FUTURE GDP GROWTH IN SLOVENIA: LOOKING FOR ROOM FOR IMPROVEMENT

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Summary

In a companion paper we project it may still take a long time before Slovenia catches up with the EU average in terms of real GDP per capita (see Jongen, 2004a). In this paper we consider where there is still 'room for improvement' in terms of GDP growth for the coming decade. Specifically, we compare various indices for inputs to production in 2002 for Slovenia with those for the EU-15, the 10 new member states that joined in the wave of 2004, and the US.

The employment rate in Slovenia is quite close to the EU-15 average, and somewhat above the average of the accession countries. However, hiding behind the average is a relatively low employment rate of elderly workers (55-64) in Slovenia compared to the EU average.

Average years of schooling in Slovenia is also quite close to the EU-15 average. Here the notable exception is the share of individuals who have finished tertiary education, which is quite low compared to the EU-15 average, although higher than in the other accession countries for which we have data.

For the capital-output ratio in Slovenia we again find that it is quite close to the EU-15 average. There is still some room left for further capital deepening though, with real interest rates still above those in the EU-15.

We next consider differences in the (residual) 'total factor productivity' (TFP). In 2002 Slovenia was at about 76% of real GDP per capita (in PPP) of the EU-25 average. Given that the labour, human capital and physical capital inputs are quite similar to the EU average, it should come as no surprise that we find that the gap in TFP is very close to the gap in GDP per capita. We further find that the growth in TFP in Slovenia relative to average TFP in the EU was only 1% over the 1990-2002 period, compared to around 9% for the 10 new member states on average. Note, however, that Slovenia started much closer to the TFP frontier than most of the other accession countries and further note that these international comparisons should be interpreted with the appropriate care. The analysis is limited by data availability and comparability, and depends on the functional form chosen for the production function. Further, in particular in the comparison across time we compare accession countries that are in different stages of the transition process.

We then turn to factors that can 'explain' the difference in TFP in Slovenia with the EU average (and the US):

(1) First, we consider factors that indicate the level of exposure to new technologies (broadly defined, so as to include institutions). The share of research and development (R&D) in GDP is much higher than the other new member states on average, but still somewhat below the EU-15 average. There is a large gap vis-*a*-vis the US. Also regarding some indicators of the quality of R&D, Slovenia takes an intermediate position between the EU-15 and the new member states. Trade and foreign direct investment (FDI) are often believed to stimulate TFP convergence. We find that exports and imports are above the EU average. However, this holds for most small countries in the EU. Where Slovenia stands out is in inward (and to a lesser extent outward) FDI stock. Slovenia is far below the EU-15 average, and even further behind the average for the other new member states.

(2) Next, we consider factors that indicate the absorption capacity for new technologies. Here we mainly look at the institutions related to job and worker flows. Although employment protection legislation was relatively strict and it is relatively time consuming to start up a business relative to the EU-15 and the other new member states, job flows do not appear out of line when compared to the EU-15 and those new member states for which we have data. Yet worker flows seem a bit low compared to job flows.

(3) We conclude the list of factors that may explain the differences in TFP with some factors that may affect the efficiency of production in general. It appears to be very time consuming to enforce a contract in Slovenia, whereas the use of credit facilities is limited. This may have limited the number of efficient transactions in Slovenia. Government expenditures as a share of GDP are quite close to the EU average, whereas state aid is still quite far above the EU-15 average (no data were available for the other new member states).

We conclude with a calculation of the growth potential based on the remaining 'rooms for improvement'. Specifically, we consider what the impact is on the average growth rate of GDP per capita over the 2002-2013 period of closing one particular 'gap' in the inputs. Relative to the base projection of Jongen (2004) we find that the remaining gaps in labour, human capital and physical capital input may raise the growth rate by somewhat less than one percentage point. In Jongen (2004) we calculate that the growth rate in Slovenia would have to be around 1.3 percentage points higher than in the base projection to catch up with the EU-25 average in terms of GDP per capita by 2013. For this, TFP will have to grow faster than in the EU-25. Fortunately, there is still a lot of room left regarding relative TFP growth and we have tried to indicate some factors that may contribute to higher TFP growth, although their impact is typically hard to quantify.

Keywords: international comparison, growth accounting, relative total factor productivity, growth potential

1. INTRODUCTION[2]

Over the period 1993-2002 real GDP per capita in Slovenia grew at a brisk pace of 4.1% per year[3]. In Jongen (2004) we project that the average annual growth in real GDP per capita over the period 2002-2013 is likely to be somewhat lower, about 3.6%. Although this growth rate would still be impressive relative to the EU average, in Jongen (2004) we project that it might still take decades before Slovenia catches up with the EU average of real GDP per capita. In this paper we consider where there is still 'room for improvement' regarding future GDP growth[4]. Specifically, we compare various indicators for inputs to production for Slovenia with those for the EU-15, the 10 new member states that joined in May 2004, and the US. Most data are for 2002[5]. For the EU we also consider the gap as against the Lisbon strategy target if a quantitative target is formulated (which typically represents a move towards the US level, hence the inclusion of the US in the international comparison)[6]. For each indicator we further quantify how much of the 'gap' is closed in the base projection of Jongen (2004), how much is left, and how much additional per capita growth would result if the 'gap' were to disappear over the period 2002-2013[7].

The paper has the following outline. In Section 2 we start by searching for room for improvement regarding labour participation. Sections 3 and 4 then consider the room left for further human and physical capital deepening, respectively. Using cross-country growth accounting in Section 5 we next try to quantify how much of the differences in GDP per capita are left after controlling for differences in labour participation, human capital and physical capital, *i.e.* the gap in 'total factor productivity'. Section 6 then considers some factors that may explain part of the gap in total factor productivity, while Section 7 considers the impact of closing one of the gaps on growth in GDP per capita over the coming decade. Section 8 concludes.

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[3] Following a period of contraction over the period 1987-1992, resulting in a cumulated drop in real GDP of about 20 percent in 1992 relative to 1986 (see Jongen, 2004).

[4] At the end of 2003 the Slovenian 'Ministry of the Economy' published 'Benchmarking Slovenia 2003' which deals partly with similar issues. However, we use more recent data and also give data on some other topics. Furthermore, in addition we try to quantify the impact of changes in the indicators on projected GDP growth.

[5] For most data series 2002 is the most recent year for which we have internationally comparable data.

[6] See Economic Policy Committee (2003, Annex 2) for an overview of the quantitative targets of the Lisbon strategy.

[7] Whether or not it makes sense to close one of the perceived gaps and, perhaps more importantly, *how* to close the gap is still beyond the scope of this paper. Indeed, although dramatic increases in *e.g.* investment in human capital, physical capital and research and development are likely to generate high per capita growth rates, at least in the short to medium run, this may have rather detrimental effects on consumption during this period which, at the end of the day, is what matters for the well-being of the population. Indeed, to assess whether or not closing a particular 'gap' is believed to be welfare enhancing or not one has to consider the underlying market failures explicitly and start from there to consider what is the most appropriate policy response, if any, to reduce the failure. Furthermore, one would then also have to move beyond the average/representative individual analysis presented here for both efficiency and equity reasons as a large part of the policy changes will have a different impact across the population.

2. LABOUR PARTICIPATION

We first consider the room left regarding labour participation. Table 1 gives an overview of the most relevant indicators for 2002. Data are taken from Eurostat. All comparison tables have the same format: we first give the indicator for Slovenia, followed by the EU-15 countries, the other new member states (that joined in May 2004), the average for the EU-15, the new member states and the 'EU-25' and, finally, also for the US. However, in Table 1 we already make an exception as we do not have comparable data for the US on most variables in Table 1[8].

Table 1: Activity, employment and unemployment rates, 2002; in %[1]

	Activity rate	Employment rate	Share part-time	Female employment rate	Share part-time females[2]	55-64 employment rate[3]	Unemployment rate	Share of long-term unemployed
Slovenia	68	63	6	59	8	25	6,0	56
Austria	73	69	20	63	38	30	4,3	19
Belgium	65	60	19	51	37	27	7,3	49
Denmark	80	76	20	72	30	58	4,5	19
Finland	75	68	13	66	18	48	9,1	25
France	69	63	16	57	29	35	8,8	31
Germany	72	65	21	59	-	39	8,6	47
Greece	63	57	5	43	8	40	10,0	51
Ireland	68	65	17	55	30	48	4,4	30
Italy	61	56	9	42	17	29	9,0	59
Luxembourg	66	64	11	52	25	28	2,8	27
Netherlands	77	74	44	66	73	42	2,7	26
Portugal	72	68	11	61	16	51	5,1	34
Spain	66	58	8	44	17	40	11,3	34
Sweden	78	74	22	72	33	68	4,9	20
United Kingdom	76	72	25	65	44	54	5,1	22
Cyprus	71	69	-	59	-	49	3,8	21
Czech Republic	71	65	5	57	8	41	7,3	50
Estonia	69	62	8	58	11	52	9,1	52
Hungary	60	57	4	50	5	27	5,6	44
Latvia	69	60	-	57	-	42	12,8	45
Lithuania	70	60	-	57	-	42	13,1	54
Malta	59	55	8	34	18	30	7,4	43
Poland	65	52	11	46	13	26	19,9	55
Slovak Republic	70	57	2	51	3	23	18,6	65
EU-15	70	64	18	56	34	40	7,7	39
New member states	66	56	8	50	10	30	14,8	55
EU-25	69	63	17	55	30	39	8,9	43

Notes:
[1] Source: Eurostat (30-04-2004). The numbers are for individuals aged 15-64.
[2] Share of part-time female employees in total female employment.
[3] Employment rate of individuals aged 55 to 64.

The first column in Table 1 gives the so-called activity rate, the number of employed and unemployed (actively looking for a job *etc.*) relative to the population aged 15-64. The

[8] The US statistics that are available typically cover a different age group.

activity rate in Slovenia is very close to the EU-15 average, which holds for most new member states (Malta and Hungary being the notable exceptions).

Turning to the employment rate, Slovenia is again very close to the EU-15 average. This is not the case for the 'average' new member state, which reflects the relatively low unemployment rate in Slovenia relative to the other new members states (see below). Furthermore, Table 1 gives the employment rate in *persons*. This may actually understate the level of participation in employment in Slovenia relative to the EU-15, as part-time employment is relatively underdeveloped in Slovenia, see column 3[9].

However, the average employment rate hides some noticeable differences across particular groups. On the one hand, female participation rates are relatively high (see column 4), in particular when one realises that again part-time employment is less common among Slovenian women than among women in the EU-15 (see column 5)[10]. On the other hand, column 6 shows a more worrisome picture regarding the participation of the elderly. Of individuals aged 55-64, only 25% is (formally) employed in Slovenia as opposed to 40 percent on average in the EU-15. Also compared to the other new member states Slovenia does relatively poorly in terms of the participation of the elderly, leaving behind only the Slovak Republic. Unsurprisingly, the gap vis-*a*-vis the US is then enormous which, according to the Bureau of Labor Statistics[11], was 60% in 2002. Note that in the EU-15 Sweden does even better, with an employment rate of older workers of 68%. According to the United Nations, the "elderly dependency ratio" (individuals aged 65+ to individuals 15-64) in Slovenia will increase from 0.20 in 2000 to 0.38 in 2025, and to 0.64 in 2050[12]. This puts Slovenia amongst countries with the steepest rise in the 'elderly dependency ratio' in the EU, making the issue of higher participation rates of the elderly all the more pressing.

We conclude with a look at unemployment. The unemployment rate was somewhat below the EU-15 average in 2002, and substantially below the average of the new member states. Insofar as the 'natural' unemployment rate in Slovenia is not below the average of the EU-15 countries[13], there seems to be little room for improvement left for reducing unemployment. However, the ageing of the working age population may cause a further reduction in unemployment as older workers have lower unemployment rates[14]. Turning to the last column we do note, however, that the duration of unemployment is relatively long in Slovenia given the high share of long-term unemployed (>1 year unemployed) in total unemployment. This can be seen as an indication that worker flows may be regarded as relatively low in Slovenia in general (see also Section 6.3 below).

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[9] This is probably the main reason why Slovenian employees appear to work much more hours on average than citizen in the EU on average (see also Section 5 below).

[10] Table 1 further suggests that the employment rate of women is on average lower in the new member states than in the EU-15, but this may partly reflect a difference in formal and informal participation rates between the new member states and the EU-15.

[11] Source: www.stats.bls.org.

[12] Source: www.un.org. The numbers refer to the 'medium variant' of the demographic projection.

[13] The 'natural' unemployment rate in Slovenia may be lower due to a less favourable welfare state, at least for individuals who do not qualify for early retirement yet, but this may be expected to change as GDP per capita moves closer to the EU-15 average.

[14] Provided that the adverse effects of the rising tax burden of the ageing population do not dominate the demographic composition effect on the average unemployment rate.

