Growth in Switzerland: is the picture really that gloomy?

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A review of measures of growth

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ABSTRACT

This paper presents and discusses a number of variables closely related to real Gross Domestic Product (GDP) and applies them to a set of 23 countries to assess Switzerland's performance relative to that of other countries during the period 1970 – 2002.

To what extent do these variables confirm Switzerland's poor economic performance, such as suggested by movements in real GDP? A partial anwer is provided in this simple, exploratory text, where the statistical and conceptual justification for choosing a variable rather than another is given priority over the investigation of the possible economic mechanisms explaining the pattern of the data presented.

Results show that Switzerland's weak real GDP growth partly reflects statistical misspecifications. On the one hand, computing real GDP per unit of labour (i.e., per worker or per hour of work) barely changes the picture that emerges from movements in real GDP alone. On the other hand, the increase in purchasing power due to favourable movements in export and import prices, which is not taken into account by real GDP, reduces the growth gap between Switzerland, on one side, and the European Union and the United States, on the other.

Moreover, the level of output produced by one unit of labour has been fairly high, on average over the last three decades, in Switzerland. Many countries, however, are catching up.

Finally, Switzerland performs very well in the dollar value generated by one hour of work, that is, in the creation of the external purchasing power created by one unit of labour.

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1. Introduction

Official statistics provide an unflattering picture of Switzerland's global economic performance over the last decade. This has raised a lively debate, which has been exacerbated by the recent longer-than-expected slowdown to such an extent that the issue has been given full priority by many policymakers. Few observers, however, question the validity of the gauge commonly used to measure the volume of economic activity – real Gross Domestic Product (GDP) – despite the attempts of researchers to point out the weakness of this statistic and to suggest alternative measures of growth.

This paper presents and discusses a number of variables closely related to real GDP, some of which will tone down the impression of a Switzerland on the edge of economic collapse. This text is a simple exploratory work with no other aim than to show that economic growth can be compared to a sculpture: it can be looked at from different angles, but each time new features appear, others are obscured. It is only by walking around once or twice and by taking a couple of steps back before focusing again on details that its shape becomes clearer. We have no ambition to discuss the possible *economic* mechanisms explaining the pattern of the data presented, although we will make one or two exceptions. Instead, we are mainly interested in putting forward the *statistical* and *conceptual* justification for choosing a variable rather than another.

Growth measurement is not a new topic and it has developed in parallel with growing criticism of – and the subsequent improvement in the quality of – real GDP as a measure of a country's overall economic performance. Measurement errors can result from the non-inclusion, in real GDP, of underground-economy activities and of self-production. Some researchers, on the other hand, claim that environmental-damaging activities should be treated separately from the other entries in real GDP. Similarly, distortions can be caused by the inappropriate treatment of specific aggregates: Abrahamsen *et al*. (2003), for instance, argue that the treatment of intangible goods in Switzerland's national accounts has caused a systematic underestimation of the growth rate. Finally, the constant-price treatment is also criticized: Diewert (1986) and, more recently, Kohli (1990 and 2004), among others, claim that constant-price GDP fails to capture the impact of changes in export and import prices on wealth creation. This argument will be illustrated in the following section.

These distortions have led to the development of a new set of measures, aiming to capture the real value of the overall *satisfaction-producing* output of a country. However, these data are still far from being widely available and the occasional national-account user might therefore focus his or her efforts on a sound utilization of the existing national-account series. This is the principle underpinning the construction of a number of measures of growth, the discussion of which is the main goal of this paper.[1]

The paper is structured as follows. Section 2 discusses real GDP, real GDP per unit of labour (per worker and per hour of work) and international-price adjusted real domestic income (total and per unit of labour). Each of these variables is computed for 23 OECD countries and for the area covered by the former 15-member European Union; attention will be focused on Switzerland's performance relative to that of the other countries. Section 3 presents and discusses variables closely related to growth, which aim to assess the cross-border purchasing power capacity of GDP per unit of labour. Section 4 concludes.[2]

2. Which growth?

2.1 Standard real GDP

Economic growth is commonly measured by movements in GDP at constant prices, or real GDP. The logic behind this practice is well known: only the quantity of goods and services produced, and not their price, capture the volume of global economic activity. Changes in this volume between two periods, say 1999 and 2000, can be assessed by comparing GDP in 1999 with what GDP would have been in 2000, *had prices not changed* in the meantime.

Cross-country comparison of movements in real GDP provides a convenient starting point for the discussion of Switzerland's macroeconomic performance. Using GDP at constant prices for 23 OECD countries,[3] we have calculated growth rates for the period 1970 – 2002 and geometric averages for the subsamples 1971-80, 1981-90 and 1991-2002 as well as for the

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[1] The data used in this paper can be obtained easily. See footnote 3.
[2] We will not review growth accounting, that is, a technique to decompose real GDP growth into the product of a set of determinants.
[3] All the raw data are drawn from the Organisation for Economic Cooperation and Development (OECD) National Accounts Statistics and the OECD Economic Outlook, online database http://new.sourceoecd.org, state as of March 2004. For most countries, data were available up to 2002.

whole period. Results, ranked in decreasing order, are presented in Table 1. The list of country symbols used is in Appendix 1.

