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Belgium: Selected Issues

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BELGIUM

Selected Issues

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Approved by the European I Department

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Contents Page

Tables

Text Boxes

Appendices

I. THE NAIRU AND POTENTIAL OUTPUT IN BELGIUM[1]

A. Introduction and Summary

1. The improved performance of the Belgian economy since 1996 has raised the possibility that sustainable growth may have risen. The assessment of potential growth is of considerable relevance for current economic policy in Belgium. The government's budgetary plans for the next five years are predicated on a trend growth rate of 2.5 percent, compared to an average over the past two decades of 2.2 percent. Higher trend growth is also the starting point of current projections of the cost of population aging, and thus of planned strategies to prepare for the demographic shock. Finally, assessment of demand pressures is important for judging inflation risks and the stance of fiscal policy.

2. This chapter gauges the cyclical position and potential growth rate of the Belgian economy. Most of the analysis focuses on separating cyclical developments from structural trends. As estimates of the cyclical position are crude, a number of methods are used, in order to provide an appreciation of the margin of uncertainty inherent in such estimates. A final section discusses the potential growth rate for the next five years.

3. Potential output is also measured for the three regions—Brussels, Flanders and Wallonia—to the extent possible given the availability of data. Cyclical developments are diverging among the different parts of the country and, as a result, aggregation may hide notable developments at the regional level. In particular, demand pressures in one region may not show up in nation-wide measures, but, given largely centralized wage-setting, repercussions on wages could spill over to other regions. Another reason to review regional cyclical developments is to assess the need to tailor policies to regional needs.

4. The main findings of this chapter are that the Belgian economy is currently operating at a level close to potential and that annual potential growth appears to be between 2¼ percent and 2½ percent. The NAIRU has fallen substantially in Flanders, whereas structural unemployment has remained very high in Wallonia and Brussels. Both Flanders and Wallonia were close to potential at end-2000, in contrast to positions of substantial excess demand at the peak of the previous business cycle. While trend growth has risen slightly above 2½ percent in 2000, this is unlikely to be sustainable over the medium-term, given adverse demographic shifts and in the absence of evidence of a productivity growth increase due to 'new economy' effects.

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[1] Prepared by Jan Kees Martijn and Marie-Odile Louppe, with contributions from Angel Ubide-Querol.

B. Estimates of Capacity and Demand Pressure

5. This section provides a number of complementary estimates of potential output and the output gap, variables that cannot be observed directly.[2] Four approaches are used: trend-based estimation, a production function approach, estimates derived from indicators of spare capacity, and a joint estimation technique for potential output and the NAIRU.[3] The NAIRU is a valuable concept in the analysis of cyclical pressure, as equilibrium unemployment links potential output with the available labor input. For example, in the production function approach, potential output is modeled as a function of the NAIRU, among other variables. An overview of the results is presented in Table 1, which shows trend growth, the output gap and the unemployment gap at end-2000.

6. Openness and wage interventions complicate assessment of the NAIRU, although they do not fundamentally undermine the concepts of potential growth and the output gap. For a small open economy within EMU, with tradables prices determined externally, it may be more appropriate to focus on the link between unemployment and nontradables prices or wages (resulting in a non-accelerating wage rate of unemployment, or NAWRU, estimate). Moreover, in Belgium the translation of cyclical pressures into wages has been affected much by government intervention aimed at wage moderation and the restoration of competitiveness.[4] Estimation is also hampered by hysteresis in unemployment developments. In light of these problems economists have tried to estimate equilibrium or natural unemployment for many European countries without making use of the price relation.[5]

Time-series and production-function estimates

7. Time-series and production-function estimates of potential output are closely related. The easiest approach to estimating the NAIRU and potential output is to smooth the actual unemployment and real output series. The production function links potential output to the trend evolution of the inputs, labor and capital, and assumed technological

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[2] The output gap is defined as actual minus potential output, in percent of the latter. For example, a "positive output gap" means that actual exceeds potential output (excess aggregate demand). For a more complete overview of the various methods, see Cerra and Saxena (2000).

[3] The unemployment gap is defined as the actual unemployment rate minus the NAIRU.

[4] Since 1976, the degree of wage intervention has increased; with the Recovery Law of 1976, wage limits from 1987-1992, the 1989 Competitiveness Law, and the 1996 Framework Law on Promoting Competitiveness. See Verlinden (1997).

[5] See Koning (1999), for example.

Table 1. Belgium: Estimates of the Output and Unemployment Gap in 1990 and 2000

Estimation procedure:	Trend Growth 2000	Output gap 1990	Output gap 2000	Unemployment gap 1991	Unemployment gap 2000
Hodrick Prescott filter					
100 (national labor data)	2.5	2.5	0.5	-2.4	-0.4
100 (harmonized data)				-2.7	0.1
200 (national labor data)	2.4	2.5	0.6	-2.6	-0.4
Elmeskov				-1.8	-0.5
OECD	2.6	3.4	0.3	-2.0	0.0
Production function, with unemployment based on:					
Hodrick Prescott filter (100)	2.6	2.5	0.8		
(and Central bank data for the capital stock)	2.6	2.6	0.7		
Hodrick Prescott filter (200)	2.6	2.6	0.8		
Elmeskov	2.8	2.0	0.9		
OECD NAWRU	2.7	2.3	0.7		
Spare Capacity indicators[1]					
Unemployment gap	2.3	2.3	1.1		
Capacity utilization	2.6	0.3	0.4		
Joint estimate[1]	2.5	1.7	-0.7	-2.6	1.0

Source: Fund staff calculations.
[1]Data for the second quarter of 2000.

progress. While adding to the understanding of the factors underlying potential output, this basically shifts the issue of smoothing from overall output to the individual arguments of the production function.

8. Time-series estimates of potential output and the NAIRU were derived using the Hodrick-Prescott filter.[6] A Cobb-Douglas production function was used to decompose output, with labor input modeled as the product of working-age population, the participation rate, one minus the unemployment rate, and average hours worked per person. To determine potential output, the unemployment rate was replaced by the NAIRU, and the other arguments—including total factor productivity, but excluding the working-age population and the capital stock—by their trend levels. In addition to the HP filter and the OECD NAWRU, Elmeskov's (1993) approach was also applied to determine trend unemployment. For this method, wage inflation is assumed to be proportional to the difference between

[6] The well-known problems related to the Hodrick-Prescott filter include the end-of-sample bias and the arbitrary choice of the detrending parameter.

actual unemployment and the NAIRU (or, more accurately, the NAWRU), while also assuming that the NAWRU does not change significantly from year to year.

9. From the trend and production-function based estimates it appears that both cyclical and structural changes underpinned the improved growth performance of 1996–2000. From a cyclical perspective, the higher growth entailed a recovery from the large unemployment and output gaps that had opened up during the 1991–93 downturn (Table 1, and Figures 1 and 2). Both gaps were closed in 1999 or 2000. This result agrees with the OECD's estimates, which are also reported. The estimates also indicate that potential growth edged up to between 2.4 percent and 2.8 percent by 2000, while the NAIRU declined from 12½ percent in 1995 to about 11 percent.[7]

10. The main source of the recent pick up of actual and potential growth (so estimated) has been the decline in unemployment. A decomposition of actual and potential growth is presented in the Tables 2 and 3, which also indicates that smaller contributions resulted from higher total factor productivity growth and a slower decline of average working hours per person. The most important structural trends over the past three decades are the gradual end of the growth of the working-age population, which has been broadly offset by an increasing participation rate and lower unemployment. Overall trends in participation reflect the balance of rising female participation, especially in part-time jobs, and a declining male participation rate. The latter development has reflected the introduction of extensive early retirement schemes and a special unemployment regime for older workers that does not require job search. There has also been a striking decline of participation rates of those below 25 years of age, with youth leaving school later than in other EU countries. Increases in part-time employment and a gradual reduction in the workweek have had a consistently negative, though diminishing, effect on labor supply.

Spare capacity indicators

11. To derive potential output from indicators of spare capacity, following Bayoumi (2000), output, Y_t, is modeled as a function of slack, X_t, and a polynomial time trend:

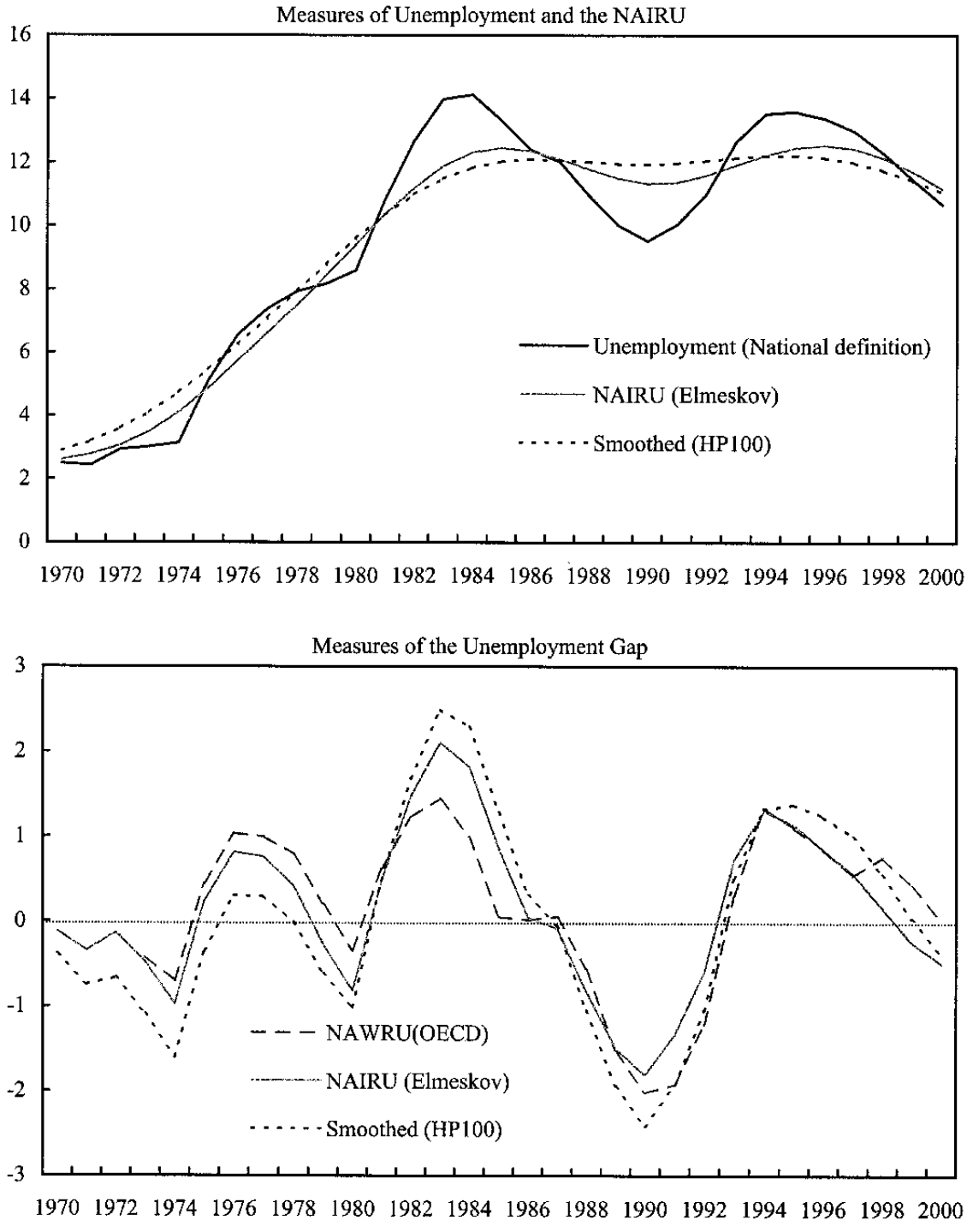
$$\log(Y_t) = \alpha + \beta X_t + \gamma_1 t + \gamma_2 t^{(1/2)} + \gamma_3 t^{(1/3)} + \epsilon_t \qquad (1)$$

Capacity utilization and the unemployment gap—with the NAIRU computed using an HP-filter—are used as indicators of slack.[8] Alternative power sequences of time trends were

[7] This figure is based on the national definition of unemployment and corresponds to a NAIRU of about 8½ percent on a harmonized basis.