Another issue regarding the room for further employment growth is migration. Over the past decade net migration has been limited[15]. However, if we believe that Slovenia will do well in the future relative to, for example, other former Yugoslav republics, then it may attract more immigrants in the future (and perhaps see fewer people leave), all the more so when the ageing of the population will drive up the wages of non-tradables (although the more dramatic changes in the dependency ratio will happen after 2013). However, even now there are big differences and we do not see big migration flows. Furthermore, for higher migration to have a positive effect on GDP per capita growth immigrants (emigrants) would need to have an above (below) average employment probability and higher (lower) than average education (or a higher (lower) average propensity to save). We do not see a big role for migration in the coming decade in the growth of GDP per capita.

Overall, we find that the biggest room for improvement regarding labour participation seems to be the participation of the elderly. We consider the additional growth potential of this residual 'participation gap' in Section 7 below.

3. HUMAN CAPITAL

Next we consider indicators related to the average human capital of workers, see Table 2. In the first column we have public expenditure on education as a percentage of GDP (the latest comparable data for Slovenia is for 1999). This gives us an indication of the public 'investment flow' into human capital. Slovenia does better than the EU-15 average and the average of the new member states in this respect.

However, perhaps more informative than the flow of public education expenditure in any given year is the stock variable 'average years of schooling'[16]. Slovenia again appears to be somewhat above average relative to the EU-15 countries on this variable. Unfortunately, we do not have reliable data for the other new member states on the average years of schooling[17].

On average, Slovenia appears to be somewhat above the EU-15 average in terms of education, but again there are marked differences when we move beyond the average. Over the relevant past, Slovenia has always had relatively high enrolment levels in primary and secondary education. This shows for example, in the stock of individuals with at least a secondary education. According to Eurostat (30-04-2004), in 2002 the percentage of individuals aged 25-64 with at least a secondary education was 64.6% in the EU-15, whereas in Slovenia it was 76.8%. Where Slovenia lags behind is in tertiary education[18]. Column 3 of Table 2 gives the share of individuals aged 25-64 who have finished tertiary education. In 2001 the share was 17% in Slovenia compared to 22% in the EU-15 and 37% in the US. For the new member states that are also a member of the OECD we also have

[15] According to the Yearbook of the Statistical Office of the Republic of Slovenia (2003) the net migration of foreigners was about 3,000 persons in 2002, compared to a population of about 2 million.

[16] Note, for example, that whereas in 2002 public expenditure on education in the US was close to the EU-15 average, 'average years of schooling' was much higher in the US. This is likely to indicate higher investment in education in the US in the past (and/or more private funding of education).

[17] The data for the average years of schooling are taken from Commission of the Economic Communities (2003), which does not report values for the accession countries. The famous Barro and Lee dataset, see *e.g.* Barro and Lee (1993, 2001), has data for all countries in Table 2 but there appear to be some problems with these data, see Section 5 below.

[18] One of the reasons for this was perhaps excessive wage compression during the socialist times.

comparable tertiary education data. Compared to the new member states for which we have data Slovenia appears to do relatively well.

Table 2: Indicators for human capital

	Public exp. on educ. as % of GDP[1]	Average years of schooling[2]	Individuals with tertiary education (25-64)[3]	Individuals with tertiary education (25-34)[4]	Gross enrolment in tertiary education[5]	Lifelong learning[6]
Year	1999	2002	2001	2001	2000/2001	2002
Slovenia	5,6	11,6	17	20	61	9,1
Austria	5,9	12,4	14	14	58	7,5
Belgium	-	11,1	28	38	58	6,5
Denmark	8,1	13,0	27	29	59	18,4
Finland	6,3	11,4	32	38	-	18,9
France	5,9	10,6	23	34	54	2,7
Germany	4,6	13,0	23	22	-	5,8
Greece	3,6	10,2	18	24	63	1,2
Ireland	4,6	10,6	36	48	48	7,7
Italy	4,8	9,7	10	12	50	4,6
Luxembourg	-	-	-	-	-	-
Netherlands	4,8	11,9	23	27	55	16,4
Portugal	5,7	7,2	9	14	50	2,9
Spain	4,5	9,2	24	36	59	5
Sweden	7,5	11,7	32	37	70	18,4
United Kingdom	4,6	12,0	26	29	60	22,3
Cyprus	5,7	-	-	-	22	3,7
Czech Republic	4,1	-	11	11	30	5,9
Estonia	6,1	-	-	-	58	5,2
Hungary	4,7	-	14	15	40	3,2
Latvia	5,8	-	-	-	63	8,2
Lithuania	6,1	-	-	-	52	3,3
Malta	4,8	-	-	-	25	4,4
Poland	4,9	-	12	15	56	4,3
Slovak Republic	4,4	-	11	12	30	9,0
EU-15	5,0	11,1	22	26	56	8,6
New member states	4,9	-	-	-	48	4,9
EU-25	5,0	-	-	-	54	8,0
United States	4,9	13.3 [7]	37	39	73	-

Notes:

1 Public expenditure on education as a percentage of GDP. Source: Eurostat (30-09-2004) for all countries except Slovenia, for which we use Hanzek and Gregorcic (2002).

2 Source: Commission of the European Communities (2003) for all countries except Slovenia, for which we use internal calculations from IMAD.

3 Source: OECD (2003a), except for Slovenia for which we use internal data from IMAD (from the census 2002).

4 Source: OECD (2003a), except for Slovenia for which we use internal data from IMAD (from the census 2002).

5 Gross enrolment of individuals in tertiary education up to 5 years after finishing secondary education. Source: Unesco at www.un.org (30-04-2004) except for Slovenia, for which we use internal data from IMAD.

6 Share of workers participating in some form of training or education in the 4 weeks before surveyed. Source: Eurostat (30-04-2004).

7 Own lineair extrapolation using data from Comission of the European Communities (2003), using the average annual growth in average years of schooling in the US over the period 1980-1995.

However, the average for the age group 25-64 is a slow moving variable. Column 4 shows that the share of individuals with a tertiary education is higher for individuals aged 25-34 than for individuals aged 25-64 in Slovenia. The same holds for the EU-15, however, for which the difference in the two cohorts is actually bigger. Indeed, it is only when we look at the enrolment in tertiary education (column 5) that Slovenia rises above the EU-15 average. Further, for enrolment we also have data for the other new member states and Slovenia does even better in terms of enrolment compared to this group. Even in terms of enrolment in tertiary education Slovenia is still behind the US though, which has an impressive enrolment rate of 73% in tertiary education.

The last column in Table 2 gives some numbers on adult education and training, it gives the share of employees that followed any kind of education or training in the 4 weeks preceding the survey ('lifelong learning'). As we see, Slovenia seems to be slightly above the EU-15 average and substantially above the average for the new member states.

Let us conclude with some qualifications. First, how about differences in quality? For the quality of primary and secondary education we can use test scores of internationally comparable tests. Barro and Lee (2001, Table 6) give an overview of average test scores over the period 1994-1998, including average scores for Slovenian pupils. The test is done in 7th grade in the US and at a comparable stage in schools in other countries. Of 39 countries, Slovenia ranks 16th in the mathematics test (in between Thailand and Australia), and 6th in 'science' (in between Austria and Bulgaria). What do we infer from this? My reading is that Slovenia is not necessarily 'behind' regarding the quality of primary and secondary education. For example, in both cases Slovenia leaves the US behind (which ranks 22nd and 11th in mathematics and 'science', respectively). However, there is always room for improvement, see *e.g.* the recommendations in OECD (1998).

Tertiary education may be a different story however. For example, Vodopivec (2002) indicates that in Economics most faculty members by far obtained their Ph.D. in Slovenia and have a poor record regarding publications in leading academic journals.[19] One may further wonder whether the dramatic increase in enrolment does not reduce the education 'output' per student of the staff and whether the average student has the same studying potential as before.

Finally, regarding adult education and training our measures of education only capture the fruits of adult education and training insofar as they lead an individual to obtain a higher education degree. Yet this may not be a serious limitation. Recent research casts doubt on the returns from other training and education efforts. For example, Leuven and Oosterbeek (2004) find that the effect of a Dutch adult education and training programme on wages was not significantly different from zero. Although this is only one type of programme in one country, it is important to note that training and education of a short duration can only have a limited impact on productivity, that the returns to education are likely to decline with the knowledge already accumulated, that it is typically assumed that it becomes harder to learn later in life, and that the period in which the training or education yields a return is shorter for older workers (albeit some training and education may also be beneficial in retirement and people will work longer in the future).

[19] Though recently this appears to be changing for the better.

4. PHYSICAL CAPITAL

How about physical capital – is there still some room left for improvement there? In Jongen (2004) we calculate that the capital-output ratio in Slovenia in 2002 is somewhere in the order of 2.14, coming from 1.70 in 1995[20]. Table 3 gives some calculations on the capital-output ratio in the EU-15 and the US from Hall and Jones (1999). The capital-output ratio seems to have largely recovered from the contraction of the late 1980s/early 1990s, and is not too far from the EU-15 average[21].

Table 3: Capital-output ratio[1]

Slovenia	2,14
Austria	2,61
Belgium	2,36
Denmark	2,64
Finland	3,13
France	2,68
Germany	2,32
Greece	2,36
Ireland	2,49
Italy	2,54
Luxembourg	-
Netherlands	2,53
Portugal	2,08
Spain	2,33
Sweden	2,38
U.K.	1,79
EU-15[2]	2,36
U.S.A.	2,25

Notes:

1 Source: Hall and Jones (1999) for all countries, except Slovenia for which we use data from Jongen (2004). For Slovenia we use the capital-output ratio of 2002, the capital-output ratios for the other countries are for 1988 (but we expect no upward or downward trend in the period 1988-2002).

2 Weighted average, using the population of 2002 reported in Groningen Growth and Development Centre (2004) as weights.

A good reason for why the capital-output ratio may still have been below the EU-15 average in 2002 was the relatively high interest rate. In 2002, the real interest rate on long-term capital loans was still 7.4% (on average)[22], compared to 3.4% in the euro-zone[23]. By

[20] The capital stock calculated for 2002 in Jongen (2004) is close to that of Doyle *et al.* (2001), who come to a capital-output ratio of 2.2 in 2000 for Slovenia (2.0 in 2000 in Jongen, 2004). For the construction method and assumptions underlying the capital series see Jongen (2004).

[21] The data for the EU-15 and the US are taken from Hall and Jones (1999). The capital-output ratio calculated by Hall and Jones is for 1988 (due to the data they use from an older version of the Penn World Tables). One of Kaldor's infamous stylised facts (Kaldor, 1963, also see Barro and Sala-i-Martin, 1998) was that the capital-output ratio seemed to be constant over longer periods. Hence, for simplicity we assume that the average capital-output ratio in the EU-15 was the same in 2002 as it was in 1988. Data from OECD (2004) suggest that the capital-output ratio may have grown somewhat over this period. Over the period 1992-2001 they have numbers on the growth in potential GDP and the capital stock in the EU-15 countries. Using the population in 2002 of Groningen Growth and Development Centre (2004) as weights I come to an annual capital deepening of 0.84% per year over the period 1992-2001. Assuming the same capital deepening in the years 1989-1991 and 2002 I come to a capital-output ratio of 2.66 in 2002. These tentative calculations suggest there is perhaps still some more room left for further capital deepening in Slovenia than Table 3 suggests.

[22] Source: Bank of Slovenia (30-04-2004) at www.bsi.si.

December 2003 the real interest rate on long-term capital loans had already fallen to 5.2% in Slovenia. With Slovenia entering in the euro-zone in coming years we may expect the real interest rate on long-term capital loans to converge to the euro-zone. This will cause a further rise in the capital-output ratio.

Perhaps another reason we can expect further capital deepening is the relatively low stock of inward foreign direct investment (relative to GDP) in Slovenia (see Section 6). The inward FDI stock was only 17% in Slovenia in 2002 compared to 29% on average in the EU-15 and 34% on average in the new member states for those countries for which we have data.

5. TOTAL FACTOR PRODUCTIVITY

From the analysis above we take that Slovenia is quite close to the EU-15 average in terms of participation, education and capital-intensity (but still quite far from the US in terms of participation and education). In this section we formally try to quantify how much of the differences in GDP per capita can be accounted for by differences in these inputs and how much is left for differences in total factor productivity (TFP), using cross-country 'growth' accounting.

5.1. Methodology

Growth accounting is typically used to calculate the contribution of different inputs to output growth (see Barro, 1998, for a nice introduction). Of particular interest is the "contribution" of the residual relative to the contribution of other inputs, typically assumed to reflect changes in technology broadly defined and typically found to be a quantitatively important contributor to the growth of GDP per capita (see *e.g.* Solow, 2000). Here, we use the growth accounting approach to account for differences in GDP per capita (in purchasing power parity units) across countries in a given year, following Hall and Jones (1999) and Caselli (2003)[24]. Of particular interest is the contribution of differences in TFP, again calculated as a residual, to differences in GDP per capita.

