenditure. For the private sector, this has involved the following two principal consequences which have slowed capital formation and therefore further spurred the swelling of the surplus labor force:

1. The government has borrowed increasingly in the capital markets (in competition with the private sector) to finance public sector deficits.
2. Money wages have increased rapidly, since they are driven upward by inflationary pressure owing to formal and informal indexing mechanisms. Thus, unit labor costs have increased in the more dynamic sectors, but industrial employees have not benefited greatly therefrom, since wage gains are accompanied by comparable increases in the cost of living.[8] Given acute international competition, this has driven down the profit rate in industry.

In conclusion, it seems that the profound and widespread sectoral and territorial disequilibria have provided the basic breeding ground for the unsatisfactory performance of the Italian economy. This happened principally because of the formation of an increasing structural surplus of labor which does not have an important role in regulating labor market conditions but instead, in various ways, shifts the burden of its unproductive presence to the national economy.

3 *Variables of the model*

Endogenous

π_1 = Industrial labor productivity
w_{1p} = Money wage rate in industry
w_{rp} = Money wage rate in the rest of the economy
O_2 = Employment in agriculture
CV = Consumer price level
PP_1 = Industrial price level
= GDP price level
I_1 = Gross industrial investment in real terms
OY_1 = Employment in industry
C = Gross domestic product in real terms
IMP = Total consumption in real terms
EX = Real imports of goods and services
KU = Real exports of goods and services
M = Degree of capacity utilization in industry
U^c = Currency
E^c = Public sector expenditure
O_3 = Public sector revenue
Y_p = Employment in the rest of the economy
Q_1 = Nominal GDP
w_1 = Profit share in industry
Y_1 = Industrial wage rate in real terms
= Real value added in industry

Exogenous

P^i = Exports unit value index of manufactures of main competitors (in lire)
P_a = Agricultural price level
Y_w = World real income
PIM = Import price level
k = Capital/employment ratio in industry

Other symbols

α = Adjustment parameter β =
Structural parameter
γ = Intercept
D = Differential operator
log = Logarithm symbol
^ Indicates values of partial equilibrium

No disturbance terms appear in the formal representation of the model to simplify the notations. All variables are referred to at time t.

Equations of the model

Industrial labor productivity

(1) $D\log\pi_1 = \alpha_1 \log(\hat{\pi}_1 / \pi_1)$ where

(1.1) $\log \hat{\pi}_1 = \beta_1 D\log I_1 - \beta_2 \log Q_1 + \beta_3 \log EX + \beta_4 D\log k + \log \gamma_1$

Money wage rate in industry

(2) $D\log w_{1p} = \alpha_2 \log(\hat{w}_{1p} / w_{1p})$ where

(2.1) $\log \hat{w}_{1p} = \beta_5 \log\pi_1 + \beta_6 \log CV + \beta_7 D\log(M/Y) + \log \gamma_2$

Money wage rate in the rest of the economy

(3) $D\log w_{rp} = \alpha_3 \log(\hat{w}_{rp} / w_{rp})$ where

(3.1) $\log \hat{w}_{rp} = \beta_8 \log w_{1p} + \log \gamma_3$

Employment in agriculture

(4) $D\log O_2 = \alpha_4 \log(\hat{O}_2 / O_2)$ where

(4.1) $\log\hat{O}_2 = -\beta_9 \log w_{1p} + \beta_{10} \log P_a + \log \gamma_4$

Consumer price level

(5) $D\log CV = \alpha_5 \log(\hat{CV}/CV)$ where

(5.1) $\log\hat{CV} = \beta_{11} \log w_{1p} - \beta_{12} \log(O_2+O_1) + \beta_{13} \log P^i + \log \gamma_5$

Price of industrial value added

(6) $D\log P_1 = \alpha_6 \log(\hat{P}_1 / P_1)$ where

(6.1) $\log\hat{P}_1 = \beta_{14} \log(w_{1p} / \pi_1) + \beta_{15} \log P^i + \log \gamma_6$

