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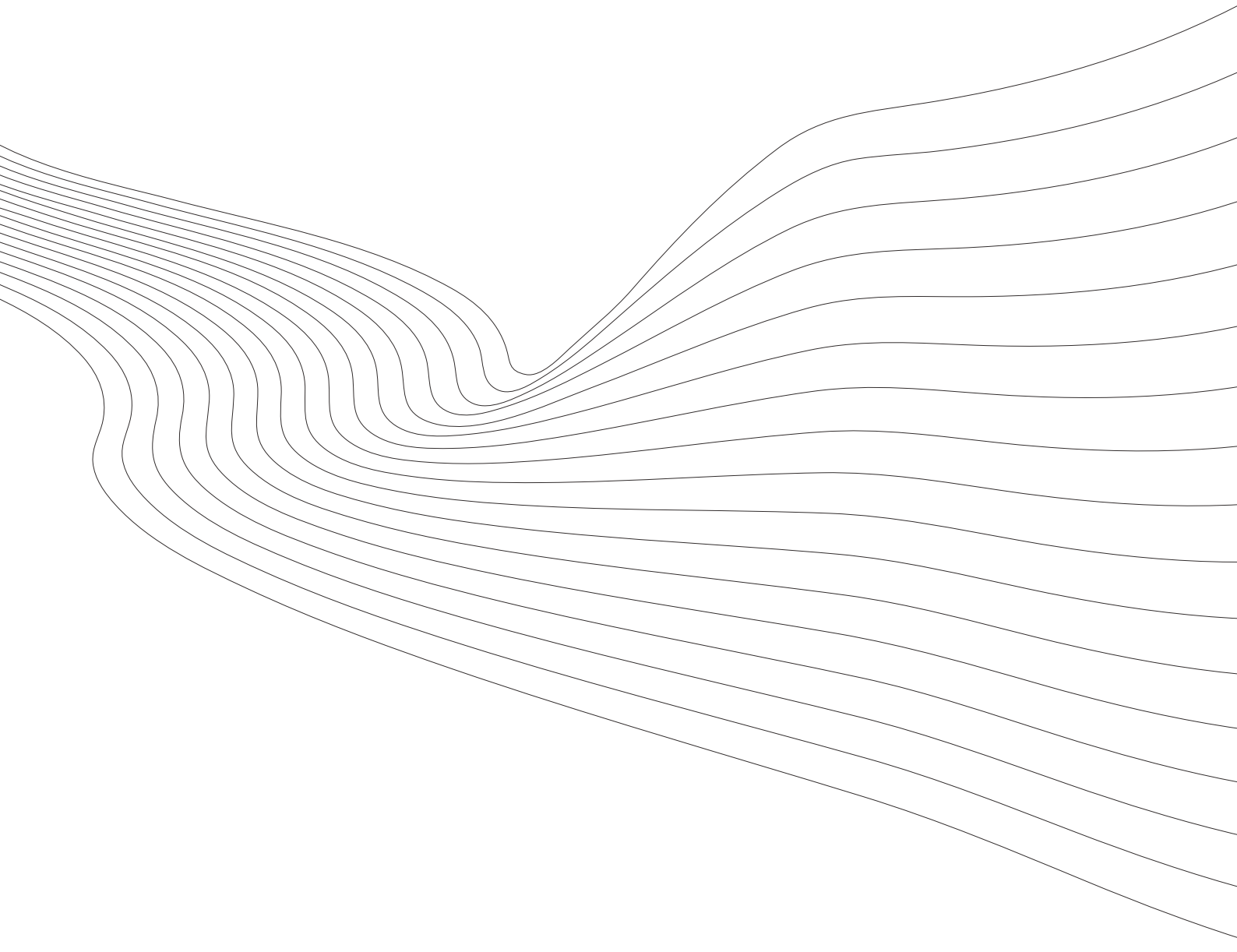

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A view on the long-run evolution of hours worked and labor productivity in Switzerland (1950–2010)

Michael Siegenthaler*

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Abstract

The discussion about the long-run evolution of labor productivity in Switzerland is flawed because the available data on the input of labor is incoherent and incomplete. It is the aim of this paper to establish a consistent aggregate series of total hours worked covering 1950–2010. The new data indicates that hours worked in Switzerland have been nearly stagnant between 1960 and 2005, implying that hours worked have grown considerably less than previously thought. As a direct consequence, Switzerland's performance in terms of labor productivity growth has been underestimated in previous work, particularly after the structural slowdown in labor productivity growth of 1973.

JEL-Classification:
Keywords: Labor productivity, hours worked, working time, economic history of Switzerland

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1 Introduction

Switzerland is, and has traditionally been, a country of high growth in the number of employed persons but a mediocre productivity growth. This is how the Swiss state secretariat for economic affairs (SECO) summarizes its analysis on Swiss labor productivity in their "growth reports" of 2002 and 2008 (SECO, 2002, 2008). And indeed, while the growth of labor input is relatively high in Switzerland, labor productivity (expressed in GDP per hour worked) is not even average among OECD countries. Moreover, the growth rate of labor productivity seems to have steadily declined since the 70s. One of the central aims of the growth policy of the SECO is thus to promote structural reforms that foster growth in Swiss labor productivity.

However, while the relative weakness of Switzerland in terms of the level of GDP per hour worked is relatively widely acknowledged, magnitude and timing of changes in the growth rate of labor productivity have led to controversies. For example, Brunetti and Zürcher (2002) and Balastèr and Surchat (2004) argue that the growth rate of GDP per hour worked has fallen on a historically low level of less than 1 % in the 90s. Using an alternative series of labor input, Hartwig and coauthors contest the robustness of this finding (Abrahamsen et al., 2005a; Hartwig, 2006, 2008).

A similar discussion arose around the proposition of Kehoe and Prescott (2002) and Kehoe and Ruhl (2003) that Switzerland experienced a "Great Depression" between 1974 and 2000. They reach this conclusion when analyzing the evolution of GDP per working age person in Switzerland. Abrahamsen et al. (2005b) contest that finding. They show that if one considers reductions in working times—i.e. looks at GDP per hour worked rather than the measure proposed by Kehoe and Prescott—, the performance of the Swiss economy since 1974 looks much better. Kehoe and Ruhl (2005) respond by criticizing the view of Abrahamsen et al. (2005b) *inter alia* by noting "that there is something wrong with the hours worked data employed by Abrahamsen et al."

Both discussions highlight the problem that there is no reliable, consistent and, in particular, long aggregate time series on the evolution of labor input in terms of hours worked in Switzerland before 1991, i.e. before data on hours worked can be taken from the work volume statistics of the Federal statistical office (FSO). Most authors therefore use data on the hours worked from other sources. The most important of these series are the series of the University of Groningen/Conference board total economy database (henceforth GGDC series)—which is the series used in Abrahamsen et al. (2005b)—and the series from Christoffel (1995) which was influential as it shaped the argumentation in the growth reports of the SECO. However, I show in this paper that both

series are questionable. In particular, the GGDC series simply links three conceptually different data sources on working time which in principle do not fit together. Christoffel's analysis, on the other hand, is questionable because of erroneous implicit assumptions and the omission of hours worked by self-employed persons.

Since the available series on hours worked are unsatisfactory and since the evolution of labor productivity is fundamental for the long-run perspectives of the Swiss economy, this paper thus establishes a consistent series of total hours worked for Switzerland from 1950 to 2010. This task requires constructing series for each component of total hours worked (cf. figure 1). In this paper, I thus establish separate time series pertaining to the number of full-time equivalent employees, normal weekly working time (for each economic sector separately), the number of paid vacation and holidays granted to employees, the extent of absences from work (i.e., absences because of accident, illness, military service, short-time work etc.), and the amount of overtime work. It is to note that all the mentioned series are of some interest for their own sake.

The resulting series on hours worked for Switzerland is then employed to study the evolution of working time and labor productivity in Switzerland in the post-war period in a comparative perspective. The results indicate that the growth rate of labor productivity structurally declined around 1973. Since then, labor productivity has grown relatively stable. I do not find evidence of a significant decline in productivity growth in the 80s or the 90s, indicating that the 90s have not been marked by an exceptionally low growth rate of labor productivity.

In that context, the study also establishes that Switzerland's growth in labor productivity after the first oil crisis has not been as weak as previously thought. This result stems from the fact that, compared to older series, overall growth of hours worked is considerably smaller in the new series. Indeed, the data indicate that it took until 2007 until hours worked in Switzerland reached their level of the mid-60s. These findings also support Abrahamsen et al. (2005b) in their reply to Kehoe and Prescott (2002) in that the apparently slow growth of GDP per head in Switzerland between 1974 and the mid-90s can be attributed to sizable reductions in working times of employees.