We assume that in all countries j aggregate output $Y_j(t)$ in year t is given by a Cobb-Douglas production function

$$Y_j(t) = A_j(t)(hc_j(t)h_j(t)ep_j(t)P_j(t))^{\beta} K_j(t)^{1-\beta},$$

where $A_j(t)$ denotes total factor productivity, $hc_j(t)$ denotes the human capital per employee, $h_j(t)$ denotes the annual number of working hours per employee, $ep_j(t)$ denotes the employment-to-population ratio, Pj (t) denotes the population, $K_j(t)$ denotes the stock of capital, all for country j at time t, and β denotes the elasticity of output with respect to the effective labour input, which is assumed to be the same across countries. The production function is assumed to exhibit constant returns to scale. Define the capital-

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[23] Source: Eurostat (30-09-2004). I subtracted the average annual rate of change in the harmonized price index of the euro-zone from the average nominal interest rate on long-term capital loans.

[24] We extend their analyses by including Slovenia, updating the analysis to 2002 (Hall and Jones (1999) consider 1988, Caselli (2003) considers 1995), and taking into account differences in working hours.

output ratio for country j at time t by $\varphi_j(t) \equiv K_j(t)/Y_j(t)$. Making the substitution for the capital-output ratio and with rewriting gives the following expression for GDP per capita

$$Y_j(t)/P_j(t) = A_j(t)^{1/\beta}\, hc_j(t) h_j(t) ep_j(t) \varphi_j(t)^{(1-\beta)/\beta}.$$

Using the data on GDP per capita and the other inputs in production we can calculate TFP as a residual

$$A_j(t) = \left(\frac{Y_j(t)/P_j(t)}{hc_j(t) h_j(t) ep_j(t) \varphi_j(t)^{(1-\beta)/\beta}} \right)^{\beta}.$$

Using the population of the EU-25 countries as weights, we may then also calculate TFP for the EU-25 on average and calculate TFP in each country relative to this average.

5.2. Inputs and results

The data used in the calculation of TFP and the resulting relative TFP numbers are given in Table 4. The data for GDP per capita (in PPP) are taken from IMAD (2004, Table 1). The data for the population, employment and hours per employee are from Groningen Growth and Development Centre (2004). The data for human capital are from Commission of the European Communities (2003) for all countries except Slovenia, for which we use data from IMAD. The data for the capital-output ratio are from Hall and Jones (1999) for the EU-15 and the US, from Doyle *et al.* (2001) for those accession countries for which we have data (the Czech Republic, Hungary, Poland and the Slovak Republic), except for Slovenia for which we use data from Jongen (2004).

Let us first consider the differences in GDP per capita. We express GDP per capita relative to the EU-25 (mainly because one of the suggested main goals of the Slovenian government's new strategy is to catch up with the EU-25 in terms of GDP per capita by 2013). In 2002 Slovenia was at about 76% of the average GDP per capita in the EU-25. Within the group of new member states Slovenia ranks second after Cyprus. Compared to the EU-15, Slovenia is already very close to Portugal and Greece but at just over one-third of Luxembourg (as we will see below, this is only partly due to differences in TFP). Finally, in 2002 Slovenians had on average 50% of the GDP per capita of citizens of the US.

Which factors can explain these differences in GDP per capita? The first is the employment-to-population ratio. Note that this is not directly comparable to the employment rates we considered before in Table 1, for those figures were restricted to the working age population. Compared to Table 1, Slovenia is still just below the EU-15, but now not too far above the average of the new member states.

The next column shows the average number of (annual) working hours per employee. Again, Slovenia is in between the EU-15 and the new member states. However, regarding the average number of working hours Slovenia is substantially above the EU-15 average, 23% to be precise, and somewhat below the average of the new member states, namely -

6%. Compared to the EU-25, the gap is 14%[25]. Hence, if Slovenians were working the same number of hours that individuals in the EU-25 work on average, GDP per capita would be much lower relative to the EU-25 presuming that this is not offset by any change in the other inputs to production.

Table 4: Factors behind differences in GDP per capita, 2002[1]

	GDP per capita[2]	Employment-population ratio[3]	Annual hours per employee[4]	Average years of schooling[5]	Capital-output ratio[6]	TFP[7]
Slovenia	76	41	1938	11,6	2,14	77
Austria	122	46	1519	12,4	2,61	106
Belgium	118	39	1581	11,1	2,36	125
Denmark	124	50	1505	13,0	2,64	99
Finland	112	46	1604	11,4	3,13	96
France	115	41	1486	10,6	2,68	121
Germany	110	44	1444	13,0	2,32	106
Greece	78	37	1930	10,2	2,36	87
Ireland	137	45	1673	10,6	2,49	121
Italy	108	41	1618	9,7	2,54	115
Luxembourg	208	64	1560	-	-	132
Netherlands	122	51	1324	11,9	2,53	112
Portugal	78	50	1715	7,2	2,08	93
Spain	95	40	1806	9,2	2,33	104
Sweden	115	49	1581	11,7	2,38	101
United Kingdom	118	46	1652	12,0	1,79	111
Cyprus	84	49	2114	-	-	68
Czech Republic	68	46	1913	-	3,08	60
Estonia	44	54	2044	-	-	41
Hungary	58	38	1766	-	2,04	74
Latvia	38	54	2141	-	-	36
Lithuania	43	50	2160	-	-	41
Malta	76	38	1958	-	-	80
Poland	45	36	2201	-	2,07	56
Slovak Republic	52	39	1979	-	2,84	56
EU-15 b	110	43	1578	11,1	2,36	110
New member states	52	40	2071	-	-	57
EU-25	100	43	1660	-	-	100
USA	152	47	1873	13,3	2,25	108

Notes:

1 All series are normalized to the EU-25 average, which itself is normalized to 100.

2 Source: EU-25 from IMAD (2004, Table 1). The data are provisional for 2002 from Eurostat. The relative position of the USA is calculated using data from Groningen Growth and Development Centre (2004).

3 Employment-to-population ratio. Source: Groningen Growth and Development Centre (2004). Averages are weighted averages using the 2002 populations as weights.

4 Annual hours worked per employee. Source: Groningen Growth and Development Centre (2004). Averages are weighted averages using the 2002 populations as weights.

5 Source: Commission of the European Communities (2003) for all countries except Slovenia, for which we use internal calculations by IMAD.

6 Source: Hall and Jones (1999) for EU-15 countries. Doyle *et al.* (2001) for the Czech Republic, Hungary, Poland and the Slovak Republic, and Jongen (2004) for Slovenia. The data from Hall and Jones (1999) are for 1988, but we expect no trend in the EU-15. Data from the Czech Republic are for 1999, and for Hungary, Poland and the Slovak Republic for 2000.

7 Total factor productivity, calculated as a residual using cross-country 'growth' accounting, see the main text.

[25] The gap is 278 hours, with 40 hours per week this means that Slovenians work on average about 7 weeks per year more than the EU-25 average! A large part of this is probably due to differences in part-time work, which is underdeveloped in Slovenia, see Section 1.

The last two columns reveal differences in the human capital per worker and the capital-output ratio, which we already considered above. Unfortunately, we do not have data on the average years of schooling for the other new member states. In our calculations we set the human capital index equal to the EU-15 average for these countries, which may not be too far from the truth though as many former socialist countries had high enrolment rates in education[26].

Regarding the capital-output ratio, we already noted that Slovenia was somewhat below the EU-15 by 2002. The other transition countries for which we have data show a mixed picture with 2 being above and 2 being below the EU-15 average. For those countries for which we do not have data we therefore simply assume that the capital-output ratio is the same as for the EU-15.

Finally, we assume that β is 0.7, in line with the findings of studies on the labour income share (see *e.g.* Gollin, 2002), which equals the elasticity of output with respect to (effective) labour when the production function is Cobb-Douglas.

The resulting values for total factor productivity, *i.e.* GDP per capita after controlling for differences in the other inputs, are shown in the last column. Given that Slovenia is very close to the EU-25 average regarding most of the inputs, though the number of hours worked and human capital are above the EU-25 average whereas the capital-output ratio is below the EU-25 average, it should come as no surprise that total factor productivity relative to the EU-25 is very close to GDP per capita relative to the EU-25. For the new member states on average relative TFP is somewhat higher than relative GDP per capita, indicating that their inputs are 'on average' (using the production function to 'weight' the various factors) somewhat lower.

Looking at the results for some other countries, we note that the US is actually not doing better than the average EU-15 country in terms of TFP (see Blanchard, 2003, for a similar observation). Indeed, its higher GDP per capita is due to the relatively high participation rate of its population, both in persons and in hours, and the relatively high education level. A similar story holds for Luxembourg, whose TFP is only 32% higher than the average of the EU-25 (though it still has the highest TFP in the set of countries considered), compared to more than 100% in terms of GDP per capita[27]. Furthermore, a large part of the relatively favourable GDP per capita in Ireland seems to be due to TFP, whereas Finland does relatively poorly in terms of TFP (both countries are sometimes considered as examples for other countries in terms of certain economic policies).

Of perhaps even bigger interest is the development of TFP over time. Have the new member states been able to catch up with the EU-15 in terms of TFP? Table 5 gives some insight into this question. We present results using two different datasets for average years of schooling. The first two columns give the results using our preferred data series for average years of schooling from Commission of the European Communities (2003). As a robustness check, the third column gives the results using the latest version of the famous Barro and Lee (1993, 2001) dataset. We did not use this dataset in Table 4 because the average years of schooling for Slovenia is unrealistically low in the Barro and Lee

[26] Barro and Lee (2001) do have some data for the accession countries on the average years of schooling. However, at least for Slovenia the data seem rather questionable, see below.

[27] Note that we do not have data on (the presumably above average) human capital variable.

dataset[28]. Indeed, in 1990 the average years of schooling is below such illustrious countries as Romania and Cuba, and even below the average for all of Yugoslavia. This goes against common wisdom regarding the level of education in Slovenia. Another problem with the Barro and Lee dataset is that the share of individuals with no education increases from 0.7% in 1990 to 4.9% in 2000, again running against common wisdom regarding the development of education in Slovenia. Still, for the development of TFP over time we are only interested in relative changes in average years of schooling, which seems not unreasonable, increasing by 6% over the period 1990-2000, compared to 4% according to data from IMAD (see Jongen, 2004).

Turning to the results, let us first consider the results with our preferred data on average years of schooling. Over the period 1990-2002 TFP relative to the EU-25 average increased by 1%. Although this suggests Slovenia has been catching up with the EU-25 in TFP terms, the catch up is almost negligible compared to the average for the new member states over this period (which is mainly driven by Poland's large gain in relative TFP over this period), 9%. These results are relatively sensitive to the starting point we choose for the comparison, however. The second column suggests that Slovenia was able to gain more ground relative to the EU-25 over the period 1992-2002. However, the gap that was closed by Slovenia was still much smaller than the average for the new member states, whose relative TFP grew at 14% over this period. Part of the difference in TFP growth using different starting points can perhaps be explained by the fact that we measure TFP as a residual. Hence, if *e.g.* the change in employment and the capital stock do not fully capture the decline in utilisation rates of these factors, TFP will be understated in the bottom of the 'transformational recession'. The fact that this 'transformational recession' was not synchronised, shifting the starting point one or two years can already make quite a difference, as shown in Table 5[29].

As a further robustness check we consider the gain in relative TFP for the various countries when we use the Barro and Lee dataset on average years of schooling[30]. The relative gain in TFP for Slovenia is (almost) the same. The average relative gain for the new member states is a bit higher. All member states for which we have data (Czech Republic, Hungary, Poland and the Slovak Republic) lose ground to the EU-15 average in terms of average years of schooling in the Barro and Lee dataset over the relevant period. Hence, TFP growth (the residual) ends up a bit higher than without controlling for relative changes in human capital over the period.

[28] De la Fuente and Doménech (2002) consider some further potential shortcomings of the Barro and Lee dataset. De la Fuente and Doménech (2002) also construct an alternative series for a small group of OECD countries (and also do not consider Slovenia) for 1995. The series of the Commission of the European Communities (2003) used in Tables 4 and 5 are an extrapolation of the De la Fuente and Doménech (2002) dataset. Other datasets are given in Cohen and Soto (2001) and Nehru *et al.* (1995), none of these include Slovenia however.

[29] The big difference in relative TFP growth in columns 1 and 2 for a country like Latvia is not a mistake. According to Groningen Growth and Development Center (2004) GDP per capita fell by almost 50% in a few years time!

[30] Source: www.columbia.edu/~xs23/data/barrlee.htm (30-04-2004).