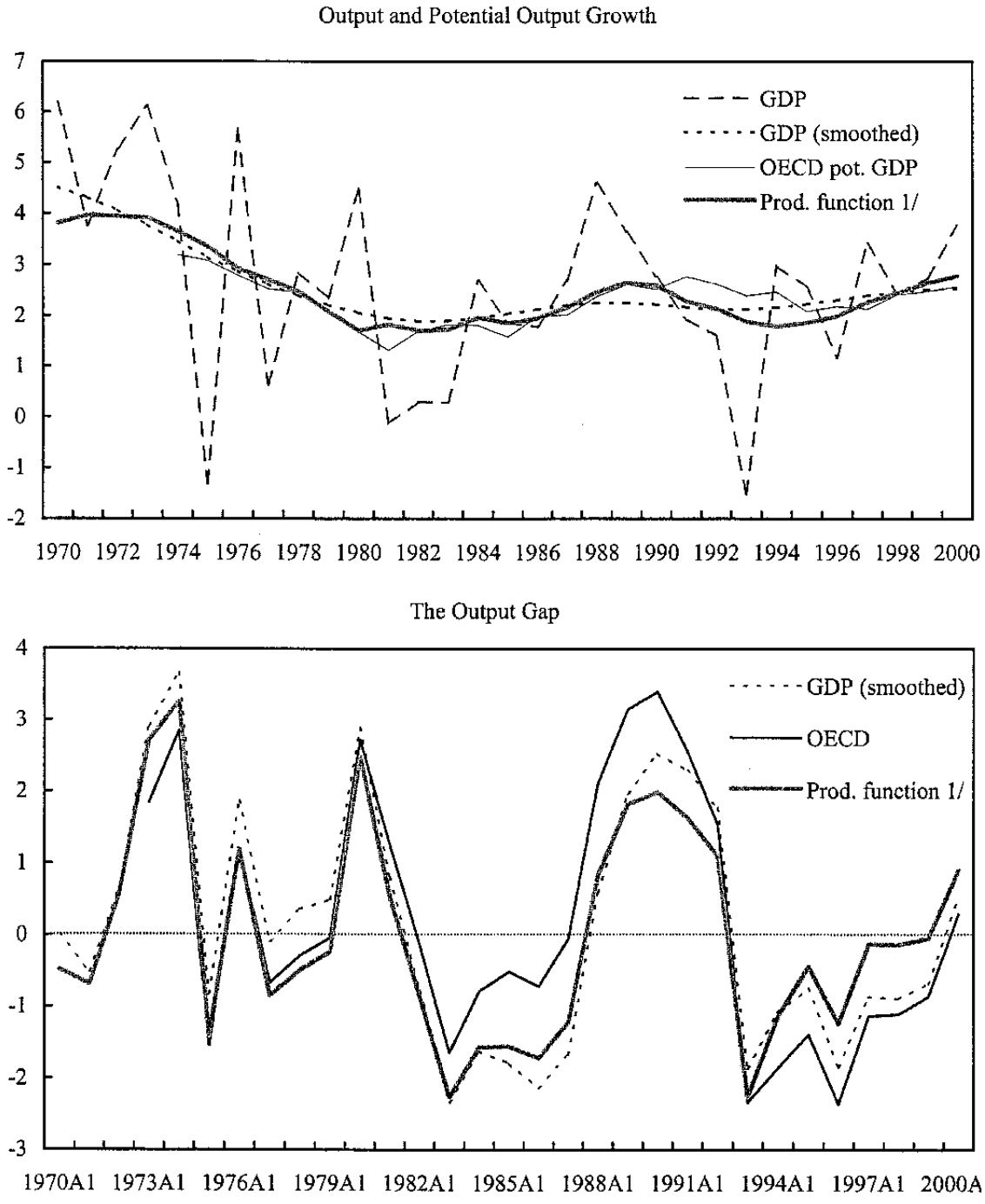
[8] The choice of indicators of spare capacity was dictated by the availability of data on a quarterly basis for a sufficiently long period. Since capacity utilization has an upward drift, the deviation from trend was used.

Figure 1. Belgium: Unemployment and the Unemployment Gap, 1970-2000
(In percent)



Source: Data provided by the authorities, OECD Analytical Database, and Fund staff calculations.

Figure 2. Belgium: GDP Growth and Output Gap--based on Trends and a Production Function,1970-2000
(In percent)



Source: Data provided by the authorities, OECD Analytical Database, and Fund staff calculations.
1/ Cobb-Douglas production function, with NAIRU based on Elmeskov approach.

Table 2. Belgium: Contribution to GDP Growth
(In percent)

Year	Actual	Decomposition of growth					
		POP	LF/POP	UN	HRS/PERS	CAP	TFP
1995	2.6	0.0	0.5	0.0	-0.1	0.8	1.3
1996	1.2	0.0	0.1	0.2	0.0	0.9	0.0
1997	3.4	0.0	0.2	0.3	-0.2	0.9	2.2
1998	2.4	0.0	0.3	0.5	-0.2	1.0	0.9
1999	2.7	0.0	0.2	0.6	-0.1	1.0	1.0
2000	3.8	0.1	0.4	0.6	0.0	1.1	1.7
1970-80	3.6	0.4	0.2	-0.4	-0.9	1.3	3.1
1981-90	2.0	0.2	0.0	-0.1	-0.2	1.0	1.2
1991-95	1.5	0.1	0.5	-0.6	-0.2	1.0	0.8
1996-2000	2.7	0.0	0.2	0.4	-0.1	1.0	1.1

Source: Fund staff estimates.

Table 3. Belgium: Contribution to Potential Growth
(In percent)

Year	GDP growth			Decomposition of potential growth					
	Actual	Smoothed	Potential	POP	LF/POP	UN	HRS/PERS	CAP	TFP
1995	2.6	2.2	2.0	0.0	0.3	0.0	-0.1	0.8	1.0
1996	1.2	2.3	2.1	0.0	0.3	0.1	-0.1	0.9	1.0
1997	3.4	2.4	2.3	0.0	0.3	0.1	-0.1	0.9	1.1
1998	2.4	2.5	2.4	0.0	0.3	0.2	-0.1	1.0	1.1
1999	2.7	2.5	2.5	0.0	0.3	0.2	-0.1	1.0	1.1
2000	3.8	2.5	2.6	0.1	0.2	0.3	-0.1	1.1	1.1
1970-80	3.6	3.2	3.1	0.4	0.1	-0.4	-0.8	1.3	2.6
1981-90	2.0	2.1	2.1	0.2	0.0	-0.2	-0.3	1.0	1.3
1991-95	1.5	2.2	2.1	0.1	0.3	0.0	-0.1	1.0	1.0
1996-2000	2.7	2.4	2.4	0.0	0.3	0.2	-0.1	1.0	1.1

Source: Fund staff calculations.

tried, but did not improve the fit. On the assumption that the error term, ϵ_t, reflects changes in potential output (Y^{pot}) rather than cyclical disturbances, it follows that

$$\log (Y_t^{pot}) = \log (Y_t) - \beta X_t \qquad (2)$$

The annualized rate of potential growth was calculated as a moving average over the previous four years, in view of the volatility of the derived estimate of potential output.

12. The trend growth and output gap estimates based on the unemployment gap are broadly similar to those derived using a production function, although the potential growth series is more volatile. The outcome of the exercise is illustrated in Figure 3, and the full regression results are shown in Appendix B. By contrast, output gaps derived using capacity utilization are much smaller than those from the production function. This reflects the fact that this measure of slack does not explain much of the fluctuation in actual output. Given that the approach attributes the remaining part of output variation (the estimated error term) to changes in potential output, this part of output variation does not show up in the output gap.

Joint estimates of potential output and the NAIRU

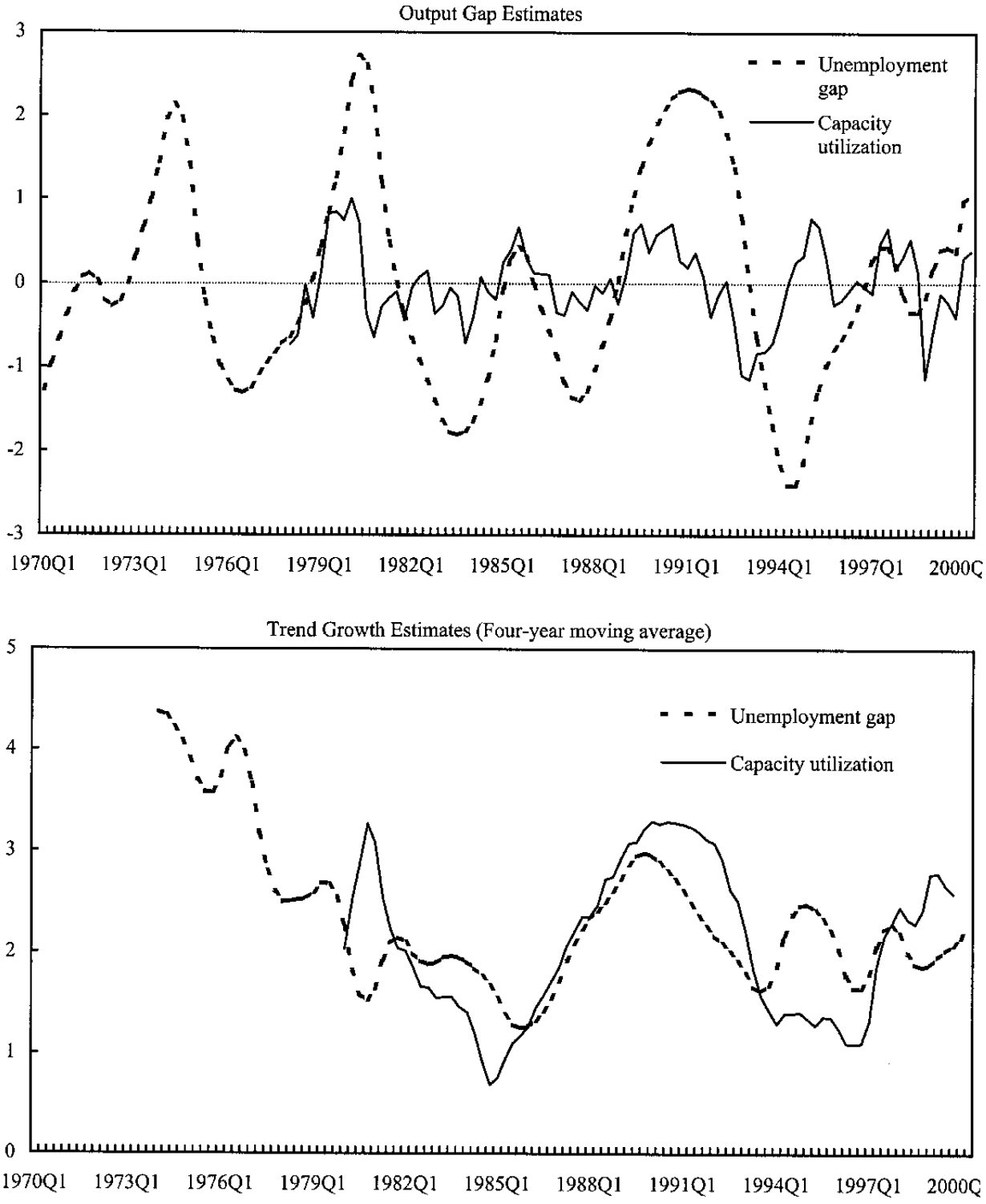
13. A drawback of the above calculations is that the mutual dependence of the output and unemployment gaps is not taken into account. Both the production function and the spare-capacity approach are based on an exogenously determined measure of the unemployment gap. A useful alternative that provides a joint estimate of potential output and the NAIRU, based on Okun's Law and a Phillips Curve relationship, is the unobserved components model of Apel and Jansson (1997) (Box 1).

