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Productivity, Taxes and Hours Worked in Spain: 1970–2000

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Abstract

In 1975 hours worked per adult were higher in Spain than in the US, one decade later they were 40 percent smaller. This paper quantitatively assesses the impact of the evolution of TFP and taxes on the evolution of aggregate hours worked in Spain. Solow decomposition shows that the sharp decrease in hours worked per adult is responsible for the negative comovement of TFP and output per adult. We show that as mcu as 80 percent of the decrease in hours worked can be accounted for by the evolution of taxation in an otherwise standard neoclassical growth model. Finally, we provide a comparison with the experience of France over the same period and show that the model fits well the French experience over the same time period.

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1. Introduction

What has driven output growth and fluctuations in Spain over the past three decades? What has been the impact of the evolution of taxes on aggregate hours worked and output? We answer these questions using the methodology developed by Cole and Ohanian (1999) and Kehoe and Prescott (2002) to study great depressions. This methodology relies on growth accounting and a simple general equilibrium growth model. Our growth accounting indicates that, over the period 1970 to 2000, the major factor in determining economic fluctuation in Spain has been fluctuations in aggregate hours worked, rather than fluctuations in productivity growth or in capital accumulation. Our applied general equilibrium analysis indicates that most of the fluctuations in hours worked can be accounted for by changes in taxes. In particular, the model accounts for more than 70 percent of the sharp decline in hours worked over the period the evolution of aggregate hours worked in Spain is consistent with the evolution of taxes from a neoclassical growth perspective. Moreover the sharp decrease in hours worked happened over a time period with high total factor productivity growth. As a way of comparison, we use the same methodology for the French case and we find that the model economy is consistent with the data for the French economy as well. Again, it is the evolution of taxes and not lack of productivity growth what drives hours worked and output per capita.

The methodology used is the one introduced in Kehoe and Prescott (eds., 2002), following the steps of a similar methodology proposed in Cole and Ohanian (1999) to the study of the US Great Depression.

In the first step, growth accounting is used to quantify the contribution of Total Factor Productivity (from now on, we refer to it as TFP), capital deepening and aggregate hours worked for the dynamics of output relative to trend. Next, a standard neoclassical growth model is constructed, where a stand-in household is choosing hours worked, consumption and capital holdings, taking as given the deterministic evolution of TFP and tax rates. Such a methodology provides a quantitative tool, at the same time that identifies the relevant margins for potential candidate explanations.

Prior to 1975 TFP and output per working age person perfectly comoved in Spain. However, after 1975 this is not the case anymore. The reason is the beginning of a generalized process of decreasing aggregate hours worked. That observation is also present

in the French economy and is in sharp contrast with the US experience, where hours worked per adult have been roughly constant, and even increasing during the last fifteen years. Spain is just an extreme case of "European-like" labor market dynamics. The comparison with France shows that the decrease in hours worked started later in time (1975 as compared to the late sixties), but was quantitatively sharper.

Such differential labor market experiences between US and Europe have been extensively studied in the literature. Most of the literature in this research area has focused on the impact of differences in labor market institutions. Bentolila and Bertola (1990), Blanchard and Jimeno (1995) or Blanchard and Summers (1986) among others, focus on the role of institutions and labor market restrictions. Sargent and Ljungqvist (1999, 2002) focus on the interaction between shocks and institutions in a labor search model. Prescott (2002), however, argues that differential taxation alone might account for the differences in the current level of aggregate hours worked between France and the US. To our knowledge, though, ours is the first attempt to quantify the implications of the evolution of taxes for the evolution of aggregate hours worked.

Our analysis shows that the evolution of the taxation of consumption and factor earnings can account for 80% of the secular trend decrease in hours worked in Spain and virtually all of the decrease in France. We show that the behaviour of aggregate hours worked is in line with the predictions of standard neoclassical theory, in contrast with most theoretical work relying in differences in labor market institutions. Of course our exercise is silent about the distribution of aggregate hours worked within the working age population. Also, the exercise proposed allows us to identify time periods in which data deviates from theory in a quantitatively important way. We want to identify these episodes, since they suggest avenues for future research.

Several papers have tried to understand whether Spain displays differential features in terms of employment dynamics than other European economies. Our exercise seems to agree with several other papers that find the Spanish economy much more in line with other economies than other authors have tried to argue. In particular, Zilibotti and Marimon (1998) find that conditioning for initial sectoral composition of output there is no substantial difference in Spanish employment dynamics relative to the rest of European economies. Also, Jimenez-Martin and Sanchez-Martin (2003) contribute to understanding

the role of retirement incentives provided by the Spanish Social Security system, which is a non-trivial component of the fall in aggregate hours worked.

2. The Growth Accounting Exercise

In order to construct the growth accounting exercise we use National Accounts using the System of National Accounts (SNA93) and data on hours worked per worker and employment rates by the corresponding country Labor Force Surveys.

We construct a series of capital by using the Perpetual Inventory Method given the available series of investment (starting back in 1954) and a value for the constant depreciation rate, chosen to be $\delta = 0.0453$. This value is chosen to be consistent with the ratio of depreciation to GDP observed in the data.

The standard growth accounting is done as in Kehoe and Prescott (2002), by using an aggregate production function of the form:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$$

where A_t is TFP, and K_t and L_t are the capital and labor inputs respectively.

Dividing by working-age population, N_t, we can decompose the evolution of output according to the following expression:

$$\frac{Y_t}{N_t} = A_t^{\frac{1}{1-\alpha}} \left(\frac{K_t}{Y_t} \right)^{\frac{\alpha}{1-\alpha}} \left(\frac{L_t}{N_t} \right)$$

Assigning a value for the capital share α we are ready to perform our decomposition. We measure directly α from the data and obtain a value of 0.31. Our estimate is slightly higher than the estimated value in Gollin (2002), who argues for a common across countries capital share of income $\alpha = 0.3$. Notice that this number is very similar to the EU estimate of 0.305 (see European Economy (1994)).

Along a balanced growth path the capital-output ratio, K_t / Y_t, and hours worked per working-age person, L_t / N_t, are constant over time. Therefore output per working-age

person should grow at rate implied by the TFP factor, $A_t^{\frac{1}{1-\alpha}}$.

First, we report the growth accounting exercise for the US in Figure 1. Notice the contrast with the case of Spain, as reported in Figure 2. Clearly, after 1975 Spain deviates from balanced growth path. A similar conclusion can be reached for the case of France, reported in Figure 3.

Notice that, while in the period 1960–1975, the data seems to indicate a Balanced Growth Path for the case of Spain, subsequent to 1975 the TFP factor and output per adult start diverging. The reason is the dramatic fall in aggregate hours worked.

Figure 4 displays the evolution of aggregate hours worked. Notice that the fall in aggregate hours worked starting in 1975 is due to both a fall in hours worked per worker and a fall in employment rates. However, the main focus of this paper is to understand the contribution of the evolution of taxes for this observed fall in aggregate hours worked, but not on its distribution across the population.

Such a sharp decline in aggregate hours worked is in line with the economic experiences of other European economies. It is illustrative to compare the evolution of hours worked in Spain with those in France and the US. This comparison is reported in Figure 5.

Notice that France and Spain have experienced a similar drop in hours worked between 1960 and 2000. However, the French case has been a more continuous and smooth process taking place since 1960, while the Spanish experience was concentrated in the decade between 1975 and 1985. Nevertheless, the French economy experience is similar to that of Spain, in the sense that the deviations of output relative to productivity are generated by falling hours worked, see Figure 3.

3. The Theoretical Framework

The simplest theoretical framework one could write is one in which a stand-in infinitely-lived consumer is going to choose sequences of consumption, hours worked and capital, taking as given the evolution of TFP and taxes. The production side of the economy takes place through a stand-in producer operating the aggregate technology taking competitive

prices as given. Finally, there is a government that levies proportional taxes on consumption, labor earnings and capital earnings, and uses the proceeds to finance a lump-sum transfer to the consumers in a balanced budget fashion. We will consider 1970 as our starting point, five years before the changes which constitute the main object of this paper take place.

In such a framework the stand-in consumer solves the following maximization problem:

$$\max \sum_{t=1970}^{\infty} \beta^t [\gamma \log C_t + (1-\gamma)\log(N_t \bar{h} - L_t)]$$

$$\begin{aligned} \text{s.t.} \quad & (1+\tau_t^c)C_t + K_{t+1} - K_t \\ & = (1-\tau_t^\ell) w_t L_t + (1-\tau_t^k)(r_t - \delta)K_t + T_t. \\ & K_{1970} = \bar{K}_{1970} \end{aligned}$$

Here N_t denotes the number of working-age population in the economy and $\bar{h}$ denotes the yearly disposable time endowment of each individual. The choice variables are then sequences of aggregate consumption, aggregate capital stock and aggregate hours worked, denoted respectively by C_t, K_t, L_t. In Section 8 we provide a sensitivity analysis with respect to the preferences specification, as well as with respect to the assumption that all tax proceeds are lump-sum rebated to the consumers.

For each period the resource constraint in this economy is given by:

$$C_t + K_{t+1} - (1-\delta)K_t = A_t K_t^\alpha L_t^{1-\alpha}, \ t = 1970, ...$$

And the government budget constraint implies:

$$\tau_t^c C_t + \tau_t^\ell w_t L_t + \tau_t^k (r_t - \delta)K_t = T_t, \ t = 1970, ...$$

The problem of the stand-in producer can be characterized by the following pricing rules for both factors of production:

$$w_t = (1-\alpha)A_t K_t^{\alpha} L_t^{-\alpha}$$
$$r_t = \alpha A_t K_t^{\alpha-1} L_t^{1-\alpha} - \delta, \;\; t = 1970,...$$

Our benchmark specification implies that all tax proceeds are rebated to the consumer in a lump-sum fashion.[1] This is equivalent to viewing government expenditure as a perfect substitute for private consumption, and it is a reasonable abstraction as long as tax proceeds are mainly used to finance transfers to consumers (social security pensions, unemployment insurance,…) or to finance publicly provided consumption goods and services (health care, education,…) that could alternatively be provided through the private sector. In fact, looking at the composition of government expenditure we find that in the year 1996 the sum of pensions, healthcare, unemployment insurance and education in Spain amounted to 63% of the government outlays (25% of GDP).

Notice that this assumption is not neutral in determining the implication of taxes for hours worked, since it generates a much bigger response of hours worked to changes in taxes. See Prescott (2002) for a discussion of this issue. In Section 8 we provide a sensitivity analysis with respect to this issue. In particular, we go to the other extreme and explore the hypothesis that all government consumption is wasted or alternatively finances the provision of public goods that enter separably in the utility function.

