Population, labour force and unemployment in Andalusia: Prospects for 1993

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Abstract: This paper is concerned with forecasting population, employment, labour force and unemployment in Andalusia to 1993. For this purpose, a block-recursive demographic model is presented. The demographic submodel is based on the component-cohort method of forecasting population by age and sex. The economic submodel uses econometric and time series analysis to forecast employment both in the medium and short-term. In the labour market part, the labour force is forecasted taking into account the encouraged-discouraged worker effects of changes in the demand for labour.

Keywords: Regional econometric models, Forecasting, Labour market.

1. Introduction

Spain is the OECD country with the highest unemployment rate. At the same time, Spain is also the OECD country with the highest rate of employment growth. Between 1985 and 1989, employment increased at a cumulative annual rate of 3%. However, in the same period, the unemployment rate only decreased from 21.5% to 16.9%.

This paradox is explained by the very rapid growth of the labour force in Spain. This rapid growth is due, first of all, to demographic factors; the fecundity rates started to decrease later in Spain than in other EEC countries and are still at a higher level than in those countries. Second, female participation rate is still relatively low in Spain compared to the mean of the EEC countries, its increase having been retarded by the discouraging effect of the oil crisis. Now, the recovery process which began in the middle of this decade, is enticing formerly discouraged people, particularly women, to participate. Thus, the female participation rate is increasing very quickly.

Within the Spanish territory there are notorious regional differences. In particular, Andalusia is the region with the highest unemployment rate, in 1990 standing at 27%. This represents around 662 thousand people without employment, according to official estimates (Encuesta de Población Activa). Employment is increasing at a higher rate in Andalusia than in the rest of Spain, as is the active population. The Andalusian fertility rate is higher than the Spanish mean. The female participation rate in Andalusia is about 28%, the Spanish mean is 32%, and the mean of the EEC countries is around 40%. In 1985 this rate was only 22%. Because of the employment creation process initiated that year, the female participation rate rose to 28% during the following three years, showing a very strong sensitivity to the economic cycle. As a consequence of this change, the unemployment rate went on increasing in spite of the higher occupation level. However, since 1988, the female participation rate has been fluctuating at around 28% and, since employment

* Research team number 1096 (Econometrics); Plan Andaluz de Investigación; and grant PBS 91-0810, CICYT. We are greatly indebted to Benito Flores who made fruitful comments and stylistic corrections to earlier versions of this paper.

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has not stopped increasing, the unemployment rate has dropped from 28% to 27%.

The central question formulated in this paper is whether or not the actual labour market conditions favour a decline in the unemployment rate in the short- and medium-term. Thus, this paper is concerned with forecasting population, employment, labour force and unemployment in Andalusia to 1993.

The format of the paper is as follows. First, a recursive demoeconomic model is presented in the next section. Then estimation results and forecasts are presented. Followed by the conclusions.

2. Model components and equations

The model consists of two basic submodels allowing for both demographic and economic forecasts.

The demographic submodel is based on the component-cohort method of forecasting population by age, sex and geographic area (provinces). In the present stage of the research, causality from economy to demography is omitted. Thus, migrations and disaggregated fertility rate are not explained by economic factors but derived exogenously by modelling their respective tendencies. Trying to forecast migrations and fertility rates using economic variables is at present difficult because research has not established appropriate forms for the equations and the economic variables cannot be accurately predicted. Linking demographic and economic variables is a challenge for future research, since a broader multiregional approach seems to be necessary. Besides, in the near future, important changes in migration behaviour are to be expected, as pointed out by Schwanse (1989), because of both the labour mobility created by the Single European Market and North African demographic pressures with their impact on illegal immigration into Andalusia. Furthermore, recent events in Eastern Europe have opened up national boundaries and thousands of East Europeans have already fled to the West. The impact on Spanish migration patterns is still unpredictable.

The economic submodel uses econometric and time series analysis to forecast value added and employment in the short- and medium-term. In addition, a labour force block provides active population forecasts by sex, depending on demographic and economic (cyclical) factors. Unemployment is then yielded as the balance between employment and active population.