With the exception of the "golden eighties", the general impression that emerges from Table 1 is a gloomy picture of Switzerland's performance, our country being ranked last in two out of the three time subsamples and over the whole period.

Table 1: Real GDP, annual growth rates, geometric averages

Rank	1971 – 1980		1981 – 1990		1991 – 2002		*1971 – 2002*	
1	KOR	7.42%	KOR	8.64%	IRL	7.06%	KOR	7.23%
2	ICE	6.34%	JPN	4.09%	KOR	5.91%	IRL	5.19%
3	NOR	4.80%	IRL	3.62%	AUS	3.58%	ICE	3.72%
4	PTL	4.74%	PTL	3.25%	NOR	3.34%	NOR	3.56%
5	IRL	4.73%	**USA**	**3.17%**	**USA**	**2.91%**	PTL	3.54%
6	GRE	4.60%	FIN	3.11%	NZL	2.90%	CAN	3.23%
7	JPN	4.46%	AUS	3.05%	CAN	2.71%	AUS	3.22%
8	CAN	4.26%	SPA	2.93%	PTL	2.71%	JPN	3.14%
9	SPA	3.63%	CAN	2.77%	GRE	2.61%	**USA**	**3.10%**
10	FIN	3.62%	ICE	2.74%	SPA	2.61%	SPA	3.03%
11	ITA	3.61%	UKG	2.67%	NET	2.55%	FIN	2.81%
12	AUT	3.61%	NOR	2.61%	ICE	2.39%	AUT	2.67%
13	BEL	3.37%	FRA	2.47%	UKG	2.26%	GRE	2.62%
14	FRA	3.31%	**EUR**	**2.42%**	DEN	2.20%	NET	2.57%
15	**USA**	**3.26%**	AUT	2.38%	AUT	2.14%	**EUR**	**2.50%**
16	**EUR**	**3.05%**	GER	2.30%	**EUR**	**2.08%**	FRA	2.49%
17	AUS	3.01%	ITA	2.26%	BEL	1.92%	ITA	2.40%
18	NET	2.92%	NET	2.25%	FIN	1.88%	BEL	2.40%
19	GER	2.77%	SWE	2.17%	SWE	1.88%	UKG	2.29%
20	SWE	1.96%	**SWI**	**2.05%**	FRA	1.83%	NZL	2.20%
21	UKG	1.94%	BEL	2.01%	GER	1.57%	GER	2.17%
22	DEN	1.92%	NZL	1.88%	ITA	1.52%	SWE	2.00%
23	NZL	1.76%	DEN	1.57%	JPN	1.26%	DEN	1.91%
24	**SWI**	**1.25%**	GRE	0.69%	**SWI**	**0.80%**	**SWI**	**1.33%**

Following the usual practice, we will compare Switzerland with two major economic powers: the European Union and the United States.

Over the period 1970 – 2002, Switzerland has lagged 1.17%/year on average behind the EU15 area (excluding Luxembourg) and as much as 1.77%/year behind the United States. To capture the magnitude of these differences, if Switzerland and the United States had been two runners on their starting blocks in 1970, the distance covered by 2002 by the Americans would have been 75% larger than that covered by the Swiss.

2.2 Real GDP per unit of labour

Is Switzerland's macroeconomic performance necessarily as poor as the above story suggests? We think not.

The above figures conceal, among other things, cross-country differences in long-term movements in labour supply. An economy is likely to grow naturally if it experiences a sustained expansion of its labour force (or its population). Different long-term trends in labour supply can therefore partly explain diverging GDP movements. Indeed, the United States has experienced a massive increase in employment, with a 74% growth in the number of workers between 1970 and 2002, versus a 29% increase in Switzerland. Compared with changes in real GDP, average growth rates of GDP *per worker* cast a somewhat different light on the relative performance of Switzerland, the United States and Europe.[4]

This is shown by Table 2. Switzerland's average annual growth gap falls from 1.77% to 0.8% with respect to the United States, but it increases from 1.17% to 1.43% with respect to the EU. Notice incidentally that the weak growth in the apparent labour productivity displayed by the United States in the 1970s reveal that the fairly strong economic expansion in this country was largely due to a massive increase in its labour force.

Unsurprisingly, moving from Table 1 to Table 2 narrows the gap between the first and the last contender (Korea and Switzerland, respectively, in both cases).

We have explicitly focused on long-run changes by computing averages over 10-year periods in order to avoid distortions due to temporary shocks: a country experiencing a recession – a temporary phenomenon by its very nature – will witness a fall in GDP along with a fall in employment: this will dampen changes in the GDP *per worke*r and will therefore tend to conceal the deterioration in the economic activity. This distortion is, of course, much less likely to occur over a long period.

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[4] Real GDP per unit of labour is also called *apparent labour productivity*. It is an average value. This must be distinguished from *marginal labour productivity*, which measures the change in real GDP that is produced with one additional unit of labour.