14. Joint estimates of potential output and the NAIRU, presented in Figure 4, suggest that at mid–2000 the cyclical improvement had not yet resulted in the complete elimination of the output and unemployment gaps. Notably, the Apel-Jansson model indicates an earlier decline of the NAIRU than the trend-based or Elmeskov methods. At a technical level, this reflects the use of the Phillips relation: there has been little inflation during the current upswing, implying that unemployment had not fallen below the NAIRU. The interpretation is that either the NAIRU is lower than its trend suggests, or that inflationary pressures have been tempered by an exogenous factor other than oil or import prices (which were controlled for in the estimation).[9] Still, like the other estimates, the output gap for 2000 is not significantly different from zero.

15. A comparison with developments during the previous cyclical upturn, at the end of the 1980s, is illuminating. After the unemployment rate started to decline in the course of

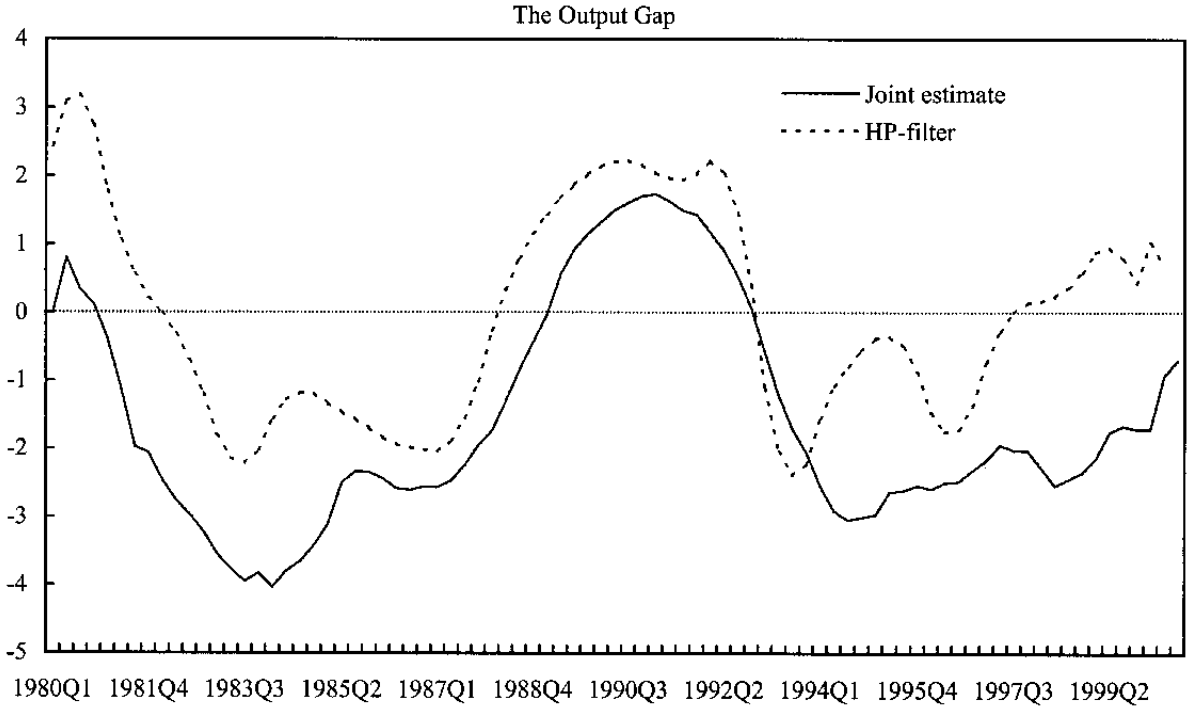
[9] A similar difference between trend-based and Apel-Jansson-based estimates of the output gap was recently found for France, see Ubide-Querol (2000).

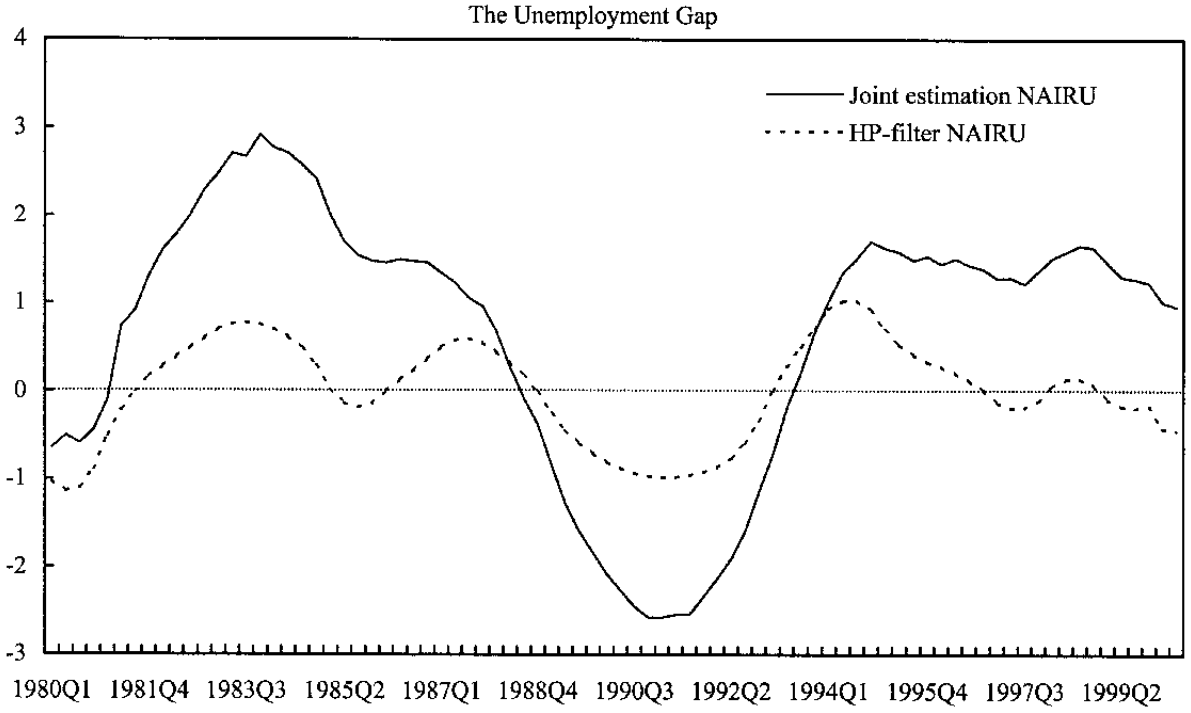
Figure 3.Belgium: GDP Growth and the Output Gap--Estimates Based on Spare Capacity
(In percent)



Source: Fund staff calculations

Figure 4. Belgium: Output and Unemployment Gap--based on joint estimation, 1980-2000





Source: Fund staff calculations.

Box 1. The Joint Estimation of Potential Output and the NAIRU

Apel and Jansson (1999) propose a procedure for joint estimation of the unobserved potential output and NAIRU variables, based on the Phillips curve for identifying capacity limits. Formally, the model reads (with the equations presented directly in their empirical format):

$$\Delta\pi_t = \sum_{i=1}^{I} \rho_i \Delta\pi_{t-i} + \sum_{j=0}^{J} (u_{t-j} - \bar{u}_{t-j}) + \sum_{k=0}^{K} \omega_k z_{t-k} + \varepsilon_{1t} \quad (1)$$

$$y_t - y_t^p = \sum_{l=o}^{L} \phi_l (u_{t-l} - \bar{u}_{t-l}) + \varepsilon_{2t} \quad (2)$$

$$\bar{u}_t = \bar{u}_{t-1} + \varepsilon_{3t} \quad (3)$$

$$y_t^p = \alpha + y_{t-1}^p + \varepsilon_{4t} \quad (4)$$

$$u_t - \bar{u}_t = \sum_{m-1}^{M} \delta_m (u_{t-m} - \bar{u}_{t-m}) + \varepsilon_{5t} \quad (5)$$

where π_t is the log difference of the CPI, u_t the unemployment rate, $\bar{u}_t$ the NAIRU, z_t exogenous (supply-shock) variables, y_t the log of real output, and y_t^p the log of potential output. The error terms ε_{1t}, ε_{2t}, ε_{3t}, ε_{4t}, and ε_{5t} are assumed to be IID distributed.

The model incorporates the Phillips curve (equation (1)) and Okun's Law (equation (2)), and assumes that the NAIRU and potential output are characterized by stochastic trends (equations (3) and (4)). Equation (5) specifies the evolution of cyclical employment to close the model. Following Apel and Jansson, z_t includes relative import prices and the relative oil price (both deflated by the CPI), the exchange rate, and productivity. The model is estimated using the Kalman filter.

1987, inflation picked up in the second quarter of 1988. Accordingly, by mid–1988 the estimated unemployment gap was closed, with a NAIRU of 8.9 percent (harmonized unemployment). Wages remained stable until the 1990–91 wage settlement, which featured annual increases by more than 7 percent. Turning to recent years, while the unemployment rate has declined steadily since 1995, there was no significant pick up of inflation until the beginning of 2000—a price hike fully explained by sharply rising import prices.

Regional estimates

16. Diverging trends among the regions within Belgium reflect the very low degree of interregional labor mobility and the distinct sectoral characteristics and economic history of the different parts of the country.[10] Wallonia still has not recovered from the downturn of its large iron, steel, and metal products industries. These declining industries featured less prominently in Flanders, which, moreover, harbors a flourishing service sector. Limited data availability restricts the scope for replicating at the regional level the exercises presented for the national level. In particular, there are no regional data on the capital stock, and output data are available only at annual frequency. In the absence of regional capital stock data, for the production-function estimates the contributions to production growth of capital and total factor productivity have been combined, and derived as a residual. In determining potential growth, this combined term was replaced by its trend using an HP filter.

17. The trend unemployment rate, measured with a Hodrick-Prescott filter on the actual rate, has fallen sharply in Flanders, whereas in Wallonia trend unemployment has stabilized at a very high level (Figure 5). This divergence is mirrored by diverging patterns of potential growth among the regions (Figure 6). In Flanders, potential growth rose to 2.6 percent during 1996–2000, whereas in Wallonia it remained at about 2 percent. The causes of this disparity are presented in terms of the arguments of the production function in Table 4. In addition to different unemployment performance, the combined growth contribution of capital and productivity has also added to the divergence in potential growth rates. In other words, trend labor productivity increased faster in Flanders than in Wallonia.