Because of data limitations, this demoeconomic model is a simplified version of a more general model proposed in Otero et al. (1988). Generally speaking, this can be classed as a 'minimal demoeconomic model' as formulated by Ledent (1982) for long-term forecasting. The model here allows for the 'encourage-discourage effect' of short- and medium-term economic fluctuations on workers. For this purpose labour force is explained by taking into account both demographic growth and the sensitivity of participation rates to labour demand cyclical fluctuations. For the later relationship we follow former contributions which use employment as an explanatory variable. In Spain this approach has been recently applied by Treadway (1989) and Novales and Mateos (1989).

To summarize, MEDEA consists of four block-recursive equations which explain the following groups of variables: population structure, value added, employment and labour force.

Exhibit 1 shows schematically the links between blocks of equations.

The demographic submodel is described in more detail in Otero and Sánchez (1987). Next, a brief description follows explaining the equations and variables entering into each economic block.

2.1. Value added and employment

Value added and employment are predicted in the medium-term by a regional econometric model. In this model a top-down approach is adopted. The national econometric model is the WHARTON-UAM forecasting model. The regional econometric model is the updated version of MEDEA, the Andalusian model in the HISPALINK project, an integrated regional modelling project started in 1986 which joins teams in twelve Spanish universities. This econometric model forecasts value added and employment for the following regional economic sectors:

1. Agriculture.
2. Energy.
4. Equipment goods manufacturing.
5. Consumption goods manufacturing.
6. Construction.
7. Transport and communications.
8. Services (other than transport and communications).

The value added block consists of eight sectoral demand equations which explain the corresponding value added using as exogenous both national and regional variables.

The employment block consists of eight dynamic sectoral derived demand equations, which explain the direction of causality from value added to employment in Exhibit 1. The underlying production functions are Cobb–Douglas type.

Exhibit 2 shows the specification of the econometric model.

2.2. Labour force block

The labour force equations provide labour force forecasts dependent on demographic (population by sex over 16 or potentially active population) and economic (employment) variables; the latter owing to the fact that participation rates depend upon labour demand fluctuations.

During the sample period both male and female participation rates seem to behave differently. The female participation rate is still very low in Andalusia (28%) and a continuous increase can be observed, in contrast to the case of the male participation rate. Furthermore, the encouraged–discouraged workers effect seems to be significant only for women.

We shall therefore specify different models for male and female participation. For males it turned out to be appropriate to have a regression model explaining the behaviour of the participation level. On the other hand, for females the model uses the participation rate as the explained variable.

Males

The male participation level (number of males over 16 who are working or looking for a job), \( MPL \), is assumed to depend on two variables representing demographic and economic forces. The demographic variable is the male population over 16, \( MO16 \). The variable representing economic forces is the labour demand (total employment). The latter is measured in natural logarithms, \( \ln TE \), in order to allow for the less than proportional effect of the exogenous variable. The partial adjustment model provides a simple dynamic formulation. Summarizing, the equation to be estimated is

\[
MPL = \alpha_1 MO16 + \alpha_2 \ln TE + \alpha_3 MPL(-1) + \epsilon_i
\]
where

- $MPL$ = Male participation level,
- $MO16$ = Males over 16,
- $\ln TE$ = Natural logarithm of total employment.

Note that there is no intercept in equation (1). This is consistent with that which is to be expected if (1) is divided by male population over 16.

**Females**

Female participation rate ($FPR$), defined as the ratio female active population/females over 16, is modelled as a function of the employment rate ($ER$), defined as the ratio employment/population over 16. The latter is a measure of labour market activity, in order to allow for the encouraged–discouraged workers effect. In addition, a trend term is included in order to allow for the observed systematic increase of female participation due to social, cultural and non-economic reasons. The logistic formulation seems appropriate, especially for forecasting purposes, because it keeps the forecasted $FPR$ within the natural 0,1 bounds. At the same time we are using a dynamic formulation based both on partial adjustment and adaptive expectations hypotheses.

The specification is as follows:

$$
\ln(FPR^{*}_{t-1} - 1)
= \alpha + \beta_1 T + \beta_2 ER_t + \beta_3 ER^e_t + u_t,
$$

(2)

where

- $FPR^*$ = Desired female participation rate,
- $T$ = Trend ($T = 1$ in 1981.1),
- $ER^e$ = Expected employment rate.

Using this specification, with ER both real and expected, we are avoiding a problem of identification in the final equation to be estimated.