4. The Evolution of Effective Tax Rates

In order to obtain estimates of the evolution of effective *marginal* tax rates we use the same methodology proposed in Mendoza et al. (1994). However, there are two main differences; first, we attribute a fraction of household's non-wage income to labor income; second, we measure marginal as compared to average tax rates.

Estimating the effective *marginal* tax rates requires taking into account the progressivity of income taxes. Taxation of labor earnings can be decomposed into income taxation and

[1] A fraction of the tax proceeds, in Spain between 18% and 24.5% depending of the year, are lump-sum rebated through the progressivity of income taxation. Since average tax rates are smaller than marginal tax rates, we should tax at marginal rates and then have lump-sum tax rebates.

payroll taxes (mainly social security contributions, that are roughly proportional). Provided that the relevant figure in terms of the distortionary implications is the marginal and not the average tax rate, we adjust our tax estimates for both capital and labor income. Calonge and Conesa (2003) have estimated an effective income tax function, as the one proposed in Gouveia and Strauss (1994), for the Spanish economy using disaggregated data taken directly from tax returns. They report that the aggregate marginal tax rate in Spain (computed as the increase in tax revenues if everybody's income were to increase by 1 percentage point, 26.5%) is 1.83 times bigger than the aggregate average tax rate (total tax revenues divided by total income, 14.5%).

Hence, we adjust by 83% the taxation of households income in order to compute effective marginal tax rates. Our final estimates are reported in Figure 6.

For a more detailed explanation of the tax estimates see Appendix A.

5. Numerical Experiment and Calibration

In the experiment we perform our theoretical economy will determine the equilibrium evolution of the endogenous variables, given the initial capital stock in 1970 as measured in the data. Our theoretical economy will react to the evolution of the exogenous variables, which are the evolution of TFP as measured in the growth decomposition exercise, the evolution of the tax rates as estimated from the data and the evolution of the working-age population as measured in the data. Then, we will compare the evolution of the main aggregate variables implied by the model with those observed in the data.

In order to determine the value of the disposable time endowment of individuals, $\bar{h}$, we assume that each adult has a time endowment of 100 hours a week.

Next, we need to assign values to all the parameters in the model.

The depreciation rate δ is chosen so that the ratio of depreciation to GDP coincides with that observed in the data on average between 1970 and 2000. Therefore, we choose $\delta = 0.0453$ so that we obtain $\delta \sum_{t=1970}^{2000} \frac{K_t}{Y_t} / 31 = 0.142$.

Our estimate of the capital share in Spain is 0.31. This estimate is obtained by using the same national accounting data as the one used for the TFP accounting exercise and for the

estimation of the marginal tax rates.

In order to calibrate the preference parameters we use the first order conditions from the household problem and the data observations for the period 1970-1974 (those are the years for which we have complete data and are prior to the phenomenon we are interested in: the sharp fall in hours worker starting in 1975). Deriving the two first order conditions and rearranging we can write the value of the preference parameters as a function of data observations:

$$\beta = \frac{(1+\tau_{t+1}^{c})C_{t+1}}{(1+\tau_{t}^{c})C_{t}} \frac{1}{1+(1-\tau_{t}^{k})(r_{t}-\delta)}$$

$$\gamma = \frac{(1+\tau_{t}^{c})C_{t}}{(1+\tau_{t}^{c})C_{t}+(1-\tau_{t}^{\ell})w_{t}(N_{t}\overline{h}-L_{t})}$$

Using these two conditions and actual data from 1970-1974 we could compute a vector of the parameters β and γ. The parameters we assign to our economy are the average of these vectors.

Given that our goal is to quantify the implications of the evolution of taxes we will perform two experiments. The first one will determine the evolution of our theoretical economy if taxes had stayed constant at their initial level in 1970. The second experiment will determine the evolution of the theoretical economy considering the evolution observed for the tax variables. Then, we will compare both outcomes.

Notice then that the right parameterization will depend crucially on the assumption about the evolution of taxes corresponding to these two experiments, yielding two different pairs of parameters.

For the case in which we assume constant taxes at the 1970 level we find the following parameter values: $\beta = 0.9790$, $\gamma = 0.3311$. When taxes are set equal to the actual estimated values we find: $\beta = 0.9791$, $\gamma = 0.3365$.

6. The Results

Figure 7 illustrates the importance of taking into account the evolution of tax rates for understanding the evolution of the Spanish economy during the last three decades. The base-case model economy predictions are much more in line with the data than those implied by the evolution of TFP alone, ignoring the evolution of taxes.

The model with taxes accounts for a sizeable fall in hours worked, see Figure 8. In fact, the order of magnitude of this fall is captured well in the model economy: between 1974 and 1994 (the time with the lowest value) hours worked per working-age person fall 41 percent in the data and 31 percent in the model. Nevertheless, the fall between 1974 and 1985 is not as sharp in our base-case model economy as compared to the data. Also, it fails to account for the recovery experienced by hours worked since 1994. In fact, several labor market reforms have taken place since 1994 and might be responsible for this deviation of the model relative to data. Table 1 shows for different subperiods the contribution of the different components of GDP. It clearly shows how the model is not able to account for the evolution of hours worked in the second part of the nineties, while the base case model does reasonably well in previous periods. This shows that the labor market reforms that were undertaken in the mid nineties have had a quantitative impact.

Finally, notice that the model predictions regarding capital deepening fall short of the data experience as shown in Figure 9. Our model represents a closed economy, while capital inflows, together with a general process of financial liberalization, might have played an important role in capital deepening for the Spanish economy. The exercise suggests that the evolution of taxation has not had a quantitatively important impact on that margin.

Nevertheless, our exercise shows that the key component is the evolution of hours worked, and that the distortions introduced by taxes in the labor market have had a non-negligible impact, especially if we compare the results in our base-case economy to the counterfactual of constant taxes at the 1970 level.

We do not want to claim, however, that other frictions or institutional features in the labor market have no role in explaining the evolution of hours worked. Indeed, tax revenues have been used to some extent to finance certain institutional programs such as unemployment

insurance or publicly provided retirement pensions. To the extent that the increase in taxes has been contemporaneous to the development of these programs, alternative explanations are clearly correlated with the evolution of taxes.

The quantitative implications of alternative model specifications relative to the data can be found in Table 1.

7. An Instructive Comparison: France

We saw in Section 2 that the Spanish economy was in line with the French experience, i.e. output falling short of that implied by the evolution of productivity due to a sharp decrease in aggregate hours worked. Now, we redo the exercise for the French economy and evaluate the impact of the evolution of TFP and tax rates. The evolution of taxes is reported in Figure 10.

First, we calibrate the French economy. The procedure followed is exactly the same as the one for Spain.

In terms of technology parameters the estimated values are $\alpha = 0.299$ and $\delta = 0.0439$. For the preference parameters, we obtain $\beta = 0.9957$, $\gamma = 0.3509$ in the case of a model with constant taxes; and $\beta = 0.9960$, $\gamma = 0.3523$ in the model version with actual taxes.

The base-case model does an impressive job in accounting for the evolution of GDP, hours worked, and capital deepening in France. See Figures 11, 12 and 13, and Table 2.

Prescott (2002) argues that the tax wedge in labor supply is responsible for the difference in hours worked between Europe and the US. Our results relative to the evolution over time are consistent with it. This increases our confidence in the ability of our exercise to capture the main aggregate performance of actual economies.

8. Sensitivity Analysis

In this section we evaluate how sensitive are our results to some of the key assumptions in our exercise. We will explore separately the role of 4 key assumptions:

- The role of TFP growth, by comparing our results with a counterfactual in which TFP would have grown at a constant rate.
- We recalibrate the preference parameters using data from the period 1975-2000 in order to determine how sensitive are the results to our choice of the time period for the base-case calibration.
- The intertemporal elasticity of substitution, by changing preferences to a CRRA specification with higher than log curvature.
- The nature of government expenditure, by exploring the results under the assumption that government consumption is wasted or used to finance the provision of public goods that enter the utility function separably.

Table 3 summarizes the quantitative implications for all of our sensitivity analysis.

Constant TFP Growth

Consider the scenario in which TFP growth would have continued over the entire period 1970-2000 at the same average growth rate as it did during 1970-1974. This way we can determine the contribution of the productivity slowdown for economic performance over that period.

Our exercise shows that under this alternative scenario the model does equally well in accounting for the evolution of aggregate hours worked, while it does worst in terms of the evolution of the capital-output ratio and output per capita. From that we conclude that productivity as measured in TFP did not have any impact in the evolution of hours worked.

Recalibrating Preference Parameters to 1975-2000

The key parameters are the preference parameters, and in order to determine those we used data prior to 1975. The question now is to see to what extent our results are sensitive to that choice.

In order to perform this sensitivity analysis we recalibrate the preference parameters using data for the period 1975-2000 and we find values of $\beta = 0.9917$, $\gamma = 0.2904$.

Under this alternative parameterization hours worked are shifted downwards, so that the model does better in accounting for the low level of hours worked after 1975, but then it is inconsistent with the high levels observed prior to 1975. Also, the model does better in terms of accounting for the evolution of the capital-output ratio.

Preferences Specification

In assuming log preferences we might be biasing our results in the sense that it implies an intertemporal elasticity of substitution that some econometric studies focusing on individual behaviour might find too high. In order to evaluate the implications of this feature for our results we change the specification of preferences to:

$$\sum_{t=1970}^{\infty} \beta^t \left(\left[\left(\frac{C_t}{\tilde{N}_t} \right)^{\gamma} \left(\frac{N_t \bar{h} - L_t}{N_t} \right)^{1-\gamma} \right]^{\phi} - 1 \right) / \phi$$

where $\tilde{N}_t$ is adult-equivalent population (we simply divide population by two) and $\phi = -1$.

In order to perform our sensitivity analysis we need to recalibrate the preference parameters in our economy. We find values of $\beta = 0.9918$, $\gamma = 0.3365$.

Our results show that the model performs better in accounting for the evolution of hours worked, but worse in accounting for capital accumulation.

Composition of Government Expenditure

In our theoretical framework government revenues are lump-sum rebated to the consumers. That implies that all tax revenues are either used to finance transfers or used to finance consumption and investment goods that are perfect substitutes of consumer's individual choices. In this section we show how the results might change with respect to this assumption.

In order to do so, we go to the other extreme and consider all of government consumption in the National Accounts to be thrown into the ocean. Notice that this is clearly an extreme

scenario since a lot of government consumption finances goods that could otherwise be provided by the private sector (health care, education,…).

9. Conclusions

In this paper we have argued that introducing exogenously the evolution of tax rates in a suitably parameterised neoclassical growth model can be used as an important tool for understanding the labor market experience in countries like Spain or France. This experiment allows the identification of the relevant margins for understanding the economic performance of actual economies, as well as identifying deviations of the model economy relative to the data suggesting avenues for future research.