18. The estimated unemployment and output gaps do not indicate a serious overheating threat; even for Flanders the gap estimates for mid–2000 are not significantly different from zero. A similar pattern was found for Wallonia, reflecting a small drop in unemployment relative to a stable trend. The elimination of the labor-market gap in Flanders is consistent with recent reports of increasing labor shortages there, which are corroborated by a sharp increase in vacancies.

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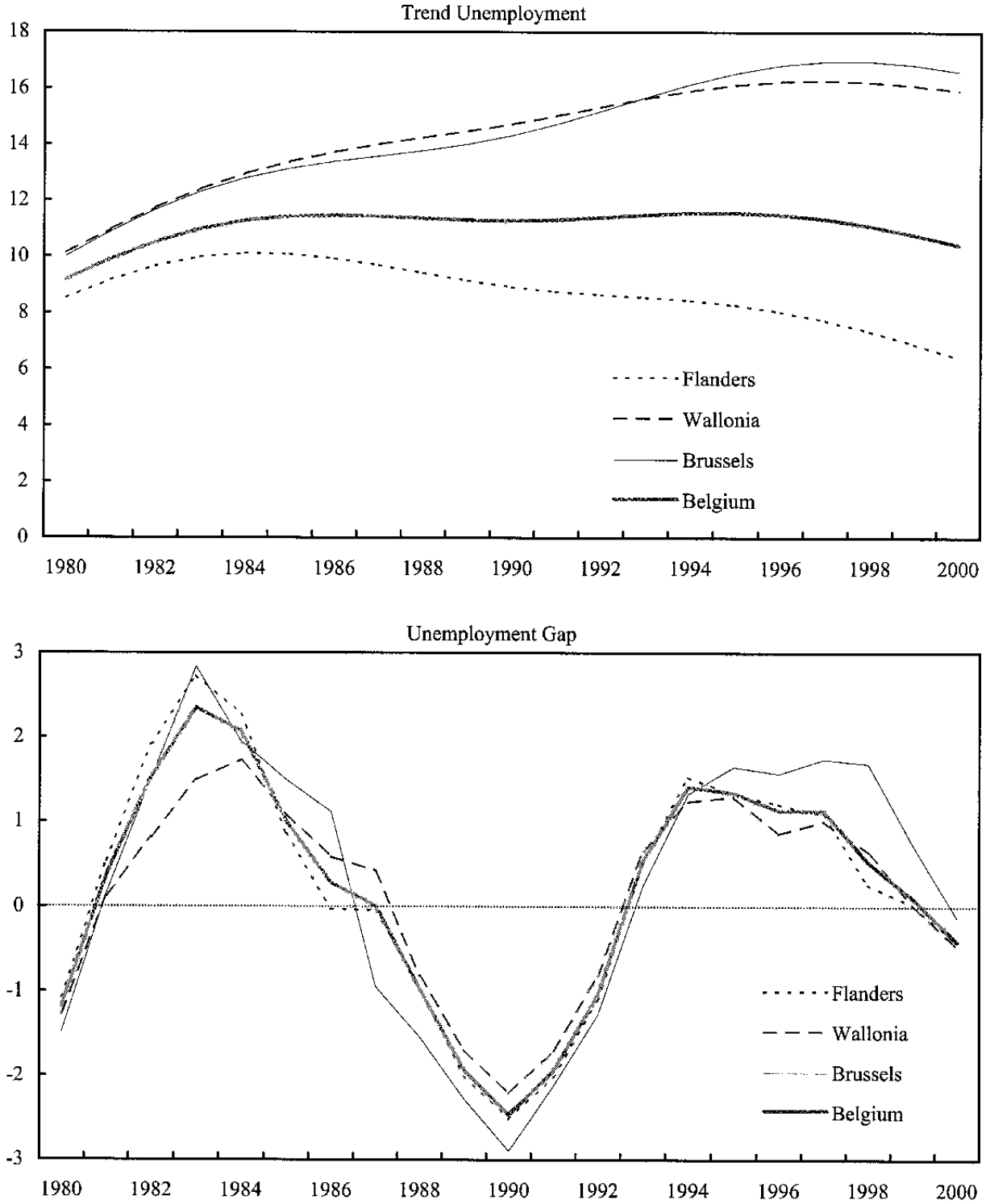
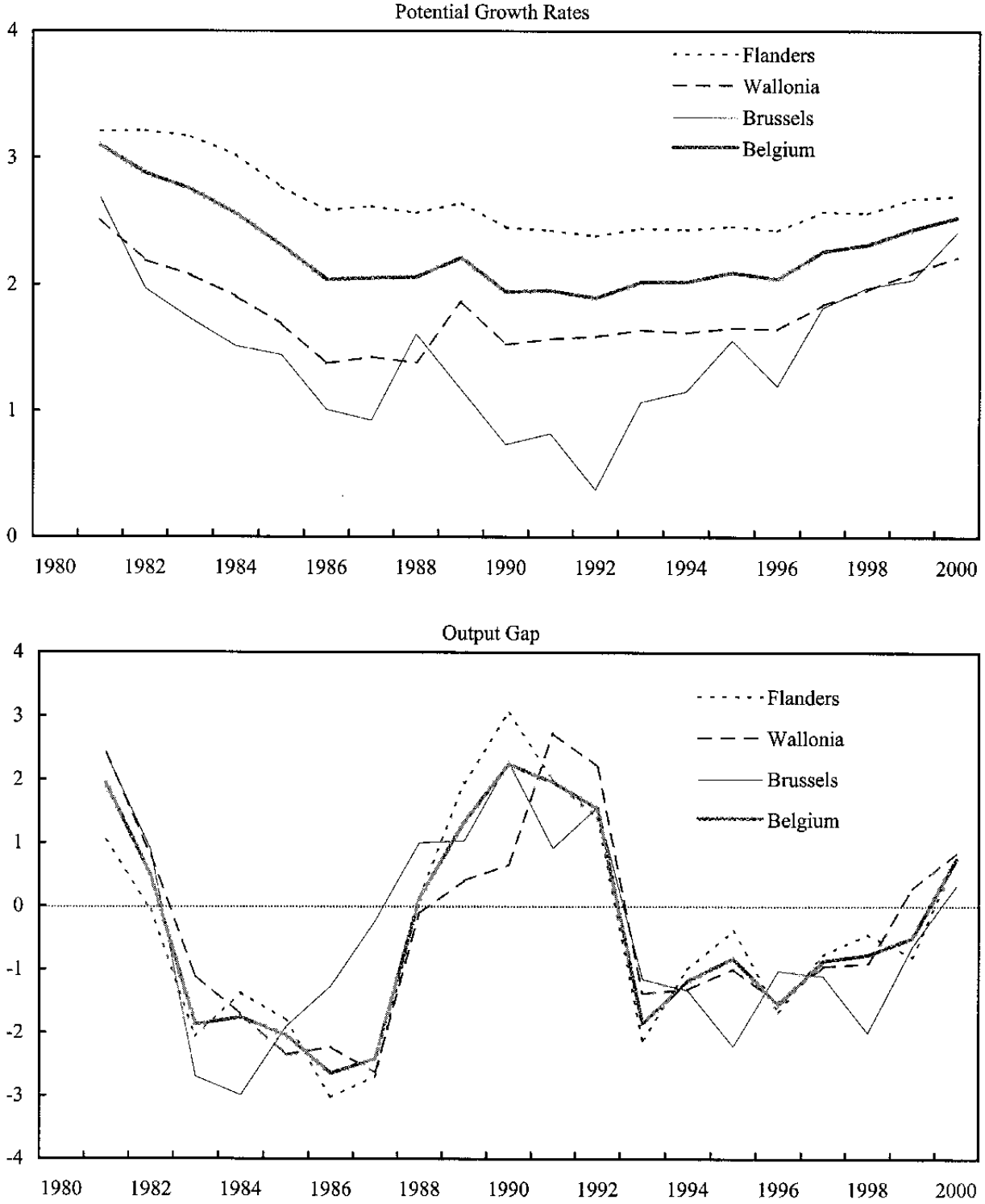
[10] There are also marked differences in economic developments within each region. Analysis of intraregional divergences is, however, beyond the scope of this chapter.

Figure 5. Belgium: Measures of Regional Unemployment, 1980-2000 1/
(In percent)



Source: Data provided by the authorities, Eurostat, and Fund staff calculations.
1/ With the NAIRU based on an HP filter.

Figure 6. Belgium: Potential Growth and the Output Gap by Region, 1980-2000 1/
(In percent)



Source: Data provided by the authorities, Eurostat, and Fund staff calculations.
1/ With potential output based on regional labor input (with the NAIRU derived using an HP filter), and trend labor productivity.

Table 4. Belgium: Contribution to Regional Potential Growth

(In percent)

	GDP Growth			Decomposition of Potential Growth				
	Actual	Smoothed	Potential	POP	LF/POP	UN	HRS/PERS	CAP and TFP
Belgium								
1990-1995	1.6	2.1	2.0	0.1	0.3	0.0	-0.2	1.8
1996-2000	2.6	2.4	2.3	0.0	0.3	0.2	-0.1	2.0
Flanders								
1990-1995	2.1	2.5	2.4	0.1	0.3	0.1	-0.2	2.1
1996-2000	2.8	2.6	2.6	0.0	0.2	0.3	-0.1	2.2
Wallonia								
1990-1995	1.4	1.7	1.6	0.0	0.4	-0.3	-0.2	1.6
1996-2000	2.3	2.1	1.9	0.0	0.4	0.0	-0.1	1.7
Brussels								
1990-1995	0.4	1.1	0.9	-0.3	0.3	-0.2	-0.2	1.2
1996-2000	2.4	1.9	1.9	0.2	0.2	0.0	-0.1	1.7

Source: Fund staff calculations.

C. Assessing the Scope for Future Growth

19. A tentative assessment suggests that potential growth during the 2001–05 period is in the 2¼ to 2½ percent range. Potential growth rose to 2.4 percent on average during 1995-2000, and reached 2.6 percent in 2000. The evolution of the components of the production function provide a useful starting point for evaluating the scope for future economic growth. Unless a fairly optimistic assessment is made of the likely evolution of TFP, capital, and labor input, there will be a slowdown in potential growth. In short, the future course of the demographics and, to a lesser extent, the likely changes in the NAIRU, workweek, and capital accumulation, indicate that for the medium-term, 2½ percent trend growth should be seen as an upper estimate. Such evaluations are, of course, subject to important caveats, for example regarding the effectiveness of labor market policies and ongoing social changes, such as increasing female labor participation.

20. Starting with the growth contribution of TFP, it is hard to predict whether the small increase in productivity growth recorded in recent years indicates the advent of a "new economy." While trend TFP growth accelerated slightly in recent years, this has been a

common feature of cyclical upswings.[11] In addition, there appears to be little evidence that a "new economy" is boosting productivity growth in Western Europe more generally.[12]

21. The growth contribution of capital accumulation is likely to return to its trend. This contribution has steadily increased since 1994, as the investment ratio has risen to about 16 percent—its peak level during the previous boom, recorded in 1990.[13] High capacity utilization and profitability and low long-term real interest rates are projected to result in a further increase in the investment ratio in 2001. Beyond that year, however, a return to historical levels could be expected, which would imply an average growth contribution during 2000–05 of about 1.0 percentage point—in line with the 1995–2000.