Let us define

$$
y^* = -\ln(FPR^{*}_{t-1} - 1).
$$

(3)

We now use the partial adjustment and adaptive expectations hypotheses in order to eliminate unobservable variables, and so

$$
y_t - y_{t-1} = \delta(y^*_t - y_{t-1}),
$$

(4)

$$
ER^e_t - ER^e_{t-1} = \mu(ER_t - ER^e_{t-1}).
$$

(5)

Suppressing unobservable variables by using the lag operator, we get the following final equation to be estimated [see Otero (1989), p. 128]:

$$
y_t = A + B \cdot T + C \cdot ER_t + D \cdot ER^e_{t-1} + E \cdot y_{t-1} + F \cdot y_{t-2} + v_t.
$$

(6)

2.3. Short-term model

Besides this medium-term approach we are using multivariate time series models to provide four term employment forecasts as a supplement to those yielded by the econometric model. Time series modelling has been used as an alternative to regional econometric models as presented by Weller (1989). For this purpose ARIMA modelling with transfer functions allows for national and regional indicator series as predictors of short-term regional employment. Usually time series models are easier and less expensive to estimate and construct than the traditional causal econometric models. Furthermore, they generally require less data and have been shown in many cases to match or to exceed the short term forecasting accuracy of the regional econometric models.

When we forecast regional employment using econometric models, judgment is introduced into the process where model specification and selection are carried out. This is a source of predictive inaccuracy that is difficult to evaluate and control. Confidence intervals and scenarios are obviously useless for this purpose. Short- and medium-term employment forecasts provide a forecasting band which we use here to test the sensitivity of participation and unemployment forecasts to different data sources and judgments. It will be a subject of future research to develop this multivariate times series modelling by using additional indicator series.

3. Data and models estimation

The main data sources used to estimate the models in this paper are the following:

- **Contabilidad Regional** (regional accounting). Published by the Spanish Instituto Nacional de Estadística (INE).
- **Encuesta de Población Activa** (EPA); Active Population Survey). Published by INE.
- **HISPALINK data base** ([HISPALINK](#)) Regional accounting data from INE started in 1980. The HISPALINK data base was built by eleven regional university teams involved in this project, in order to cover the period 1970–1980. To obtain these data we applied the methodology of INE.

- **WHARTON-UAM data base** (particularly for national variables).

Data are annual from 1979 to 1989 for the value added and employment blocks. The labour force block and the short-term model were estimated with quarterly data, using EPA data. For the short term model the sample period is 1976.3 (the third quarter) to 1989.4. For the labour force block the sample period starts in 1981.1 because of some data defects.

In the value added block four single equations were estimated by ordinary least squares (OLS) and four simultaneous equations were estimated by two-stage least squares (2SLSQ) (equations that include \( VT \) and \( VI \) as regressors).

The employment block was estimated by 2SLSQ because of the supposed contemporary correlations between disturbances entering in different blocks.

Exhibit 3a–c show the econometric model estimation results. Some equations show different specifications than those of Exhibit 2. Thus in the value added block, the model was enriched by adding specific exogenous variables for each branch. At the same time, new exogenous variables have been added in some equations belonging to the employment block in order to allow for productivity and technological changes (Exhibit 3).

Concerning the labour force equations, the one corresponding to males does not include employment as an explanatory variable since Ln TE, included in equation (1), has proved non-significant. This means that there is no evidence that male participation depends on the economic cycle. A dummy variable, \( W5 \), has been included both in male and female equations to allow for a methodological change in EPA data which occurred in 1987.

All the equations have been estimated using Micro TSP (Quantitative Micro Software, Irvine, CA).

Exhibit 4 displays the short term model estimation results. Intervention analyses have been carried out for agriculture, construction and ser-