Table 1: Average annual growth in labor productivity (GDP per hour worked) in % according to different data sources

Years	Estimated series	OECD	GGDC	WV statistics	Christoffel (1995)
1950–1960	3.40	-	3.64	-	-
1960–1970	4.30	-	3.61	-	2.4
1970–1980	2.02	2.06	2.23	-	1.5
1980–1990	1.41	0.92	0.93	-	1.0
1990–2000	1.28	0.32	0.88	1.35	-
2000–2010	0.54	0.78	0.86	0.80	-

Sources: GGDC total economy database, OECD statistics portal, work volume statistics, and Christoffel (1995)

2 Hours worked in Switzerland (1950–2010)

2.1 Conceptual problems of available series of the volume of work

Table 1 illustrates the substantial differences that arise when using different hours worked series to evaluate average growth of labor productivity per decade. The first column shows average growth in GDP per hour worked according to the series established in this paper. The second column uses productivity data from the OECD. The hours worked series that leads to these productivity growth rates is not available on the website. It was, however, published in several *economic outlooks* of the OECD. The OECD hours worked series is *in principle* also the data source used to construct the GGDC series (column 3) in the 70s and 80s. Similarly, official figures on hours worked from the work volume statistics (column four) form the basis of hours worked according to the OECD and the GGDC series since 1991. The last column in the table shows labor productivity growth according to the labor input series computed by Christoffel (1995) used in the growth reports of the SECO (cf. Brunetti and Zürcher, 2002; SECO, 2002, 2008).
It is to mention that the GDP series used is identical in all columns. Moreover, the series in the first four columns all employ the same data on the growth in the number of employees from the employment statistics (*Erwerbstätigenstatistik*). Hence, the differences in the growth rates of labor productivity shown between these series solely arise because of different series on

the annual working time of employees.[1]

Since the GGDC series is the only publicly available hours worked series prior to 1991, it is widely used in empirical work (among others in Abrahamsen et al., 2005b; Gomez-Salvador et al., 2006; Rogerson et al., 2005; Rogerson, 2006). As indicated above, the GGDC series links three different data sources: it employs linearly interpolated level data on working times of Maddison (1991) for 1950, 1960, and 1970, links it to the growth rates of the mentioned working time figures from the OECD economic outlooks, and employs the data from the work volume statistics of the FSO since 1991.

The resulting series is questionable. First, Maddison's (1991) figures on weekly hours worked in Switzerland are substantially too low. The data on working time he employs only cover blue-collar workers that were subject to the factory act ("Fabrikgesetz") aiming at protecting workers. The act fixed the normal weekly working time to a maximum of 48 hours. Aware of that fact, Maddison decreased all figures by 5 % percent, arguing that white-collar workers are likely to work less than blue-collar workers. However, as we will show in section 2.3, using data from representative business censuses and collective labor agreements, workers and employees not covered by the factory act worked substantially *more* than those amenable to it. As a result, Maddison (1991) underestimates weekly working time in Switzerland in the 50s by about 4 hours.

Second, linking the three data sources mentioned above is problematic because they are conceptually different. For instance, while the series from the work volume statistics takes into account absences from work and the increase in paid vacation granted to employees—which for itself is a major omission—, the former two data sources do not.

Third, the series has, per construction, dubious dynamics. From 1950–1970, the figures on annual working time per person employed are based on simple linear interpolations of Maddison's benchmark figures. In 1970, the year-to-year changes of the series increase because annual data about annual working times are used. In 1991, the cyclicality of the GGDC series increases again

[1] Other series of the volume of work in Switzerland covering years prior to 1991 are constructed in Baltensperger (1963), Rossi and Thomas (1971), Butare and Favarger (1992), and in Kehoe and Ruhl (2003). All of them are similar to the GGDC and/or OECD series, i.e., most of them use the statistics of normal workweeks in companies in order to construct hours worked and thus share the problems of the OECD and GGDC series discussed in section 2.3. Moreover, also the Swiss National Bank estimated a (quarterly) series on total hours worked for Switzerland. Their computations are documented in a technical report by Andrist (1989). However, the resulting quarterly series is not publicly available and it only starts in the mid-70s. Furthermore, the series is in principle only reliable for the three benchmark years (1975, 1980, and 1985) for which working times are computed in detail.

because the working time figures of the work volume statistics now also take into account exact year-to-year differences in the number of workdays (i.e. the figures account for the fact that certain holidays may fall on a workday or not). These structural breaks in the volatility of the GGDC series confound an analysis of year-to-year changes in the growth rate of labor productivity. Finally, linking the data from the OECD economic outlook to data from the work volume statistics in 1991 has another unpleasant effect. The figures from the OECD are constructed using data from the statistics of normal workweeks in companies (*Statistik der betriebsüblichen Arbeitszeit*, henceforth NW statistics) published by the FSO. The NW statistics is based on accident reports filled out by employers and does not cover self-employed persons. On the other hand, the data of the work volume statistics stem from statements from employees in a household survey and include the self-employed. Both facts imply that the reported working time will in general be larger in the work volume statistics. As a consequence, the level of the GGDC series on hours worked per employed person, extrapolated using the NW statistics from Maddison's benchmarks (that are too low) will not be sufficiently high when it is linked to the new level data of the work volume statistics in 1991. In other words, merging the two series is not possible without *decreasing* the trend *decline* of the working time data from the NW statistics (i.e., increasing the level of the total hours worked series). It seems that as though this has been done, and an analysis of labor productivity using the GGDC series will in tendency underestimate growth in GDP per hour worked.
Recall that the OECD series on labor productivity in table 1 also links the hours worked series from the OECD economic outlooks to the new data from the work volume statistics. Hence, the same incompatibility arises and also the OECD had to adjust its original data (apparently even more markedly). This is also the likely reason why, according to the OECD series, Switzerland experienced an enormous decline of -8.8 % in labor productivity in 1991.[2]
The third important series of the volume of work in Switzerland is from Christoffel (1995). At first sight, Christoffel's approach to assess the evolution of labor input in Switzerland seems very promising. Rather than estimating each component of the volume of work separately, he computes hours worked by dividing real total labor income (from the national accounts) by hourly real wages from the Swiss wage index (SWI). The approach seems appealing as the labor income series from the national accounts is based on reliable social security data from the Swiss old age insurance (OASI).

[2]The corrections necessary for the year 1991 also explain why the GGDC, the OECD and the work volume series come to very different conclusions concerning average labor productivity growth in the 90s in table 1 despite the fact that their source is identical.

However, there are not only errors in his calculations, but also several conceptual shortcomings in his reasoning. To understand this it is best to formalize his argument. Christoffel implicitly assumes the following relationship:

$$\frac{Y_t}{P_t} = H_t/E_t * E_t * \frac{W_t}{P_t} \tag{1}$$

According to this equation, the real total gross annual labor income $\frac{Y_t}{P_t}$ in year t basically equals hours worked per full-time employee H_t/E_t times full-time equivalent employed persons (E_t) times their average hourly gross real wage W_t/P_t. Consequently, equation total hours worked (H_t) can be computed by dividing Y_t by W_t.[3]

This approach, however, is seriously flawed. First, labor income according to the national account does not contain income of self-employed persons. Hence, changes in their labor input are omitted from Christoffel's analysis. A second important problem of the approach is the implicit assumption that the labor income fluctuates one to one with hours worked per employee. This does not hold true for employees that have labor contracts with (monthly) fixed-level salaries and unpaid overtime. Their labor incomes are obviously irrespective of working time. In an extreme case, dividing Y_t by W_t just yields full-time equivalent employment (E_t). Moreover, Christoffel's results are partly driven by the increase of labor contracts with unpaid overtime since the 50s (as documented in OECD, 1998, p. 161).[4]

A second problem of Christoffel's approach concerns the use of the SWI. Conceptually, the SWI is a weighted average of hourly, monthly, and yearly wages depending on the labor contract of the respective worker. Hence, the SWI does not represent the hourly real wage of a "representative" Swiss employee.[5] Another problem with using the SWI in his analysis arises from the fact that the SWI represents "pure" wage growth within given jobs (at least from 1968 onwards). Consequently, the index is unaffected by movements of workers from low- into high-wage industries. Because wage growth accruing

[3]Equation 1 shows that deflating both variables, as Christoffel does, is not necessary because total labor income and wages should anyway be deflated using the same price index.

[4]Log-linearizing equation 1 and taking first differences, the performance of Christoffels' method can be examined for the period 1991–2010 for which we have hours worked from the work volume statistics (i.e., a reference series for H_t). OLS regressions of the transformed equation demonstrate my concerns: Y_t/W_t is correlated to fluctuations of the number of full-time employees (although not one-to-one) but not with hours worked per full-time employee.

[5]This is probably the reason why Christoffel suggests to additionally control for the decrease in working time of employees. However, this adjustment is only valid for wages of workers with monthly and yearly wages and is thus likely to confound the analysis.

from such shifts in the composition of employees do not alter the index, the SWI clearly underestimates trend growth in the hourly wage of the representative employee. Therefore, Christoffel is *ceteris paribus* overestimating growth in labor input and hence underestimating growth in labor productivity.[6]

2.2 Full-time equivalent employment

The discussion of the last section shows that there does not exist a reliable, consistent and sufficiently long series on hours worked in Switzerland. It is the aim of this section to establish one. To this end, each of the components of total hours worked have to be separately estimated. The components are illustrated in Figure 1. To compute total hours worked, it is our task

1. to calculate how many hours should have been worked by a full-time employee in Switzerland each year (i.e. the number of workweeks times normal weekly working time)
2. to subtract the hours he or she was absent from work each year
3. to add overtime hours worked
4. to combine this information with the amount of full-time workers

In Appendix A, I discuss why the appropriate employment series in our case is the number of employees according to the employment statistics. Although this series has some shortcomings, it is the most appropriate data source, mostly because the two other potential employment series have even greater disadvantages for our purpose.
One problem of the employment statistics is that until 1991 it does not apply the international standard pertaining to the definition of an employed person. According to the ILO standard, a person is considered as employed if she or he worked at least 1 hour a week. The FSO, however, used the (Swiss) standard of a minimum of 6 hours a week until 1991. There is hence no data on the amount of employees working 1–6 hours before 1991.[7]

[6]Moreover, "compositional" wage effects follow a pro-cyclical pattern in Switzerland. This is apparent if one compares wage growth according to the SWI with wage growth according to the OASI statistics that shows actual growth of the total wage bill in Switzerland. Thus, the SWI also misrepresents business cycle dynamics of the hourly wage of the representative worker.