Table 2: Real GDP per worker, annual growth rates, geometric averages

rank	1971 – 1980		1981 – 1990		1991 – 2002		1971 – 2002	
1	SPA	4.04%	KOR	5.66%	KOR	4.13%	KOR	4.47%
2	GRE	4.00%	IRL	3.57%	IRL	3.19%	IRL	3.50%
3	IRL	3.76%	JPN	2.84%	SWE	2.35%	NOR	2.50%
4	KOR	3.70%	FIN	2.37%	FIN	2.34%	FIN	2.45%
5	JPN	3.60%	AUT	2.20%	NOR	2.33%	JPN	2.44%
6	ICE	3.59%	FRA	2.19%	AUS	2.20%	AUT	2.29%
7	NOR	3.22%	ITA	2.12%	GRE	2.15%	SPA	2.15%
8	BEL	3.20%	SPA	2.06%	UKG	1.99%	PTL	2.14%
9	PTL	2.97%	NOR	1.98%	DEN	1.92%	BEL	2.05%
10	AUT	2.97%	UKG	1.95%	AUT	1.79%	ITA	2.05%
11	ITA	2.91%	BEL	1.82%	**USA**	**1.72%**	FRA	1.97%
12	FRA	2.78%	PTL	1.82%	PTL	1.67%	**EUR**	**1.97%**
13	FIN	2.67%	**EUR**	**1.79%**	**EUR**	**1.52%**	GRE	1.93%
14	**EUR**	**2.65%**	NZL	1.66%	GER	1.46%	UKG	1.90%
15	NET	2.59%	SWE	1.59%	CAN	1.40%	ICE	1.89%
16	GER	2.48%	NET	1.39%	BEL	1.30%	GER	1.72%
17	UKG	1.74%	**USA**	**1.34%**	ITA	1.28%	SWE	1.69%
18	DEN	1.49%	GER	1.28%	ICE	1.25%	AUS	1.51%
19	AUS	1.49%	CAN	0.97%	JPN	1.15%	NET	1.45%
20	**SWI**	**1.14%**	ICE	0.97%	FRA	1.12%	DEN	1.39%
21	SWE	1.00%	AUS	0.79%	NZL	0.98%	**USA**	**1.34%**
22	CAN	0.92%	DEN	0.67%	SPA	0.69%	CAN	1.11%
23	**USA**	**0.88%**	**SWI**	**0.15%**	NET	0.56%	NZL	0.94%
24	NZL	0.18%	GRE	-0.34%	**SWI**	**0.36%**	**SWI**	**0.54%**

While this analysis seems to penalize the United States along with Canada and Australia, it is of no help to Switzerland, since it leaves its position (as well as the European Union's) in the ranking virtually unchanged. Even the "golden eighties" lose most of their shine! Indeed, these figures seem to reveal that, in the eighties, Swiss real GDP growth was strongly sustained by a massive inflow of workers into the labour force.

One might argue that the number of workers is not a measure accurate enough of total labour quantity, given that no account is made of differences in the average length of the workweek and in holiday endowment. From a macroeconomic perspective, a more precise measure of labour quantity is the total number of hours worked annually in the whole economy. This distinction is particularly crucial in international and intertemporal comparisons. Indeed, the number of hours worked annually by the "average employee" has fallen by 10% in Switzerland, by 15% in the European Union and only 5% in the US over the period 1970 – 2002.

Official statistics do not usually provide this type of information, due to the enormous difficulties that arise in its estimation. This task is therefore left to researchers themselves,

who can construct a proxy of labour quantity based on available data. More specifically, total labour quantity can be estimated by multiplying the numbers of workers by the average number of hours worked annually per employee.[5] This is what has been done in this paper.

We have thus calculated real GDP *per hour worked*. The results are reported, as rates of change, in Table 3.

Table 3: Real GDP per worker, annual growth rates, geometric averages

Rank	1971 – 1980		1981 – 1990		1991 – 2002		1971 – 2002	
1	GRE	5.15%	KOR	5.74%	IRL	4.50%	KOR	4.70%
2	ICE	5.12%	IRL	3.74%	KOR	4.11%	IRL	4.33%
3	NOR	4.94%	JPN	3.28%	NOR	2.79%	NOR	3.38%
4	IRL	4.75%	NET	3.18%	FIN	2.73%	JPN	3.12%
5	SPA	4.39%	FRA	3.00%	AUS	2.34%	AUT	2.80%
6	KOR	4.38%	SPA	2.94%	UKG	2.29%	FIN	2.80%
7	BEL	4.23%	FIN	2.84%	SWE	2.19%	FRA	2.79%
8	JPN	4.18%	AUT	2.71%	JPN	2.11%	BEL	2.74%
9	AUT	4.04%	NOR	2.54%	BEL	2.10%	**EUR**	**2.59%**
10	ITA	3.90%	ITA	2.38%	GER	2.05%	ITA	2.58%
11	FRA	3.68%	**EUR**	**2.31%**	DEN	2.03%	SPA	2.56%
12	PTL	3.68%	BEL	2.04%	GRE	2.03%	GER	2.51%
13	GER	3.65%	UKG	1.96%	**EUR**	**1.96%**	ICE	2.40%
14	**EUR**	**3.58%**	NZL	1.95%	FRA	1.89%	PTL	2.36%
15	DEN	2.99%	GER	1.93%	AUT	1.85%	NET	2.36%
16	FIN	2.84%	DEN	1.64%	PTL	1.84%	UKG	2.31%
17	NET	2.82%	PTL	1.63%	**USA**	**1.81%**	GRE	2.22%
18	UKG	2.68%	SWE	1.30%	ITA	1.66%	DEN	2.21%
19	SWE	2.31%	**USA**	**1.25%**	CAN	1.44%	SWE	1.95%
20	AUS	1.87%	ICE	1.11%	NET	1.29%	AUS	1.71%
21	CAN	1.59%	CAN	1.05%	ICE	1.25%	**USA**	**1.50%**
22	**SWI**	**1.55%**	AUS	0.85%	NZL	0.99%	CAN	1.36%
23	**USA**	**1.38%**	**SWI**	**0.59%**	SPA	0.76%	NZL	1.10%
24	NZL	0.37%	GRE	-0.41%	**SWI**	**0.57%**	**SWI**	**0.88%**