Price of GDP

(7) $D\log P = \alpha_7 \log(\hat{P}/P)$ where

(7.1) $\log\hat{P} = \beta_{16} \log P_1 - \beta_{17} \log O_2 + \beta_{18} \log P_a + \log \gamma_7$

Gross investment in industry

(8) $D^2\log I_1 = \alpha_8 \log(\hat{I}_1 / I_1)$ where

(8.1) $\log\hat{I}_1 = \beta_{19} \log Q_1 + \beta_{20} \log M \ \beta_{21} D\log(U^c/E^c) + \log \gamma_8$

Employment in industry

(9) $D\log O_1 = \alpha_9 \log(\hat{O}_1 / O_1)$ where

(9.1) $\log\hat{O}_1 = \beta_{22}\log I_1 + \beta_{23}\log KU - \beta_{24} D\log K + \log\gamma_9$

Real GDP

(10) $D\log Y = \alpha_{10}\log(\hat{Y}/ Y)$ where

(10.1) $\log\hat{Y} = \beta_{25}\log Y_1 + \log\gamma_{10}$

Total real consumption

(11) $D\log C = \alpha_{11}\log(\hat{C}/C)$ where

(11.1) $\log\hat{C} = \beta_{26}\log Y - \beta_{27}\log CV + \beta_{28}\log M + \log\gamma_{11}$

Real imports

(12) $D\log IMP = \alpha_{12}\log(\hat{IMP}/IMP)$ where

(12.1) $\log\hat{IMP} = \beta_{29}\log Y_1 + \beta_{30}\log w_1 + \beta_{31}\log(P/PIM) + \log\gamma_{12}$

Real exports

(13) $D\log EX = \alpha_{13}\log(\hat{EX}/EX)$ where

(13.1) $\log\hat{EX} = - \beta_{32}\log(C+I) - \beta_{33}\log P_1 + \beta_{34}\log P^i + \beta_{35}\log Y_w + \log\gamma_{13}$

Degree of capacity utilization in industry

(14) $D\log KU = \alpha_{14}\log(\hat{KU}/KU)$ where

(14.1) $\log\hat{KU} = + \beta_{36}\log(C+I_1+EX) + \log\gamma_{14}$

Currency reaction function

(15) $D^2\log M = \beta_{37}\log(P^i/P_1) + \beta_{38}D\log(P^i/P_1) + \beta_{39}\log(EX/IMP) + \beta_{39}\log(P^i/PIM) + \log\gamma_{15}$

Public sector expenditure

(16) $D\log U^c = \alpha_{15}\log(\hat{U}^c/U^c)$ where

(16.1) $\log\hat{U}^c = \beta_{40}\log(w_{1p}O_1) + \beta_{41}\log(O_2+O_3)\, w_{rp} + \log\gamma_{16}$

Public sector revenue

(17) $D\log E^c = \alpha_{16}\log(\hat{E}^c/E^c)$ where

(17.1) $\log\hat{E}^c = \beta_{42}\log Y_p + \log\gamma_{17}$

Employment in the rest of the economy

(18) $D\log O_3 = \alpha_{17}\log(\hat{O}_3/O_3)$ where

(18.1) $\log\hat{O}_3 = -\beta_{43}\log(O_1 + O_2) + \log\gamma_{18}$

Nominal GDP

(19) $\log Y_p = \log Y + \log P$

Profit share in industry

(20) $\log Q_1 = \log(1 - w_{1p}/ \pi_1 P_1)$

Real wage rate in industry

(21) $\log w_1 = \log w_{1p} - \log CV$

Industrial value added

(22) $\log Y_1 = \log O_1 + \log \pi_1$

4 Results of estimation

The parameters of the model have been estimated by using a sample of quarterly observations which range from the first quarter of 1960 to the fourth quarter of 1981. We have used, for estimation, a FIML procedure developed by C. Wymer.[9]
The nonlinear model has been linearized in the logarithms about the sample means by taking a first-order Taylor series expansion. It is worth noting that the method of estimation endogenously determines the lags (α) with which the effective