[7]The FSO published a retrospective aggregate employment series covering 1975–2010 that applies the threshold of 1 hour. However, the evolution of the series prior to 1991 does

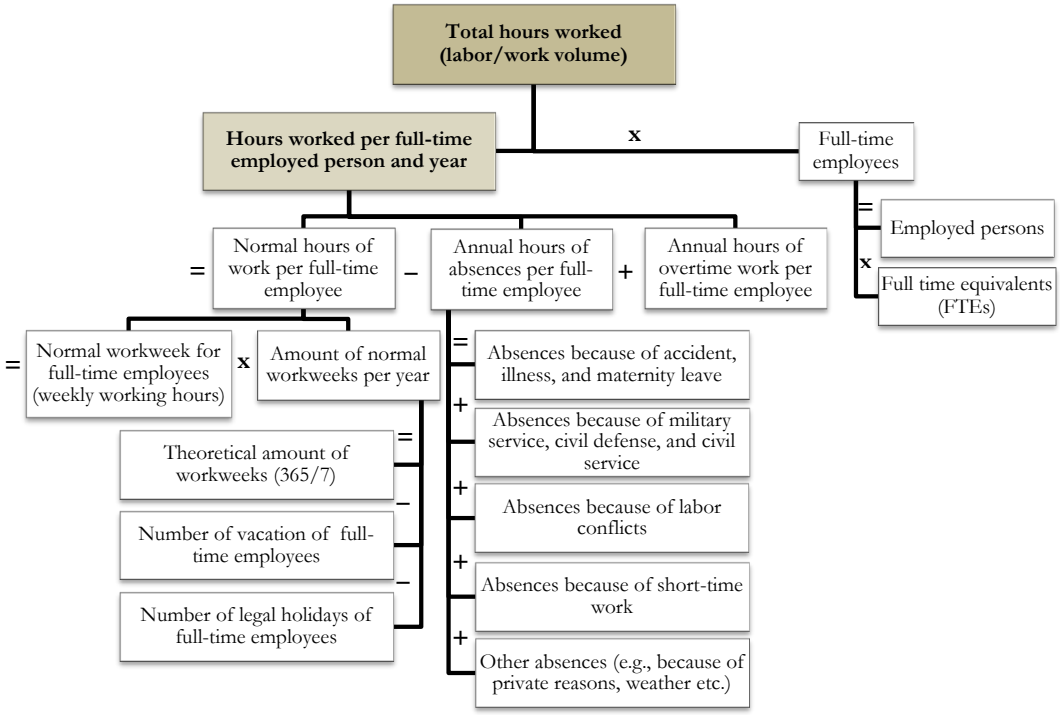

Figure 1: Components of total hours worked

It would be problematic to use the data conforming to the new standard (available from 1991 onwards) and to somehow link it to the series according to the old definition—as, for example, the GGDC series implicitly does. First, all other labor market data before 1991 were collected applying the old definition. In particular, the job statistics, business and population censuses apply the old standard. Hence, using the new standard would for instance introduce an inconsistency between our series on full-time equivalents and on the number of employees. Second, it would be problematic to assume that the share of employees working 1–6 hours has remained constant over time.[8] It thus seems to be most reasonable and consistent to stick to the figures that conform to the old definition of the employment statistics. This implies that our series on total hours worked will be on a slightly lower level than the GGDC series or the series of the work volume statistics.

While the employment statistics provides us with information on the number of employed persons, it does not say something about their activity levels which have presumably changed markedly since the 50s. To account for the shifts in part-time work, we have to compute the full-time equivalent (FTE) number of employees. From the third quarter of 1991 to 2010, FTEs are computed by simply dividing the amount of full-time jobs by the number of jobs using data from the job statistics. Choosing the job statistics to analyze activity levels for this period—and not data from the SLFS—was a controversial issue because the dynamics of labor input (and hence labor productivity) during the 90s depended substantially on the data source of the FTEs employed (Abrahamsen et al., 2005a; Balastèr and Surchat, 2004; Hartwig, 2006, 2008). A revision of the job statistics in 2007 has reduced the problem. I use the job statistics for the following reasons. First, Hartwig (2008) argues that FTEs according to the job statistics better conform to the desired domestic concept such that consistency between numerator (GDP) and denominator (labor input) when measuring labor productivity is given. Second and trivially, the job statistics covers a (slightly) longer time period than the SLFS. Still, one remark is in order: the series does not cover the agricultural sector. An assumption behind my approach is thus that the

not appear very trustworthy because it just links the level of the new series (according to the 1 hour threshold) in 1991 to the growth rates of the old series. The implicit assumption—that the fraction of employees working 1–6 hours a week remained constant between 1975 and 1991—is however very questionable (cf. footnote 8).

[8] Newer data reveals that mainly female employees work 1–6 hours a week. Because the female participation rate has steadily increased over the period examined, also the fraction of employed persons working less than 6 hours is likely to have changed over time, even rather markedly. Naturally, also the fact that part-time employment increased over time indicates that the fraction of these employees might have a trend.

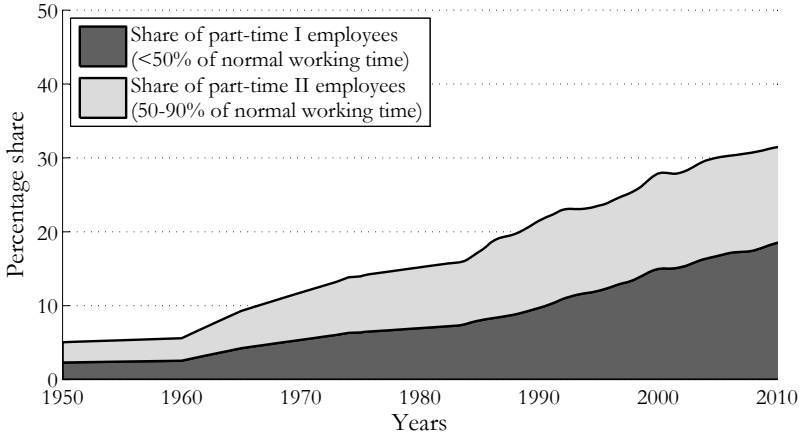

Figure 2: Estimated trend increase in part-time employment in Switzerland. *Source: own calculations*

agricultural sector has displayed similar dynamics in part-time employment as the rest of the economy.

Using the mentioned data from the job statistics allows us (after some adjustments) to describe the evolution of part-time work back until the fourth quarter of 1983. Prior to this date, the statistics did not contain the information on activity levels and the only source about part- and full-time work in Switzerland are different business and population censuses. Because we lack other data, we basically linearly interpolate the figures between these benchmarks. Doing this, however, requires keeping track definitional changes in the distinction between full- and part-time work. The exact procedure how the series on FTEs is built prior to 1991 is described in Appendix C.

The evolution of full-, part-time I, and part-time II shares that result from the calculations are depicted in figure 2. In 1950, nearly 95 % of all Swiss employees worked full-time. In June 2010, the picture had changed markedly: 12.6 % of the employees in manufacturing and even 39.3 % of the employees in the services sector were part-time workers.

2.3 Normal weekly working time

The main source to analyze the evolution of working time in Switzerland before 1991 is the statistics of normal workweeks in companies (NW statistics), available since 1942. However, working with this data poses problems. First, the NW statistics has two structural breaks in 1973 and 1984. For example, despite its name, the series shows "actual" rather than "normal"

weekly working time (i.e. contains overtime work) until 1972. The statistics switches to the concept of "normal" (i.e. customary) hours only then.
Figure 3 illustrates the two resulting jumps in the NW series. A second and more important problem of the data is that it only covers blue-collar workers of the industrial sector until 1973 because it only considers workers covered by the factory act (*Fabrikgesetz*). Working times of white-collar workers in the industrial sector and of employees in the third sector remain disregarded by the series. Moreover, the statistics does not cover working times in agriculture, even after 1973, as well as working times of self-employed persons. The latter issue will be discussed when assessing our hours worked series in section 2.7.
The problems of the series cast doubts on papers (e.g., Mordasini (1982), Rossi and Thomas (1971), Butare and Favarger (1992), and Kehoe and Ruhl (2003)) and series—notably, the GGDC and OECD series—that use this data without extending and adjusting it. Any such series will have two jumps in weekly working times that are statistical artifacts. Moreover, it is unclear whether excluding working times of white-collar workers and employees from the third sector will lead to an over- or underestimation of the actual average normal working time in Switzerland at that time. As the factory act aimed at protecting workers, the NW statistics might easily underestimate average normal working times in Switzerland before 1973.
Thus, the approach I follow to estimate a series on normal weekly working time is different. Prior to 1973, I derive normal weekly working times from representative and reliable figures from two business censuses (1955 and 1965). The censuses contain comprehensive data on normal weekly working hours of every job holder in the second and third sector in Switzerland for the respective year. In a second step, the two benchmark figures are inter- and extrapolated using several related series. For the industrial sector, I use the NW statistics. For the third sector, changes in regulations about weekly working times in collective labor agreements and in legal regulations for state workers are traced. After 1973, I stick to the figures from the NW statistics but harmonize the series before and after the structural break in 1984. Working times in the agricultural sector are derived from the work volume statistics and from population censuses (cf. Appendix D for further comments on the approach followed). Having computed a series on normal weekly working hours for each economic sector, the three series are averaged by weighting them according to each sector's share in the total number of employed persons.[9]