Despite the differences in their construction, Table 2 and Table 3 convey virtually the same information: ranks and growth rates are nearly unchanged for all subperiods, and Switzerland still sits at the bottom.

2.3 International-price adjusted domestic income

Shall we once again infer from the figures above that Switzerland's economic performance is really that bad? Again, not necessarily. In the above calculations, we related changes in real GDP with movements in labour quantity, with two measures of the latter. In computing GDP

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[5] In 2002, the number of hours actually worked by employees ranges from 1300 to 1900 per year. (Source: OECD Economic Outlook, online database http://new.sourceoecd.org.) However, these data are subject to a considerable estimation error and must therefore be used with caution.

per unit of labour, we focused our attention on the quality of the denominator only. Another legitimate question is whether standard real GDP is the appropriate numerator. Put otherwise, does constant-price GDP provide an accurate measure of changes in an economy's wealth, as is commonly assumed?

The answer is no. A few reasons have been invoked in the introduction, but we will focus on the non-inclusion of wealth created by changes in import and export prices. This international-price effect on real income can be illustrated as follows.[6]

Recall that GDP can be calculated as the final production for domestic consumption (V_D) *plus* exports (V_X) *minus* imports (V_M):

$$GDP = V_D + V_X - V_M$$

and that it also approximates domestic income.[7]

Values V_D, V_X and V_M can be decomposed into the product of the corresponding price P_i and quantity (or volume) Q_i (i = D, X, M):

$$V_D = P_D \cdot Q_D,$$
$$V_X = P_X \cdot Q_X,$$
$$V_M = P_M \cdot Q_M.$$

Therefore GDP can be rewritten as:

$$GDP = P_D \cdot Q_D + P_X \cdot Q_X - P_M \cdot Q_M$$

or, recalling that the balance of trade is the difference between export revenue and import bill (i.e., $P_X \cdot Q_X - P_M \cdot Q_M$):

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[6] This effect has been widely discussed by Diewert (1986) and Kohli (1990, 2004).

[7] A firm uses the difference between the value of sales and the cost of raw materials (or intermediate goods and serviced purchased) to pay workers and to retain profit. Similary, from a macroeconomic point of view, the difference between $V_D + V_X$ and V_M is redistributed among workers and capital owners and therefore it approximates national income.

$$GDP = P_D \cdot Q_D + \text{balance of trade.}$$

Let us assume that the balance of trade is equal to zero initially. If the economy experiences an increase in the ratio P_X/P_M, i.e., in the *terms of trade*, its balance of trade will become *positive*, other things being equal, because P_X grows faster than P_M. Keeping the price of goods for domestic absorption (P_D) constant, the improvement in the terms of trade will also translate into an increase in GDP.

In other words, the net income imputable to changes in import and export (i.e., international) prices increases and so does total income paid to domestic production factors (capital and labour). Given the assumption of constant domestic prices, the purchasing power thus created obviously increases.

It can also be shown that the relative improvement in the balance of trade is even larger if its initial value is (already) positive.[8]

To sum up, the change in total income results from the combined effect of movements in the terms of trade and of the (initial) magnitude of the balance of trade.

Unarguably, this international-price effect is not a simple *price* phenomenon. On the contrary, given that it increases purchasing power, i.e., *real* income available to domestic labour and capital, it is a *real* phenomenon. In this respect, improvements in the terms of trade are sometimes said to be equivalent to technological progress: they both create wealth, even when labour or capital quantity is held constant.

How does all this relate to "standard" real GDP? Remember that the latter is given by:

> real GDP = domestic final absorption valued at constant prices
> + exports valued at constant prices
> - imports valued at constant prices.

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[8] See Kohli (2004).