22. Some slowdown in the growth of effective labor input, the third argument of the production function, also appears likely. The evolution of labor input can be analyzed in four steps.

- Pure demographic changes are a relatively predictable factor. There are two major factors to consider: the total working-age population, and its changing composition by age group. The net effect is to reduce annual potential output growth by 0.1 percentage points (Table 5).[14] Total working-age population is expected to increase slightly over the 2001–05 period, by 0.2 percent a year on average, following five years of virtually no growth. For a given participation rate, this would boost annual GDP growth by 0.1 percentage point. However, this will be more than offset by the effects of aging within the working-age population. The share of the total working-age population of those between 20–55 years old is expected to decline from 75.4 percent in 2000 to 73.8 percent by 2005. Given the very low employment rates of those below 20 years or above 55 years of age, this would lower the participation rate by 1 percentage point from 2000 to 2005 and reduce GDP growth —relative to the previous five-year period—by 0.2 percentage points a year on average.

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[11] During 1996–2000, average annual trend TFP growth was 0.05 of 1 percentage point above its level during the previous five years. During the upswing of the late 1980's, the increase amounted to 0.03 of 1 percentage point.

[12] See Estevão (2000) and van Ark (2000).

[13] Potential growth is based on actual rather than trend capital accumulation.

[14] These calculations assume unchanged participation rates by age group and by sex from the latest observation.

Table 5. Belgium: Demographics, Participation, and Growth 1/
(In percent)

	Working-age population		Population aging		Participation rate by cohort	Overall participation rate		Participation level
	Growth	GDP growth Effect (1)	Ratio 20-55 to total 2/	GDP growth Effect 3/ (2)	GDP growth effect (3)	Level	GDP growth effect (4)=(2)+(3)	GDP growth effect (5)=((1)+(4)
1995	0.0	0.0	74.4	0.1	0.3	64.4	0.4	0.4
1996	0.0	0.0	74.7	0.1	0.1	64.6	0.2	0.2
1997	0.0	0.0	75.1	0.1	0.2	64.9	0.3	0.3
1998	0.0	0.0	75.3	0.0	0.1	65.0	0.1	0.1
1999	0.1	0.0	75.3	0.0	0.2	65.0	0.2	0.2
2000	0.1	0.1	75.4	0.0	0.4	65.0	0.4	0.4
2001	0.4	0.2	75.3	-0.1		64.9	-0.1	0.2
2002	0.2	0.2	75.0	-0.2		64.7	-0.2	0.0
2003	0.1	0.1	74.6	-0.2		64.5	-0.2	-0.1
2004	0.1	0.1	74.2	-0.3		64.3	-0.3	-0.2
2005	0.2	0.2	73.8	-0.3		64.0	-0.3	-0.2
Averages								
1991-1995	0.1	0.1	74.0	0.2	0.2	63.8	0.4	0.4
1996-2000	0.0	0.0	75.1	0.0	0.2	64.9	0.2	0.3
2001-2005	0.2	0.1	74.6	-0.2		64.5	-0.2	-0.1

Source: Data provided by the authorities and Fund staff calculations. Labor force data include unemployment as defined by the Ministry of Employment, exlaining a small difference with participation effects mentioned in Table 1, based on the national definition.

1/ GDP growth effects are derived using a Cobb-Douglas production function with a labor input coefficient of 0.67.

2/ The ratio of the 20-55 age group over the 15-65 group serves as a proxy for relevant population aging.

3/ The data reflect changes in the distribution of the working-age population over cohorts (defined by age group and sex). As older cohorts have lower participation rates, population aging reduces overall participation.

- Although participation rates per age cohort may well continue increasing, this is unlikely to compensate fully for the negative net demographic shock. Over the previous five-year period, higher participation within each cohort (defined by age-group and sex) added 1 percentage point to the participation rate and 0.2 percentage point to average annual output growth. It is hard to project to what extent this contribution will be repeated in the medium-term future. On the one hand, in the recent past, participation may have benefited from an encouraged worker effect. On the other hand, several new policies aim to encourage participation, including a plan for starter jobs (introduced in 2000), restrictions on the special unemployment regime

for older workers (to be introduced in 2001), and a workers tax credit to reduce unemployment trap problems (starting in 2002). Of particular importance is the effect of the increase in the pensionable age for women. The Federal Planning Bureau (2000) has projected that between 1999 and 2005 this measure alone will account for almost 0.1 percentage point annual increase in potential labor supply.[15] Overall, and in spite of the negative demographic effect, the Bureau projected an average increase in the (actual) labor force by almost 0.2 percentage points a year during this period, only slightly less than during 1995–99.

- It is unlikely that the NAIRU will decline more during the next five years than it has during the 1996-2000. The improvement recorded during the latter period amounted to between 0.5 (OECD) and 1.2 (HP filter) percentage points. This resulted almost exclusively from a 2 percentage point (HP filter) fall in the NAIRU in Flanders to about 6¾ percent (5½ percent on a harmonized basis). The latter figure is not far from unemployment rates of booming countries like the Netherlands (with a 4½ percent harmonized NAWRU according to the OECD). Although there is ample scope for the NAIRU in Wallonia and Brussels to go down, such trend is not evident yet.

- Finally, a gradual shortening of working hours is likely to continue to dampen effective labor supply. The 2001–2002 interprofessional agreement proposed a reduction of the maximum workweek from 39 to 38 hours by 2002 and accepted government proposals for more extensive individual leave schemes. These initiatives suggest a further reduction in average working hours. The labor supply effect of new leave schemes for older workers is more ambiguous, as workers could be motivated to remain in the workforce longer.

23. Beyond 2005, demographic projections suggest a further slowdown in potential growth. The working-age population is expected to contract at an accelerating pace, on average by 0.2 percent between 2006 and 2020, and by 0.6 percent between 2020 and 2030. The share of those between 20 and 55 years of age relative to the total working-age population would decrease from 74 percent in 2005 to 69½ percent by 2020, and recover slightly thereafter. Together, these developments would imply an average slowdown in economic growth by 0.5 percent during 2006–30 relative to 1991–2000. Increasing employment by age cohort could offset them, however, to this negative shock. For example, the Lisbon agreement aims to raise the employment rate to 70 percent by 2010. Applied to Belgium, this would imply an increase of 11 percentage points from the rate in 2000. Attaining this very ambitious target would contribute more than a percentage point to the potential growth rate, more than offsetting the ageing effect.

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[15] The Bureau defined potential labor supply as the sum of the labor force, those in early retirement schemes, and the older unemployed on the special unemployment regime.

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Data Sources

24. Trend and production functions were calculated using annual data for 1970–2000 (for the regions, 1980–2000). Trends were obtained using an HP-filter, with a smoothing coefficient of 100, unless mentioned otherwise. OECD data were used for the capital stock; using central bank estimates did not materially alter the results. Data on working-age population were provided by the central bank. Unemployment and employment data were based on the national definition and provided by the central bank. Data on working hours per person were provided by the authorities for the period from 1983 onwards; for earlier years, a matching series was derived from data in: Ministere Federal de l'Emploi et du Travail (1999), *Salaires et Durée de Travail*, Table 5.1.

25. The regional NAIRU estimates in Figure 4 are based on employment recorded by location of the employee. Data on employment and unemployment were provided by the Ministry of Employment. The potential output estimates per region use employment recorded by location of the workplace, in order to match the output data. Output at the regional level is measured by value added created within the region, including by commuters from other regions. Data for 1985–97 are available from the Regional Accounts published by the National Accounts Institute. Extended series were provided by the KBC bank. Data on working-age population by region were provided by the National Statistics Institute.

26. The estimation of potential output using indicators of slack, was based on quarterly data1970:Q1 to 2000:Q2, using OECD data for real GDP, unemployment, and capacity utilization. The smoothing coefficient for the HP-filter for detrending unemployment and capacity utilization was set at 1600.

27. The Apel-Jansson model was estimated using quarterly data for 1970:Q1 to 2000:Q2. OECD *Analytical Database* data were used for GDP and productivity, unemployment and import prices. The CPI and oil prices was taken from the IMF's *International Financial Statistics*.

28. Calculations of demographic effects on labor supply were made using population data provided by the authorities.

Spare Capacity-Based Regressions of the Unemployment Gap[1]

	Unemployment gap	Capacity utilization
Unemployment gap	-0.023	
	(9.963)	
Capacity utilization		-0.003
		(2.733)
Time trend	0.007	-0.023
	(8.774)	(2.098)
Time trend to the power one-half	-0.126	1.992
	(3.654)	(2.721)
Time trend to the power one-third	0.304	-4.606
	(4.543)	(2.771)
Adjusted R^2	0.995	0.987
DW	0.161	0.112

Source: Fund staff calculations.

[1]The sample period is 1970:Q1 (or 1978:Q1 for regressions including capacity utilization) to 2000:Q2. T-statistics are presented in parentheses, with one or more asterisks indicating significance at the 5 and 1 percent level, respectively.

II. The Effect of Tax Changes on Belgian Employment[1]

A. Introduction

29. Belgian employment has been increasing at a rapid clip for some years, following a brief decline in the early 1990s, and the pace has even accelerated somewhat in the last four years. Private sector dependent employment grew, on average, by 1.2 percent a year between 1994 and 1999, well above the average 0.4 percent growth of the previous expansion (Table 1). To some extent, this record reflects a pickup in aggregate economic activity, but it may also be due to changes in taxation implemented after 1993 aimed at reducing firms' labor costs and thereby stimulating labor demand. This chapter examines the effect of these tax changes on employment.

Table 1. Belgium: Recent Labor Market Performance
(Annual change over the period indicated, in percent)

	1982-91	1991-94	1994-99	1997-99
Total employment	0.48	-0.53	0.86	1.24
Dependent employment	0.33	-0.79	1.09	1.66
Public administration	0.11	-1.04	0.75	0.98
Other sectors	0.40	-0.71	1.19	1.86
Self-employed	1.21	0.61	-0.15	-0.61
Unemployment rate change at an annual rate	-0.55	1.14	-0.19	-0.17
Labor productivity	1.85	1.53	1.57	1.36

Source: Banque Nationale de Belgique.

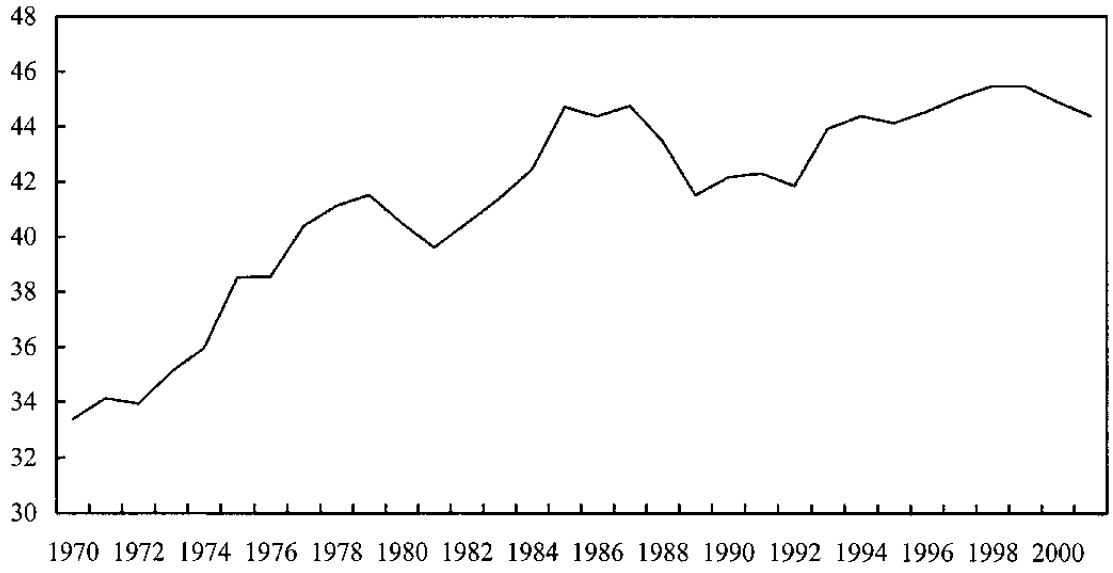
30. Tax policy since 1993 might, on theoretical grounds, be expected to have boosted the labor intensity of production, thus stimulating employment beyond what would be expected from output increases alone. The effect of this policy would depend on, among other parameters, its effect on wage negotiations and the elasticity of labor demand with respect to changes in labor costs. This chapter first describes in detail tax changes of the last twenty years in Belgium and their effect on aggregate tax measures. It then outlines a theory of wage bargaining and employment determination in which it takes income taxes and social security contributions explicitly into account. Finally, simulations present estimates of the effect on employment of the tax changes implemented since the 1980s.