Table 1 Estimated adjustment parameters

Parameter	*Equation number*	*Estimate of parameter*	*Asymptotic standard error*	*t ratio*	*Mean time lag (quarters)*
α_1	(1)	0.551	0.089	6.13	1.815
α_2	(2)	0.715	0.118	6.03	1.398
α_3	(3)	0.868	0.135	6.44	1.152
α_4	(4)	0.190	0.050	3.82	5.263
α_5	(5)	0.090	0.019	4.77	11.111
α_6	(6)	0.542	0.094	5.73	1.845
α_7	(7)	0.317	0.050	6.29	3,154
α_8	(8)	1.345	0.223	6.03	0.743
α_9	(9)	0.061	0.007	8.11	16.393
α_{10}	(10)	1.025	0.171	6.00	0.975
α_{11}	(11)	1.460	0.199	7.33	0.680
α_{12}	(12)	1.141	0.194	5.88	0.876
α_{13}	(13)	1.245	0.175	7.12	0.803
α_{14}	(14)	0.309	0.065	4.75	3.236
α_{15}	(16)	3.701	0.706	5.24	0.270
α_{16}	(17)	2.312	0.372	6.21	0.432
α_{17}	(18)	0.352	0.109	3.22	2.840

Table .2 Estimated elasticities and growth rates

Parameter	*Equation number*	*Estimate of parameter*	*Asymptotic standard error*	*t ratio*
β_1	(1)	0.062	0.031	2.00
β_2	(1)	0.144	0.136	1.05
β_3	(1)	0.476	0.025	18.49
β_4	(1)	5.093	1.268	4.02
β_5	(2)	1.049	0.087	12.02
β_6	(2)	0.976	0.035	28.01
β_7	(2)	4.894	0.766	6.39
β_8	(3)	0.996	0.010	98.61
β_9	(4)	0.692	0.060	11.46
β_{10}	(4)	0.684	0.094	7.27
β_{11}	(5)	0.183	0.047	3.87
β_{12}	(5)	0.300	0.229	0.87
β_{13}	(5)	0.938	0.091	10.35
β_{14}	(6)	0.585	0.068	8.58
β_{15}	(6)	0.383	0.066	5.76
β_{16}	(7)	0.903	0.095	9.50
β_{17}	(7)	0.347	0.039	8.85
β_{18}	(7)	0.116	0.097	1.19
β_{19}	(8)	0.153	0.099	1.54
β_{20}	(8)	0.010	0.009	1.14
β_{21}	(8)	0.015	0.027	0.57
β_{22}	(9)	0.143	0.018	7.83
β_{23}	(9)	0.105	0.112	0.94
β_{24}	(9)	29.954	3.738	4.02
β_{25}	(10)	0.742	0.012	60.01
β_{26}	(11)	0.826	0.055	15.00
β_{27}	(11)	0.114	0.025	4.43
β_{28}	(11)	0.110	0.027	4.01
β_{29}	(12)	1.282	0.040	31.63
β_{30}	(12)	0.110	0.019	5.77
β_{31}	(12)	0.099	0.090	1.10
β_{32}	(13)	0.300	0.226	1.33
β_{33}	(13)	1.287	0.212	6.06
β_{34}	(13)	1.054	0.181	5.83
β_{35}	(13)	2.945	0.272	10.82
β_{36}	(14)	0.016	0.006	2.51
β_{37}	(15)	0.144	0.062	2.32
β_{38}	(15)	0.932	0.222	4.21
β_{39}	(15)	0.084	0.030	2.82
β_{40}	(16)	0.788	0.139	5.66
β_{41}	(16)	0.306	0.147	2.08
β_{42}	(17)	1.089	0.010	99.09
β_{43}	(18)	1.190	0.166	7.15