[9]For the years 1960–2010, I use weights according to data from the employment statistics. Prior to 1960, I linearly interpolate the employee shares between the figures in

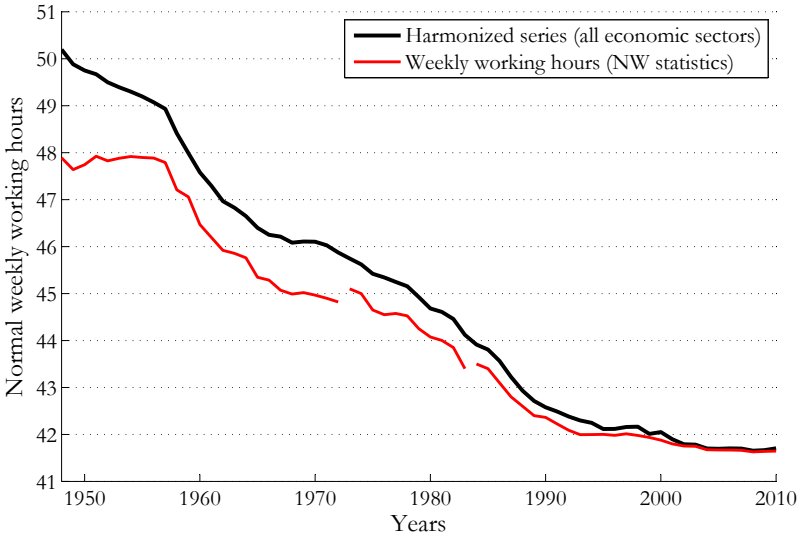

Figure 3: Normal weekly working hours (original and harmonized series). *Sources: NW statistics and own calculations*

The resulting series of normal weekly working time is plotted in figure 3. In the 50s and 60s, the level of the new series is substantially above the level of the series of the NW statistics. The reason for this finding is that normal weekly working times were higher for employees not covered by the factory act. The figure illustrates the point already made: Maddison (1991) who decreases the figures from the NW statistics by 5 % substantially underestimates working times in Switzerland. Consequently, the GGDC substantially underestimates hours worked in Switzerland in the 50s and 60s.

2.4 Overtime work

The next component of the volume of work to be considered are hours of overtime work. Before 1991, the only series available pertaining to overtime work is a quarterly series published by the BIGA, the predecessor of the state secretariat for economic affairs SECO. The BIGA disposed of the relevant

Schweizerische Bankgesellschaft (1987, p. 29) and the shares of the employment statistics of 1960. The number of employed persons in the first sector prior to 1960 is derived from an own series. This series bases on benchmark figures from Schweizerische Bankgesellschaft (1987, p. 29) and the employment statistics of 1960. These benchmarks are subsequently interpolated using a related annual series on the number of cattle owners in Switzerland. The estimation of this series is documented in Appendix B.

data material because overtime work above a certain threshold was subject to permit by the government. From 1966–1987, the threshold was 60 hours per year and employee. The series of "granted" overtime was released in per capita terms, i.e., hours granted were normalized by dividing them by the appropriate reference labor force.

There is a major problem with this dataset. Overtime work below the threshold is not contained such that the figures clearly underestimate the actual amount of overtime work in the economy. A further consequence of this feature is that the series scarcely represents overtime work in services: because firms from this sector are less exposed to cyclical fluctuations in demand and production, they were less constrained by the overtime limit and hence, they did not have to ask for permission. As a consequence, the series might overstate the actual cyclical reaction of overtime work to the business cycle. To examine this issue, we compare the cyclical behavior of the old series with the cyclical response of the representative overtime series of the work volume statistics available since 1991. As expected, if we regress the amount of extra overtime hours granted to firms—i.e., the old overtime series—on distributed lags of real GDP growth, the unemployment rate and/or changes in the rate of capacity utilization, there is clear evidence for a strong pro-cyclical responsiveness of the series. On the other hand, the work volume series seems to be only weakly related to business cycle fluctuations. The overtime hours are a relatively stable fraction of the overall working time, fluctuating between 1–1.23 hours per week and employee. These results are very similar to the findings of Bauer and Zimmermann (1999) who show that overtime hours in Germany are a relatively constant share in effective working time between 1982 and 1998. Other OECD countries such as Australia, Japan or the UK show similar patterns in overtime work (cf. OECD, 1998, table 5.5).

Because the (newer) work volume series matches the desired concept of overtime work and can hence be used as a reference series, I build an overtime series by making the assumption that weekly overtime hours prior to 1991 are composed of two components: a cyclical component represented by the old statistics of "granted" overtime, and a second component which is a fixed share in normal weekly working time. Taking the extent of overtime hours in the work volume statistics as a benchmark, this fixed share is about 2.5 % of a normal workweek. In 1991, I link the estimated series to the reference overtime series of the work volume statistics. However, this approach requires extrapolating and harmonizing the series of overtime hours granted because the series only covers the years 1966–1987 and has a structural break in 1979. The steps followed to harmonize the series and to link it to the data from the work volume statistics are documented in Appendix E.

2.5 Vacation and legal holidays

Reductions in weekly working hours are not the sole reason leading to a decline in yearly working time. Another sizable reduction has resulted from an increase in the amount of (paid) vacation and holidays granted to employees. For example, Swiss full-time employees only enjoyed 1–2 weeks of paid vacation per year in the 50s. In 2010, this figure had increased by about 350 % to nearly 5 weeks on average. Thus, the amount of paid vacation has increased more in Switzerland than in most other OECD countries in the last six decades (OECD, 1998).

Concerning weeks of vacation, the data I put together stem from different sources. The first two points of reference stem from the factory statistics (*Fabrikstatistik*) for the years 1944 and 1954 (BIGA, 1956). One year later, the FSO collected data on the amount of vacation granted to employees in Switzerland in the course of the Business census 1955 (Eidgenössisches Statistisches Amt, 1962, p. 89). It repeated this exercise ten years later (Eidgenössisches Statistisches Amt, 1968, p. 15). These four points of reference provide, for a long time, the only representative figures on the extent of yearly vacation granted to employees.

In order to interpolate these benchmark figures I rely on two distinct series. The first series is built from data of periodical publications of the Swiss state secretariat for economic affairs (SECO, formerly BIGA) which list, for each canton, the legal minimum entitlement of vacation to be granted to full-time employees. I estimate missing values by linearly interpolating the figures and we obtain an average figure for Switzerland by weighting the minimum entitlements according to cantonal share in total employment derived from the business censuses. The second series builds on regulations concerning vacations in all collective labor agreements valid in a given year. The FSO regularly assembled these regulations and published the results (BIGA, 1983, p. 5). I average these regulations and linearly interpolate the resulting figures where necessary. Subsequently, I average the two series[10] and use this average series to interpolate and update the benchmark figures described above up to 1979.

From 1979 until 1996, I rely on data from the UBS Prices and Earnings survey conducted in a three-year interval (Weisser, 2010). The survey contains declarations about the annual amount of paid vacation for a relatively representative set of 15 professions in two Swiss cities (Zurich and Geneva). I

[10] Averaging is valid under the assumption that the former series represents a lower while the latter is an upper bound pertaining to vacations that employees actually had—an assumption that is confirmed for 1965 for which we dispose of representative figures from the business census.

linearly interpolate the missing values. Finally, from 1996 onwards, I rely on data from the SLFS published by the FSO (cf. Appendix F for the estimated series).
In addition to the decline in working time because of more paid vacation, employees in Switzerland also profited from more statutory holidays. The data put togehter shows that the number of holidays granted to employees in Switzerland increased from about 5.5 in 1950 to 9.5 nowadays.
Legal holidays may fall on a working day or not. This fact contributes quite substantially to the overall year-to-year fluctuations in hours worked per employee. Considering whether legal holidays actually led to a reduction in workdays or not, however, is difficult in Switzerland, mainly because the cantons are responsible for determining which holiday is a non-working day, and cantons introduced different holidays at different points in time.
Rather than treating each canton separately, I commit myself to a "representative" sample of statutory holidays for Switzerland, and only consider these holidays over time. Two sources guide my choice: on the one hand, cantonal regulations put together in different publications (*Ferien und Feiertage in den Gesamtarbeitsverträgen*, various issues; Fricker (1958)) as well as several *eidgenössische Staatskalender*, i.e. annual information brochures published by the Federal Chancellery that contain information on legal holidays of state workers and civil servants. The resulting selection of holidays considered in this study is shown in table 2. Using a historical calendar, I then calculate the amount of workdays per year by subtracting the holidays falling on a day of the workweek from the amount of potential workdays. Naturally, I thus also consider leap-year effects.[11]

2.6 Absences from work

The last step to calculate total hours worked is to take into account absences from work. To consider are absences due to accident, illness, military service, civil defense, civil service,[12] labor conflicts, short-time work, and other absences, e.g., due to private reasons. Figure 4 depicts the evolution of all of

[11] The appropriateness of my method can be assessed using the work volume statistics. It contains the number of holidays per year in Switzerland for the years 1991–2010, computed by averaging separate figures for each canton. My pragmatic approach does a good job in yielding the amount of workdays for of the representative Swiss employee. The correlation between the two series is 0.95.