By the very nature of any constant-price measure, standard real GDP does *not* take into account changes in import and export prices. Therefore it *leaves out* changes in real income that can be attributed to movements in the terms of trade and in the balance of trade altogether.[9]

To further illustrate this idea, imagine that a factory can buy a fixed quantity of raw materials at an increasingly lower price and that it can sell a fixed quantity of its final product at an increasingly higher price. There is no reason to think that the income created, or the real value added created, stays the same. And yet, this is what standard real GDP says about Switzerland. In fact, Switzerland has displayed positive balance of trade for the last three decades and has benefited from a favourable long-run improvement in the terms of trade. The resulting international-price effect has thus been large or, equivalently, the underestimation of real domestic income by standard statistics has been large.

Table 4: international-price adjusted domestic income, annual growth rates, geometric averages

Rank	1971 – 1980		1981 – 1990		1991 – 2002		1971 – 2002	
1	KOR	6.16%	KOR	9.68%	IRL	7.04%	KOR	6.46%
2	ICE	5.54%	JPN	4.21%	NOR	4.44%	IRL	4.51%
3	CAN	5.53%	**USA**	**3.19%**	KOR	4.10%	NOR	3.74%
4	NOR	4.91%	IRL	3.00%	AUS	3.58%	ICE	3.56%
5	JPN	3.92%	SPA	2.99%	NZL	3.39%	CAN	3.48%
6	GRE	3.83%	FIN	2.90%	**USA**	**2.97%**	**USA**	**3.05%**
7	AUT	3.45%	**SWI**	**2.71%**	CAN	2.82%	JPN	3.04%
8	SPA	3.44%	ICE	2.70%	PTL	2.78%	SPA	2.98%
9	ITA	3.30%	AUT	2.57%	ICE	2.65%	AUS	2.95%
10	IRL	3.29%	UKG	2.56%	SPA	2.60%	AUT	2.61%
11	BEL	3.25%	AUS	2.54%	UKG	2.51%	FIN	2.41%
12	**USA**	**3.01%**	FRA	2.45%	NET	2.24%	NET	2.39%
13	FIN	2.98%	**EUR**	**2.36%**	DEN	2.22%	PTL	2.39%
14	FRA	2.92%	NET	2.33%	AUT	1.95%	FRA	2.39%
15	**EUR**	**2.74%**	GER	2.31%	GRE	1.94%	**EUR**	**2.34%**
16	PTL	2.71%	ITA	2.25%	**EUR**	**1.92%**	BEL	2.33%
17	AUS	2.67%	CAN	2.17%	FRA	1.85%	UKG	2.33%
18	NET	2.64%	DEN	2.04%	BEL	1.83%	ITA	2.13%
19	GER	2.47%	BEL	2.03%	FIN	1.55%	NZL	2.07%
20	UKG	1.90%	SWE	1.85%	GER	1.54%	GER	2.07%
21	SWE	1.77%	NOR	1.83%	SWE	1.49%	DEN	1.86%
22	**SWI**	**1.46%**	PTL	1.68%	**SWI**	**1.25%**	**SWI**	**1.81%**
23	DEN	1.25%	NZL	1.54%	JPN	1.19%	GRE	1.78%
24	NZL	1.18%	GRE	-0.44%	ITA	1.08%	SWE	1.69%

[9] For more details, see Kohli (2004).

Fortunately, *international-price adjusted domestic income* (IPADI) can be easily computed following the technique presented by Kohli (1990, 2004), among others. Values for our sample are given in Table 4.

Comparing Table 4 with Table 1, it can be seen that growth in IPADI does not change the overall ranking radically, with the exception of the important fall of Portugal and Greece. As for Switzerland, it is worth noting that, the "golden eighties" were in fact even more prosperous than what is revealed by standard statistics, with a real domestic income in Switzerland growing at a rate higher than in most countries.[10]

Table 5: international-price adjusted domestic income per worker, annual growth rates, geometric averages

Rank	1971 – 1980		1981 – 1990		1991 – 2002		1971 – 2002	
1	SPA	3.85%	KOR	6.66%	NOR	3.35%	KOR	3.72%
2	NOR	3.33%	JPN	2.95%	IRL	3.17%	IRL	2.82%
3	GRE	3.24%	IRL	2.95%	KOR	2.35%	NOR	2.64%
4	BEL	3.09%	AUT	2.39%	UKG	2.24%	JPN	2.27%
5	JPN	3.06%	FRA	2.17%	AUS	2.20%	AUT	2.22%
6	ICE	2.82%	FIN	2.16%	FIN	2.00%	SPA	2.11%
7	AUT	2.80%	SPA	2.11%	SWE	1.96%	FIN	2.06%
8	ITA	2.60%	ITA	2.11%	DEN	1.94%	BEL	1.99%
9	KOR	2.48%	UKG	1.84%	PTL	1.81%	UKG	1.95%
10	FRA	2.39%	BEL	1.84%	**USA**	**1.79%**	FRA	1.86%
11	**EUR**	**2.35%**	**EUR**	**1.73%**	AUT	1.60%	**EUR**	**1.84%**
12	IRL	2.33%	NET	1.47%	CAN	1.51%	ITA	1.79%
13	NET	2.31%	**USA**	**1.36%**	ICE	1.50%	ICE	1.73%
14	GER	2.18%	NZL	1.32%	GRE	1.49%	GER	1.61%
15	CAN	2.15%	GER	1.28%	NZL	1.46%	SWE	1.38%
16	FIN	2.03%	SWE	1.27%	**EUR**	**1.44%**	CAN	1.35%
17	UKG	1.71%	NOR	1.20%	GER	1.42%	DEN	1.34%
18	**SWI**	**1.36%**	DEN	1.14%	BEL	1.21%	**USA**	**1.29%**
19	AUS	1.16%	ICE	0.93%	FRA	1.11%	NET	1.27%
20	PTL	0.98%	**SWI**	**0.80%**	JPN	0.96%	AUS	1.24%
21	DEN	0.83%	CAN	0.38%	**SWI**	**0.92%**	GRE	1.10%
22	SWE	0.81%	AUS	0.30%	ITA	0.84%	**SWI**	**1.02%**
23	**USA**	**0.63%**	PTL	0.27%	SPA	0.68%	PTL	1.02%
24	NZL	-0.39%	GRE	-1.46%	NET	0.25%	NZL	0.81%