values adjust themselves to the desired ones (which are expressed by the func-tional equations used to explain the phenomena under observation). Finally, this method distinguishes stock variables from flow variables and permits forecasts (or simulations) for any desired time interval (yearly, quarterly, monthly etc.). This is made possible by the fact that the parameter estimates are independent from the interval of observation of the data series. The estimation iterative procedure converges with a tolerance of 0.50%. The Carter-Nagar system R square statistic is 0.975, and the associated χ^2 statistic is 72327.2 with 74 degrees of freedom;
therefore, the hypothesis that the model is not consistent with the data is rejected (See Tables 1 and 2). On the whole, the estimation results are very satisfactory and conform with the
theory presented in Section 2. All parameters have the correct sign and plausible values; some of the high absolute values of the parameters are due to the fact that the associated variables are rates of change and not levels. Of the 60 parameters estimated, 47 are significantly different from zero at least at the 1% level on asymptotic text and 4 are significant at the 5% level. The significance level of the remaining nine parameters is below the 5% level.[10]

5 Stability and sensitivity analysis

We can analyze the stability properties of the model on the basis of its characteristic roots (eigenvalues) (see Table 9.3). Asymptotic standard errors, damping periods and periods of cycles are not given for space limitations.

Table 3 Stability and sensitivity analysis

Eigenvalues	*Partial derivatives with respect to β_{20}*	*Partial derivatives with respect to β_{37}*	*Partial derivatives with respect to β_{39}*
–0.072	0.031	0.072	–0.067
–0.102	–0.817	0.259	0.103
–0.134	0.467	–0.932	–0.436
–0.188	–0.012	0.033	0.057
–0.308	–0.002	0.017	0.067
–0.310	0.020	0.005	0.021
–0.352	0.0	0.0	0.0
–0.868	0.0	0.0	0.0
–1.142	0.002	0.001	–0.017
–1.340	0.004	0.002	0.049
–2.311	0.0	0.0	0.0
–3.700	0.0	0.0	0.0
0.005 +/ –0.01	0.116 +/ –0.59	–0.021+/ –0.02	0.034 +/ –0.04
–0.260 +/ –0.56	–0.009 +/ –0.01	0.223 +/ –0.40	0.505 + /–1.09
–0.955 + /–1.08	0.008 +/ –0.00	0.065 +/ –0.29	–0.506 +/ –0.37
–1.537 +/ –0.24	0.003 +/ –0.00	0.005 + /–0.03	0.080 +/ –0.01

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Table 9.3 shows that all the real eigenvalues are negative. This means that the model has a stable trend.

The complex conjugate eigenvalues describe the cyclical behavior of the model. Three of these eigenvalues have negative real part and a stable cycle (with cyclical periods of about 3 years, 1.5 years and 6.5 years). Finally, a complex conjugate eigenvalue has a positive real part, which means the system will converge to a limit cycle associated with this eigenvalue. However, asymptotic standard error shows that this positive real part appears not to be significantly different from zero, so this cause of instability does not worth much consideration.

In order to explore better the dynamic behavior of the system, we turn now to sensitivity analysis. This consists of computing the partial derivatives of eigenval-ues with respect to the parameters of the model.

Sensitivity analysis does not show particularly large partial derivatives; however, increases in adjustment parameters appear, in general, to have appreciable stabilizing effects. For reasons of space, we consider here only derivatives of major significance. More precisely, in Table 9.3 we included only the partial derivatives with respect to some policy parameters, namely that of the money variable in the investment equation and that of the currency reaction function.

As we can see, an increase in β_{20} (that is in the parameter of money in the invest-ment equation) tends to have a stabilizing effect on the trend (due to the large negative value of the partial derivative of the second eigenvalue) and a destabiliz-ing effect on the cycle (owing to the positive value of the partial derivative with respect to the real part of the complex eigenvalue), the period of which would become longer.

Likewise, an increase of the parameter β_{37} (the ratio of domestic to international prices) in the reaction function of money will have a stabilizing effect on the trend and a destabilizing one on the cycle. Finally, an increase in β_{39} (the parameter of the balance of payments on current account) in the same equation would also have a stabilizing effect on the trend and a destabilizing one on the cycle, but this would have a longer period, since the derivative of the imaginary part of the 15th complex conjugate eigenvalue has a large positive value.