Notice that this methodology is in sharp contrast with a stream of the literature that has focused on labor market institutions in order to understand differential labor market experiences. We view our exercise as an illustration of a methodology for identifying the main sources for potential candidate explanations. Needless to say, potential explanations might well be correlated, since the development of certain institutional features has been parallel to the increase in tax rates we observe in the data.

Our results show that the evolution of aggregate hours worked in Spain is roughly consistent with neoclassical growth theory given the observed evolution of taxes and the size of the government. However, the computational exercise suggests that capital accumulation in Spain over the 1975-2000 period has been higher than implied by the model economy. This is an interesting feature of our results since our theoretical exercise abstracts from changes in trade policies as well as capital flows liberalization taking place over the period. As a comparison, when we use the same methodology to examine the French experience we observe that the model is in line with the data in terms of both the evolution of aggregate hours worked and capital deepening.

This results are in sharp contrast with the main conclusions in other similar studies using the same methodology, where the driving force was always the evolution of total factor productivity.

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Table 1

Growth Accounting in Spain

Decomposition of Average Annual Changes in Real GDP per Working-Age Person (Percent)

	Data	Model base case	Model constant taxes
1970-2000			
Change in Y/N	2.18	2.01	3.40
Due to TFP	2.84	2.84	2.84
Due to K/Y	0.54	0.21	0.46
Due to L/N	-1.20	-1.04	0.10
1970-1974			
Change in Y/N	5.85	4.84	5.41
Due to TFP	5.47	5.47	5.47
Due to K/Y	0.47	-0.81	-1.02
Due to L/N	-0.09	0.18	0.96
1974-1994			
Change in Y/N	1.23	1.77	3.77
Due to TFP	3.07	3.07	3.07
Due to K/Y	0.81	0.25	0.50
Due to L/N	-2.65	-1.54	0.20
1994-2000			
Change in Y/N	2.90	0.92	0.81
Due to TFP	0.35	0.35	0.35
Due to K/Y	-0.31	0.77	1.28
Due to L/N	2.87	-0.19	-0.82

Table 2

Growth Accounting in France

Decomposition of Average Annual Changes in Real GDP per Working-Age Person (Percent)

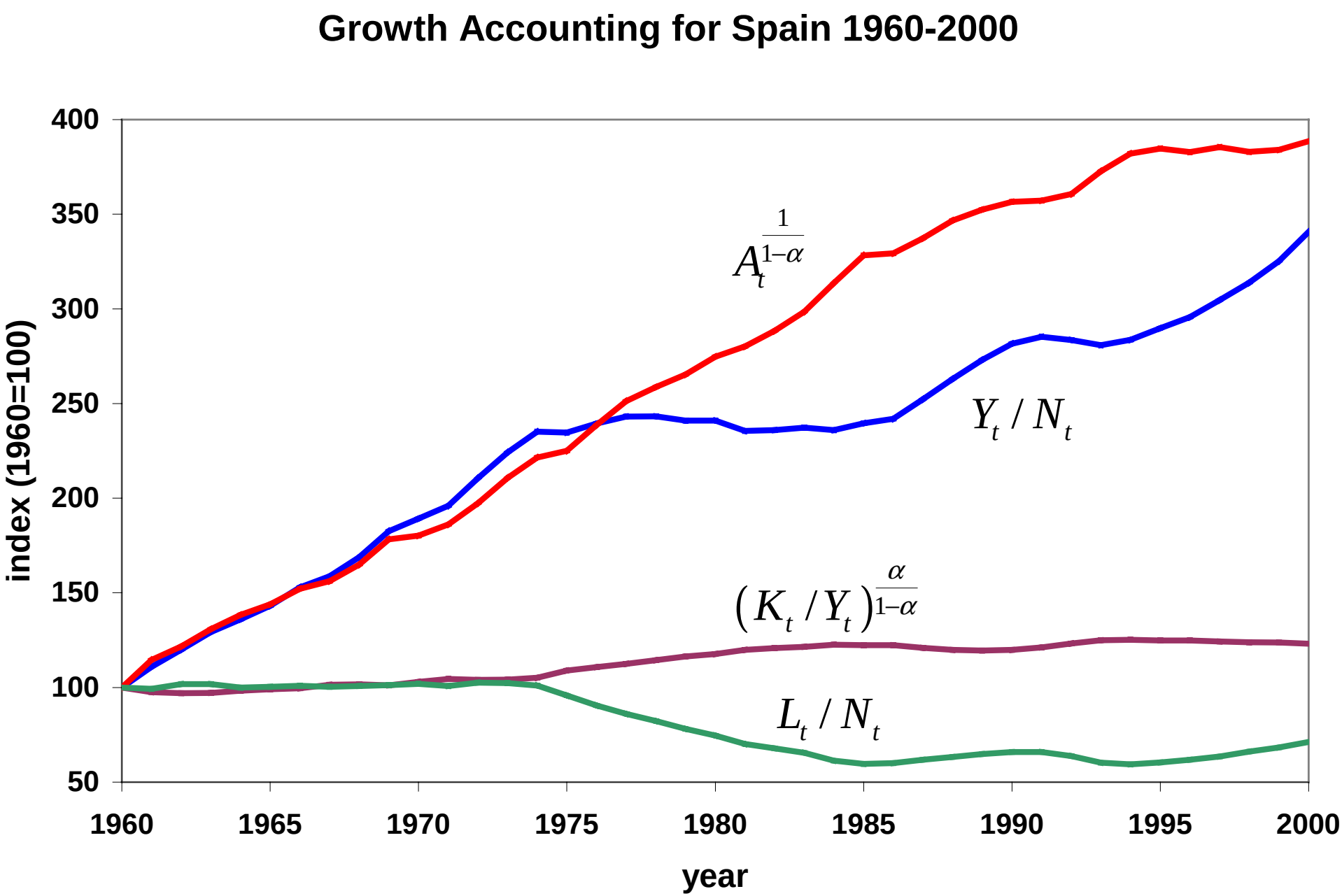
	Data	Model base case	Model constant taxes
1970-2000			
Change in Y/N	1.90	1.60	2.77
Due to TFP	2.46	2.46	2.46
Due to K/Y	0.35	0.35	0.28
Due to L/N	-0.91	-1.21	0.03