[12] Hours worked lost due to military service, civil defense and civil service have to be subtracted because value added from these activities do not enter the calculation of GDP in Switzerland.

Table 2: Legal holidays considered

Years	Legal holidays
1950–1959	New Year's Day, Good Friday, Easter Monday (1/2 day), Ascension Day, Pentecost Monday (1/2 day), Christmas Eve (1/2 day), Christmas Day
Since 1960	+ Easter Monday (full day) and December 26 (1/2 day)
Since 1970	+ January 2 (1/2 day), Pentecost Monday (full day) and December 26 (full day)
Since 1985	+ August 1 (1/2 day)
Since 1990	+ January 2 (full day)
Since 1994	+ August 1 (full day)

these components of absences from work.

- Absences because of accidents: Pertaining to absences due to accidents, I rely my analysis mainly on data from the Swiss accident insurance fund (SUVA) as published in several five-year annual reports (series *Unfallstatistik der Schweiz*). For each year, the reports show the number of wage compensation payments (daily allowances) that the SUVA paid to insured persons because of occupational and non-occupational accidents. These figures together with the associated absolute amount of occupational and non-occupational accidents enable us to compute the absolute amount of daily allowances in a year. To end up with the actual amount of working days lost, I also consider that it on average takes two workdays until compensation payments are paid. Moreover, the data also incorporates information on accidents not leading to wage compensation payments (*Bagatellunfälle*). According to an expert of SUVA, it is reasonable to assume that these accidents cause an average work lay-off of one day per accident.
  Using the figures of customary weekly working hours of section 2, I calculate the amount of hours lost because of accidents. Finally, this aggregate figure is divided by the absolute amount of people insured by the SUVA. During this period, the legal accident insurance of the SUVA covered between 40–60% of all employed persons in Switzerland (cf. the series plotted in figure 9 in the Appendix). Problematically, these were mainly employees amenable to the factory act already mentioned above. Because these workers (mainly blue-collar workers from the industrial sector) are likely to have a higher risk of having an accident, the figures calculated from the SUVA statistics overestimate the

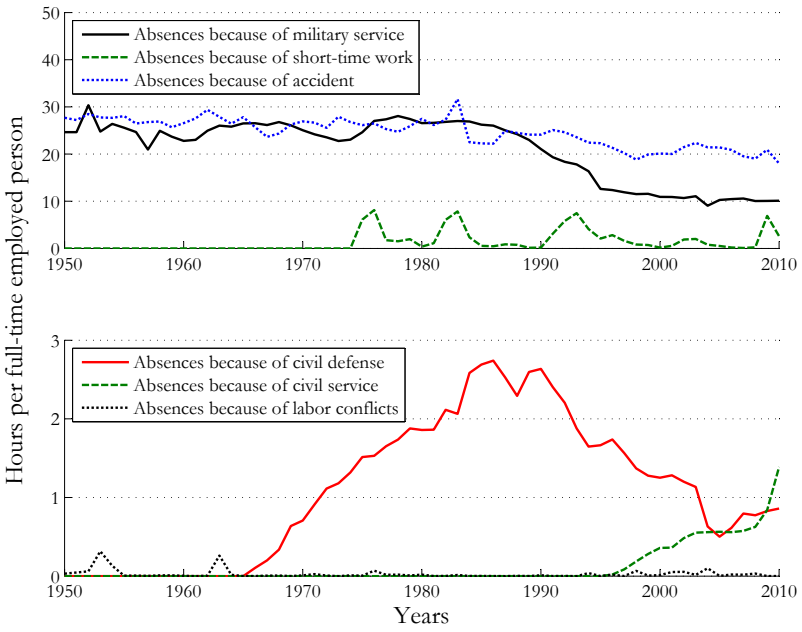

Figure 4: Working time lost due to different forms of absences from work. *Sources: own calculations*

actual amount of working days lost because of accidents for the representative employee.
To correct this bias, I exploit a second data source: the amount of absences due to accident of employees in the Swiss federal administration, the customs administration, and the administration of the federal post and telecoms company (PTT) as indicated in the statistical yearbooks of Switzerland from 1948–1987. I average the figures by weighting them according to employment data also available in the statistical yearbooks. Finally, working days are transformed into working hours. To this end, I use legal working time regulations of the federal state.
Arguably, the state worker series is a better representation of absences due to accident in the third sector, while the SUVA covers most workers of the second sector. Consequently, I average the two series by weighting them according to relative employment weights of the second and the third sector.
With the commencement of the Swiss federal law on accident insurance (UVG) in 1984, insurance against the consequences of accidents became compulsory for Swiss employees. At the same time, the statistics of the SUVA was extended to all insurance providers of the new UVG. In other words, the data of the SUVA now covers all employees. Consequently, for 1984–2010, I calculate a series on absences from work by making similar calculations as for the SUVA data from 1950–1983. However, the initial data on the amount of daily allowances require an upward adjustment.[13]

- Absences because of military service: I take into account that all young men of Swiss nationality are subject to compulsory military service. The Federal department of defense, civil protection and sport (DDPS) provided us with a series showing the amount of days for which military pay was paid to Swiss soldiers and recruits in each year. Since some of these days fall on Saturdays and Sundays, I adjust the number of days by multiplying it with the ratio of workdays to 365 or 366, re-

[13]The SUVA statistics distinguishes between the number of daily allowances of *newly registered* cases (i.e., accidents occurring in a given year) and the number of actual days for which allowances were paid. The ratio between these "old" allowances and the newly registered cases is on average about 3:2 because accidents may lead to compensation payments in the following year(s). With the introduction of the UVG in 1984, however, the amount of "old" is exactly equal to the amount of newly registered daily allowances *amenable to the UVG*. To correct for this consistency problem in the data, the SUVA suggested adjusting the figures from 1984–1992 upwards such that they match the ratio of 3:2.

spectively.[14] Figure 4 contains the resulting series in the upper part. It shows that the amount of absences due to military service has decreased over the period examined, particularly in the 90s. This reduction is, on the one hand, the result of a reduced duration of the military service per conscript (arising from army reforms), and, on the other hand, a decreasing proportion of conscripts in the labor force.

- Absences because of civil defense: In the 50s, Switzerland began building up its civil defense. At least since 1956, a non-negligible part of the male population served in civil defense each year instead of doing military service. I consider these absences using data supplied by the Swiss federal office for civil protection (FOCP). The data covers the period 1966–2009, and it shows the amount of days that were served in civil defense each year. According to an expert from the FOCP, about 95 % of these days are actual workdays. Using this assessment, I can compute the amount of workdays lost per employed person. The extent of these absences from work varies from irrelevant amounts in the 60s to 2.68 hours in 1986 (cf. figure 4).

- Absences because of civil service: Since 1996, men liable to enlistment can serve as conscientious objectors performing community service instead of doing their military service. The number of men that chooses to do this has steadily increased since then. I consider these additional absences from work by using data on the number of days spent in civil service from the official homepage of the civil service (www.zivi.admin.ch).

- Absences because of labor conflicts: There exists a series on hours lost due to labor conflicts per year (cf. the Swiss economic and social history online database and, for recent years, the FSO as well as the statistical yearbooks of Switzerland). I incorporate these absences from work. They are, however, quantitatively unimportant (cf. the discussion in Oesch, 2011).

- Absences because of short-time work: Moreover, I also consider reductions in the labor volume because of short-time work. From 1975–2006, the statistical office (FSO) recorded the amount of "reported" working

[14] Because the series starts in 1951, I assume that in 1950 equally many workdays were lost due to military service as in the subsequent year.

hours lost due to this reason (*Gemeldete Ausfallstunden*). For the most recent years, I extrapolate the series with the growth rates of a newer series on "actual" working hours lost because of short-time work. I assume that no working hours were lost prior to 1975. This assumption is reasonable because Switzerland experienced an unprecedented economic boom in the 50s and 60s, rendering labor markets tight and short-time work unlikely. The series has its peak in 1976 when about 21 million working hours were lost because of short-time work over the whole year. Thus, even in the presumably most severe recession after World War II, short-time work reduced the annual labor volume only by 8.1 hours per full-time equivalent worker (cf. figure 4).

- Absences because of illness and other reasons: Finally, pertaining to absences because of illness and maternity leave as well as other absences (i.e., absences because of weather or private reasons), there seem to be no reliable and sufficiently representative series that would allow calculating aggregate figures on the volume of absences over the whole time period. Thus, I simply subtract a fixed share from the normal volume of work to incorporate the residual reasons for absences from work. Newer data from the work volume statistics (revealing the relative contributions of the different causes of absences to the total volume of absences) shows that it is reasonable to assume that absences because of illness and maternity leave reduce the labor input by about 2 % in Switzerland and other absences account for a further reduction of 0.3 %.