The magnitude of the overall under- or overestimation is of interest: the growth rates of only three countries of our sample, namely the United Kingdom, Canada and Switzerland, display an underestimation, on average, over the whole period. In particular, Switzerland is the country with the highest or the second-highest underestimation in *all* the time subsamples

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[10] One should thus rather speak of "platinum eighties"!

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considered; the cumulated improvement in real domestic income not captured by real-GDP statistics amounts to a non-negligible 15% between 1970 and 2000.[11]

Consequently, comparing IPADI growth rates with changes in real GDP, Switzerland's annual growth gap shrinks from 1.17% to 0.54% with respect to the European Union and from 1.77% to 1.24% with respect to the United States.

We have also computed IPADI *per worker*, reported in Table 5. They reveal that real income created by one worker has again risen more slowly in Switzerland than in most countries of our sample. However, the growth lag narrows to a mere 0.81% behind the European Union and to only 0.24% behind the United States, on average for the whole period. The gap is somewhat larger during the 1990s.

Table 6: international-price adjusted domestic income per hour worked, annual growth rates, geometric averages

Rank	1971 – 1980		1981 – 1990		1991 – 2002		1971 – 2002	
1	NOR	5.05%	KOR	6.74%	IRL	4.47%	KOR	3.95%
2	GRE	4.38%	JPN	3.40%	NOR	3.81%	IRL	3.66%
3	ICE	4.33%	NET	3.27%	UKG	2.53%	NOR	3.54%
4	SPA	4.20%	IRL	3.12%	FIN	2.39%	JPN	2.97%
5	BEL	4.11%	SPA	2.99%	AUS	2.34%	AUT	2.74%
6	AUT	3.88%	FRA	2.99%	KOR	2.33%	BEL	2.68%
7	JPN	3.64%	AUT	2.89%	DEN	2.05%	FRA	2.67%
8	ITA	3.59%	FIN	2.63%	GER	2.01%	SPA	2.52%
9	GER	3.35%	ITA	2.36%	BEL	2.01%	**EUR**	**2.44%**
10	IRL	3.30%	**EUR**	**2.24%**	PTL	1.99%	FIN	2.40%
11	FRA	3.29%	DEN	2.11%	JPN	1.98%	GER	2.40%
12	**EUR**	**3.27%**	BEL	2.06%	**USA**	**1.88%**	UKG	2.36%
13	KOR	3.16%	GER	1.94%	FRA	1.84%	ITA	2.31%
14	CAN	2.83%	UKG	1.85%	**EUR**	**1.80%**	ICE	2.24%
15	UKG	2.64%	NOR	1.75%	SWE	1.80%	NET	2.18%
16	NET	2.54%	NZL	1.61%	AUT	1.66%	DEN	2.15%
17	DEN	2.31%	**USA**	**1.27%**	CAN	1.55%	SWE	1.64%
18	FIN	2.20%	**SWI**	**1.24%**	ICE	1.51%	CAN	1.61%
19	SWE	2.12%	ICE	1.06%	NZL	1.47%	**USA**	**1.45%**
20	**SWI**	**1.76%**	SWE	0.98%	GRE	1.36%	AUS	1.44%
21	PTL	1.67%	CAN	0.46%	ITA	1.22%	**SWI**	**1.39%**
22	AUS	1.53%	AUS	0.36%	**SWI**	**1.17%**	GRE	1.38%
23	**USA**	**1.13%**	PTL	0.09%	NET	0.99%	PTL	1.25%
24	NZL	-0.20%	GRE	-1.52%	SPA	0.75%	NZL	0.97%

Table 6, which displays IPADI *per hour worked*, confirms the general trend that emerges from Table 5. Interestingly, while unit real income has increased smoothly in the United

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[11] Even though Switzerland's international-price adjusted growth is lower than the European Union's, the difference is found to be statistically non-significant. See Lambelet and Sfreddo (2004).

States over the period 1970-2002, the European Union and, to a lesser extent, Switzerland display a downward trend.