Table 5: Change in TFP relative to EU-25 average, percentage changes[1]

	Data for human capital		
	Commission of the European Communities (2003)		Barro and Lee (2001)
	1990-2002	1992-2002	1990-2002
Slovenia	1	4	1
Austria	0	3	2
Belgium	-1	-1	1
Denmark	3	7	3
Finland	8	11	6
France	-2	1	-7
Germany	8	7	7
Greece	-7	-5	-2
Ireland	22	20	25
Italy	-9	-7	-8
Luxembourg	-3	-4	-3
Netherlands	-10	-6	-9
Portugal	3	-2	4
Spain	-17	-16	-14
Sweden	-1	2	-5
United Kingdom	-1	-1	3
Cyprus	5	7	5
Czech Republic	-10	-2	-7
Estonia	-6	17	-6
Hungary	10	11	13
Latvia	-27	11	-27
Lithuania	-23	-1	-23
Malta	10	6	9
Poland	27	24	29
Slovak Republic	11	18	15
EU-15	-2	-1	-2
New member states	9	14	11
EU-25	0	0	0
USA	0	2	-3

Note:

1 TFP relative to the EU-25 is calculated in all years using cross-country 'growth' accounting. The data used in the calculations are from Groningen Growth and Development Centre (2004) for GDP per capita in PPP, the employment to population ratio and hours worked per employee. For 1990 and 1992 we use data on average years of schooling for 1990 from Commission of the European Communities (2003) and Barro and Lee (2001), and for 2002 we use data for 2002 from Commission of the European Communities (2003) and the projection for 2000 from Barro and Lee (2001). The capital-output ratio in the EU-15 is assumed to remain constant at the level of 1988. The capital-output ratio for Slovenia is taken from Jongen (2004). The capital-outpu ratio for the Czech Republic, Hungary, Poland and the Slovak Republic are taken from Doyle *et al.* (*2*001), where we use data from 1999 for the Czech Republic for 2002 and data from 2000 for Hungary, Poland and the Slovak Republic, the end data of these data series in Doyle *et al.* (2001). For the transition countries for which we do not have data we set the human capital index and the capital-output ratio equal to the EU-15 average.

One final remark, according to data from Groningen Growth and Development Centre (2004) GDP per capita (in PPP) in Slovenia relative to the EU-25 grew by about 18% over the period 1992-2002. Over the same period we calculate growth in relative TFP of 'only' 4%. Hence, most of the convergence with the EU-25 over this period was driven by the growth in labour and capital input[31]. With the participation of labour, education and capital-output ratio's close to the EU-average in 2002, these factors may become less important for future convergence with the EU-25, (though in some sub-areas there is still ample room for improvement regarding these inputs, see above).

[31] For a similar finding regarding the 'Asian tigers' see Young (1995). This suggests that the convergence with the Western world is a costly process of capital accumulation and higher working hours, rather than a costless adoption of more efficient technologies and institutions.

5.3. Limitations

The results above should be interpreted with the appropriate care however. First, there are problems with data availability. For example, for most new member states we do not have data on the human and physical capital stock. Consider again the first column with results in Table 5. We observe a large drop of 27% and 23% in relative TFP over the period 1990-2002 for Latvia and Lithuania. However, this may in part be driven by the drop in physical capital for which we do not have data, which therefore ends up in TFP. Fortunately, we do have data on the capital stock for the by far largest new member state, Poland.

Second, there are problems with data comparability. Specifically, differences in TFP may in part simply reflect differences in quality in *e.g.* schooling or capital. This may be particularly problematic for transition countries. For example, it is hard to determine how much physical and human capital became obsolete during the transition. However, we should not be too pessimistic regarding the distortion of quality differences. Caselli (2003) finds that allowing for differences in the quality of inputs in production does not qualitatively affect his cross-country comparison of TFP. Furthermore, he also finds that the use of different datasets for the inputs does not qualitatively affect the results. Unfortunately, his analysis does not single out Slovenia.

Third, we assume that the production function is Cobb-Douglas in all countries, and that the relative weight of effective labour in production is the same in all countries. Caselli (2003) shows that allowing for more or less substitution, but still assuming the same substitutability in all countries between effective labour and capital, using a CES production function does make quite a difference to the results. Caselli and Coleman II (2004) further find that allowing for imperfect substitutability between workers of different skill types and differences in TFP across skill types also makes a big difference. Yet one should note that these studies are more concerned with differences between rich and poor countries around the globe. The differences in the production structure are likely to be bigger between rich and really poor countries than between Slovenia and the EU or US. However, the analysis of Caselli (2003) and Caselli and Coleman II (2004) does show that one has to be careful in relying too much on the Cobb-Douglas form of the production function.

Another type of problem with this type of analysis is that, although it "accounts" for differences in GDP per capita, it 'does not attempt to explain how the changes in inputs and the improvements in total factor productivity relate to elements – such as aspects of preferences, technology, and government policies – that can reasonably be viewed as fundamentals' (Barro and Sala-i-Martin, 1998, p. 352).

6. EXPLAINING THE TFP GAP

The growth accounting exercise above suggests that a sizeable gap between TFP in Slovenia and the EU-25 remains in 2002. Which factors can explain this gap[32]? Below we consider differences in the following candidates (for which we have internationally comparable data): i) resources devoted to research and development (R&D), 'openness' (trade and foreign direct investment), both R&D and 'openness' being an indication of the exposure of the Slovenian to new technologies; ii) 'absorption capacity' for new technologies (job and worker flows); and iii) other factors like the size of the government and the 'rule of law'.

6.1. R&D

TFP is calculated as a residual, but is typically assumed to reflect in part the state of technology in a country. One factor for TFP growth that has received much attention in the literature is R&D. Where a higher share of GDP is spent on R&D this results in an increase in the level of GDP in the medium- and perhaps even long-run[33]. Table 6 gives some indicators for the quantity and quality of R&D in Slovenia relative to EU countries and the US, in 2001.

In the first column we find expenditures on R&D as a percentage of GDP. Slovenia scores much better on this indicator than the average new member state, but is still somewhat behind the EU-15 and EU-25 average. The gap vis-à-vis the US is much bigger, which holds for most EU countries (Finland and Sweden being notable exceptions).

The second column gives the number of researchers as a percentage of the population. Also according to this measure Slovenia does relatively well relative to the new member states and lags behind the EU-15. However, in terms of the percentage of researchers Slovenia is closer to the average of the new member states than to the EU-15 (although data on more countries in the EU-15 is missing for this indicator than for R&D as a percentage of GDP).

The other columns give indicators of the quality of R&D in Slovenia. First, the private sector takes a lower share of total R&D in Slovenia than in the EU-15, and in particular than in the US, but again it is above the average of the new member states. Public R&D expenditures are typically assumed to be less productive than private sector R&D (Cameron, 1998). When we consider the number of patent applications per 1 million inhabitants (columns 4 and 5), we find that the gap with the EU-15 and the US widens. This may indicate that Slovenian R&D is, on average, less productive than EU-15 and US R&D, but it may also indicate that Slovenian R&D is more about imitation than

[32] One of the main findings of Hall and Jones (1999) is that huge differences in GDP per capita around the globe remain after controlling for differences in labour input, human capital and physical capital. They then continue to explain these residual differences with differences in 'social infrastructure' and use indicators such as distance to the equator and the share of the population speaking English as instruments for social infrastructure (also see Acemoglu *et al.*, 2004). Here we take a more mundane approach, quantifying differences in other inputs such as R&D *etc*.

[33] In semi-endogenous growth models, a higher R&D share will increase the level but not the growth rate of GDP in the long run, in endogenous growth models a higher R&D share also increases the growth rate of GDP in the long run. Whether or not growth is endogenous or semi-endogenous is a hotly debated topic, see *e.g.* Dalgaard and Kreiner (2003), Ha and Howitt (2003), Jones (2003), Li (2003) and Solow (2000).

invention[34]. Overall, we conclude that part of the gap in TFP with the EU-25 can be explained by the lower quantity and perhaps quality of R&D in Slovenia.

Table 6: Indicators of quantity and quality of R&D, 2001[1]

	R&D as % of GDP	Number of researchers per 1000 workforce	Share of business R&D	Patents at EPO (per mln. inhab.)[2]	Patents at US PO (per mln. inhab.)[3]
Slovenia	1,6	4,6	55	41	13
Austria	1,9	-	41	174	83
Belgium	2,2	-	-	152	93
Denmark	2,4	6,9	62	211	106
Finland	3,4	13,8	71	338	156
France	2,2	-	-	145	77
Germany	2,5	6,6	66	310	147
Greece	-	-	-	8	3
Ireland	1,2	5,0	67	86	49
Italy	1,1	-	50	75	33
Luxembourg	-	-	-	-	-
Netherlands	-	-	-	243	99
Portugal	0,8	3,4	32	6	2
Spain	1,0	4,5	47	24	9
Sweden	4,3	10,1	72	367	214
United Kingdom	1,9	11,6	90	134	77
Cyprus	0,3	1,1	15	15	3
Czech Republic	1,3	2,9	52	11	3
Estonia	0,8	3,8	33	11	2
Hungary	1,0	3,6	35	19	7
Latvia	0,4	3,2	18	8	1
Lithuania	0,7	4,6	36	2	1
Malta	-	-	-	-	-
Poland	0,7	3,3	31	3	1
Slovak Republic	0,6	3,7	60	6	1
EU-15	1,9	7,7	63	161	80
New member states	0,8	3,6	51	10	2
EU-25	1,7	6,7	61	138	68
United States	2,8	-	75	170	323

Notes:
1 Source: Eurostat, except for Italy and the US for which we use data from OECD (2003b).
2 Patents at European Patent Office, per million inhabitants.
3 Patents at US Patent Office, per million inhabitants.

6.2. Trade and foreign direct investment

Domestic R&D is probably an important determinant of TFP. However, exposure to foreign technology and institutions may also lead to an increase in TFP as individuals in different countries learn from each other when they interact. Two main channels for interaction are imports and exports, and inward and outward foreign direct investment (FDI)[35].

[34] For more on the quality of Slovenian R&D, see Fritsch (2002) and Ministry of the Economy (2003, Chapter 8).

[35] Furthermore, over and above technology transfer trade and FDI may further enhance GDP growth by increasing specialisation and a lower cost of capital, for example.

6.2.1. Trade

The consensus view appears to be that more open economies grow faster (Ben-David, 2000; Sala-i-Martin, 2001), although the issue is not settled (Rodríguez and Rodrik, 1999). For Slovenia we can take a somewhat less controversial position, which is that economies that trade intensively with each other converge in terms of per capita income, see *e.g.* Ben-David (2000) for an interesting look at some European data. As most trading is with the EU (see below), we may expect a faster convergence with the EU regarding TFP when trade increases following the entrance of Slovenia into the EU.

Table 7: Trade and FDI, 2002[1]

	Imports as % of GDP	Exports as % of GDP	Share of imports to EU-15 in %	Share of export to EU-15 in %		Inward FDI stock as % of GDP	Outward FDI stock as % of GDP
Slovenia	49	47	68	59		17	6
Austria	38	38	-	-		21	20
Belgium	81	88	-	-		82	73
Denmark	29	33	-	-		42	43
Finland	26	34	-	-		33	33
France	23	23	-	-		9	5
Germany	25	31	-	-		27	53
Greece	23	8	-	-		28	46
Ireland	43	72	-	-		129	30
Italy	21	21	-	-		11	16
Luxembourg	-	-	-	-		-	-
Netherlands	52	58	-	-		75	85
Portugal	33	22	-	-		36	26
Spain	25	19	-	-		23	29
Sweden	28	34	-	-		46	61
United Kingdom	22	18	-	-		41	66
Cyprus	36	4	56	53		55	2
Czech Republic	55	52	60	68		66	11
Estonia	74	53	58	68		-	-
Hungary	58	53	56	75		38	7
Latvia	48	27	53	60		32	1
Lithuania	53	37	45	50		31	1
Malta	63	49	67	46		-	-
Poland	29	21	62	69		24	1
Slovak Republic	68	59	50	61		43	2
EU-15	27	27	-	-		29	39
New member states	43	35	59	67		34	3
EU-25	29	29	-	-		30	33
United States	11	6	-	-		13	14

Note:
[1] Import and export data are from Eurostat (30-04-2004), FDI data are from Unctad (2003). The averages for EU-15, the new member states and the EU-25 are weighted averages using the population data of Groningen Growth and Development Center (2004) in 2002 as weights.

Table 7 gives an overview of imports and exports relative to GDP for Slovenia and the other countries for 2002. Slovenia is above-average regarding imports and exports when we consider the EU-15 or the new member states[36]. Slovenia is also far above the US in this respect. This is not surprising given that Slovenia is a relatively small country and

[36] The share of exports in GDP is surprisingly low in Cyprus in 2002 according to Eurostat.

hence is more likely to depend on trade. This is not to downplay the relative importance of trade for technology transfer however. Indeed, as a small country, foreign factors are typically relatively important for domestic output and TFP.

In brackets we give imports from and exports to the EU-15 as a share of total imports and exports per country, in which direction we hope that TFP will converge. We find that Slovenia is above-average regarding imports, and below-average regarding exports relative to the other new member states on average. This may be a favourable mix, as Keller (2004) suggests that imports matter more for domestic technology than exports (importing technology is more important than 'learning-from-exporting').

Returning to our main theme, is there still room for improvement? Probably there is. Indeed, accession to the EU-15 may help in bringing down explicit (*e.g.* tariffs, quotas and exchange rate risks) and other (*e.g.* cultural) barriers to trade. We conclude that Slovenia's relative openness means it is in a relatively favourable position to adopt technology from other countries via trade.