For the years 1991–2010, we can evaluate the appropriateness of the resulting series of the annual volume of absences from work by comparing it with the official series of the work volume statistics published by the FSO. Absences in the work volume statistics are computed from individual-level data from the SLFS. The comparison reveals that the new series is accurately estimating the level of absences and the correlation between the two series is 0.88. A closer examination, however, reveals that the new series seems to underestimate the cyclicality of absences. The likely explanation for this result is that absences because of illness and other reasons are not a fixed share in annual working time—as in our new series—but behave pro-cyclically (cf., e.g., Leigh, 1985; Arai and Thoursie, 2005).

2.7 Assessing the series

We now have all ingredients to put together the series on total hours of work. The series obtained can be compared with the two comparable series on the issue that exist for Switzerland: with hours worked from the GGDC/Total Economy Database and with hours worked from the work volume statistics 1991–2010—the latter can be regarded as our reference series. Recall that the figures from the GGDC series are, since 1991, *identical* to those from the work volume statistics.

Figure 5 shows annual hours worked per full-time employee according to the new series as well hours worked per full-time job according to the work volume statistics. The picture shown is encouraging: the correlation between the two series is 0.86.[15] This is remarkable considering that the data sources of the two series are quite different.

A detailed examination shows that there are two reasons for the differences in the *dynamics*. First, the new series underestimates the cyclicality in absences from work (as discussed above). Second, the dynamics in the underlying series of normal hours worked per week are different, particularly from 1991–1996, partly because of a questionable evolution of weekly working time in the first sector (cf. the discussion in Appendix D). According to the work volume statistics, the weekly working time of employees rose from 1991 to 1994, and then dropped by more than one hour a week within the next two years. The statistics of the normal workweek employed to estimate the new series, however, shows a steady decrease from 1991–1996. Finally, note the large difference in the growth rate of hours worked for 2010 between the two series. On the one hand, the difference arises because of a sizable disparity in the underlying growth rate of employment[16]. On the other hand, the work volume statistics reports a substantial reduction in normal weekly working times from 2009 to 2010. The NW statistics, however, indicates an increase. The differences in the levels of the two series originate from different series on normal weekly working time. The average difference between the figures on weekly working time from the work volume statistics and the NW statistics (that I use) is 0.64 hours per week 1991–2010. Most of this difference results from the fact that the NW statistics, in contrast to the work volume statistics, does not cover working times of self-employed persons.[17] One might therefore

[15] The correlation with the hours worked series from the GGDC database is 0.84 over the whole period examined (1950–2010).

[16] While *jobs* grew by 0.4 % according to the work volume statistics, the number of employees increased by 2.63 % according to the employment statistics which is the basis of my series.

[17] The average normal weekly working time of self-employed persons is on average about 1 % larger than normal weekly working time of workers. I compute this share using

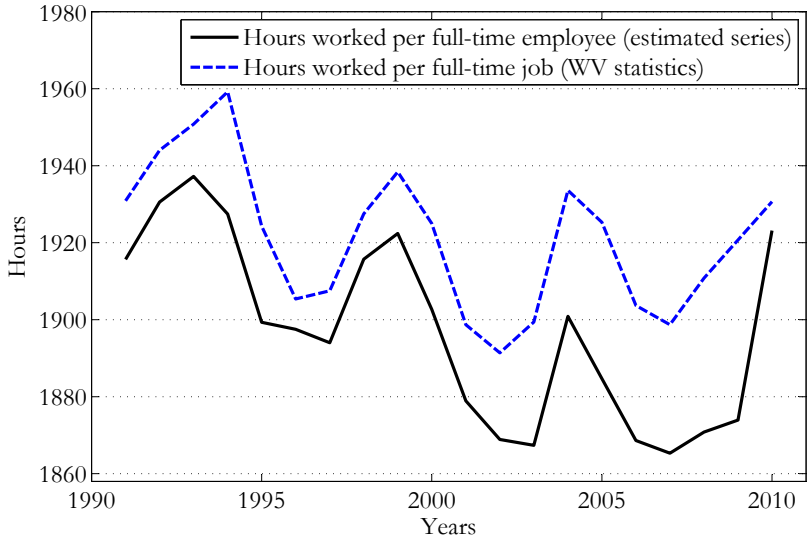

Figure 5: Hours worked per full-time employed person according to the estimated series and the work volume statistics. *Source: own calculations and work volume statistics*

argue that I should correct my figures upwards. However, I abstain from doing that. First, by including working time in the agricultural sector and, hence, working times of farmers, my figures already contain a relatively large fraction of the self-employed in Switzerland. Second, we do not dispose of any figures about working times of self-employed before 1991. Thus, the only possible adjustment I could make is to revise my figures upwards by a (more or less) constant fraction—apparently a very crude correction that would leave the dynamics of the series essentially unchanged, and would thus not affect my analysis in the next section.

Figure 6 compares total hours worked according to the new series with total hours worked from the GGDC/Total economy database. Recall that the GGDC series in principle applies the ILO definition of an employed person (considers employees working 1–6 hours) and should thus lie above my series at any point in time. The figure illustrates sizable differences in the evolution of the two series. In particular, according to the new series, the volume of work has grown considerably less since 1950. The most important reason for the difference in the trend growth rate of the two series is that the GGDC

figures from the *labour market indicators*, an annual publication of the FSO, that contains figures on normal hours worked per full-time employee from the SLFS that exclude the self-employed persons.

Figure 6: Total hours worked according to the new series and the series from the GGDC database. *Source: own calculations and GGDC/Total economy database*

series until 1991 does not take into account the growth in the number of weeks of paid vacation granted to employees. Moreover, normal hours worked in the 50s and 60s according to the GGDC series, based on Maddisons' benchmark figures for 1950, 1960 and 1970, are substantially too low. Finally, we clearly see the adjustments in trend growth needed in the 80s in order to be able to link the old GGDC data to the new benchmark of the work volume statistics in 1991.

3 The evolution of Swiss labor productivity

Probably the most intriguing fact visualized in figure 6 is that the input of labor in Switzerland's economy of 1964 is not reached until 2007, i.e., the 3.05 million employees of 1964 worked as many hours as the 4.22 million employees in 2007. In fact, the labor input is relatively stagnant in the long-run for more than 40 years. Put differently, the contribution of hours worked to growth in GDP in the long-term has essentially been zero during that period. Recently, however, the growth rate of labor input reaches the level of the boom phases in the 50s and 60s. Between 2005 and 2010, the number of employees in Switzerland grew by about 365'000 persons. In contrast to

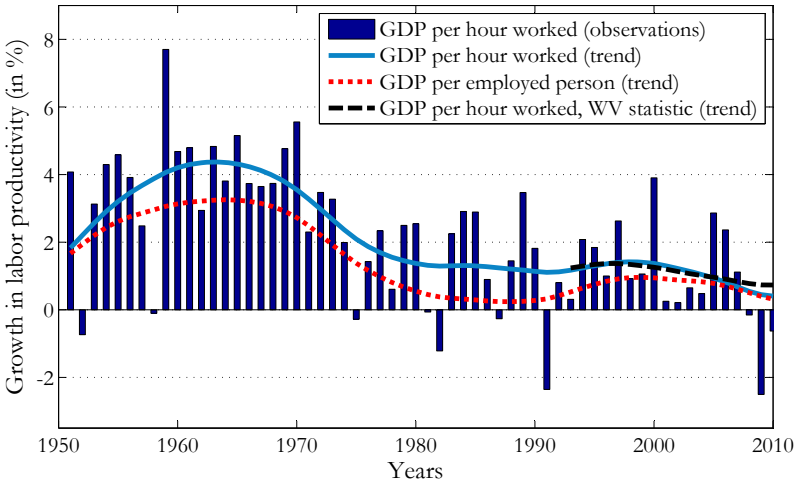

Figure 7: Annual growth rates of GDP per hour worked and per employed person (trends are HP trends using a weighting parameter of $\lambda = 100$).

earlier periods, the latest job growth in Switzerland's labor market is not accompanied by reductions in weekly working time, large increases in part-time work or growth in the duration of paid vacations. Not even the latest recession in the course of the financial crisis of 2008 interrupts this period of strong growth of labor input.

Over the whole period examined, hours worked per employed person in Switzerland decrease by -32 % since 1950, from 2377 hours to 1622 hours in 2010. For full-time employees, the reduction is -21 %. Although international comparisons are problematic because of severe comparability and measurement problems arising with hours worked data from different countries (Bruyere and Chagny, 2002; Hartwig, 2006; OECD, 2004; Scarpetta et al., 2000), the evolution of hours worked per person employment in Switzerland thus seems to be similar to the one in other European countries such as Austria, (West) Germany, or Italy, but the reduction is much larger, for example, than in the US or in Australia (cf. Rogerson, 2006; OECD, 1998). Compared to other European countries, however, hours worked have always been, and still are, on a relatively high level: in relation to the number of employed persons, and even more in relation to the working age population, as the labor force participation rate in Switzerland is the highest among all OECD countries.