3. External values of output per labour unit

All the above measures suggest that Switzerland's macroeconomic performance is probably not as bad as real GDP suggests but certainly not as good as one might hope. In other words, there seems to be room for improvement. In this respect, it is generally assumed that the more developed a country, the less its room for improvement and therefore the lower its growth rate.

Assuming that a higher development is reflected by a higher GDP per worker, a question that arises naturally is the following: is Switzerland's GDP per unit of labour so high as to slow its own growth? To put it otherwise, is Switzerland's weak economic expansion somehow the price to pay to enjoy a high level of development? These questions lead us to turn our attention to an alternative variable capturing macroeconomic performance, mainly nominal GDP *per hour worked* converted in US dollars using purchasing power parities (PPP).[12] The PPP conversion allows us to determine the US dollar value of a representative basket of GDP goods and services produced, on average, by one hour of work in a given country, if this basket were produced and sold in the United States. The resulting values make it thus possible to compare the quantity of output produced in different countries with one unit of labour. The construction of this variable implies that, if workers are very productive or if the goods produced are highly valuable (according to the US price or preference set), then PPP-converted GDP/labour ratio will be high.[13] Is this case for Switzerland? Table 7 provides the answer.

Table 7 shows that during period 1971 – 1980, Switzerland displayed the highest value of goods produced by one hour of work, while the United States provided the second-best. However, the relative positions of these two countries (especially Switzerland) have

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[12] Purchasing power parities were drawn from OECD, National Accounts, online statistics (http://new.sourceoecd.org), as of March 2004.
[13] Nominal GDP per unit of labour is also called *average labour revenue*. This should not be confused with *labour marginal revenue*, which measures the change in nominal GDP following the utilization of one extra unit of labour.

deteriorated since.[14] Also notice the fall of Canada and Iceland. Norway and, unsurprisingly, Ireland display the best improvements, while Korea and Portugal sit at the bottom of the ranking.

Table 7: PPP-converted GDP per hour worked, US dollars, annual averages

rank	1971 – 1980		1981 – 1990		1991 – 2002		1971 – 2002	
1	**SWI**	**10.452**	NET	24.451	NET	41.606	NET	25.939
2	**USA**	**10.444**	GER	22.508	NOR	39.556	ITA	23.286
3	NET	10.200	ITA	21.876	ITA	37.554	NOR	23.093
4	GER	9.846	BEL	21.688	BEL	36.869	BEL	22.952
5	CAN	9.179	**USA**	**21.568**	FRA	36.136	**USA**	**22.468**
6	ITA	9.004	FRA	21.158	**USA**	**34.239**	FRA	22.340
7	SWE	8.938	**SWI**	**20.843**	GER	32.138	GER	21.789
8	BEL	8.920	NOR	20.079	DEN	31.884	**SWI**	**20.535**
9	DEN	8.522	**EUR**	**19.986**	**EUR**	**31.862**	DEN	20.261
10	**EUR**	**8.369**	SWE	19.305	SWE	30.658	**EUR**	**20.075**
11	FRA	8.364	DEN	19.226	IRL	30.030	SWE	19.978
12	AUS	7.907	CAN	18.817	**SWI**	**29.521**	CAN	18.798
13	NOR	7.875	AUT	16.924	AUT	29.119	AUT	18.037
14	ICE	7.026	SPA	16.885	CAN	28.400	UKG	17.304
15	NZL	6.999	AUS	16.859	FIN	28.153	FIN	17.199
16	AUT	6.960	UKG	16.253	UKG	27.686	SPA	17.172
17	UKG	6.934	ICE	16.119	SPA	27.334	AUS	16.924
18	GRE	6.593	FIN	15.760	AUS	26.002	IRL	16.877
19	FIN	6.559	IRL	14.899	JPN	24.643	ICE	16.127
20	SPA	6.346	NZL	14.321	ICE	24.475	JPN	14.803
21	IRL	5.521	GRE	13.506	NZL	21.439	NZL	14.251
22	JPN	5.361	JPN	13.382	GRE	20.180	GRE	13.629
23	PTL	4.400	PTL	9.754	PTL	16.239	PTL	10.143
24	KOR	2.249	KOR	6.854	KOR	15.467	KOR	8.451

An alternative way to gauge the value of GDP per unit of labour is to convert nominal GDP per hour worked into US dollars using market exchange rates. This will tell us how many dollars can be purchased with the income generated, on average, by one hour of work. It is a measure of the average nominal labour productivity, valued in US dollars. The corresponding figures are reported in Table 8.

Switzerland, along with the Netherlands and Norway, ranks high: the *external* purchasing power of the income generated *domestically* by one hour of work in these countries has been among the highest since early 1970s, i.e., well above the corresponding values for the United States and the European Union. Japan displays the largest improvement in ranking, while

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[14] When PPP-converted GDP is related to the number of workers (instead of hours worked), Switzerland's deterioration is even more marked. The United States, on the contrary, displays the highest value in each of the three time subsamples.