6.2.2. Foreign direct investment

Whether or not FDI stimulates growth or convergence appears to be more controversial than trade. The consensus view once appeared to be that micro-level studies found no impact of FDI on TFP, whereas macro-level studies typically found that more FDI raises TFP (if some complementary factors were present). This seems to have changed. Reviewing the latest findings, Keller (2004) concludes that FDI raises TFP when using micro-level data. However, an extensive robustness check of Carkovic and Levine (2002) on macro-level data suggests that FDI does not affect TFP, also not conditional on the level of human capital and other factors believed to be complementary to FDI effects on TFP[37]. However, it is hard to imagine that more trade and FDI lowers TFP. Indeed, personal contacts with foreigners seem to matter for technology transfer, see *e.g.* Keller (2004), and trade and FDI may be expected to increase the number of contacts with foreigners.

Table 7 shows that if more FDI is beneficial for TFP, Slovenia has relatively much to gain since it is a clear outlier. Column 3 displays the capital stock of inward FDI while column 4 shows the capital stock of outward FDI, both as a percentage of Slovenian GDP in 2002. Slovenia is far behind the average of the new member states regarding inward FDI, but also relative to the EU-15.

6.3. Absorption capacity

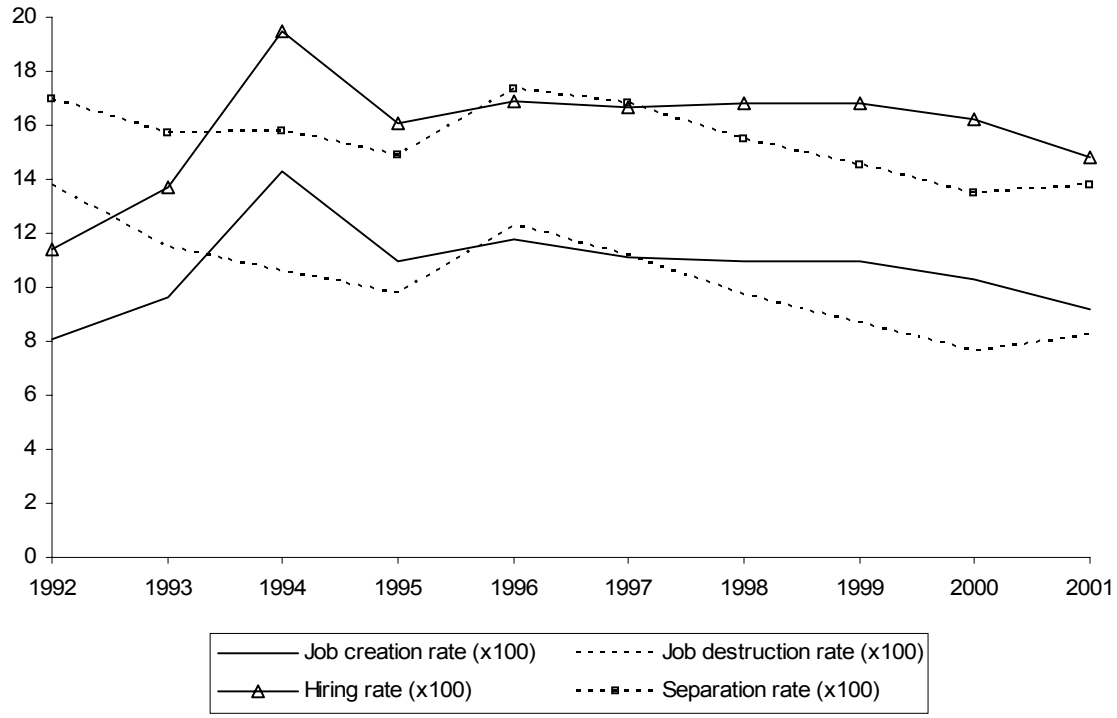
Whereas R&D, trade and FDI may give us an idea of the 'exposure' of Slovenian firms and workers to new technologies, job and worker flows may give us an indication of how quickly new technologies are absorbed by the Slovenian economy. Job and worker flows give an indication of the pace of 'creative destruction' (Schumpeter, 1975) in the economy, the idea being that technology is largely embodied in production units which must be reallocated to absorb the new technologies[38].

[37] The studies of Carkovic and Levine (2002) for FDI and Rodríguez and Rodrik (1999) for trade highlight a typical problem in cross-country studies effects on FDI and trade. These studies often omit variables that can explain both above-average TFP, trade and FDI.

[38] The link between embodied technology and creative destruction rests on a relatively subtle assumption, namely the incumbent firm is typically assumed to have less of an incentive to develop or adopt the new

Figure 1 shows the flow of jobs and workers in Slovenia for the 1992-2001 period. The lower two lines are the annual job creation and destruction rates (in %). The job creation rate is the share of jobs created at expanding plants over the stock of employment. The job destruction rate is the share of jobs destroyed at contracting plants (see Davis *et al.*, 1996, for the methodology of measuring job and worker flows). There appears to be a downward trend in job destruction, which may indicate the restructuring of the economy following the separation from the rest of Yugoslavia in the early 1990s. We see that job creation responded with a lag, and after 1994 also appears to display a mild downward trend, again suggesting that restructuring was more intense in the early 1990s than in recent years.

Figure 1: Job and worker flows in Slovenia



Source: Vodopivec (2004).

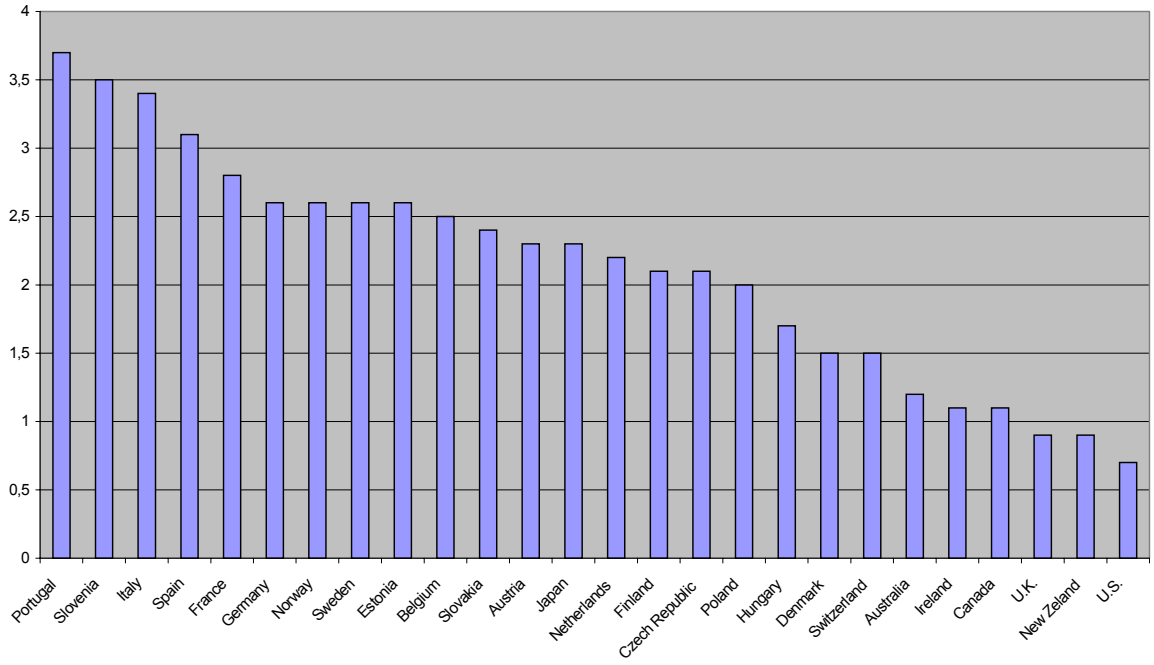
Note: The job creation rate is the share of jobs created at expending plants over the stock of employment, the job destruction rate is the share of jobs destroyed at contracting plants. The hiring rate is the inflow of employees over the stock of employment, the seperation rate is the outflow of employees over the stock of employment.

Figure 1 also gives the (remarkably similar) flow rate (in %) of workers in and out of jobs (which can be either from a job to no job or *vice versa*, or from one job to another). The worker flows are always larger than job flows as a job cannot change without a worker, but

technology than others, see *e.g.* Aghion and Howitt (1998). But indeed, one does observe large job and worker flows in narrowly defined industries, which do seem to be driven at least in part by technology adoption, see *e.g.* Davis *et al.* (1996).

a worker can change without a job (by the definition used). The question is: are these flows below average, above average or just average?

Figure 2: Indicators of employment protection legislation



Source: Riboud et al. (2002).

Note: low=1, high=6.

Before we consider the international data, let us first consider some reasons why we may expect these flows to be lower or higher in Slovenia than in other countries. Figure 2 gives indicators of the strictness of employment protection legislation for OECD countries and the new member states. As we can see, Slovenia ranks second after Portugal! (recently employment protection has become less strict in Slovenia, see Riboud *et al.*, 2002) This accords with the common wisdom that, at least until recently, even after the "desocialization" employment protection was still relatively strict for a long time in Slovenia (see Riboud *et al.*, 2002 for the components of the EPL index for each transition country). Stricter employment protection is typically assumed to reduce job and worker flows.

Furthermore, at least for some time reallocation may further have been hampered by taxing productive sites to subsidise unproductive sites (to 'save' jobs), 'soft budget constraints' for unproductive sites and high costs for starting up new businesses (see below). Table 8 gives an indication of the costs of starting and closing a business in Slovenia relative to the other countries. The Worldbank and International Finance Corporation (2004) asked local experts to determine how many procedures one needs to go through, how much time it takes and what is the initial cost for starting and closing a business in all the countries, assuming the start-up or closure of a hypothetical representative business which was the same in all countries. We see entrepreneurs in Slovenia have to deal with more procedures and have to devote more time to start up a business in Slovenia relative to the EU-15 and

the other new member states on average. On the positive side, the required monetary start-up costs and in particular the start-up capital are relatively low compared to the average new member states. Regarding closing a business (which is important for entrepreneurs wanting to start an alternative business), Slovenia does not appear to be out of line, although the cost is substantially higher than in the other EU countries on average.

Table 8: Costs of starting and closing a business, 2003[1]

	Starting a business				Closing a business	
	Number of procedures	Duration (in days)	Cost (% GNI per capita)[2]	Min. capital (% GNI per capita)[3]	Actual time (in years)	Actual cost (% of estate)
Slovenia	10	61	12	20	2	18
Austria	9	29	6	66	1	18
Belgium	4	34	12	14	1	4
Denmark	4	4	0	50	4	8
Finland	3	14	1	30	2	18
France	7	8	1	29	3	1
Germany	9	45	6	49	na	na
Greece	15	38	36	135	4	18
Ireland	4	24	10	0	4	38
Italy	9	13	23	12	1	18
Luxembourg	-	-	-	-	-	-
Netherlands	7	11	13	67	2	4
Portugal	-	-	-	-	-	-
Spain	6	108	17	18	2	18
Sweden	3	16	1	39	5	4
United Kingdom	6	18	1	0	3	4
Cyprus	-	-	-	-	-	-
Czech Republic	10	88	11	47	9	38
Estonia	6	72	8	53	2	8
Hungary	6	52	23	96	11	8
Latvia	7	17	17	45	4	18
Lithuania	8	26	4	68	4	38
Malta	-	-	-	-	-	-
Poland	10	31	21	247	3	8
Slovak Republic	9	52	6	50	4	18
EU-15	7	32	9	30	1,9	8
New member states	9	44	17	160	3,5	11
EU-25	8	34	11	52	2,2	8
United States	5	5	1	0	4	8

Notes:
1 Source: Worldbank and International Finance Corporation (2004).
2 Cost to start up a business, as a percentage of gross national income per capita.
3 Startup capital required to start a business, as a percentage of gross national income per capita.

Most of the above indicators suggest that institutions related to resource reallocation may have held back the reallocation of workers and other inputs from less to more productive sites. However, on the other hand we may expect job flows to be higher for Slovenia than, for example, the EU-15 countries as there was a bigger need for restructuring in Slovenia than in the EU-15.

Table 9: Job creation and destruction rates, in %, average for 1990s[1]

	Job creation rate	Job destruction rate	Job reallocation rate[2]	Net employment growth rate[3]	Excess job reallocation rate[4]
Slovenia	(4) 11	(5) 10	(10) 21	(-1) 0	(9) 21
Austria	5	3	8	1	7
Belgium	(4) 5	(3) 4	(7) 9	(0) 1	(6) 8
Denmark	6	3	10	3	7
Finland	7	3	10	4	6
France	5	3	8	2	7
Germany	(5) 4	(4) 4	(9) 8	(0) 1	(9) 7
Greece	-	-	-	-	
Ireland	9	3	12	5	6
Italy	8	4	12	4	8
Luxembourg	-	-	-	-	
Netherlands	(7) 7	(3) 4	(9) 11	(4) 2	(5) 9
Portugal	5	4	8	2	7
Spain	9	3	12	5	7
Sweden	8	4	12	5	7
UK	(5) 7	(5) 4	(11) 11	(0) 2	(11) 9
Cyprus	-	-	-	-	
Czech Republic	-	-	-	-	
Estonia	8	8	16	0	16
Hungary	-	-	-	-	
Latvia	-	-	-	-	
Lithuania	-	-	-	-	
Malta	-	-	-	-	
Poland	3	5	9	-2	7
Slovak Republic	-	-	-	-	
EU-15	6	4	10	2	8
New member states	-	-	-	-	-
EU-25	-	-	-	-	-
United States	11	10	21	1	20

Notes:

1 Source: Gomez-Salvador *et al*. (2004) for the EU-15 (series range from 1992 to 2001 (when available)), Faggio and Konings (2001) for Estonia and Poland (series range from 1994 to 1997), except for Slovenia for which we use data from Vodopivec (2004) for which the series range from 1992-2001. For the US we use data from Haltiwanger (2004) which range from 1979-1983. In brackets are the data from Faggio and Konings (2001) for comparison. The EU-15 average is a weighted average using the population in 1996 from Groningen Growth and Development Centre (2004) as weights.