Using the historical GDP series of the FSO, the new series of hours worked can now be used to examine the long-term evolution of labor productivity in Switzerland. Figure 7 plots the resulting annual growth rates as well as

Hodrick-Prescott trend growth rate of labor productivity. A HP-trend of the growth of labor productivity using hours worked from the work volume statistics is plotted as well. The graph shows that Switzerland's growth in GDP per hour worked can essentially be divided into a period of strong growth that ends sometime in the early 70s and a period of persistent and relatively low productivity growth afterwards. The evolution of labor productivity per head (i.e., labor productivity per person employed) also plotted is similar. The series displays a stronger decrease in the early 70s and a slight resurgence in the early 90s.

Using endogeneous break tests, I examine the timing of the structural break in the means of the two productivity growth series more closely (cf. Hansen (2001) and Benati (2007) for recent overviews of the procedures). Table 3 contains the results when applying i) the Bai and Perron (1998, 2003) double maximum tests (UDmax and WDmax) for testing the null of no structural break in the two mean productivity growth rates against the alternative of an unknown number of breaks one at a time and ii) the Bai and Perron (1998, 2003) sup-F$(l+1|l)$ test to evaluate the alternative of $l+1$ structural breaks conditional on having found l breaks. All p-values are bootstrapped according to the procedure proposed by Diebold and Chen (1996) using 1000 bootstrap replications. Finally, the table contains the estimated break dates according to the method proposed by Bai (1997a), and respective 90 % confidence intervals according to Bai (1997b). The procedure closely follows the recommendations in Bai and Perron (2003). I set the maximum number of breaks allowed to 3 and the trimming parameter to $\epsilon = 0.15$. The qualitative results, however, do not depend on these assumptions.

The tests indicate that both productivity growth rates experience a structural break around the year 1973. The null of no structural break (as indicated by the UDmax and WDmax statistics) is clearly rejected in all cases while the null of having just one structural break is not rejected according to the sup-F$(2|1)$ tests.

Switzerland's evolution of labor productivity is thus similar to the one in other European countries (Crafts and Toniolo, 1996; Eichengreen, 2007; Timmer et al., 2010). The period before the first oil crisis is characterized by large productivity growth in the process of the post-war "European catch-up" to the US. While Switzerland's average annual growth rate in GDP per hour worked of 3.76 % from 1950–1973 is not as high as the growth rate of 4.9 % reached by the EU-15 countries during that period, it is substantially higher than the US growth rate of 2.6 % (Timmer et al., 2010; Turner and Boulhol, 2011). The high growth of labor productivity—realized despite the fact that Switzerland had been spared from devastation during the Second World War—coupled with a large increase in the input of labor in the

Table 3: Endogenous break tests of annual productivity growth series

Tests for multiple breaks at unknown points in the sample in the mean Bai and Perron (1998, 2003) double maximum tests				
	UDmax	*p-value*	*WDmax*	*p-value*
GDP per employed person	28.49	0.013	28.49	0.019
GDP per hour worked	34.51	0.018	34.51	0.028

Tests for multiple breaks at unknown points in the sample in the mean Bai and Perron (1998, 2003) sup-F($l+1\|l$) test statistics				
	F(2|1)	*p-value*	*F*(3|2)	*p-value*
GDP per employed person	1.37	0.96	1.96	0.69
GDP per hour worked	2.46	0.88	0.82	0.95

Estimated break dates and 90 % confidence intervals				
	Breakdate	*CI*	*Subperiod*	*Mean*
GDP per employed person	1973	[1970 1978]	1950–1973	2.94
			1974–2010	0.68
GDP per hour worked	1973	[1969 1977]	1950–1973	3.76
			1974–2010	1.23

Notes: The maximum number of breaks allowed is 3. The trimming parameter is $\epsilon = 0.15$. *Bootstrapped p-values.*

Swiss economy and growth-enhancing institutions are important sources for Switzerland's ascent to one of the world's richest countries in the 70s and 80s (cf. Eichengreen, 2007).

As in most other European countries, the "golden age" of prosperity and strong labor productivity growth ends around the first oil crisis. In 1975, Switzerland's GDP falls by 6.7 %, and total hours worked decrease to a level of the early 50s between 1973–1979. The average annual growth in GDP per hour worked declines to 1.23 % between 1973 and 2010 in Switzerland. Still, the picture emerging from the data about growth in labor productivity in Switzerland since 1973 is substantially brighter than the one drawn in the growth reports (SECO, 2002, 2008) based on the data of Christoffel (1995), or the one in Zürcher (2008). The latter uses hours worked from the GGDC database (recall table 1). His results about the weak average annual growth in labor productivity since 1973 are driven by the fact that the GGDC series overestimates growth in hours worked, particularly in the 80s. Since the GGDC series has the same data source as the OECD series, an analysis using data from the OECD will lead to similarly erroneous conclusions about Switzerland's performance in GDP per hour worked in the 80s and 90s.

Moreover, the new series also shows that the growth rate of labor productivity in Switzerland has not been particularly low in the 90s as it was the concern in Brunetti and Zürcher (2002) and Balastèr and Surchat (2004). In fact, it seems that labor productivity growth in the 90s just marks the continuation of a trend that started after the structural break in 1973. Switzerland's bad performance in terms of productivity per head in the 80s and early 90s—be it in terms of GDP per employed person (cf. figure 7) or per person aged 15–64 as in Kehoe and Prescott (2002) that made them conclude that Switzerland was in Great Depression at that time—can be explained by a large expansion of part-time work, an increase in paid vacation granted to employees, and a continuously strong reduction in weekly working times.

Still, the average growth of GDP per hour worked in Switzerland lies substantially below the average growth rates reached in most European countries since 1973. For instance, GDP per hour worked has grown by more than 2 % in the 80s and the 90s in Belgium, France, Germany, Norway, or the UK (Timmer et al., 2010). Thus, the new series does not challenge the finding that Switzerland's growth rate in GDP per hour worked has been weak in a comparative perspective since the mid-70s.

What are possible explanations for the relative weakness of Switzerland pertaining to this measure since the structural break in 1973? One simple answer to this question is the relatively high level of labor productivity attained in 1973. Since Switzerland had come close to the technological frontier in 1973, the scope for large productivity gains was limited in the following years. A

second explanation is the integrative labor market in Switzerland (i.e. the high and at the time rising participation rate), enabling the labor market participation of many relatively unskilled workers at the cost of lowering labor productivity (Brunetti and Zürcher, 2002). However, as Brunetti and Zürcher (2002) point out, these arguments can only partially explain the productivity shortfall in Switzerland as, first, Switzerland's level of labor productivity has already fallen below the level in other OECD countries during the 80s, and, second, other countries—above all, the US—have reached a higher level of productivity with similar participation rates.

Therefore, other explanations for Switzerland's low performance pertaining to labor productivity growth have been put forward. The growth reports of the SECO (SECO, 2002, 2008), Brunetti and Zürcher (2002), and Zürcher (2008) emphasize structural deficits of the economy such as lack of competition in certain industries, a large sheltered sector and lack of antitrust policy in order to explain the low productivity growth. Another explanation is that the low productivity growth rate is the result of the migration policy of the past that led to a continuous and substantial inflow of unskilled labor to Switzerland (cf. OECD, 2007, for a recent discussion of this hypothesis).[18]

It has been argued that the scarcity of the factor labor—mirrored in the increase in wage's share in GDP—provides an explanation why Europe performed comparatively better than the US after the oil crisis in terms of labor productivity growth (Timmer et al., 2010; Gordon, 2007). The argument is that the relative scarcity of labor induced shifts in relative prices of factors of production which, in turn, led to an increase in the capital-labor ratio and to a rising need for gains in labor productivity. In this respect, Switzerland is no exception within Europe. In the mid-seventies, hours worked dropped substantially (cf. figure 6), the capital-labor ratio increased and wage's share in GDP grew (Butare and Favarger, 1992). Thus, the labor market can not provide another rationale to explain Switzerland's shortfall pertaining to labor productivity growth compared to other European economies.

However, as already pointed out by Abrahamsen et al. (2005b), the relative weakness of Switzerland in terms of GDP per hour worked might to be searched in measurement issues pertaining to GDP rather than structural deficits of the economy (cf. on this issue also Hartwig, 2008). In particular,

[18]Moreover, Hartwig (2010) has explored the question whether the cost and growth disease(s) of Baumol (1967) can explain the relatively low growth rates of labor productivity in Switzerland. This is an obvious question because industries dominated by public enterprises have gained more and more weight in terms of employment in Switzerland's economy. Hartwig finds, however, that these structural shifts towards low productive industries are offset by changes in relative prices, and concludes that the shifts did not slow down aggregate productivity growth in Switzerland.

Switzerland's terms of trade, i.e., the ratio between export and import prices, show a significant trend increase over time since the beginning of the 80s, implying that there was imperfect pass-through of exchange rate changes on imports and exports. The appreciation of the terms of trade indicates that Switzerland's population could finance more imports for a given amount of exports, i.e., it indicates a positive effect on the real domestic income of the country. The size of this effect can be evaluated by looking at the evolution of command-basis GDP that tries to take into account the effects of changes in the terms of trade on the purchasing power of a nation. Instead of deflating nominal imports and nominal exports by the respective deflator, the whole trade balance is deflated by the same price index. Switzerland's annual growth in CGDP from 1980 to 2010 is 0.65 percentage points larger than annual growth in real GDP (Kohli, 2004; Kugler, 2011). In conclusion, the shortfall of Switzerland in terms of growth of GDP per hour worked compared to other OECD countries after the first oil crisis might actually entirely explainable by two factors: a substantial terms of trade effect on real domestic income disregarded when calculating real GDP; and an overestimation of the growth of hours worked in previous studies.