[1] Prepared by Marcello Estevão.

B. Tax Changes in the Last Two Decades

31. In Belgium, tax revenues including social security contributions rose from 33 percent of GDP in 1970 to about 45 percent in 1999 (Figure 1). (This upward trend was not unique to Belgium, and indeed it broadly mirrors the pattern in other continental European countries.) In addition, direct taxation on individuals and corporations (income taxes, corporate taxes, and social security contributions) has risen sharply relative to GDP since 1970, whereas indirect taxes have remained roughly constant (Table 2). Since 1993, the rise in the tax burden has slowed markedly, as an increase of 2.5 percentage points of GDP in corporate and indirect taxes was partly offset by a leveling of direct taxation on individuals and a reduction of 1 percentage point of GDP in social security contributions by employers and employees. Thus, a period of several years of rising taxes on individuals and labor has been followed by a period when the tax burden has shifted somewhat to consumption and, perhaps, to corporations. This recent trend seems set to continue: the government cut social security contributions in 2000, and according to official estimates they will fall again as a percentage of GDP in 2001. Also, a tax package of cuts in individuals' income tax rates through 2006 was introduced in October 2000.

Figure 1. Belgium: Tax and Social Security Revenues
(Percentage of GDP)



Source: Belgian authorities and Fund staff calculations. Observations for 2000 and 2001 are based on authorities' estimates.

Table 2. Belgium: Composition of Tax and Social Security Revenues in Selected Years
(Percentage of GDP)

	1970	1980	1989	1993	1999	1999-93	2000[e]	2001[e]
Total	33.4	40.5	41.5	43.9	45.4	1.5	44.9	44.4
Taxes on income, profits, capital gains, and property	10.4	17.1	15.6	16.3	17.6	1.3	17.6	17.5
Individuals	n.a.	n.a.	12.9	13.8	13.7	-0.1	13.7	13.6
Corporations and residual	n.a.	n.a.	2.7	2.5	3.9	1.4	3.9	3.8
Taxes on goods and services	13.4	11.4	11.6	12.2	13.3	1.1	13.2	13.1
VAT	n.a.	6.6	6.4	6.2	6.9	0.7	n.a.	n.a.
Social security contributions	9.5	12.0	14.2	15.4	14.5	-0.9	14.1	13.8
Employees	n.a.	n.a.	8.9	9.5	8.8	-0.6	8.7	n.a.
Employers	n.a.	n.a.	4.3	4.7	4.4	-0.2	4.2	n.a.
Self-employees	n.a.	n.a.	1.1	1.3	1.3	-0.1	1.2	n.a.

Source: Belgian authorities and Fund staff calculations.

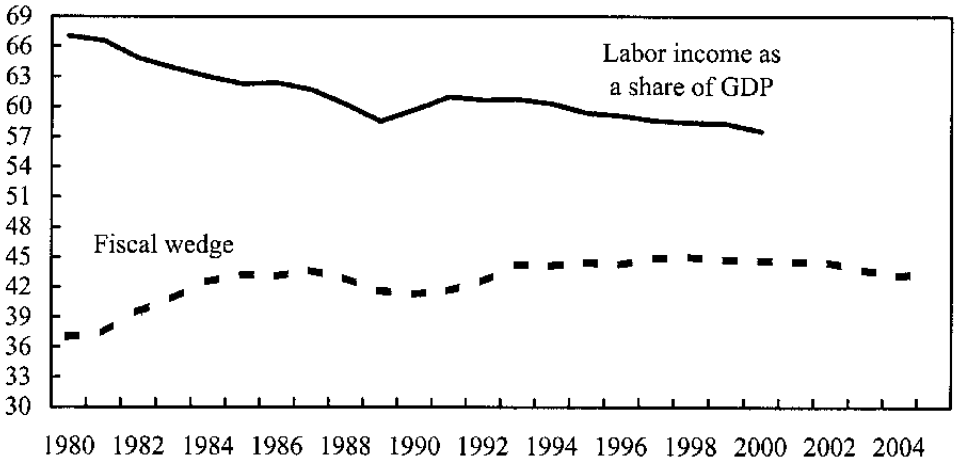
32. The strategy of reducing direct taxes on labor income assumes that the high unemployment rate in Belgium is, at least in large part, due to the wedge between labor costs and workers' take-home pay. Changes in employers' social security contributions (hereafter, SSC) affected the wedge between labor costs and labor income while changes in individuals' SSC and personal income tax modified the wedge between gross and net income.[2] The sum of all these taxes determines the wedge between labor costs and disposable income, viewed by many researchers and policymakers as a crucial determinant of labor market outcomes (see, for instance, Daveri and Tabellini, 2000).

33. Figure 2 shows the evolution of the wedge since the 1980s and Figure 3 presents each of the two main components: the sum of the employers' and employees' SSC, and the income tax. The overall wedge increased markedly in the 1980s, reflecting a sharp hike in

[2] Labor cost is labor income plus employers' SSC. Labor income includes earnings of dependent and self-employed workers. Individuals' SSC include SSC of self-employed workers as well as a small residual from special contributions and from workers who are out of the labor force. It should be emphasized that, here and elsewhere in this chapter, references to the impact of the tax changes on firms and workers do not necessarily refer to the ultimate incidence, which depends on a variety of factors. To illustrate with an extreme but clear-cut example, if labor supply were perfectly inelastic and labor markets competitive, then a reduction of either employers' or employees' SSC would ultimately benefit the employee. The size of the wedges, however, does not depend on the ultimate incidence.

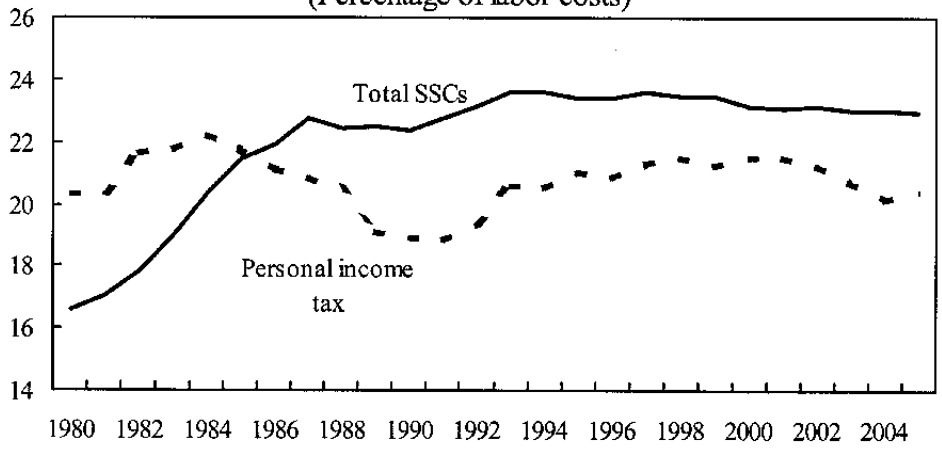
SSC. In the 1990s, the rise continued, but at a much reduced pace. In effect, increases in income taxes were mostly, but not fully, offset by reductions in SSC.

Figure 2. Belgium: The Fiscal Wedge
(Percentage points)



Source: Banque Nationale de Belgique and Fund staff calculations. The path for the fiscal wedge between 2001-2005 is consistent with Saintrain (2001).

Figure 3. Belgium: Decomposition of the Fiscal Wedge
(Percentage of labor costs)



Source: Banque Nationale de Belgique and Fund staff calculations. Paths for 2001-2005 are consistent with calculations by Saintrain (2001).

34. Policies to lower SSC were envisaged as early as 1981, however, with the adoption of the *Plan Maribel*, which targeted reductions in employers' SSC at blue-collar workers, mainly in manufacturing. Other programs focused mostly on long-term unemployed individuals and young unemployed workers. The *Plan plus un*, for instance, was created

in 1983 and reduced a firm's SSC when it hired one extra worker from the unemployment pool. The reduction was 100 percent in the first year and was phased out after three years. Another example, the *Plan d'insertion professionnelle des jeunes*, created in 1984, allowed firms to pay to some newly hired young workers in their first year of employment 90 percent of the regular wage paid to regular employees. In the second year, the employee would receive 100 percent of the regular wage but firms were granted a 10 percent discount in SSC.

35. Policies of reducing firms' SSC were reinforced in 1993. The *Maribel-bis* and *Maribel-ter*, modifications of the original plan, allocated SSC reductions to sectors deemed sensitive to international exposure. More importantly, the *Plan Global* was introduced. This initiative can be divided into four parts: 1) overall reductions in the rate of employers' SSC, which tapered off at higher wages; 2) a reduction in employers' SSC conditional on hiring young workers; 3) further reductions in SSC for firms hiring their first worker; 4) creation of the *Plan d'entreprises*, which links reductions in SSC to hiring within the context of eight different ways of reorganizing the production process.

36. The *Plan Global* has since been modified in many ways. At the end of 1994, the social partners adopted industry employment agreements that expanded SSC cuts when an enterprise boosted its labor force. In the same year, the *Plan d'embauche des jeunes* began to be phased out and the *Plan d'avantage à l'embauche*, targeting the long-term unemployed, was introduced. In 1995, the government raised the maximum salary threshold applied to the schedule of reductions in SSC. In 1996, the *Plan Maribel* was expanded to all the industries and the *Plan plus un* was extended to a second or third employee (*Plan plus deux* and *plus trois*). In 1997, the *Plan Maribel social* established a reduction in SSC to employers in the health and social services industries as long as they fully used the credit to augment employment. The industry employment agreements were broadened in 1997-98, when reductions in SSC were more closely linked to net employment increases associated with work reorganization, but in 1999 they were abolished by the social partners.

37. In 1998, the *emplois-services* program introduced further reductions in SSC to reintegrate long-term and/or low-skilled unemployed workers into tasks which had become extinct owing to high labor costs. In 1999, the *Maribel social* was expanded and the size of the reductions in SSC was amplified. In the same year, the other *Maribel* schemes and policies targeted toward low-wage earners were reorganized under the *Mésure structurelle.* In 2000, the *Mésure structurelle* was reinforced and the *Premier emploi* program was introduced. The latter reduces, under certain conditions, the SSC of employers that hire young individuals fresh from school. After many years focusing on SSC of employers, in 2000 the government introduced reductions in SSC of employees, with a view to increasing the rewards from work for low-wage earners and thereby boosting labor supply at the lower end of the skill distribution. Estimates of the budgetary impact of these measures are shown in Table 3. Box 1 summarizes these measures and highlights some that raised the rate of SSC during the 1980s and 1990s.