6 Predictive performance of the model

The analysis of the root mean square errors of the residuals allows us to consider the in-sample predictive performance of the model. Since the model is in logarithms, the root mean square error gives the average percentage error around the level of the associated endogenous variable (Table 9.4).

The root mean square errors (RMSE) included in Table 9.4 show values of more than 10% in only three cases; for about half of the endogenous variables the errors are less than 5%. These results can be considered quite satisfactory.

The in-sample predictive performance of the model might be better seen by means of the actual and forecast values of each variable and also through some policy simulations.

Table 4 Ex post root mean square errors of dynamic forecasts

Considered sample periods			
Variable	*1976–1981 (24 quarters)*	*1969–1981 (48 quarters)*	*1960–1981 (whole sample period)*
π_1	0.054	0.054	0.053
w1p	0.061	0.067	0.065
wrp	0.067	0.070	0.066
O_2	0.036	0.031	0.035
CV	0.035	0.051	0.039
P_1	0.038	0.037	0.039
P	0.045	0.044	0.042
DI_1	0.017	0.034	0.034
O_1	0.021	0.020	0.023
Y	0.036	0.036	0.039
C	0.026	0.030	0.043
IMP	0.098	0.094	0.098
EX	0.094	0.092	0.075
KU	0.037	0.043	0.039
DM	0.055	0.058	0.049
U^c	0.129	0.118	0.100
E^c	0.087	0.073	0.063
O_3	0.035	0.034	0.053
I	0.046	0.120	0.245
M	0.075	0.136	0.220
Y_p	0.045	0.053	0.042
Q_1	0.087	0.099	0.085
w_1	0.047	0.075	0.070
Y_1	0.042	0.047	0.053

7 Conclusion

Quantitative analysis confirms the peculiarities of an advanced dualistic economy like Italy; these concern principally the inflationary process, the employment equations and the wage mechanism. It also confirms their impact on capital formation, on activity levels, on the public deficit and on the balance of payments. Obviously, this implies that the adoption of the policies pursued by the principal developed countries could be quite mistaken for Italy. At least, such policies seem inadequate to check the growth-inhibiting tendencies typical of the Italian economy.

Notes

1 As previously seen, in the 1960s another influential student, J. K. Galbraith, in his book *The New Industrial State* (1967), underlined with augmented emphasis the convergence between capitalism and socialism on the wings of big business.

2 We are indebted to Dr. C. Wymer and to Dr. D. Richard of the IMF for the use of the continuous methodology and programs.

3 See, for example, Streeten (1959), Ranis and Fei (1961), Lutz (1962) and Kindleberger (1967).

4 A more satisfactory framework of analysis would require an intermediate sector between the advanced and the backward sectors. Notionally, it would consist of small business basic consumer goods and would be

characterized by lower productivity than the advanced sector. It operates in competitive goods markets and partially competitive labor markets.

5 The surplus labor force in Italy has had an extremely limited influence on the process of wage formation. The fact that workers have learned how to separate the dynamics of wages from the automatic mechanism of the labor market has radically changed the way the economic system reacts to the surplus labor force.
6 In the equation of the cost of living, O2 + O1 intends to act as a proxy of the opposite of the excess of labor force.
7 In the model, this aspect is expressed by the functional dependence of the cost of living on industrial wages, as increases in these stimulate wage increases in the *less dynamic sectors* of the economy and then parallel increases in consumer prices.
8 Basically, the rise in unit labor costs sustained by the dynamic sectors has gone mostly to subsidize the inefficiency and parasitism of other sectors of the economy.
9 See Wymer (1976).
10 In the discussion of the results, the term *t-ratio* simply denotes the ratio of a parameter estimate to the estimate of its asymptotic standard error. In a sufficiently large sample, this ratio is significantly different from zero at the 5% level if it lies outside the interval +/–1.96 and significantly different from zero at the 1% level if it is outside the interval +/–2.58.

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