2 Job reallocation rate (= job creation rate + job destruction rate).

3 Net employment growth rate (= job creation rate - job destruction rate).

4 Excess reallocation rate (= job creation rate - | job destruction rate |).

Let us now consider the international data. Table 9 presents the results from some studies on job creation and destruction rates. Comparing these data across countries is tricky as the studies typically do not compare the same flows. The preferred data are given first, where the criteria are that the data had to cover the whole economy (not only, say, manufacturing), the data period was as long as possible, and also included small firms. We do not have data for all countries that satisfy these criteria and we will highlight some perhaps crucial differences below in the comparison.

Our preferred data are from Vodopivec (2004) for Slovenia[39], from Gomez-Salvador *et al.* (2004) for the EU-15, from Faggio and Konings (2001) for Estonia and Po-land and from Haltiwanger (2004) for the US. In brackets we give data from the study of Faggio and Konings (2001), which is the only study that presents comparable data on Slovenia, some

[39] Various studies on job (and worker) flows in Slovenia exist, apart from Vodopivec (2004) see *e.g.* Bojnec and Konings (1998), De Loecker and Konings (2003), Faggio and Konings (2001) and Haltiwanger and Vodopivec (2003).

EU countries and two other new member states. This is not our preferred series for Slovenia and the EU countries (for which we have data) however, as the sample is restricted to large firms (>100 employees).

We present data on the following variables: a) the job creation rate, the creation of jobs at expanding plants over the stock of employment; b) the job destruction rate, the destruction of jobs at contracting plants over the stock of employment; c) the job reallocation rate, the sum of job creation and destruction rates; d) the net employment growth rate, the job creation rate minus the job destruction rate; and e) the excess reallocation rate, the gross reallocation rate minus the absolute value of the net employment growth rate, indicating the reallocation of jobs over and above the adjustment required to meet the change in net employment.

The data from Vodopivec (2004) covers the whole economy for a decade. The only data comparable to this is data from the US (the other studies do not consider the smallest firms). The flows are almost of a similar magnitude in Slovenia and the US.

Next, comparing the data from the EU-15 to the US we see that these are substantially lower on average. However, the data are not comparable as Gomez-Salvador *et al.* (2004) restrict the sample to larger firms. Data from Haltiwanger (2004) show that flows in the EU-15 are actually quantitatively not that different from the US.

Turning to the flows reported in Faggio and Konings (2001), see the numbers in brackets, we also have data for Estonia and Poland and some EU-15 countries. Compared to the EU-15 countries we find that the flow rates in Slovenia are not that different. Compared to the two other new member states we find that the flow rates are bigger than in Poland but much smaller than in Estonia. Faggio and Konings (2001) also report data for Bulgaria and Romania (not in the table). The gross reallocation rate for Bulgaria is comparable to Slovenia, whereas the excess reallocation rate is lower than in Slovenia. For Romania, they find that the gross reallocation rate is higher than in Slovenia and the excess reallocation rate is comparable to Slovenia. Overall, Slovenia does not appear to stand out.

Finally, conclude with some remarks regarding worker flows. This may be a different story. Data from Vodopivec (2004) suggest that for the period 1992-2001 the average hiring and separation rates were about 50% higher than the job creation and destruction rates. This is relatively low by international standards. Indeed, Haltiwanger (2004) suggests that across countries worker flows are on average about 100% to 200% higher than job flows. Haltiwanger and Vodopivec (2003) consider the relative low worker flows in Slovenia in depth, where wage compression (differences in wages being smaller than differences in productivity's across workers/jobs) seems to be a limiting factor[40].

What do we make of this analysis? My reading is that, despite some indicators suggesting that job flows may have been held back in Slovenia over the past decade, these flows are quite similar to most EU-15 countries and the US. Yet, the flow rates are a bit lower than in some other new member states. Insofar as this does not reflect a different stage in the transition (Slovenia being ahead in the transition process), this could still be taken as an indication that job flows have been held back to some extent in Slovenia. Note though that recently some of these institutions have become less restrictive.

[40] Another limiting factor on worker mobility might be frictions on the housing market like credit constraints.

Finally, worker flows seem to be relatively low in Slovenia, suggesting that there is at least some further room for improvement regarding the flow of workers. But again, this may change since employment protection legislation has become less strict.

6.4. Other factors

Clearly, many other factors play a part in the gaps in TFP across countries. Here we consider some further indicators for which we have internationally comparable data[41].

We already came across the interesting study of the Worldbank and International Finance Corporation (2004) when we looked at the costs of starting up and closing a business in Table 8. They also considered the time and costs it takes to enforce contracts, how much individuals use credit and an index of the strength of creditors' rights (see Table 10). According to this study, it is very time consuming to enforce a contract in Slovenia, which can take almost 3 years. Together with Poland, Slovenia has the longest time needed to enforce a contract. This may have held back the number of productive transactions in Slovenia. Regarding the use of credit, Slovenians are far below the EU-15 average[42] and somewhat above the average of the new member states, though Slovenia scores above average in terms of creditors' rights (low creditor's rights are assumed to hamper the willingness of creditors to give loans). The limited use of credit may have limited the number of efficient transactions by Slovenian citizens.

Table 11 gives some data on government expenditures and state aid as a percentage of GDP. Government expenditures give an indication of the size of the public sector, noting that a larger public sector is associated with lower productivity (once the public sector covers the main tasks of any government, *e.g.* defence *etc.*)[43]. The data suggest that the share of government expenditures in GDP is somewhat higher in Slovenia than in the EU-15, and the other new member states for which we have data. Note further the remarkably low share of government expenditures in GDP in Ireland, Latvia and Lithuania.

[41] Further international comparisons related to this study can be found in EBRD (2003), IMD (2003) and World Economic Forum (2003). We present only data from Worldbank and International Finance Corporation (2004). EBRD (2003) only gives indices on a discrete scale whereas World Economic Forum (2003) relies heavily on survey data, which are hard to compare across countries (but perhaps not across time). The data source description in IMD (2003) is rather imprecise.

[42] See also Coricelli and Masten (2004).

[43] Some authors prefer to use government consumption, which may be more appropriate as various investments of the government may be quite productive (*e.g.* infrastructure).

Table 10: Contract enforcement costs and credit facilities, 2003[1]

	Number of procedures	Duration (days)	Cost (% GNI per capita)[2]	Procedural complexity index		Public credit registry coverage[3]	Private bureau coverage[4]	Creditor rights index
Slovenia	22	1003	4	65		1	0	3
Austria	20	374	1	54		1	31	3
Belgium	27	112	9	54		7	4	2
Denmark	14	83	4	40		0	6	3
Finland	19	240	16	48		0	10	1
France	21	210	4	79		1	0	0
Germany	26	154	6	61		1	69	3
Greece	15	315	8	64		0	9	1
Ireland	16	217	7	42		0	73	1
Italy	16	645	4	64		6	42	1
Luxembourg	-	-	-	-		-	-	-
Netherlands	21	39	1	46		0	53	3
Portugal	22	420	5	54		50	2	1
Spain	20	147	11	83		31	5	2
Sweden	23	90	8	44		0	49	1
United Kingdom	12	101	1	36		0	65	4
Cyprus	-	-	-	-		-	-	-
Czech Republic	16	270	19	65		1	14	3
Estonia	-	-	-	-		-	-	-
Hungary	17	365	5	57		0	2	2
Latvia	19	189	8	56		0	0	3
Lithuania	17	74	13	58		1	0	2
Malta	-	-	-	-		-	-	-
Poland	18	1000	11	65		0	54	2
Slovak Republic	26	420	13	40		0	0	2
EU-15	20	238	5	61		6	38	2,0
New member states	18	692	11	61		0	31	2,2
EU-25	19	311	6	61		5	37	2,1
United States	17	365	0	46		0	81	1

Notes:

1 Source: Worldbank and International Finance Corporation (2004). The averages for the EU-15, new member states and EU-25 are weighted averages using the population of Groningen Growth and Development Centre (2004) as weights.

2 Cost as a percentage of gross national income per capita.

3 Percentage of borrowers relative to population registered at public registry.

4 Percentage of borrowers relative to population registered at private registry.

Table 11 also gives 'total' state aid (which excludes aid to railways according to the latest definiton of the European Commission), and state aid excluding aid to agriculture and fisheries. Regarding total state aid, Slovenia is still quite far above the EU-15 average (no data are available for the other new member states). Furthermore, a much larger part goes to agriculture and fisheries than in the EU-15 on average. On a positive note, IMAD (2004) reports that in 2002 in Slovenia 74% of state aid not going to agriculture, fisheries and transport was for (the supposedly less distortionary) 'horizontal' objectives, compared to 59% in the EU-15.

Table 11: Government expenditures, and state aid, as % of GDP, 2002

	Government expenditures[1]	State aid total[2]	State aid excl. agriculture and fisheries[3]
Slovenia	48	1.36 [4]	0.49
Austria	51	0.63	0.21
Belgium	51	0.53	0.37
Denmark	56	0.92	0.72
Finland	50	1.28	0.17
France	54	0.66	0.42
Germany	49	0.65	0.56
Greece	47	0.52	0.31
Ireland	33	0.85	0.45
Italy	48	0.50	0.38
Luxembourg	44	0.41	0.26
Netherlands	48	0.46	0.19
Portugal	46	0.83	0.55
Spain	40	0.68	0.55
Sweden	58	0.39	0.16
United Kingdom	41	0.25	0.17
Cyprus	42	-	-
Czech Republic	52	-	-
Estonia	-	-	-
Hungary	53	-	-
Latvia	39	-	-
Lithuania	34	-	-
Malta	-	-	-
Poland	-	-	-
Slovak Republic	51	-	-
EU-15	47	0.56	0.39
New member states	-	-	-
EU-25	-	-	-
United States	39	-	-

Notes:

1 Government expenditures as a percentage of GDP. Source: Eurostat (30-04-2004) for all countries except Slovenia, for which we use Statistical Office of the Republic of Slovenia (2004), and the US, for which we use IMD International (2003).

2 State aid (excluding aid to railways) as a percentage of GDP. Source: Commission of the European Communities (2004) for the EU-15, IMAD (2004) for Slovenia.

3 State aid (excluding aid to railways), excluding aid to agriculture and fisheries, as a percentage of GDP. Source: Commission of the European Communities (2004) for the EU-15, IMAD (2004) for Slovenia.

4 Total state aid as a percentage of GDP minus the aid to transport (6.5% of total aid, see IMAD, 2004).

7. POTENTIAL GROWTH

We conclude with a calculation of the remaining growth potential from the 'rooms for improvements' we considered above. In Section 7.1 we start with the methodology. Next we consider the base projection of Jongen (2004), and then turn to the potential contribution to future growth rates by narrowing the remaining 'gaps' in inputs to production. The focus is on the average growth rate in real GDP per capita over the period 2002-2013.

7.1. Methodology

We make a projection of the growth in real GDP per capita using a projection for the growth in inputs and the production function. Consider again the expression for output we derived before in Section 5.1

$$Y_j(t)/P_j(t) = A_j(t)^{1/\beta}\, hc_j(t) h_j(t) ep_j(t) \varphi_j(t)^{(1-\beta)/\beta}.$$

We only consider the growth in GDP per capita in Slovenia here, and hence drop the subscript *j*. Furthermore, introduce the alternative 'employment-population' ratio *EP(t)* at time *t* as $EP(t) \equiv h(t)ep(t)$. Taking the derivative of the above expression with respect to time and dividing by GDP per capita gives the following growth rate for GDP per capita

$$g_{Y/P}(t) = \frac{1}{\beta} g_A(t) + g_{hc}(t) + g_{EP}(t) + \frac{1-\beta}{\beta} g_{\varphi}(t),$$

where g_X denotes the growth rate of *x*, $g_X \equiv X'(t)/X(t)$. For simplicity we convert the growth in inputs and output to average annual growth rates over the period 2002-2013 because we are primarily interested in how far Slovenia would get relative to the EU-25 by 2013.

7.2. Base projection of Jongen (2004)

Jongen (2004) considers a base projection for the inputs over the period 2002-2013, and also gives an extensive sensitivity analysis of this base projection. Here, we suffice with a brief reiteration of the base projection for the inputs, and output.