Table 3. Belgium: Decrease in Social Security Contributions
(In billions of Belgian francs)

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total employers' contributions	15.0	32.8	42.2	53.5	49.3	65.6	69.5	117.1	133.2
Structural policies	10.6	26.0	27.8	31.1	36.8	41.4	50.5	90.5	107.7
Bas salaires	---	7.0	9.6	13.3	14.9	15.1	3.6	3.6	n.a.
Maribel	10.6	19.0	18.2	17.8	21.9	26.3	6.2	6.2	n.a.
Structural measure	---	---	---	---	---	---	40.7	80.7	n.a.
Other	4.4	6.8	14.4	22.4	12.5	24.2	19.0	26.6	25.5
Plan d'embauche des jeunes	---	6.0	5.7	2.6	0.9	0.0	0.0	0.0	n.a.
Premier emploi	---	---	---	---	---	---	---	3.0	n.a.
Plan d'avantage a l'embauche	---	---	1.9	4.0	4.5	4.4	4.2	4.2	n.a.
Emplois services	---	---	---	---	---	0.2	0.8	1.3	n.a.
Plans +1,+2,+3	n.a.	0.6	1.5	2.2	2.7	3.5	3.8	3.9	n.a.
Maribel social	---	---	---	---	0.6	4.1	8.0	11.3	n.a.
Redistribution du travail	n.a.	0.2	4.6	13.2	3.5	11.5	1.2	1.2	n.a.
Others	n.a.	n.a.	0.7	0.4	0.3	0.5	1.0	1.7	n.a.
Total employees' contributions (low-wage earners)	---	---	---	---	---	---	---	6.0	7.4
Total contributions	15.0	32.8	42.2	53.5	49.3	65.6	69.5	123.1	140.6
Variation with respect to the previous year		17.80	9.40	11.30	-4.20	16.30	3.90	53.60	17.50

Source: Budget, ONSS, Banque Nationale dc Belgique, and Bureau Federal du Plan.

38. The government introduced several income tax reforms in the 1980s and 1990s. In the 1980s, tax brackets and the taxable threshold were indexed to inflation, the taxable threshold was raised, the tax schedule was changed, and, overall, rates were slightly reduced (Box 1). While these reforms tended to lower the income tax burden, in the 1990s other changes worked in the opposite direction, including the 3 percent complementary crisis contribution (CCC), the partial de-indexation of tax brackets, and the extra contribution to the social security system imposed on individual income taxes. In 1999, the government re-introduced full indexation of tax thresholds and brackets to the so-called health index of prices, reduced the CCC to 2 percent for low-income families, and instituted a number of other measures.

39. Looking ahead, the government has established a schedule to discontinue the CCC by 2003 and, as laid out in the multi-year fiscal framework presented along with the 2001

Box 1. A Time-Line for the Fiscal and Quasi-Fiscal Reforms in Belgium in the Last 20 Years

Principal Measures Reducing the Fiscal and Quasi-Fiscal Pressure on Labor Income

- **1981:** *Plan Maribel* targeted declines in firms' social security contributions (SSC) to the hiring of blue-collar workers.
- **1983-1984:** *Plan plus un* reduced SSC when a firm's employment level increased by one worker coming from the unemployment pool. *Plan d'insertion professionnelle des jeunes* aimed at facilitating the hiring of young workers. These plans, together with other minor ones, did not mobilize as many resources as the *Plan Maribel*.
- **1985:** Personal income tax reform
  - indexation of tax brackets and taxable threshold
  - raising the taxable threshold
  - slight decrease of the tax rates
  - Budgetary impact: about BEF 80 billion.
- **1988:** Personal income tax reform
  - indexation of tax brackets and taxable threshold
  - reshuffling of the tax schedule
  - separate taxation of labor income for married couples with two earners
  - income splitting for married couples with one earner
  - tax rebates for replacement incomes
  - new system for child burden rebates
  - Budgetary impact: about BEF 90 billion.
- **1993-2000:** Reduction of SSC mainly focusing on specific target groups. This period began by the introduction of the *Plan Global* in 1993. Also includes the revamping of the *Plan Maribel* at different points in time and an expansion of the *Plan plus un*. Since April 2000 employees' contributions were also reduced. Budgetary impact: see Table 3.
- **1999:** Phasing out of the "complementary crisis contribution" (CCC) begun.
- **October 2000:** The government presented a back-loaded reform of the income tax system. Among the main items, the reform introduced once again a complete indexation of fiscal parameters, accelerated the reduction of the CCC—which by 2003 will be eliminated—and raised the deductions per child. The effects of the reform will begin to be felt by 2002 and its total budgetary impact is estimated at about BEF 164.4 billion, with the elimination of the CCC accounting for BEF 30 billion.

Principal Measures Augmenting the Fiscal and Quasi-fiscal Pressure on Labor Income

- **1980-84:** Gradual increase of employees' SSC from 10.11 percent to 12.07 percent.
- **1984, 1985 and 1987:** In each year, 2 percent of wage indexation was actually directed to the social security system. Starting in 1987, these proceeds became a permanent levy for the social security system formally assimilated in the employers' contribution. By the end of 1987, the employers' rate of SSC had risen by about 6 percentage points when compared with its level at the end of 1983.
- **1992:** Increase of 1 percentage point of the rate of employees' SSC to 13.07 percent.
- **1993:** Introduction of the "complementary crisis contribution", a 3 percent supplement on all income taxes paid. This measure generated revenues of about BEF 30 billion.
- **1994:** Introduction of a special social security contribution. This measure generated revenues of about BEF 20 billion.
- **1993-98:** Suspension of indexation of tax brackets and some thresholds for tax rebates.

budget, to reduce income taxes through 2006. The specific measures under this plan include the following: a tax credit for low-income families (reducing revenue by BEF 18 billion), changes in tax brackets (BEF 31 billion), an increase in professional tax rebates (BEF 13 billion), the elimination of marginal tax rates above 50 percent (BEF 7 billion), equalizing the treatment of married and nonmarried couples (BEF 44 billion), and decreasing taxes on social transfers (BEF 16 billion). These measures are expected to reduce the revenue-GDP ratio by about 1.6 percentage points by 2005, with the elimination of the CCC accounting for about 0.3 percentage point. Under this policy, the average income tax on wages and salaries is expected to fall to its 1993 level by 2005, though not to its level at the beginning of the 1990s (Table 4).

Table 4. Belgium: Average Income Tax Rate on Labor Income
Before and After Different Reforms
(Percent rate)

	Before (a)	After (b)	(b)-(a)	(b)/(a) (percent change)
1985 Reform	27.9 (1985)	25.7 (1988)	-2.1	-7.6
1988 Reform	25.7 (1988)	23.3 (1991)	-2.5	-9.6
1993 reforms and *Plan Global*	23.3 (1991)	27.4 (2000)	4.1	17.6
Fiscal reform project of Oct. 2000 and elimination of CCC	27.4 (2000)	26.0 (2005)	-1.4	-5.2

Source: Fund staff calculations.

C. A Theoretical Framework

40. The net impact of past and prospective policies regarding SSC and income taxes on employment depends on a set of parameters linking taxes to wage formation and employment determination. This terrain has been the subject of intensive scrutiny during the last decade. Most of the studies have focused on cross-county differences in institutional arrangements, notably, Layard et al (1991), Scarpetta (1996), Nickell (1997), Nickell and Layard (1997), and Daveri and Tabellini (2000). In broad terms, this literature has concluded that: (i) generous and long-lasting unemployment benefit entitlements raise unemployment; (ii) strong trade unions can be expected to raise unemployment, except if there is coordination with firms over wage setting; (iii) increases in the tax wedge raise the unemployment rate, although there is some disagreement about the magnitude of this effect. (Daveri and Tabellini (2000) concluded that it can explain almost all the increase in European unemployment between 1965 and 1995, whereas Nickell and Layard (1997) adopted a more skeptical view.)

41. It is not clear how these results can best be applied to an analysis of the performance in a particular country, especially in view of cross-country institutional differences. For Belgium, a few studies have produced estimates for the elasticities of wages and employment to changes in tax parameters, but these estimates vary significantly. This section develops a simple model for wage and employment determination in Belgium, which will then be used

to inform simulation exercises carried out in the next section. The model and the ideas presented below freely borrow aspects of the theoretical setup discussed in Layard et al. (1991), Cotis et al. (1996), and Bruyne et al. (1998).

42. One of the key characteristics of the Belgian labor market is the importance of centralized wage bargaining between employers and labor unions. Thus, the first step in wage negotiations is to establish an economy-wide wage norm designed, by law, to preserve the external competitive position of the Belgian economy vis-à-vis its three main trading partners: Germany, France, and the Netherlands. This arrangement suggests that a firm-level bargaining model would be inappropriate for Belgium. However, the wage norm serves as a focal point for a second round of negotiations carried out at the sectoral or enterprise level, and the outcomes of this second round can vary substantially.[3] Therefore, a firm-level (or in an industry where numerous small firms band together, a sectoral-level) model of wage bargaining may be more suitable than would appear at first sight.

43. In such a model, firms are assumed to determine employment by maximizing profits given the negotiated wages. On the other hand, unions take into consideration the employment effects when negotiating the wage.[4] This is the *right-to-manage* model. Formally, the profit maximization of the representative firm assumes the capital stock is fixed, the production function is Cobb-Douglas, and the demand for output is a function of the real exchange rate (the ratio of foreign prices, P^f, to domestic prices times the nominal exchange rate, e), since Belgium is a small open economy. This setup can be considered a "medium-run" model because firms do not face costs to adjust the labor force but capital is fixed.

$$\underset{N}{Max}\,\Pi = P(Y^d)Y - W(1+t^e)N \qquad (1)$$

$$\text{s.t. } Y = TK^{\alpha}N^{1-\alpha}$$

$$Y^d = \left(\frac{eP^f}{P}\right)^{\varepsilon} H(X), \quad \varepsilon > 1$$

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[3] Evidence of wage dispersion across firms can be found in the *Bilan Social*, published by the National Bank of Belgium.

[4] The model can be modified to accommodate the wage norm, set either by the government or by negotiations at a central level. So modified, the model assumes firms and unions bargain over deviations from the exogenously given wage norm and generates similar conclusions to the more standard version derived here.

$$Y^d = Y$$

where N, T, K, t^e, ε, and $H(X)$ represent, respectively, employment, total factor productivity, capital, the payroll tax rate paid by the firms, the absolute value for the price elasticity of aggregate demand and a function of an exogenous set of income variables. The firm's optimal demand for labor derived from this problem is

$$N = \left(\frac{W(1+t^e)}{P}\right)^{-\frac{1}{\alpha}} \left(\frac{\varepsilon - 1}{\varepsilon}(1-\alpha)T\right)^{\frac{1}{\alpha}} K \tag{2}$$

44. Note that output depends on prices through a markup over marginal costs, which depends on the aggregate output elasticity, ε. Note also that the elasticities of labor demand to exogenous changes in the negotiated wages or in social security taxes, ε_{NW} (obtained by solving (2) explicitly for P), and the share of labor costs in profits, λ, are constant parameters, depending only on the aggregate output elasticity and on the labor intensity of production, $(1-\alpha)$.