### Exhibit 3a
Econometric model: Estimation results, value added block

<table>
<thead>
<tr>
<th>Equations</th>
<th>( R^2 )</th>
<th>DW</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>( VA = -125.978 + 0.311 \times IV + 0.194 \times VA_{-1} )</td>
<td>0.86</td>
<td>-</td>
<td>-0.81</td>
</tr>
<tr>
<td>( (3.41) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( (6.09) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( (1.64) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( VE = -18.382 - 0.179 \times NPE + 0.1461 \times NVE + 0.0774 \times VT )</td>
<td>0.90</td>
<td>1.77</td>
<td>-</td>
</tr>
<tr>
<td>( (1.65) * \times (6.34) \times (5.32) \times (1.78) * )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( VQ = 12.815 + 20.340 \times W1 + 0.0732 \times NIVQ + 0.051 \times NMQ )</td>
<td>0.82</td>
<td>1.91</td>
<td>-</td>
</tr>
<tr>
<td>( (8.83) * \times (2.78) \times (3.27) \times (2.98) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( VK = -33.164 + 60.669 \times NIVK - 0.07 \times NPK + 0.521 \times V_{-1} )</td>
<td>0.86</td>
<td>-</td>
<td>0.26</td>
</tr>
<tr>
<td>( (3.70) \times (5.43) \times (1.52) * \times (2.51) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( VC = -90.909 + 0.103 \times \times V + 0.117 \times NIMC + 0.474 \times VC_{-1} )</td>
<td>0.92</td>
<td>-</td>
<td>0.81</td>
</tr>
<tr>
<td>( (1.61) * \times (2.29) \times (2.09) \times (2.78) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( VB = -105.359 - 29.465 \times W1 + 0.0324 \times VT + 0.064 \times NIVB + 0.545 \times V_{-1} )</td>
<td>0.91</td>
<td>-</td>
<td>1.15</td>
</tr>
<tr>
<td>( (3.72) \times (3.21) \times (2.64) \times (4.5) \times (3.33) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( VZ = -23.089 + 0.0241 \times VT - 0.046 \times NIPZ + 0.835 \times VZ_{-1} )</td>
<td>0.98</td>
<td>-</td>
<td>-1.05</td>
</tr>
<tr>
<td>( (1.75) * \times (3.04) \times (0.99) \times (8.97) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( VS = -80.080 + 0.285 \times NEXT + 0.039 \times NIVS + 0.682 \times V_{-1} )</td>
<td>0.99</td>
<td>-</td>
<td>-1.00</td>
</tr>
<tr>
<td>( (2.35) \times (3.54) \times (2.69) \times (5.59) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( VT = VA + VB + VK + VC + VQ + VE + VZ + VS )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( VT = VC + VQ + VZ )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *-statistics in parentheses (\(*\) not significant at 5%). \( R^2 \) are the coefficients of multiple determination. DW and h are the Durbin–Watson and Durbin autocorrelation tests (\(*\*\) autocorrelation at 1%).
Exhibit 3b
Econometric model: Estimation results, employment block

<table>
<thead>
<tr>
<th>Equations</th>
<th>$R^2$</th>
<th>DW</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\ln E_4 = 4.467 + 0.329 \ln V_A - 0.207 \ln N_R A + 0.514 \ln E_{A-1}$</td>
<td>0.96</td>
<td>-</td>
<td>-1.60</td>
</tr>
<tr>
<td>(0.74) (1.57) * (3.09) (3.29)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\ln E_E = 10.300 - 0.677 \ln N_P A E + 0.0219 T - 0.0038 \ln E_{E-1} - 0.761 M_A^2$</td>
<td>0.79</td>
<td>-</td>
<td>-1.22</td>
</tr>
<tr>
<td>(6.32) (-4.37) (3.15) (-2.13) (-2.75)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\ln E_Q = 5.815 + 0.321 \ln V_Q - 0.256 \ln N_R Q + 0.364 \ln E_{Q-1}$</td>
<td>0.89</td>
<td>-</td>
<td>0.82</td>
</tr>
<tr>
<td>(1.47) *(1.24) * (-2.66) * (1.87)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\ln E_K = 9.515 + 0.0601 \ln V_K - 0.0495 \ln N_R K - 0.204 W^2 + 0.123 \ln E_{K-1}$</td>
<td>0.84</td>
<td>-</td>
<td>-0.34</td>
</tr>
<tr>
<td>(7.48) (2.01) * (3.68) * (8.01) *(1.18)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\ln E_C = 10.840 - 1.638 \ln N_P A C + 0.0361 T + 0.0708 \ln E_{C-1}$</td>
<td>0.90</td>
<td>-</td>
<td>-0.27</td>
</tr>
<tr>
<td>(7.45) (-5.06) (3.25) (1.58) *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\ln E_B = 9.558 + 0.414 \ln V_B - 0.534 \ln N_R B + 0.458 W^4 + 0.0721 T$</td>
<td>0.85</td>
<td>1.89</td>
<td>-</td>
</tr>
<tr>
<td>(2.70) (2.03) * (-3.24) * (6.56) * (3.07)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\ln E_Z = 6.740 + 0.413 W^3 \ln V_Z - 0.160 \ln V Z + 0.786 \ln N_E Z - 4.956 W^3$</td>
<td>0.94</td>
<td>-</td>
<td>-0.05</td>
</tr>
<tr>
<td>(0.99) *(4.09) * (-2.18) * (3.89) * (4.26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\ln E_S = 0.613 + 0.609 \ln V_S - 0.0956 \ln N_R S + 0.612 \ln E_{S-1}$</td>
<td>0.94</td>
<td>-</td>
<td>-2.41</td>
</tr>
<tr>
<td>(2.50) (4.99) * (-4.09) * (4.81)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Variables:

- $V_i$ = Regional value added in sector $i$ (10$^9$ ptas.)
- $E_i$ = Regional employment in sector $i$
- $N_P i$ = National industrial prices in sector $i$
- $N_R i$ = National (wage/capital price) relation in sector $i$
- $N_P A i$ = National apparent productivity in sector $i$
- $N_M Q$ = National intermediate goods imports (10$^9$ ptas.)
- $N_V K$ = National equipment goods investment (10$^9$ ptas.)
- $N_V \beta$ = National consumption goods imports (10$^9$ ptas.)
- $N_V B$ = National construction investment (10$^9$ ptas.)
- $N_V i$ = National value added in sector $i$ (10$^9$ ptas.)
- $N_E X T$ = National tourism exports (10$^9$ ptas.)
- $N_E Z$ = National employment in transport and communication
- $M A 2$ = Moving average of order 2
- $T$ = Trend ($T = 1$ in 1970)
- $W_1$ = Dummy $I_{(1976,77)}$
- $W_2$ = Dummy $I_{(1977,73)}$
- $W_3$ = Dummy $I_{(1977,83)}$
- $W_4$ = Dummy $I_{(1983,93)}$


Note: t-statistics in parentheses (* not significant at 5%). $R^2$ are the coefficients of multiple determination. DW and h are the Durbin–Watson and Durbin autocorrelation tests (** autocorrelation at 1%).

...services employment before estimating. This was done because of two methodological changes in the EPA statistics. There is no evidence that industrial employment has been affected by these methodological changes. Forecast figures are related to the uncorrected variables.

We have tested as leading indicators, among others, national and regional variables such as the industrial production index, electricity consumption, cement consumption, and number of tourists staying in hotels. Until now only the regional industrial production index has successfully anticipated industrial employment. Further research on leading indicators for construction and services employment is needed.

4. Forecasts to 1993

Annual forecasts for total value added and total employment are shown in Exhibit 5a. These results are conditioned by the forecasts of the exogenous variables, which are obtained from the WHARTON-UAM model. According to the results, next year total regional value added and employ-
Exhibit 3c
Econometric model: Estimation results, Labour force block

Equations

\[ Y = -1.120 + 0.007526 T + 3.072 ER - 2.446 ER_{-1} + 0.3988 Y_{-1} \]
\[ (-2.71) (3.97) (3.84) (-3.02) (2.90) \]
\[ R^2 = 0.9887 \]
\[ DW = 2.0666 \]

\[ MPL = 0.1394 MO16 + 0.7942 MPL_{-1} + 7.104 W5 \]
\[ (2.71) (10.32) (1.96) \]
\[ R^2 = 0.9821 \]
\[ DW = 2.2831 \]

Variables:
- \( MPL \) = Male participation level (in thousands)
- \( MO16 \) = Males over 16
- \( W5 = 1 \) for sample period 1981.1 to 1986.4 and 0 for the rest \(^a\)
- \( T \) = Trend (\( T = 1 \) in 1981.1)
- \( ER \) = Employment rate
- \( Y = - \ln \left( FPR^{-1} - 1 \right) \)
- \( FPR \) = Female participation rate
- \( Data: \) Quarterly (1981.1–1990.1)

Note: \( t \)-statistics in parentheses. \( R^2 \) are the coefficients of multiple determination. \( DW \) are the Durbin–Watson autocorrelation tests.

\(^a\) To take into account new criteria in EPA since 1987.