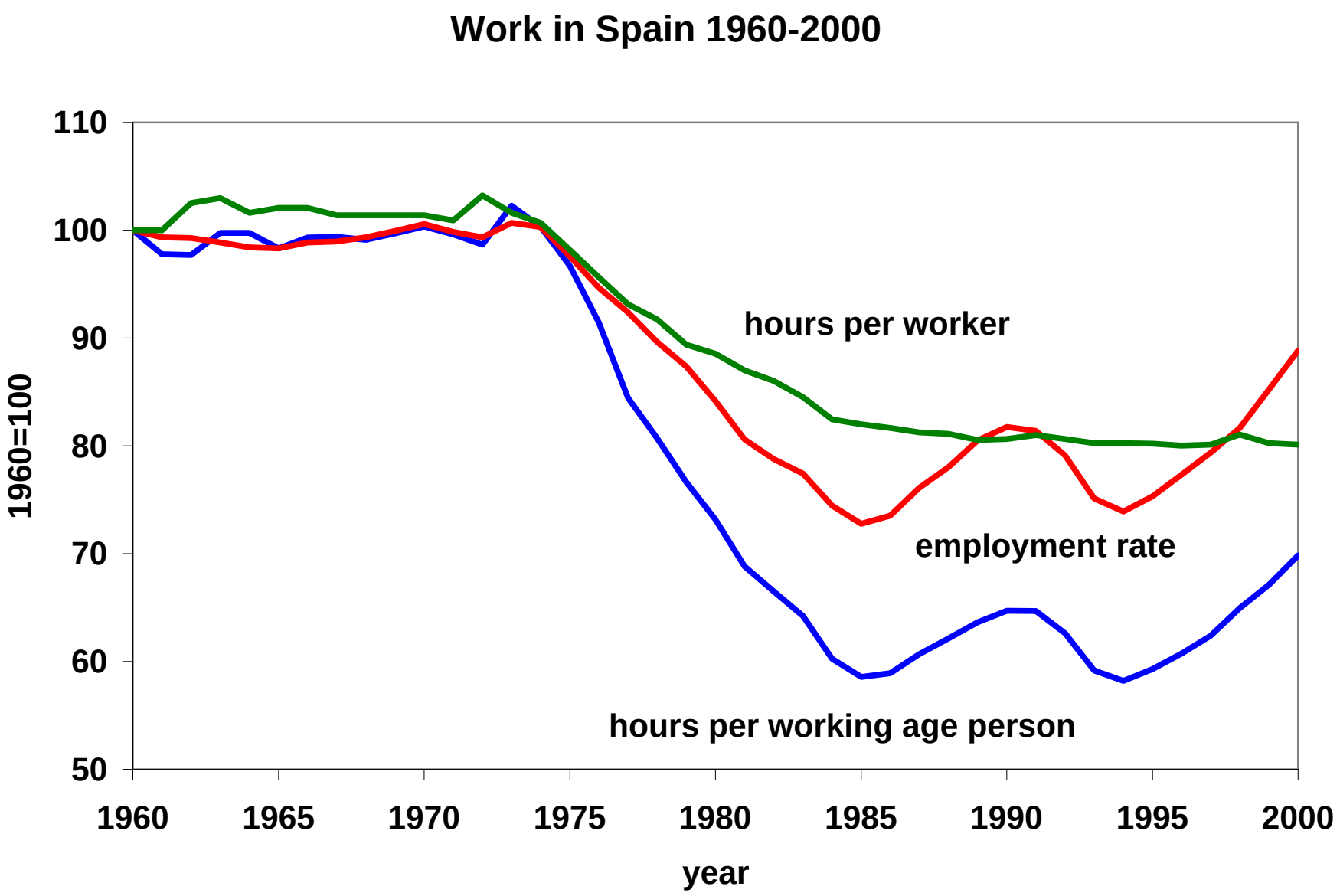
Table 3

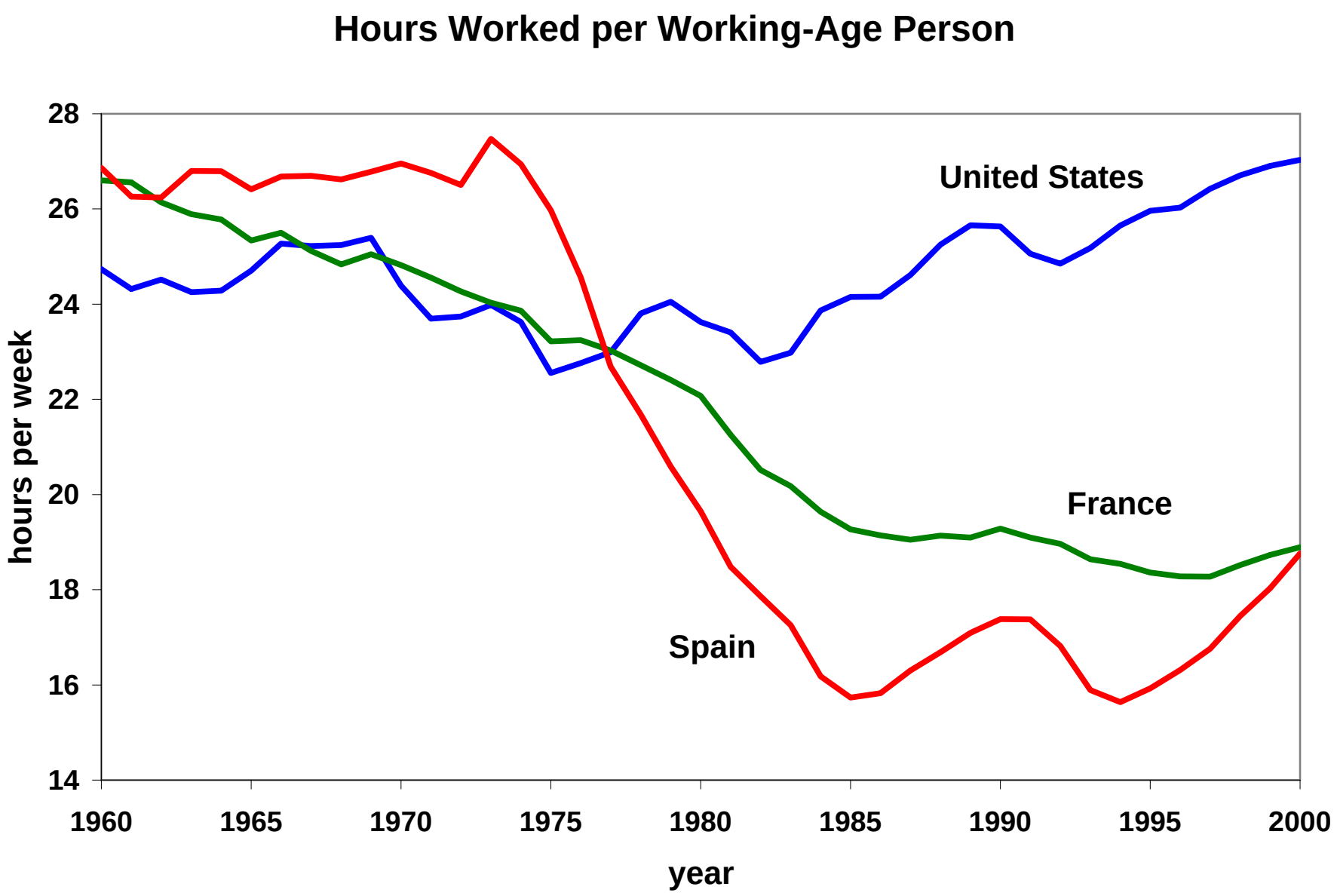
Growth Accounting in Spain: Sensitivity Analysis

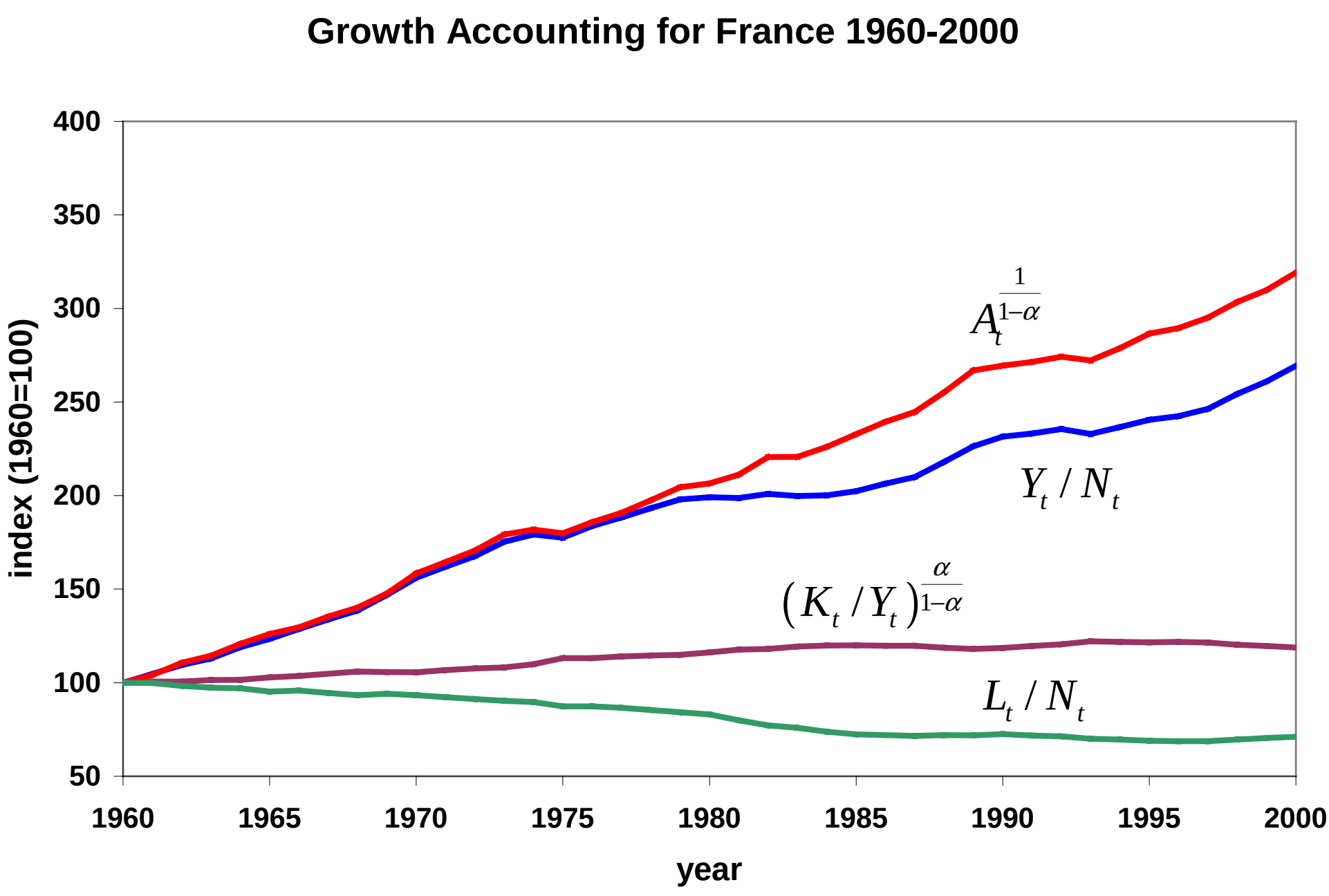
Decomposition of Average Annual Changes in Real GDP per Working-Age Person (Percent)

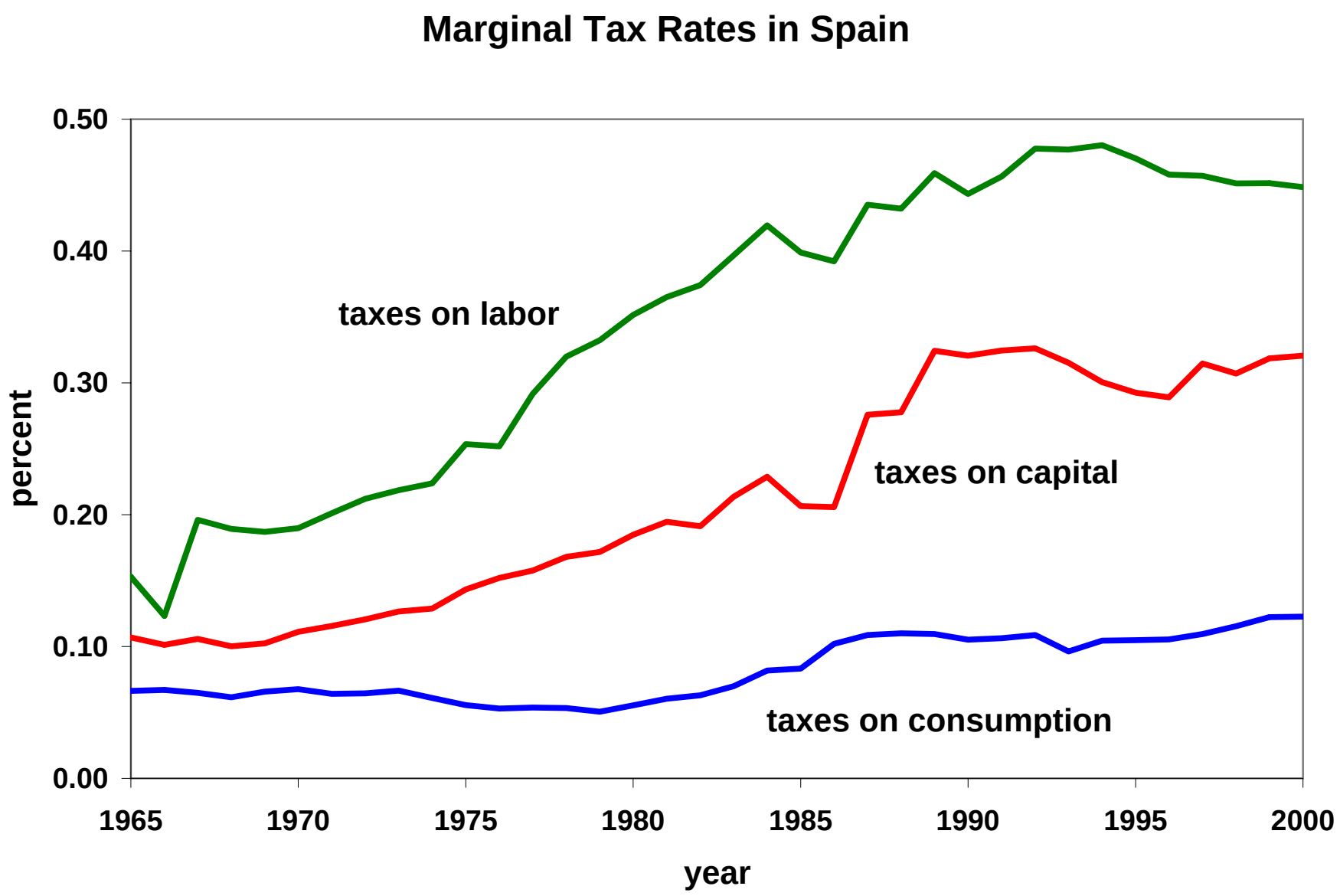
	Data	Model base case	Model constant TFP growth	Model recalibrated parameters	Model alternative utility	Model government consumption	Model myopic expectations
1970-2000							
Change in Y/N	2.18	2.01	2.71	2.11	2.30	2.20	1.94
Due to TFP	2.84	2.84	4.24	2.84	2.84	2.84	2.84
Due to K/Y	0.54	0.21	-0.23	0.50	0.59	0.24	0.32
Due to L/N	-1.20	-1.04	-1.30	-1.23	-1.13	-0.88	-1.22
1970-1974							
Change in Y/N	5.85	4.84	3.75	5.39	5.46	5.31	5.13
Due to TFP	5.47	5.47	4.24	5.47	5.47	5.47	5.47
Due to K/Y	0.47	-0.81	0.35	-0.04	0.16	-0.56	-0.36
Due to L/N	-0.09	0.18	-0.84	-0.04	-0.17	0.40	0.02
1974-1994							
Change in Y/N	1.23	1.77	2.11	1.77	2.01	1.90	1.65
Due to TFP	3.07	3.07	4.24	3.07	3.07	3.07	3.07
Due to K/Y	0.81	0.25	-0.17	0.57	0.63	0.33	0.40
Due to L/N	-2.65	-1.54	-1.96	-1.87	-1.69	-1.50	-1.82
1994-2000							
Change in Y/N	2.90	0.92	4.00	1.16	0.25	1.12	0.79
Due to TFP	0.35	0.35	4.24	0.35	0.35	0.35	0.35
Due to K/Y	-0.31	0.77	-0.83	0.73	0.58	0.47	0.49
Due to L/N	2.87	-0.19	0.59	0.08	-0.68	0.30	-0.04