Kraigher (2004) projects a minor annual decline of 0.02% of the population over the period 2002-2013. Since we are interested in the growth in GDP per capita up to the first digit, we ignore the small projected drop in the population. In the 'trend' projection of Kraigher (2004) employment is projected to grow slowly at 0.12% annually over the period 2002-2013. This average annual growth rate is comparable in size to the growth rate in employment over the past decade.

For human capital, Jongen (2004) uses a CES (constant-elasticity-of-substitution) weighted average of low- and high-skilled workers, including skill-biased technological change. We shall continue to use the CES-composite of low- and high-skilled labour for the calculation of the growth potential since Jongen (2004) cannot reject that there is skill-biased technological change in Slovenia and that low- and high-skilled workers are imperfect substitutes[44]. Jongen (2004) projects the CES-composite of human capital to grow at 2.3% annually, which is higher than over the past decade (though not unrealistic given the recent high enrolment rates in tertiary education).

Jongen (2004) projects the capital-output ratio to rise somewhat over the period 2002-2013, mainly driven by the presumption that real interest rates will still continue to fall for some time to come. The projected annual growth rate for the capital-output ratio for the

[44] Above we focused on the average years of schooling as this is most common in the literature. We did not use the CES-composite for the international comparison would require data on relative wages, which are not directly available.

period 2002-2013 is 1.05%. This is far below the 'catch-up' growth rate of the capital-output ratio calculated by Jongen (2004) over the period 1993-2002, 2.6%.

Finally, for TFP, Jongen (2004) 'simply' projects the growth to be somewhat lower than over the past decade, 0.5% annually. On the one hand, the closer Slovenia gets to the EU-25 TFP 'frontier' the slower the convergence rate might be. However, on the other hand, the analysis in Section 5 suggests that a sizeable gap in TFP remains in 2002 and further integration with the markets of the EU-15 may stimulate TFP growth (Ben-David, 2000)[45].

Again by using a value for the elasticity of output with respect to labour β of 0.7 we come to an annual average growth rate of 3.6% over the period 2002-2013. This is somewhat below the 4.1% over the period 1993-2002, but still impressive.

For completeness, without the growth in labour participation an increase in the level of education and further capital deepening the growth in output would be 2.3% because of the growth in TFP and the rise in the human capital index due to skill-biased technological change.

7.3. Closing the gaps

We next consider how closing the residual gaps in inputs in production might raise the growth in GDP per capita for the period 2002-2013, using the framework outlined above.

Regarding labour input, in Section 2 we concluded that the biggest room for improvement was the employment rate of older workers (55-64). To calculate the growth potential we need to know how many individuals we project will be aged 55-64 by 2013, and the size of the participation 'gap'. According to Kraigher (2004) there will be 291,000 individuals aged 55-64 in 2013. There is a participation gap of 14 percentage points as against the current EU-25 average, and 25 percentage points as against the Lisbon strategy target[46].

Raising the participation of the elderly to these respective targets would increase employment by 41,000 and 73,000 persons, respectively. Assuming these individuals would have the same level of human capital as the average employee[47], this implies a potential annual growth in labour (and hence GDP per capita) of 0.4% and 0.7% over the period 2002-2013, for catching up with the EU-25 average in 2002 and the Lisbon strategy in terms of participation of the elderly respectively. However, in the base projection of Jongen (2004) the employment rate of older workers already rises to 32%. The additional growth potential of catching up with the EU-25 average of 2002 and the Lisbon strategy relative to this base projection is then 0.2% and 0.5%, respectively.

Next, we consider the remaining growth potential coming from education. In 2001 the share of tertiary educated workers was 17%, compared to 22% in the EU-15 and 37% in the US. Using our CES-composite of low- and high-skilled workers, catching up with the EU-15 average of 2001 by 2013 would imply an annual growth rate of human capital of

[45] In the calculation of past TFP we did not make a correction for the change in average working hours. We may expect working hours per employee to fall as GDP per capita increases in the future. However, since the growth in GDP per capita is not projected to be that different from the past the 'bias' in TFP due to the change in working hours may be expected to be quite similar for the future as it was for the past.

[46] See Economic Policy Committee (2003, Annex 2) for the quantitative targets of the Lisbon strategy.

[47] The level of (formal) education may be lower for older workers, but they have more experience.

1.9%. Catching up with the US level of 2001 would imply an annual growth rate of human capital of 2.6%. Note that the difference in the growth rates in human capital is smaller than the difference in the 'education gaps' that are closed, as we keep skill-biased technological change the same in both scenarios[48].

A comparison with the base scenario reveals however, that the share of tertiary educated workers in the EU-15 in 2001 is far below the 'trend' projection of Kraigher (2004) for this share in Slovenia in 2013, 29%. Hence the EU-15 average in 2001 is not a sensible target for Slovenia. Perhaps another useful target to consider is the target formulated in the education strategy of the government (Ministry of Education, Knowledge and Sports, 2004). Table 12 gives the transition rates between education classes, the share of tertiary educated and the average years of schooling in the 'trend' scenario of Kraigher (2004) and the scenario where the targets of the Slovenian government's education strategy are realised (in the 'translation' of Kraigher, 2004, of the education strategy). Table 12 also reports the averages for the 1995-2002 period and the levels for 2002, to add some perspective.

When the education strategy would be realised, the share of tertiary educated workers and average years of schooling in 2013 in Slovenia would be getting close to the US level in 2001 (see Table 2). Realising the education strategy would boost the annual growth in the human capital index from 2.3% in the base projection of Jongen (2004) to 2.6% over the period 2002-2013. Again the change in the growth of the human capital index is not that dramatic due to the fact that we keep the growth in skill-biased technological change the same in all scenarios. Furthermore, note from Table 12 that the realisation of the education strategy would require some drastic breaks from the trend (in part due to the unfavourable demographic composition of the population in Slovenia).

Table 12: Transition rates between education classes, 'trend' and government education strategy, in %[1]

	Average 1995-2000	2002	'Trend'	Education strategy of the government
			2013	2013
Unskilled to elementary	1.7	3.7	16.7	16.7
Elementary to lower vocational	0.6	0.3	0.2	1.5
Elementary to vocational	3.2	3.3	3.2	8.5
Elementary to higher secondary	5.4	7.0	9.7	14.9
Vocational to higher secondary	0.7	1.9	3.7	3.7
Higher secondary to non-university degree	0.9	0.5	1.1	4.4
Higher secondary to university degree	1.5	2.5	3.0	5.6
University degree to post-graduate	1.6	1.6	2.0	3.2
Share of tertiary educated (stock in %)	5.9	18.4	28.7	38.8
Average years of schooling (in years)	11.2	11.6	12.4	12.9

Note:
[1] Transition probabilities for the population aged 15-49, after 49 individuals are not expected to change education classes anymore. Source: Kraigher (2004).

[48] The rate of skill-biased technological change may change in response to a bigger increase in the share of tertiary educated workers, as the invention and adoption of new technologies is directed more towards the high-skilled (see *e.g.* Acemoglu, 2002).

Regarding the capital-output ratio, in Jongen (2004) we project a further increase in this ratio due to a projected further decline in real interest rates in Slovenia (at least relative to 2002). However, the closing of this 'room' is already incorporated in the base projection of Jongen (2004).

Finally, we turn to the growth potential for TFP. First, as an (admittedly unrealistic) exercise we may consider the impact of closing the gap with the EU-25 by 2013. Presuming that little if any of the gap is closed in the base projection of Jongen (2004)[49], closing the 23 percentage points gap would raise the annual growth rate of TFP over the period 2002-2013 from 0.5% to 2.9%, and the growth rate of GDP per capita from 3.6 to 7.0%. Clearly, this calculation is a mere exercise, but it still indicates the large growth potential that remains in terms of TFP.

Turning to some individual factors that might raise the growth in TFP, let us first consider R&D. We will consider two targets: a) catching up with the EU-15 level of 2001, 1.9%; and b) meeting the Lisbon strategy target, 3.0%, which is close to the US level in 2001 of 2.8%. To quantify the potential growth impact of reaching these targets we follow the past R&D as a stock of knowledge approach. We assume that in the base projection the R&D intensity would remain unchanged from 2002 onwards.

Suppose that knowledge originating from R&D, $Q_{R\&D}(t)$, is the sum of R&D expenditures in the past[50]

$$Q_{R\&D}(t) = \int_{-\infty}^{t} R\&D(s)ds.$$

Furthermore, suppose that there are two sources of TFP growth, R&D and 'other' (*e.g.* basic science *etc.*). Denote 'other' by $Q_{exo}(t)$, which grows at rate γ. Furthermore, suppose there are diminishing returns to knowledge input into production, and the elasticity of output with respect to knowledge from accumulated R&D investment is denoted by β_r. Specifically, suppose that output is given by

$$Y(t) = Q_{exo}(t)(Q_{R\&D}(t))^{\beta_r}(hc(t)E(t))^{\beta}K(t)^{1-\beta}.$$

Given the assumptions above we have $g_A = \gamma + \beta_r g_{Q,\,R\&D}$.. From the production function we have $\beta_r = (dY(t)/dQ_{R\&D}(t))(Q_{R\&D}(t)/Y(t))$. Substitution into the growth rate of TFP gives $g_A = \gamma + (dY(t)/dQ_{R\&D}(t))\ (R\&D(t)/Y(t))$. Hence, we have expressed growth in terms of the share of GDP spent on R&D, the 'rate of return' to R&D given by $dY(t)/dQ_{R\&D}(t)$, and a residual trend γ. We know the share of R&D, all we need is a rate of return to obtain a guestimate for the impact of a higher share of R&D on output growth.

[49] For the EU-25 we do not decompose the projection into labour, human capital, physical capital and TFP growth due to a lack of projections for the inputs. In Section 5 we found that Slovenia was able to close only a small part of the TFP gap over the period 1990-2002.

[50] We assume no depreciation of this knowledge.

Typically, market failures feature prominently in R&D[51]. The consensus view appears to be that empirically the net effect is too little R&D (*e.g.* Jones and Williams (1998) suggest that R&D in the US is about four times lower than the social optimum). Therefore, studies typically find returns to R&D much higher than on other types of investment (probably also after correcting for the risk profile of R&D expenditures). For example, Nadiri (1993) suggested a direct return of 20%-30% and an average social return of about 50% (significantly above the return on other investment opportunities). More recent studies typically find lower social rates of return, but they may still be an impressive 30 percent. To be conservative we take 10% as the lower bound and 30% as the upper bound[52].

In 2001, spending on R&D in Slovenia was about 1.6%. Raising the share to the EU-15 level of 2001 of 1.9% would increase the annual growth in TFP by 0.03% and 0.09%, for the lower and upper bounds of the social rate of return, respectively, in turn raising annual per capita growth by 0.04% and 0.13%, respectively. Raising the R&D intensity to the Lisbon strategy target would increase TFP growth by 0.14% and 0.42%, for the lower and upper bounds of the social rate of return, respectively, thereby raising annual per capita growth by 0.2% and 0.6%, respectively.

We conclude our analysis of the growth potential of R&D with a cautionary note. Apart from the relatively dramatic changes that would be required to almost double expenditure on R&D, the quality indicators in Table 6 suggest that the 'productivity' of R&D in Slovenia may be relatively low. Hence, in terms of both quantity and quality, the above back-of-the-envelope calculations should be taken as an upper bound on the growth potential coming from R&D for the period 2002-2013. Furthermore, for this to raise the average annual growth rate over the period 2002-2013 the R&D intensity would already have to be at the target level from 2003 onwards.

Unfortunately, for most of the other factors we considered in Section 6 it is relatively hard to quantify what closing a particular 'gap', for example in the stock of inward FDI, would imply for the potential growth in GDP per capita. Let us conclude with a very tentative analysis of the impact of the institutions related to the flow of jobs and workers. In Jongen (2004) we find that the growth rate of skill-biased technological change is substantially lower in Slovenia, about 1.7% per annum, than typically found in studies on skill-biased technological change, about 3.0% per annum (see *e.g.* Katz and Autor, 1999). When the rate of skill-biased technological change rises to the international pace of 3.0% per year after 2002, the human capital index would grow at 3.9%, raising the growth in GDP per capita by 1.6%. This is merely to indicate that, in terms of human capital, raising the pace of skill-biased technological change could have a large pay-off in terms of GDP per capita (this would increase wage differentials between low- and high-skilled workers though, at least insofar as the higher wage differentials will not stimulate an additional increase in the share of high-skilled workers).

[51] The surplus extraction problem for a monopolist gives rise to too little R&D (does not reap all the consumer surplus). Positive intertemporal spillovers ('standing on shoulders') also give rise to too little R&D. However, creative destruction (private profits of invention are higher than social profits) and stepping-on-toes (duplication of research) give rise to too much R&D. Empirically, rates of return appear to be high, suggesting too little R&D overall, see *e.g.* Jones and Williams (1998).

[52] The rate of return will fall as the knowledge stock rises relative to output. However, note that the rates of return used here are from the US, which has above-average expenditure on R&D as a % of GDP. Hence, the rates of return in the analysis here, for Slovenia, might still be conservative.