Canada and Australia have experienced a large deterioration. Again, Portugal and Korea rank last. [15]

Table 8: exchange-rate converted GDP per hour worked, US dollars, annual averages

rank	1971 – 1980		1981 – 1990		1991 – 2002		1971 – 2002	
1	SWE	11.866	NOR	26.626	NOR	49.237	NOR	29.789
2	NOR	11.449	**SWI**	**23.522**	NET	42.583	NET	26.087
3	NET	10.968	NET	22.924	DEN	40.464	**SWI**	**25.415**
4	**SWI**	**10.797**	SWE	22.533	**SWI**	**40.394**	DEN	24.346
5	GER	10.529	GER	21.568	BEL	37.901	SWE	24.217
6	**USA**	**10.444**	**USA**	**21.568**	FRA	37.565	GER	23.091
7	BEL	9.841	DEN	21.005	SWE	36.943	BEL	22.829
8	DEN	9.800	FRA	20.330	JPN	35.996	FRA	22.807
9	CAN	9.489	BEL	19.030	GER	35.877	**USA**	**22.468**
10	FRA	8.958	CAN	18.578	**USA**	**34.239**	ITA	19.923
11	AUS	8.600	**EUR**	**18.010**	ITA	33.901	JPN	19.627
12	ICE	8.150	ITA	17.966	**EUR**	**32.738**	**EUR**	**19.601**
13	**EUR**	**7.910**	FIN	17.844	FIN	30.744	FIN	18.834
14	FIN	6.742	ICE	16.985	AUT	30.457	ICE	17.715
15	ITA	6.454	AUS	16.814	IRL	29.219	AUT	17.696
16	AUT	6.170	JPN	15.896	UKG	27.469	CAN	17.694
17	UKG	5.542	AUT	15.063	ICE	27.092	AUS	16.266
18	NZL	5.347	UKG	14.124	CAN	25.095	UKG	16.116
19	JPN	5.161	IRL	13.020	AUS	23.433	IRL	15.668
20	IRL	4.525	SPA	12.072	SPA	23.113	SPA	13.545
21	SPA	4.447	NZL	11.387	NZL	17.528	NZL	11.422
22	GRE	4.109	GRE	7.798	GRE	14.997	GRE	9.186
23	PTL	2.431	PTL	4.870	PTL	11.654	PTL	6.364
24	KOR	1.271	KOR	4.505	KOR	11.277	KOR	5.890

4. Conclusion

This paper discussed a number of variables closely related to real GDP and applied them to a set of 23 countries to assess Switzerland's performance relative to that of other countries during the period 1970 – 2002 and during three subperiods. For all the variables, the conceptual justification for their use was discussed.

We assessed the position of Switzerland's performance relative to that of other countries. The picture that emerges from the data is that Swizerland's situation seems to have worsened over time, but not necessarily as much as suggested by standard real GDP, by real GDP per worker

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[15] The Swiss franc's overvaluation could explain slow growth as well as Switzerland's exchange-rated-converted GDP/labour ratios higher than their PPP-converted counterpart. However, one should keep in mind that PPPs used in this paper have been constructed to reflect prices of all goods and services included in GDP, whereas the trade-determined exchange rates reflect prices of tradable goods only.

or by real GDP per hour of work. Indeed, when the effect of changes in export and import prices on real domestic income is taken into account, Switzerland manages to reduce the gap with the European Union and with the United States. Its ranking barely changes when international-price adjusted domestic income is divided by labour quantity.

To compare the quantity of output per unit of labour produced in different countries, we looked at PPP-converted GDP per unit of labour. Switzerland, which ranks first at the beginning of the period, falls to mid-high rank in last years of the sample, not far from the European Union. GDP per unit of labour converted in US dollars using market exchange rates tells us a completely different story: the quantity of dollars that can be bought from GDP goods and services produced by one hour of work is among the highest of our sample, over the entire period.

Whether Switzerland's high value of GDP per labour, converted in foreign currency, is indeed the cause for (or somehow related to) slow growth is a matter that deserves to be looked into but that would have gone beyond the scope of the this paper, the goal of which was *not* to discuss the possible *economic* mecanisms driving the data presented.

There would also be much to say about other measures of growth, namely, GDP/working-age population, or GDP/labour force (instead of employment) to take account of unused resources. The data necessary to compute these variables can be obtained easily. This is not the case, however, for GDP per unit of capital, which is subject to sometimes questionable quality of the series for capital stock.

Finally, we could have tested the differences between Switzerland and other countries: are these differences statistically significant? While this is certainly an interesting question, and has partly been addressed in Lambelet and Sfreddo (2004), answering it would have forced us to reduce the number of variables under analysis and therefore to depart from the original goal of this paper.

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Appendix 1: list of country symbols used

AUS   Australia
AUT   Austria
BEL   Belgium
CAN   Canada
DEN   Denmark
EUR   European Union (15 members without Luxembourg)
FIN   Finland
FRA   France
GER   Germany
GRE   Greece
ICE   Iceland
IRL   Ireland
ITA   Italy
JPN   Japan
KOR   Korea
NET   Netherlands
NOR   Norway
NZL   New Zealand
PTL   Portugal
SPA   Spain
SWE   Sweden
SWI   Switzerland
UKG   United Kingdom
USA   United States