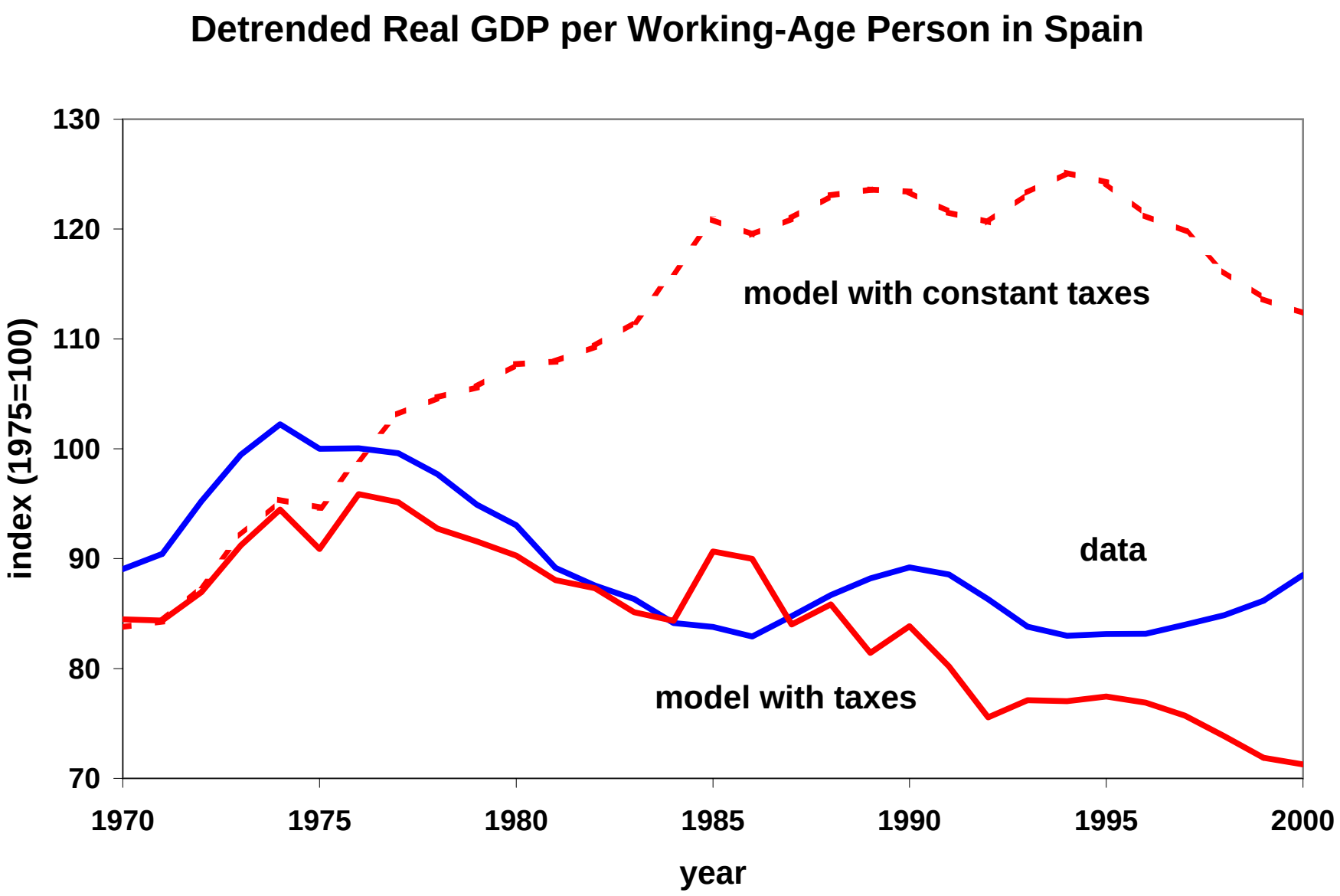

Growth Accounting for Spain 1960-2000
400
350
300
250
200
150
100
50
index (1960=100)
1960
1965
1970
1975
1980
1985
1990
1995
2000
year
$A_t^{\frac{1}{1-\alpha}}$
Y_t / N_t
$(K_t / Y_t)^{\frac{\alpha}{1-\alpha}}$
L_t / N_t

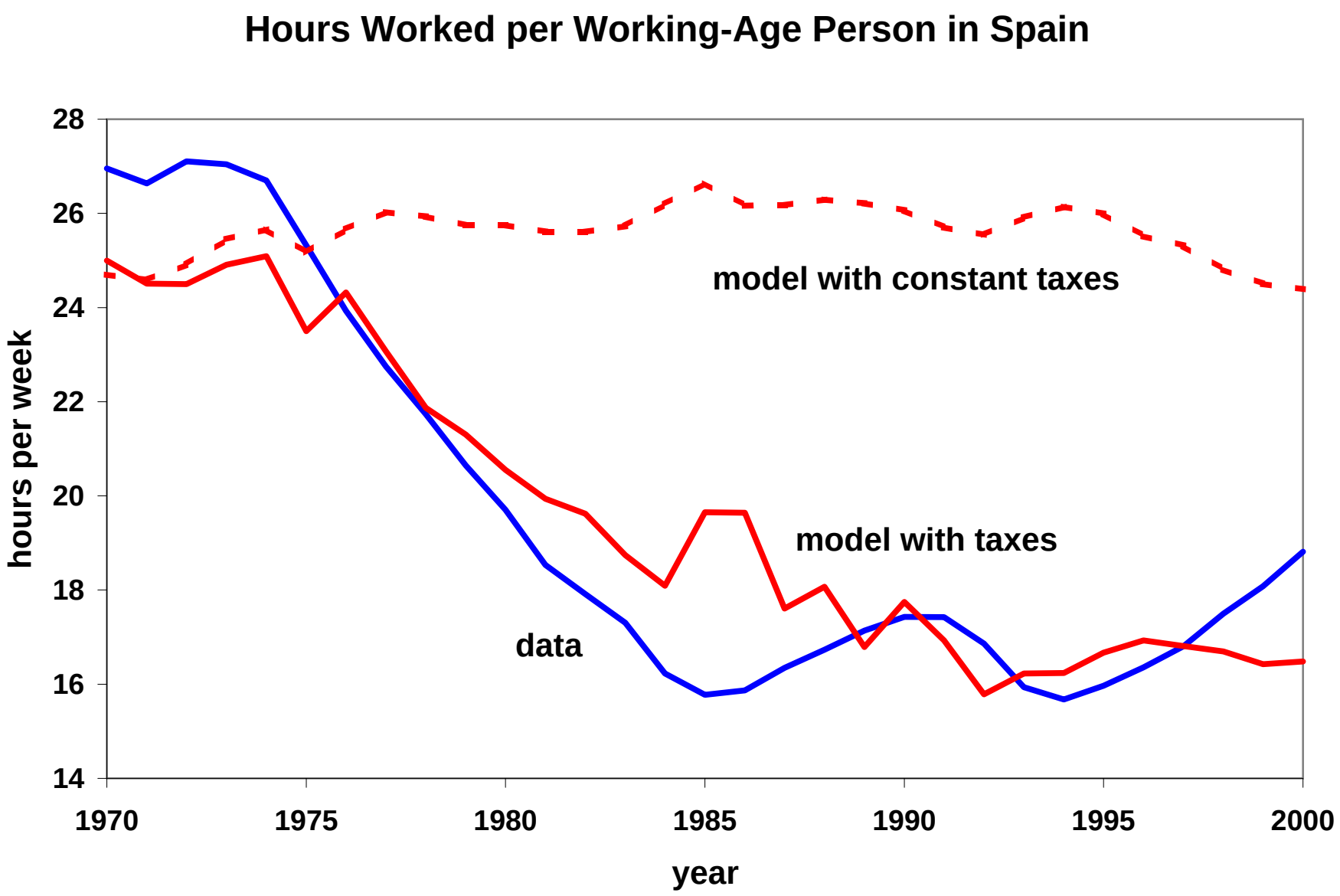

Work in Spain 1960-2000
110
100
90
80
70
60
50
1960=100
1960
1965
1970
1975
1980
1985
1990
1995
2000
year
hours per worker
employment rate
hours per working age person