Table 13: Growth potential, average annual growth rates, in %, 2002-2013

	Labor	Human capital	Capital-output ratio	TFP		GDP per capita
No growth in labor, education and capital-output ratio	0.0	1.6	0.0	0.5		2.3
Base projection of Jongen (2004)	0.1	2.3	1.1	0.5		3.6
Additional room for improvement relative to base proj Jongen (2004)						
Employment rate of workers aged 55-64 to EU-25 (2002) level	+0.2	-	-	-		+0.2
Employment rate of workers aged 55-64 to Lisbon strategy target level	+0.5	-	-	-		+0.5
Reaching education strategy targets	-	+0.3	-	-		+0.3
Closing the TFP gap with the EU-25	-	-	-	+2.4		+3.4
R&D/GDP to EU-15 (2002) level	-	-	-	+0.0-0.1[1]		+0.0-0.1 [1]
R&D/GDP to Lisbon strategy level	-	-	-	+0.1-0.4[1]		+0.2-0.6 [1]
Skill-biased technological change to int. level	-	+1.6	-	-		+1.6

Note:
[1] Results are for the lower (0.10) and upper (0.30) bound on the social rate of return to R&D, respectively.

Table 13 gives an overview of the growth potential based on the various rooms for improvement. In Sections 2-4 we saw that Slovenia is quite close to the EU average in terms of labour participation, average years of schooling and the capital-output ratio. Still, hiding behind the averages, some room is left regarding the labour participation of the elderly and the share of the tertiary educated. Yet closing these gaps would raise the growth rate in GDP per capita by less than a percentage point over the base projection. In Jongen (2004) we find that the annual growth in GDP per capita over the 2002-2013 period would have to be 1.3% higher than the base projection of Jongen (2004) to catch up with the EU-25 in terms of GDP per capita by 2013. Hence, higher labour participation and education are not enough to achieve this goal. For this, TFP growth would have to be increased. Fortunately, Table 13 shows there is still a lot of growth potential as far as TFP growth is concerned. In Section 6 we considered some factors that may 'explain' the residual TFP gap. Unfortunately, for most of them it is relatively hard to quantify the impact on potential output growth.

8. CONCLUDING REMARKS

Slovenia enjoyed remarkable growth in real GDP per capita over the period 1993-2002 period, on average 4.1% per year. In recent years growth has slowed down considerably, but this is presumably largely driven by the business cycle downturn.

Although the Slovenian economy has grown rapidly, in some respects there is still a lot of room for improvement. Compared to the EU-15 the labour participation of older workers is exceptionally low, the share of tertiary educated workers is low, and interest rates are still relatively high (at least they were at the end of 2002). As a result, for the period up to 2013 we still project growth rates substantially above the EU level, 3.6%.

The base projection of Jongen (2004) narrows down a lot of the room regarding participation, education and capital deepening. Still, a sizeable gap in 'total factor productivity' relative to the EU remains. Hence, over and above the base projection there remains great potential for growth from factors that raise TFP growth. The future of real GDP per capita growth in Slovenia still seems bright.

References

Acemoglu, D., 2002, Directed Technical Change, *Review of Economic Studies*, 69(3), pp. 781-810.

Acemoglu, D., Johnson, S. and J. Robinson, 2004, *Institutions as the Fundamental Cause of Long-Run Growth*, mimeo (forthcoming in *Handbook of Economic Growth*), MIT.

Aghion, P. and P. Howitt, 1998, *Endogenous Growth Theory*, MIT Press, Cambridge.

Barro, R.J., 1998, *Notes on Growth Accounting*, mimeo, Harvard University.

Barro, R. and J.-W. Lee, 1993, International Comparisons of Educational Attainment*, Journal of Monetary Economics*, 32(3), pp. 363-94.

Barro, R. and J.-W. Lee, 2001, International Data on Educational Attainment: Updates and Implications, *Oxford Economic Papers*, 53(3), pp. 541-63.

Barro, R.J. and X. Sala-i-Martin, 1998, *Economic Growth*, MIT Press, Cambridge.

Ben-David, D., 2000, Trade, Growth and Disparity Among Nations, in: World Trade Organization, *Trade, Income Disparity and Poverty*, Special Study 5, pp. 11-42.

Blanchard, O., 2003, *European Growth over the Coming Decade*, mimeo, MIT.

Bojnec, S. and J. Konings, 1998*, Job Creation, Job Destruction and Labour Demand in Slovenia*, LICOS Discussion Paper, No. 74, Leuven.

Cameron, G., 1998, *Innovation and Growth: A Survey of the Empirical Evidence*, mimeo, Nuffield College.

Carkovic, M. and R. Levine, 2002, *Does Foreign Direct Investment Accelerate Economic Growth?*, mimeo, University of Minnesota.

Caselli, F., 2003, *The Missing Input: Accounting for Cross-Country Income Differences*, mimeo (forthcoming in the *Handbook of Economic Growth*), Harvard University.

Casseli, F. and W. Coleman II, 2004, *The World Technology Frontier*, mimeo, Harvard University.

Commission of the European Communities, 2003, *The EU Economy: 2003 Review*, CEC, Brussels.

Commission of the European Communities, 2004, *State Aid Scoreboard – Spring 2004 Update*, CEC, Brussels.

Cohen, D. and M. Soto, 2001, *Growth and Human Capital: Good Data, Good Results*, CEPR Discussion Paper, No. 3025, London.

Coricelli, F. and I. Masten, 2004, *Growth and Volatility in Transition Countries: The Role of Credit*, mimeo, University of Siena.

Dalgaard, C.-J. and C. Kreiner, 2003, Endogenous Growth: A Knife Edge or the Razor's Edge?, *Scandinavian Journal of Economics*, 105(1), pp.73-85.

Davis, J., J. Haltiwanger and S. Schuh, 1996, *Job Creation and Destruction*, MIT Press, Cambridge.

De la Fuente, A. and R. Domenech, 2002, *Human Capital in Growth Regressions: How Much Difference Does Data Quality Make? An Update and Further Results*, mimeo, Instituto de Análisis and Económico, Barcelona.

De Loecker, J. and J. Konings, 2003, *Creative Destruction and Productivity Growth in an Emerging Economy: Evidence from Slovenian Manufacturing*, IZA Discussion Paper, No. 971, Bonn.

Doyle, P., Kuijs L. and G. Jiang, 2001, *Real Convergence to EU Income Levels: Central Europe from 1990 to the Long-Term*, IMF Working Paper, No. 146, Washington.

European Bank for Reconstruction and Development, 2003, *Transition Report 2003*, EBRD, London.

Economic Policy Committee, 2003, *Key Structural Challenges in the Acceding Countries: The Integration of the Acceding Countries into the Community's Economic Policy Co-Ordination Processes*, European Commission, Directorate-General for Economic and Financial Affairs, Occasional Papers, No. 4, Brussels.

Faggio, G. and J. Konings, 2001, *Job Creation, Job Destruction and Employment Growth in Transition Countries in the 90's*, IZA Discussion Paper, No. 242, Bonn.

Fritsch, M., 2002, *How and Why Does the Efficiency of Regional Innovation Systems Differ?*, Freiberg Working Papers, No. 5, Freiberg.

Groningen Growth and Development Centre, 2004, *Total Economy Database*, February, Groningen.

Gollin, D., 2002, Getting Income Shares Right, *Journal of Political Economy*, 110(2), pp. 458-74.

Gomez-Salvador, R., J. Messina and G. Vallanti, 2004, *Gross Job Flows and Institutions in Europe*, ECB Working Paper Series, No. 318, Frankfurt am Main.

Ha, J. and P. Howitt, 2003, *Accounting for Trends in Productivity and R&D: A Schumpeterian Critique of Semi-Endogenous Growth Theory*, mimeo, Brown University.

Hall, R.E. and C.I. Jones, 1999, Why Do Some Countries Produce so Much More Output than Others?, *Quarterly Journal of Economics*, 114(1), pp. 83-116.

Haltiwanger, J. and M. Vodopivec, 2003, *Worker Flows, Job Flows and Firm Wage Policies: An Analysis of Slovenia*, mimeo, University of Maryland.
Haltiwanger, J., 2004, *Basic Facts on Reallocation*, mimeo, University of Maryland.

Hanzek, M. and M. Gregorcic, eds., 2002, *Human Development Report - Slovenia 2000/2001*, IMAD, Ljubljana.

IMAD, 2004, *Development Report 2004*, IMAD, Ljubljana.

IMD International, *World Competitiveness Yearbook 2003*, IMD International, Lausanne.

Jones, C., 2003, *Growth and Ideas*, mimeo (forthcoming in *Handbook of Economic Growth*), Berkeley.

Jones, C.I. and J.C. Williams, 1998, Measuring the Social Return to R&D, *Quarterly Journal of Economics*, 113(4), pp. 1119-35.

Jongen, E.L.W., 2004, *An Analysis of Past and Future GDP Growth in Slovenia*, IMAD Working Paper, No. 3/2004, Ljubljana.

Kaldor, N., 1963, Capital Accumulation and Economic Growth, in F.A. Lutz and D.C. Hague, eds., *Proceedings of a Conference Held by the International Economics Association*, Macmillan, London.

Katz, L.F. and D.H. Autor, 1999, Changes in the Wage Structure and Wage Inequality, in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics*, Vol. 3A, Elsevier, Amsterdam.

Keller, W., 2004, International Technology Diffusion, *Journal of Economic Literature*, forthcoming.

Kraigher, T., 2004, *Projections for Population, Participation and Education*, mimeo, May, IMAD, Ljubljana.

Leuven, E. and H. Oosterbeek, 2004, Evaluating the Effect of Tax Deductions on Training, *Journal of Labor Economics*, 22(2), pp. 461-88.

Li, C.-W., 2003, *R&D-Based Growth Models*, mimeo, University of Glasgow.

Ministry of Education, Knowledge and Sports, 2004, *Resolucija o Nacionalnem Programu Izobrževanja Odraslih v Republiki Sloveniji*, UL 70/2004, Ministry of Education, Knowledge and Sports, Ljubljana.

Ministry of the Economy, 2003, *Benchmarking Slovenia 2003: An Evaluation of Slovenia's Competitiveness, Strengths and Weaknesses*, Ministry of the Economy, Ljubljana.

Nadiri, M.I., 1993, *Innovations and Technological Spillovers*, NBER Working Paper, No. 4423, Cambridge.

Nehru, V., E. Swanson and A. Dubey, 1995, A New Database on Human Capital Stocks in Developing and Industrial Countries: Sources Methodology and Results, *Journal of Development Economics*, 46(2), pp. 370-401.

OECD, 1998, *Review of Educational Policy in Slovenia*, OECD, Paris.

OECD, 2003a, *Education at a Glance*, OECD, Paris.

OECD, 2003b, *Technology and Industry Scoreboard 2003*, OECD, Paris.

OECD, 2004, *Economic Outlook*, No. 75, OECD Paris.

Potocnik, J., M. Senjur and F. Stiblar, 1995, *Approaching Europe: Growth, Competitiveness and Integration*, IMAD, Ljubljana.

Potocnik, J., M. Mrak and M. Rojec, 1998, *Strategy of the Republic of Slovenia for Accession to the European Union: Economic and Social Part*, IMAD, Ljubljana.

Riboud, M., C. Sanchez-Paramo and C. Silva-Jauregui, 2002, *Does Eurosclerosis Matter? Institutional Reform and Labor Market Performance in Central and Eastern European Countries in the 1990s*, Social Protection Discussion Paper Series, No. 202, Worldbank, Washington.

Rodriguez, F. and D. Rodrik, 1999, *Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence*, NBER Working Paper, No. 7081, Cambridge.

Sala-i-Martin, X., 2001, *15 Years of New Growth Economics: What Have We Learnt?*, mimeo, Columbia University.

Schumpeter, J., 1975, *Capitalism, Socialism and Democracy*, Harper, New York.

Solow, R.M. 2000, *Growth Theory: An Exposition*, 2nd ed., Oxford University Press, Oxford.

Statistical Office of the Republic of Slovenia, 2003, *Statistical Yearbook 2003*, SORS, Ljubljana.

Statistical Office of the Republic of Slovenia, 2004, *First Release*, No. 128, SORS, Ljubljana.

Unctad, 2003, *World Investment Report*, Unctad, New York.

Vodopivec, M., 2002, Comments, in: Kaase, M., Sparschuh and A. Wenninger, eds., *Three Social Science Disciplines in Central and Eastern Europe: Handbook on Economics, Political Science and Sociology (1989-2001)*, Bern.

Vodopivec, M., 2004, Labor Market Developments in the 1990s, in: Mrak, M., M. Rojec and C. Silva-Jauregui, eds., *Slovenia: From Yugoslavia to the European Union*, Worldbank, Washington.

World Economic Forum, 2004, *The Global Competitiveness Report 2003-2004*, Oxford University Press, Oxford.

Worldbank and International Finance Corporation, 2004, *Doing Business in 2004: Understanding Regulation*, Oxford University Press, Oxford.

Young, A., 1995, The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience, *Quarterly Journal of Economics*, 110(3), pp. 641-80.

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