Exhibit 4
Short-term model: Estimation results

Equations

Agriculture:
\[ EAC_t = EA_t - 70.3 W1_t \]
\[ (1 - 0.475 B) V_t EAC_t = (1 - 0.855 B) a l_t \]
\[ (0.150) (0.072) \]
\[ Q_{23} = 10.97 \]

Industry:
\[ \nabla V_t \ln EI_t = 0.230 \nabla V_t \ln IPAN_t + (1 - 0.794 B^4)(1 + 0.269 B)^{-1} u_t \]
\[ (0.079) (0.130) (0.173) \]
\[ Q_{23} = 11.27 \]

Construction:
\[ ECC_t = EC_t - 39.9 W2_t \]
\[ \nabla V_t \ln ECC_t = (1 - 0.781 B^4)(1 - 0.409 B^4) a^2_t \]
\[ (0.151) (0.184) \]
\[ Q_{23} = 9.68 \]
\[ Q_{23} = 28.74 \]

Services:
\[ ESC_t = ES_t + 19.65 W3_t \]
\[ \nabla V_t \ln ESC_t = (1 - 0.780 B^4) a^2_t \]
\[ (0.094) \]
\[ Q_{23} = 10.63 \]

Variables:
- \( EA \) = Agricultural employment
- \( EAC \) = Corrected agricultural employment
- \( EI \) = Industrial employment
- \( EC \) = Construction employment
- \( ECC \) = Corrected construction employment
- \( ES \) = Services employment

\( W1, W2, W3 = \) Dummy, \( l_{[80.1-83.4]} \)


Note: Standard errors in parentheses (\(^*\) not significant at 5%). \( B \) is the backward shift operator. \( V = 1 - B, V_t = 1 - B^4 \). \( Q_{\pi} \) is the Box–Pierce statistic, distributed as a \( \chi^2 \) with \( n \) degrees of freedom. According to this test, at the usual significance levels, the hypothesis of model adequacy can be accepted in the four models.
Exhibit 5a
Forecasting results

<table>
<thead>
<tr>
<th>Date</th>
<th>Total value added (10^6 ptas. and annual rates)</th>
<th>Total employment (10^3 and annual rates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>3042018.00 (5.71)</td>
<td>1856 (6.30)</td>
</tr>
<tr>
<td>1991</td>
<td>3203151.00 (5.30)</td>
<td>1930 (5.07)</td>
</tr>
<tr>
<td>1992</td>
<td>3382278.00 (5.59)</td>
<td>2050 (5.14)</td>
</tr>
<tr>
<td>1993</td>
<td>3551305.00 (5.00)</td>
<td>2156 (5.17)</td>
</tr>
</tbody>
</table>

Exhibit 5b
Forecasting results

<table>
<thead>
<tr>
<th>Date</th>
<th>Total employment (Short-term models) (Thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990.1</td>
<td>1829.8</td>
</tr>
<tr>
<td>1990.2</td>
<td>1837.8</td>
</tr>
<tr>
<td>1990.3</td>
<td>1854.1</td>
</tr>
<tr>
<td>1990.4</td>
<td>1864.5</td>
</tr>
<tr>
<td>1991.1</td>
<td>1907.2</td>
</tr>
<tr>
<td>1991.2</td>
<td>1908.7</td>
</tr>
<tr>
<td>1991.3</td>
<td>1925.8</td>
</tr>
<tr>
<td>1991.4</td>
<td>1935.7</td>
</tr>
</tbody>
</table>