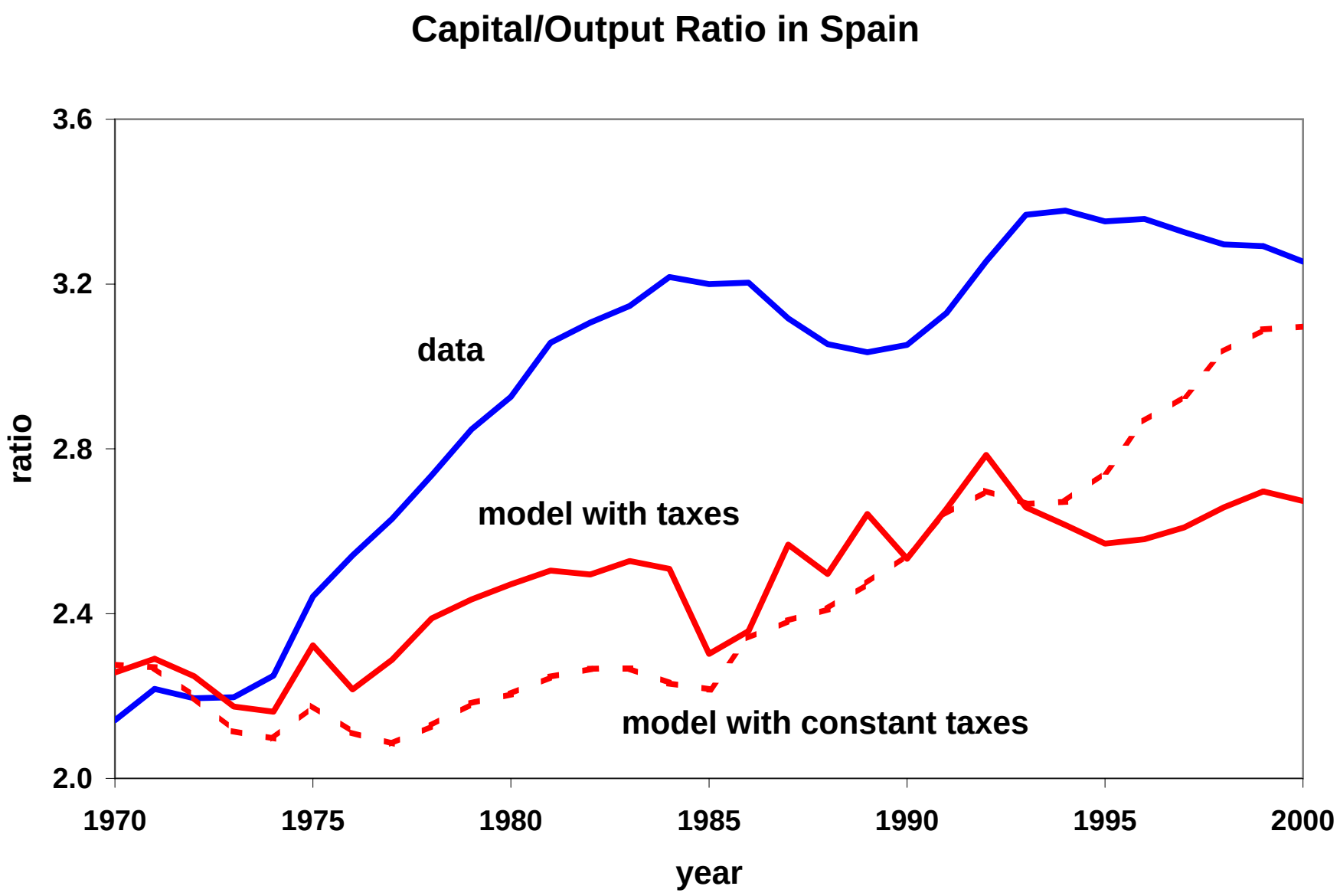

Hours Worked per Working-Age Person
28
26
24
22
20
18
16
14
hours per week
1960
1965
1970
1975
1980
1985
1990
1995
2000
year
United States
France
Spain

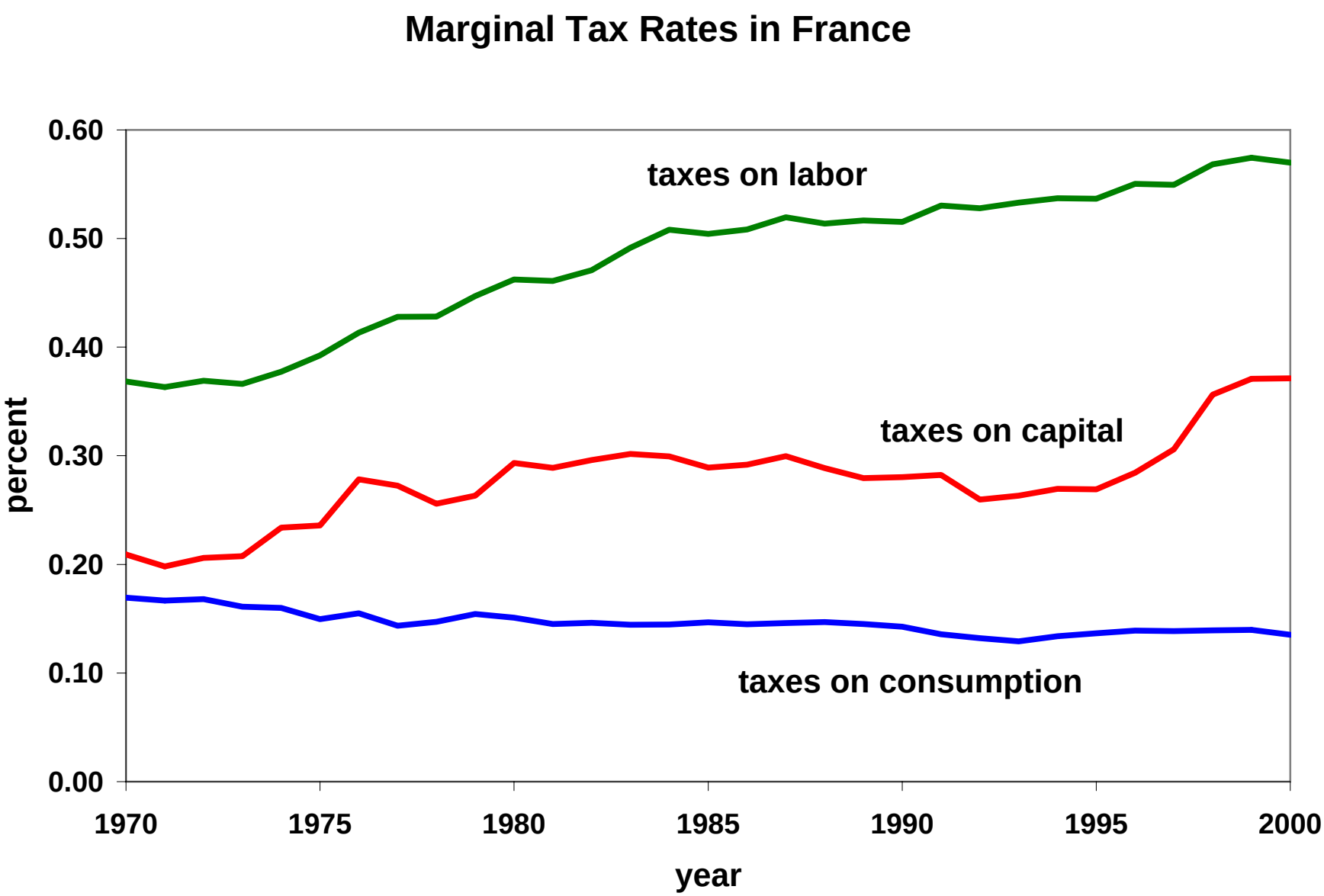

Growth Accounting for France 1960-2000
400
350
300
250
200
150
100
50
index (1960=100)
1960
1965
1970
1975
1980
1985
1990
1995
2000
year
$A_t^{\frac{1}{1-\alpha}}$
Y_t / N_t
$(K_t / Y_t)^{\frac{\alpha}{1-\alpha}}$
L_t / N_t

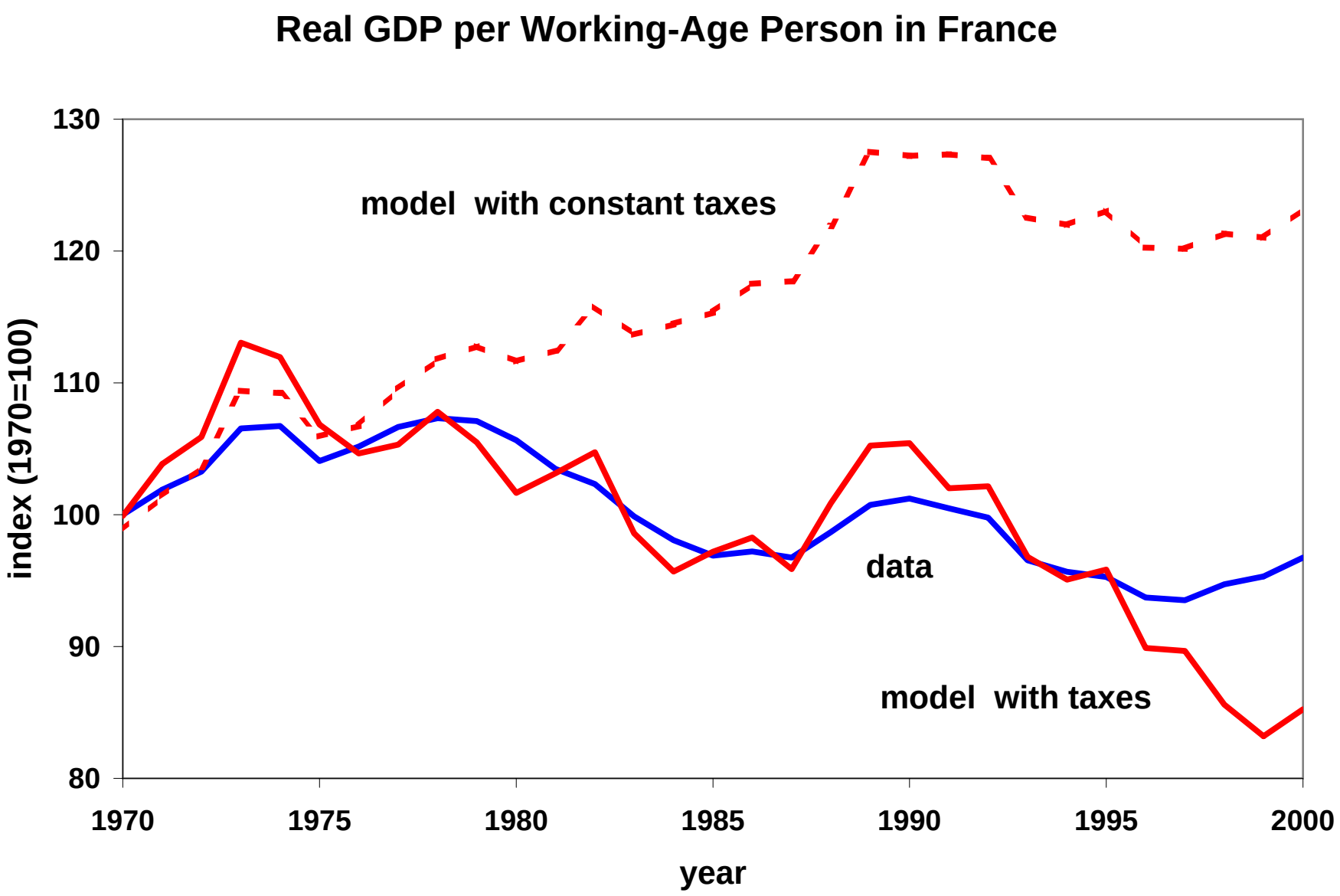

Marginal Tax Rates in Spain
0.50
0.40
0.30
0.20
0.10
0.00
percent
taxes on labor
taxes on capital
taxes on consumption
1965
1970
1975
1980
1985
1990
1995
2000
year