45. The bargaining problem can be described as the maximization of a Nash function subject to this labor demand function:

$$\underset{W_i}{Max}\,\Omega_i = \left[N_i^{\gamma}\left(\frac{W_i}{C} - A\right)\right]^{\theta} \Pi_i \tag{3}$$

$$\text{s.t. } N_i = N(W_i), \text{ from firm's profit maximization,}$$

where N_i, W_i, and Π_i represent, respectively, employment, wage, and profits for firm i. θ measures workers' relative bargaining power and γ indicates how much unions care about aggregate employment. C is the consumer price index adjusted for the fiscal wedge between earned wages and workers' true purchasing power. Defining P_C as the net-of-tax consumer price index, t^c as the consumption tax rate, t^d as the income tax rate, and t^{ss} as the social security tax rate, C can be written as

$$C = P_C\left[\frac{1+t^c}{(1-t^d)(1-t^{ss})}\right] \tag{4}$$

A represents workers' outside opportunities, is assumed to be the same for every worker in the economy, and can be written as

$$A = (1-u)\frac{W}{C} + u\frac{B}{C_U} \tag{5}$$

where u, W, B, and C_U are the unemployment rate, aggregate wages, unemployment benefits, and the consumer price index adjusted for the fiscal wedge on unemployment benefits. The unemployment rate is a proxy for the probability of finding work elsewhere in case of disagreement during the bargaining process.

46. The first-order condition of this bargaining problem yields:

$$\frac{\theta\gamma\left(\frac{W_i}{C}-A\right)\varepsilon_{NW}+\frac{W_i}{C}}{\frac{W_i}{C}-A}=\lambda \tag{6}$$

or

$$\frac{W_i}{C}=mA\ ,\ \ m(\theta,\gamma,\lambda(\varepsilon,\alpha),\varepsilon_{NW}(\varepsilon,\alpha)) \tag{7}$$

In words, real wages corrected for the tax wedge are determined as a markup over workers' alternative income. This markup will be higher when workers' bargaining power is stronger, when the demand for output and the demand for labor are less elastic, when the labor intensity of production is less, and when workers care little about the level of employment. As all workers are assumed to be identical, $W_i = W$, and using the formula for A shown in equation (5) yields,

$$W=\frac{mu}{1-m(1-u)}B\frac{C}{C_U} \tag{8}$$

47. Equations (2) and (8) determine the equilibrium in the labor market. It is important to note that wages will be higher when the ratio between the fiscal wedge on labor income and the fiscal wedge on unemployment benefits is larger. So, to the extent that employed and unemployed individuals pay the same consumption price including taxes, indirect taxation (and the level of consumer prices) will not play a role in wage determination. Log-linearizing both equations and taking first-differences yields,

$$\Delta n=\Delta q_n+a\Delta(w-p)-a\Delta t^e+a\Delta t+\Delta k \tag{2'}$$

$$\Delta w=\Delta q_w+\Delta b+\Delta(t^{ss}+t^d-t_u)+\nu\Delta n \tag{8'}$$

where the lower-case symbols represent the logarithm of the respective variables, Δ is the first-difference operator, and the q parameters are shift variables. The relative tax wedge can be simplified as the difference between the rate of SSC and income taxes of employed individuals and the direct taxes on unemployment benefits, t_u. The linearization of the wage setting equation was done with respect to the ratio of employment to the labor force, $(1-u)$.

Changes in this ratio were approximated by changes in the logarithm of employment.[5] Solving, changes in employment can be written as:

$$\Delta n^* = \frac{1}{1+a\nu}\left[(\Delta q_n - a\Delta q_w) - a\Delta\left(t^{ss} + t^d - t_u\right) - a\Delta t^e - a\Delta(b-p) + a\Delta t + \Delta k\right] \qquad (9)$$

Employment will grow with reductions in the relative tax wedge of employed individuals, in the rate of employers' SSC, and in real unemployment benefits. Increases in the capital stock, and in total factor productivity, as well as wage moderation, will also boost employment.[6] Wage moderation is captured by the model as an increase in the "preference for employment", γ, which causes a decline in wages' markup over workers' alternative income, m, and thus a downward shift in the wage-setting equation, $\Delta q_w<0$. In the context of the model presented here, a change in γ, and therefore in m, also affects the sensitivity of wages to the unemployment rate, but this effect is not considered in the simulations below.[7]

D. Simulations

48. Available elasticities can be applied to the structure of the model to evaluate the impact of tax changes on employment. (Estimation of the model is beyond the scope of this paper.) The key parameters needed for this exercise are: the (absolute value of the) elasticity of demand for labor to changes in real labor costs, a; and the (absolute value of the) sensitivity of wages to changes in the unemployment rate, ν. One important limitation of this exercise, given the lack of further information, should be kept in mind: it is assumed that the

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[5] For a given size of the labor force, the change in the logarithm of employment will be quite close to the percentage point change in the ratio of employment to the labor force if the latter is not much bigger than employment. This assumption is reasonable for Belgium. Obviously, the approximation will be worse if the labor force varies a lot when employment changes.

[6] The model could be modified to include the utilization of intermediate products in the production function (Bruyne et al., 1998), a long-run equilibrium condition where firms are allowed to choose the stock of capital (Cotis et al., 1996) or inter-temporal decisions to generate an equation for equilibrium output growth (Daveri and Tabellini, 2000). The basic effects of tax changes on the level of equilibrium employment would not substantially change. Also, marginal tax rates could have an effect on wages and employment independently of the average tax rates. For example, a higher level of tax progressivity implies that wage increases are less valuable and so, in standard union models, wages are reduced (Lockwood and Manning, 1993).

[7] Note that changes in the rate of employers' SSC, in individual SSC, and in direct income taxes will all have the same effect on the equilibrium level of employment. This symmetry is also present in the empirical model for Belgium estimated by Jeanfils (2000).

average direct tax on unemployment benefits, t_u, remained constant throughout the period under analysis.

49. For the value of a, the estimate of 0.5 reported in Bossier et al. (1995), a publication by the *Bureau du Plan*, is adopted. This estimate is consistent with the implied long-run elasticity of labor demand in Jeanfils (2000). Other direct estimates for the elasticity of labor demand in Belgium are shown in Table 4. To match the concept used in the model derived here, where firms do not face costs of adjusting employment, the discussion below focus on what some papers call "long-run elasticities." These estimates take into account the lengthy adjustment of employment to cost changes but still consider capital as exogenously given. The chosen estimate lies near the middle of the –0.2 to –0.7 interval presented by Hamermesh (1993) for a variety of countries, and the –0.41 to –0.64 range for the United Kingdom estimated by Nickell and Wadhwani (1991). By contrast, the estimates presented in Konings and Roodhooft (1997) and Drèze and Modigliani (1981) are at the high end, not only for Belgium but also for other countries. The only well-known estimates with the same order of magnitude are reported in Symons and Layard (1984) for the United States, Canada, and Japan (-1.25, -2.5, and –1.75, respectively). By the same standard, the estimates presented in Bruyne et al. (1998) seem too low.

Table 5. Belgium: Selected Estimates of Labor Demand Elasticity

	Short-run elasticity	Long-run elasticity
	Studies using macroeconomic data	
Bruyne et al. (1998)	-0.07	-0.18
Bossier et al. (1995)	-0.17	-0.50
Drèze and Modigliani (1981)	-0.20	-2.00
	Study using microeconomic data	
Konings and Roodhooft (1997)	from -0.37 to -0.65	from -1.2 to -1.8

50. Jeanfils (2000) updates the quarterly macroeconomic model of the National Bank of Belgium. From his results, a ν equal to 0.007 can be inferred. The simulations based on the chosen values for a and ν are presented in Table 6.[8] The negative employment effect due to the increase in SSC in the 1980s is substantial: employment would eventually have declined by about 4½ percent in the absence of wage moderation, capital accumulation or technical progress.[9] The 1990s were characterized not only by reductions in employers' SSC, which

[8] To conform with the model, the tax rates used here—t^d, t^e and t^{ss}—are defined as individual income tax receipts, and employers' and employees' SSC as a proportion of labor income and not of labor costs.

[9] Note that in the model prices are determined as a markup over marginal costs and therefore an increase in employers' SSC will tend to raise prices and offset in real terms some of the

(continued)

provided a small stimulus to job creation, but also by rises in personal income taxes. As a result, the tax wedge on labor costs changed little but its final effect on employment, albeit small, was still negative.[10]

51. Looking ahead, the tax changes scheduled to be phased in over the next four years are simulated to boost employment by 1 percent. This figure is only a bit larger than the 0.6 percent—or 24,000 extra workers—for the same period provided by Saintrain (2001). The gap between the two figures is not only due to different assumptions for the key elasticities: Saintrain's estimate was obtained by using the large-scale macro-model from the *Bureau du Plan* and likely takes into consideration the feedback of tax increases into key economic variables (e.g. prices) that are ignored here.

Table 6. Belgium: The Impact of Changes in the Tax Wedge on Employment
(Percent changes from the beginning to the end of each period)

	1980-1993	1993-2000	1997-2000	2000-2005	1980-2000	1980-2005
Changes in direct income tax rates	-0.3	-0.9	-0.2	1.0	-1.2	-0.3
Changes in rate of employees' SSC	-1.9	0.0	0.2	-0.1	-2.0	-2.0
Changes in rate of employers' SSC	-2.3	0.3	0.1	0.2	-2.0	-1.8
Total effect	-4.5	-0.7	0.1	1.0	-5.2	-4.1

Source: Fund staff calculations. Simulations use elasticity in equation (9).

E. Conclusions

52. After a substantial increase in the tax wedge in the 1970s and in the 1980s, which has been widely thought to have been partly responsible for the sharp rise in unemployment rates, the Belgian authorities instituted a policy of reductions in employers' social security contributions. Social security contributions have indeed fallen, but the overall tax wedge—including income taxes—has not been reduced. This outcome mainly reflected the limited size of the cuts in social security contributions and a continued, if slow, rise in income taxes. As a result, based on the model developed here, the policy changes of the 1990s were

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wage increase, and thus reduce the impact on employment. This effect is not taken into account in the simulation.

[10] Several of the policies aiming to reduce the tax wedge in the 1990s were directed toward low-skilled workers. Their positive effect could have been greater if the cost-elasticity of demand for this type of worker were larger than the average elasticity used here. However, even if the elasticity of demand for low-skilled workers were twice the one used here and the whole reduction in the rate of SSC were directed to them, the positive effect of the overall package on aggregate employment would still have been small.

successful in ending the negative employment effects of the previous decade, but they did not actually raise employment.

53. Looking ahead, the income tax reform introduced in October 2000 on employment may have more substantial effects. As budgeted, this reform will reverse the increase in average income tax rates during the 1990s, and in addition, the rate of social security contributions is also expected to decline to its 1992 level. However, both will remain very high relative to levels that prevailed in 1980.

54. This exercise has, therefore, both a positive and a cautionary conclusion. On the positive side, the model implies that reductions in the tax burden would raise employment. Moreover, the application of broadly accepted estimated parameters suggests that this effect is economically significant, as illustrated by the episode of tax increases in the 1980s. The cautionary conclusion is that rebalancing taxes between social security contributions and income taxes is likely to have only a very limited impact on employment, since in equilibrium both affect total labor costs in the same way. Put differently, direct tax cuts must be broad based if they are to raise employment significantly. Looking forward, tax policy has a substantial way to go to reverse the negative employment effects of past policies.

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