Exhibit 5c
Forecasting results

<table>
<thead>
<tr>
<th>Date</th>
<th>Labour force (Thousands)</th>
<th>Unemployment</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active males</td>
<td>Active females</td>
<td>Medium-t.</td>
</tr>
<tr>
<td>1990.1</td>
<td>1673.0</td>
<td>807.0</td>
<td>799.0</td>
</tr>
<tr>
<td>1990.2</td>
<td>1682.0</td>
<td>808.0</td>
<td>813.0</td>
</tr>
<tr>
<td>1990.3</td>
<td>1691.0</td>
<td>816.0</td>
<td>820.0</td>
</tr>
<tr>
<td>1990.4</td>
<td>1700.0</td>
<td>816.0</td>
<td>820.0</td>
</tr>
<tr>
<td>1991.1</td>
<td>1709.0</td>
<td>854.0</td>
<td></td>
</tr>
<tr>
<td>1991.2</td>
<td>1718.0</td>
<td>853.0</td>
<td></td>
</tr>
<tr>
<td>1991.3</td>
<td>1726.0</td>
<td>856.0</td>
<td></td>
</tr>
<tr>
<td>1991.4</td>
<td>1735.0</td>
<td>860.0</td>
<td></td>
</tr>
<tr>
<td>1992.1</td>
<td>1743.0</td>
<td>900.0</td>
<td></td>
</tr>
<tr>
<td>1992.2</td>
<td>1751.0</td>
<td>900.0</td>
<td></td>
</tr>
<tr>
<td>1992.3</td>
<td>1759.0</td>
<td>901.0</td>
<td></td>
</tr>
<tr>
<td>1992.4</td>
<td>1767.0</td>
<td>910.0</td>
<td></td>
</tr>
<tr>
<td>1993.1</td>
<td>1775.0</td>
<td>948.0</td>
<td></td>
</tr>
<tr>
<td>1993.2</td>
<td>1783.0</td>
<td>948.0</td>
<td></td>
</tr>
<tr>
<td>1993.3</td>
<td>1791.0</td>
<td>950.0</td>
<td></td>
</tr>
<tr>
<td>1993.4</td>
<td>1799.0</td>
<td>957.0</td>
<td></td>
</tr>
</tbody>
</table>

The most significant discrepancy is that found in the Agriculture sector. From 1990 to 1991 the econometric model forecasts a decrease in employment of about 0.3%, in contrast with the short-term model which forecasts an increase of about 2.3% between the second quarters of 1990 and 1991. Concerning the remaining sectors, both models forecast employment increases. For construction and services, the short-term forecasts are lower than the medium-term ones. The opposite happens for industrial employment. Total employment forecasts provided by the econometric model are 1% higher than short-term forecasts in 1990 and 2.1% in 1991.

Annual forecast values of employment and population over 16, which are exogenous vari-
ables in the labour force block, have been linearly disaggregated into quarterly series for forecasting purposes.

Finally Exhibit 5c shows quarterly forecasts, related to labour force and unemployment respectively, for medium-term using the econometric model and for short-term from ARIMA models. (Active female forecasts are obtained by multiplying forecasted participation rates by forecasted female population over 16.)

5. Conclusions

In this paper we have formulated and applied a demoeconomic model to forecast population, employment, labour force and unemployment in Andalusia.

According to the results shown in the last section, two main conclusions can be drawn.

First, unemployment, defined as the difference between labour force and employment, is affected by employment, because of the encourage–discourage effect, in two opposite directions. Thus, the sensitivity of unemployment to employment forecasts is less than might be expected. So, in spite of the difference between the two employment forecasts yielded by the short- and medium-term models, the central question formulated in the introduction can be answered without ambiguities: both short- and medium-term models forecast unemployment decreases. In the medium-term, the forecast decrease for the whole period (1989 to 1993, fourth quarter) is about 69 thousands.

As a consequence of the expected expansion of the labour force, the unemployment rate is expected to remain close to the current level in the short-term, in spite of the forecast unemployment level rise. In the medium-term, however, an important decrease of unemployment rate is to be expected (from 27% to around 21%).

Second, considering labour force behaviour by sex, the conclusions are as follows. On the one hand, the male labour force is not sensitive to employment, being mainly determined by demographic forces. On the other hand, the female labour force shows a trend indicating the increasing participation of women in the labour market as a socioeconomic phenomenon. At the same time, the female participation rate shows a sensitivity to employment forecasts because of the encourage–discourage effect. The female participation rate is expected to increase from 28% to about 33% because of both the observed trend and the expected employment rise until 1993. This means that while the number of active males is expected to increase by around 136 thousand, the number of active females is expected to rise by around 191 thousand.

Unemployment is expected to remain a social problem for Andalusia in the short-term in spite of an expected important labour demand increase. The reason for this is that the labour force will rise in the same period, mainly due to higher participation by women. Although female participation has not increased in the last two years, this fact, according to the model, should be interpreted as a short-term oscillation.

As a practical conclusion for medium-term economic planning, policy makers should have in mind that for the first time in recent Andalusian economic history, both the unemployment level and rate could be reduced if new jobs were to be created at a plausible rate according to national economic prospects. Thus, the use of policy instruments related to the stimulation of regional employment should be emphasized.

References

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