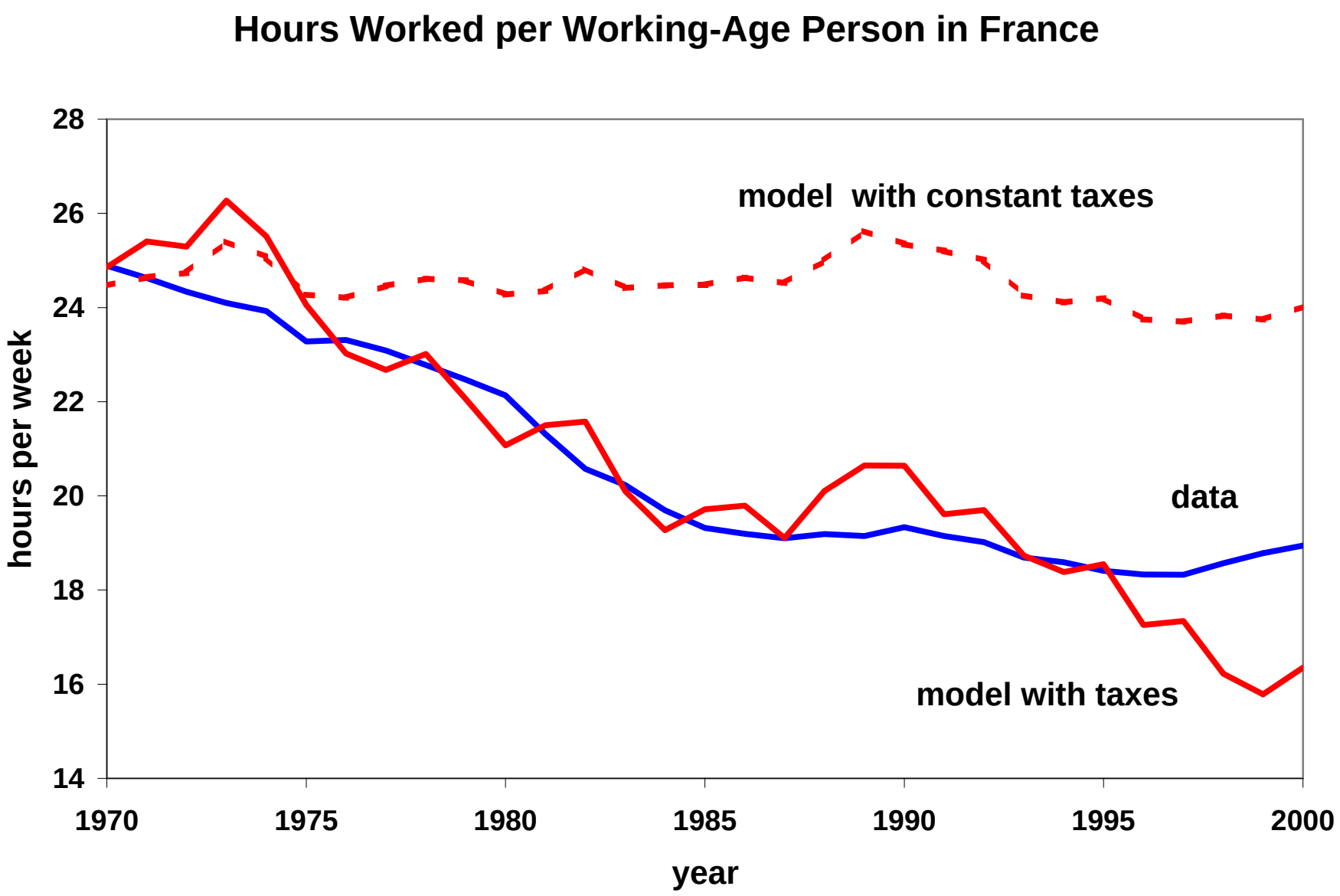

Detrended Real GDP per Working-Age Person in Spain
130
120
110
100
90
80
70
index (1975=100)
1970
1975
1980
1985
1990
1995
2000
year
model with constant taxes
data
model with taxes

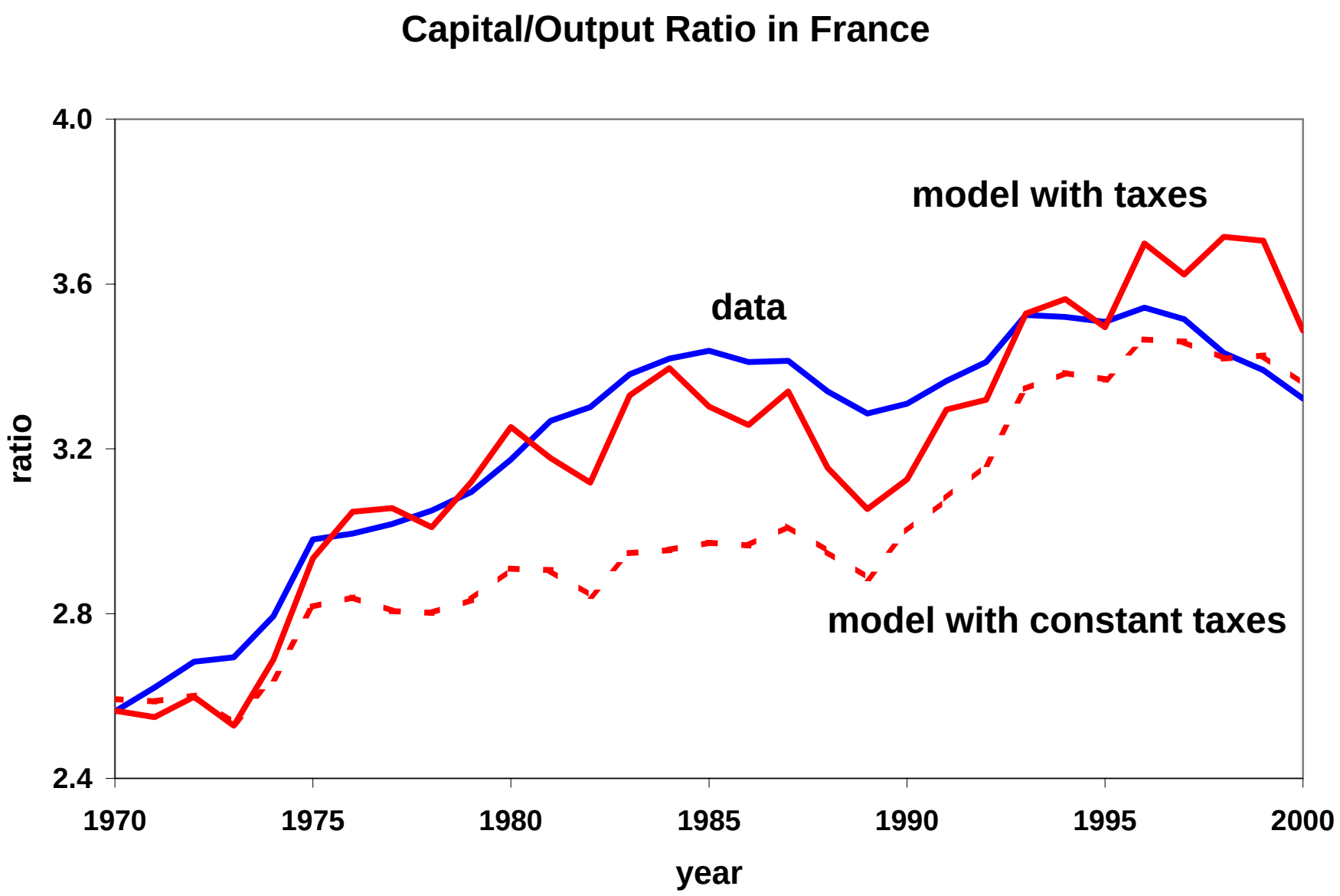

Hours Worked per Working-Age Person in Spain
28
26
24
22
20
18
16
14
hours per week
1970
1975
1980
1985
1990
1995
2000
year
model with constant taxes
model with taxes
data

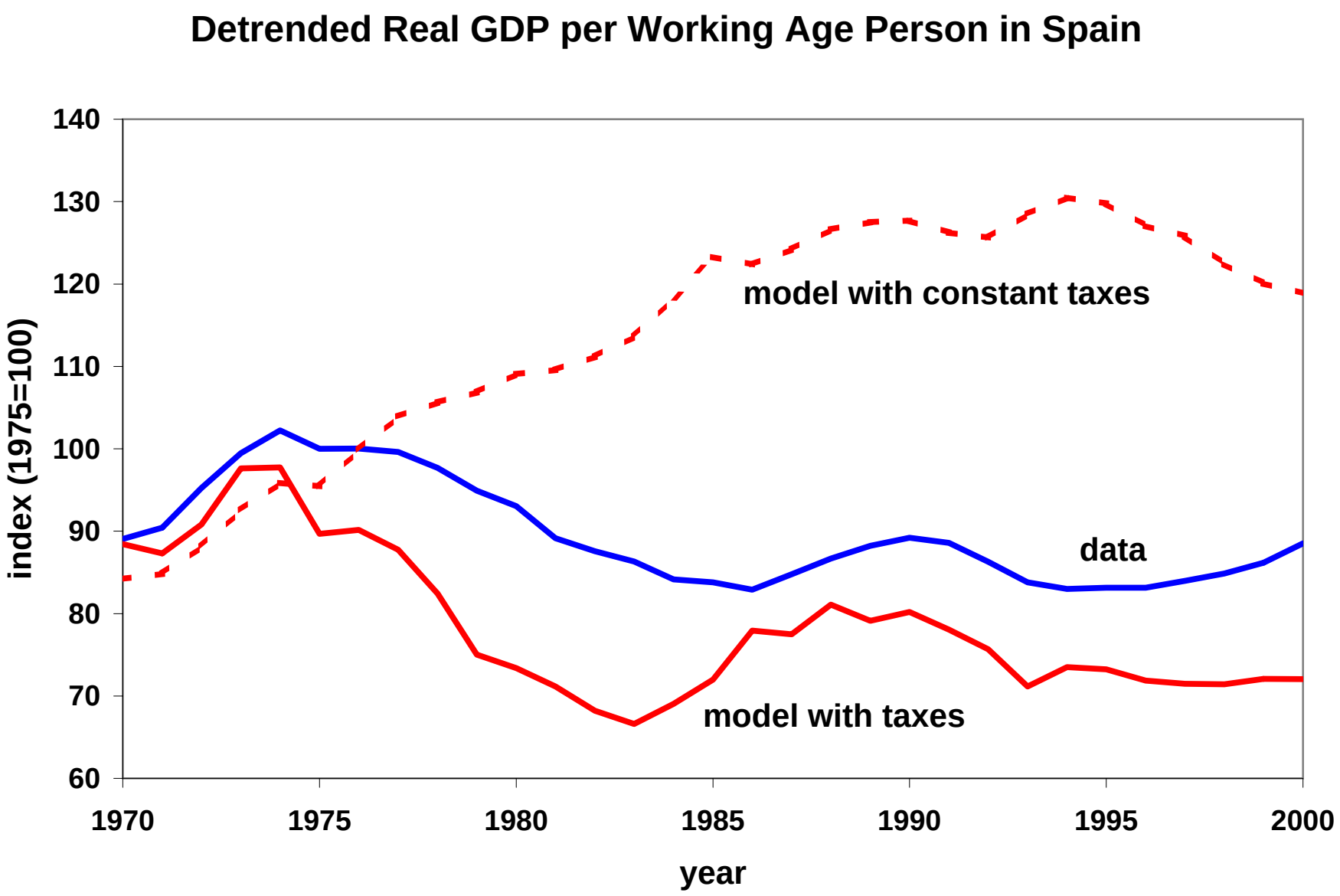

Capital/Output Ratio in Spain
3.6
3.2
2.8
2.4
2.0
ratio
data
model with taxes
model with constant taxes
1970
1975
1980
1985
1990
1995
2000
year

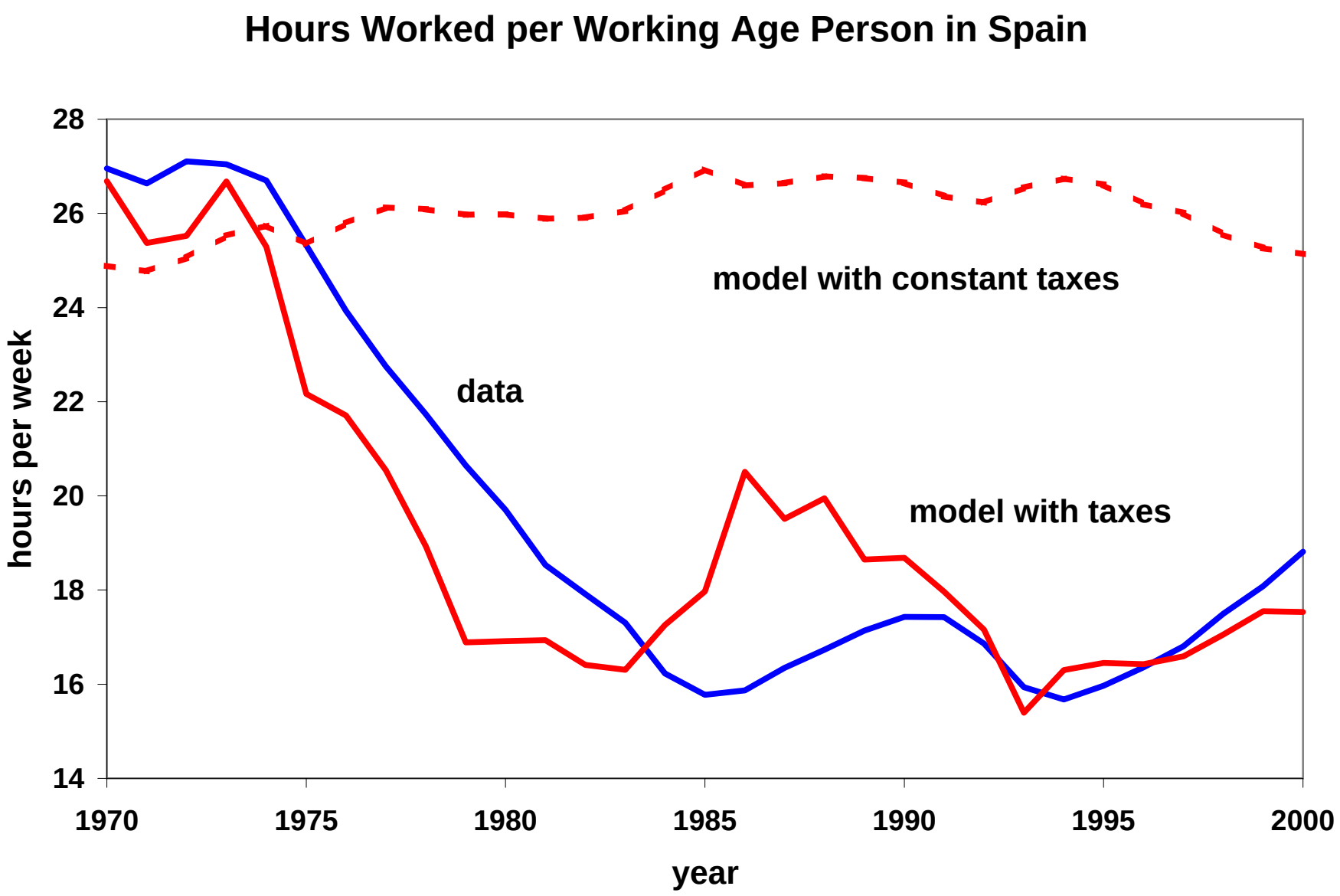

Marginal Tax Rates in France
0.60
0.50
0.40
0.30
0.20
0.10
0.00
percent
taxes on labor
taxes on capital
taxes on consumption
1970
1975
1980
1985
1990
1995
2000
year

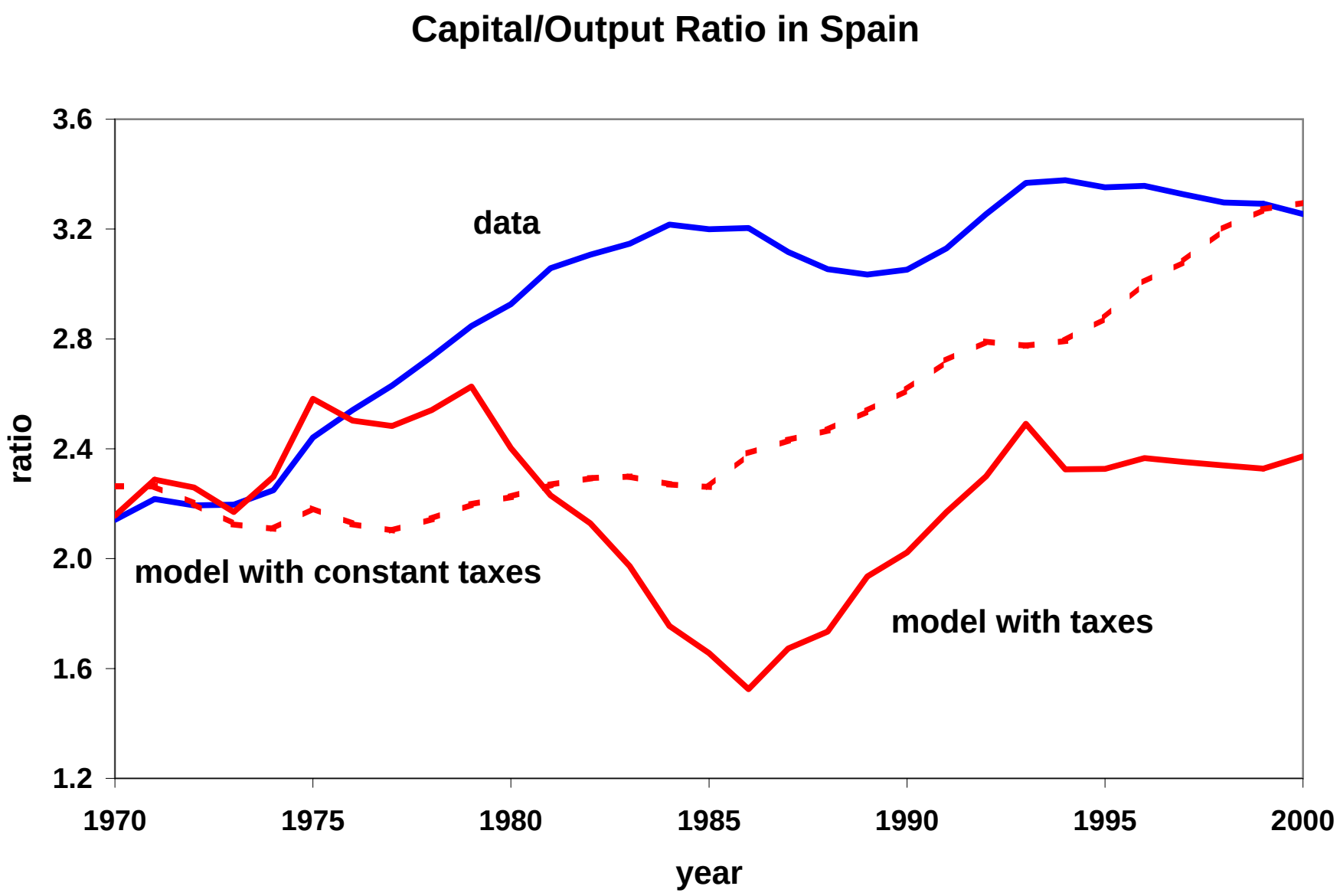

Real GDP per Working-Age Person in France
130
120
110
100
90
80
index (1970=100)
model with constant taxes
data
model with taxes
1970
1975
1980
1985
1990
1995
2000
year


Hours Worked per Working-Age Person in France
model with constant taxes
data
model with taxes
hours per week
28
26
24
22
20
18
16
14
1970
1975
1980
1985
1990
1995
2000
year


Capital/Output Ratio in France
4.0
3.6
3.2
2.8
2.4
ratio
1970
1975
1980
1985
1990
1995
2000
year
model with taxes
data
model with constant taxes


Detrended Real GDP per Working Age Person in Spain
140
130
120
110
100
90
80
70
60
index (1975=100)
1970
1975
1980
1985
1990
1995
2000
year
model with constant taxes
data
model with taxes


Hours Worked per Working Age Person in Spain
28
26
24
22
20
18
16
14
hours per week
1970
1975
1980
1985
1990
1995
2000
year
model with constant taxes
data
model with taxes


Capital/Output Ratio in Spain
3.6
3.2
2.8
2.4
2.0
1.6
1.2
ratio
data
model with constant taxes
model with taxes
1970
1975
1980
1985
1990
1995
2000
year