Nevertheless, it is still an important insight from the new hours worked series that growth in GDP per hour worked has never been so low as in the last decade (i.e. 0.54 % annually). According to the work volume statistics, the average annual growth rate was 0.8 % which is also below the officially projected trend of 1 % (SECO, 2008). Interestingly, other authors document similar declines in growth rates of labor productivity for other European economies (Turner and Boulhol, 2011). Spencer Dale, chief economist of the Bank of England, has noted in a public speech that the shortfall in the UK productivity series might be the result of a *structural* decline in the growth rate of labor productivity.[19] He argues that the financial crisis of 2008 and particularly the credit crunch to which it led has limited firm's possibilities to finance their innovation activities. This shortfall in innovative investments structurally decreased growth in labor productivity after the crisis. Might Switzerland thus just have experienced another structural slowdown of labor productivity growth?

Care must be taken when interpreting recent productivity figures because they are substantially driven by the severe economic crisis in 2008 and 2009, leading to a cyclical decrease in (pro-cyclical) labor-productivity. For instance, Turner and Boulhol (2011) show that the finding of a structural break in the EU-15 productivity growth series is not robust to including forecasts

[19] "Productivity and monetary policy", Speech given by Spencer Dale, Bank of England, 21 September 2011, http://www.bankofengland.co.uk/publications/news/2011/088.htm.

for future GDP and labor force trends. Similarly, Switzerland's low value in terms of labor productivity growth according the new series is to some extent driven by three consecutive years of negative productivity growth. The result might thus be just indicate (substantial) labor hoarding in the economy.
We can get a clearer picture about the recent evolution of labor productivity in Switzerland when looking at more disaggregated data. To this end, figure 8 shows annualized growth rates of labor productivity (expressed in terms of FTE jobs per gross value added) for certain key industries in Switzerland, similar as in Brunetti and Zürcher (2002), SECO (2008), and Hartwig (2010). The plotted lines show a simple moving average of labor productivity growth of the two years preceding the respective observation.[20]

Three things are notable in the figure. First, the two industries that were important drivers of aggregate productivity growth in Switzerland 1991–2005—namely financial intermediation and insurance, and transport, storage and communication (cf. Hartwig, 2010)—show declines in the rate of growth of labor productivity since approximately 2005. Endogenous break tests, however, do not indicate structural breaks in the two series. Second, productivity in the manufacturing sector displays a (presumably cyclical) decline in labor productivity growth during the crisis of 2008/2009. Third, most other industries have had fairly constant growth of labor productivity over the whole period shown. In general, there is thus not much evidence that would support the view of a second *structural* slowdown of labor productivity growth in Switzerland.
However, it is an important insight from this discussion that Switzerland's productivity growth rate did not resurge in the mid-90s as it was the case in the US (growth in labor productivity accelerated to about 2 % a year, cf. Blanchard, 2004; Gordon, 2007; Jorgenson et al., 2008; Timmer et al., 2010).

[20]The data on gross value added stem from the production account of the FSO. I use the (seasonally adjusted) number of full-time jobs according to the December 2011 release of the job statistics as denominator. Both series are quarterly and cover 1991:3 to 2011:3. The newest release of the job statistics uses the newer NOGA 2008 industry classification, while the figures of the production account are still published according to the old NOGA 2002 nomenclature. I choose to use the newest release of the job statistics nevertheless, first, because the data have been revised considerably in some industries, and, second, because the job statistics according to the old classification ranges only until 2010:2. I take care of inconsistencies between the two industry classifications. This is relatively unproblematic for most industries plotted in figure 8. The exception are the groups "real estate, renting and related activities, computer, R&D and other business activities" and " Transport, storage and communication" where the classification changed substantially. Thus, I use data from an older release of the job statistics according to NOGA 2002 here. In any case, the picture is qualitatively similar when the older data of the job statistics is used.

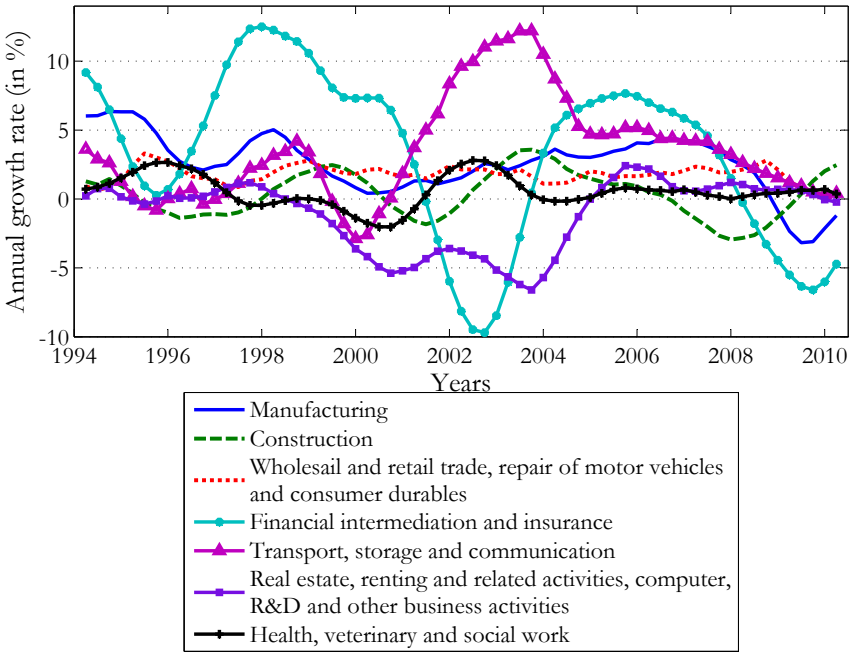

Figure 8: Moving average of annualized growth rates of gross value added per full-time equivalent job (two-year recursive window)

Akin to most other European countries, Switzerland has thus substantially fallen behind the US pertaining to the level of labor productivity (Brunetti and Zürcher, 2002; Hartwig, 2006; SECO, 2008; Zürcher, 2008). The most prominent explanation for the gap in productivity growth between Europe and the US in recent years is that productivity growth in the US is fueled by the "new economy", i.e. by productivity gains in information and communication technology (ICT) that have led to falling prices for these products, and to capital deepening and productivity gains in other industries. In particular, IT spillovers have increased productivity in market services (Jorgenson et al., 2008; Turner and Boulhol, 2011). Labor productivity growth in European economies has not accelerated as in the US because productivity enhancements in ICT industries happened against an adverse macroeconomic shock not related to ICT (Timmer et al., 2010; Dahl et al., 2011). In that respect, Switzerland seems to be no exception. For example, labor productivity growth in the "market services industries" (broadly including trade, transportation, communication, financial, business and personal services) are during most of the period far away from reaching the 2–3 % in the US.

4 Concluding remarks

The discussion in the last section highlights that the debate about Switzerland's performance pertaining to labor productivity growth was seriously flawed by the lack of a consistent and long time series on hours worked, especially in the 80s and 90s. It indicates that the GGDC and OECD data on the issue will lead to a substantial underestimation of Switzerland's growth in GDP per hour worked. This underestimation follows from the simple fact that hours worked in Switzerland have increased considerably less in the last 60 years than previously thought, mostly because the available series on hours worked do not account for the substantial increase in paid vacation granted to employees and because they underestimate annual hours worked in the 50s and 60s.

The discussion also illustrates that Switzerland's growth in hours worked has lately been historically exceptional: because GDP did not keep up with the strong growth in hours worked, Switzerland's average labor productivity growth fell on a level unseen in 60 years in the last decade. Further research should examine the sources of this decrease. Is the phenomena, especially the strong growth in hours worked, linked to the gradual introduction of a Swiss-EU bilateral agreement on the free movement of persons since 2002 or is the contemporaneity of these two events just a coincidence? Is the low

productivity growth rate just the result of a transitory effect or does it indicate a regime-shift?
I gave some preliminary answers to the latter question, arguing that the latest experience should not be taken as a sign of another structural decline in the growth rate of labor productivity. However, the productivity performance of Switzerland in the last 10 years merits a more detailed examination. Because if labor productivity growth actually *decreased* structurally, this would be in contrast to the prediction of some economists that the inflow of (high-skilled) labor (to which the free movement agreement with the EU led) might positively contribute to the growth rate of labor productivity in Switzerland in the future (cf. Aeppli et al., 2008; SECO, 2008).

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Appendix

A Choosing the appropriate employment series

This section discusses advantages and disadvantages of the three different employment series that could be used to compute hours worked: the total number of employed persons according to the employment statistics, the total number of jobs in companies operating in the secondary and tertiary sectors according to the job statistics (*Beschäftigtenstatistik*), and the number of persons paying old-age insurance (*AHV-Beitragspflichtige*) according to data published by the Swiss old age and survivors insurance (OASI). The latter is relevant because contributions to the OASI are compulsory for employees in Switzerland since 1950.

From the three candidate statistics, the job statistics does not lend itself for the analysis we aim at. The problem is not its concept[21] but its insufficient coverage, length and consistency. Until 1961, the statistics only covers blue-collar workers of the second sector. Moreover, until the 90s, the statistics systematically underestimated job creation (due to a non-dynamic sampling method). Therefore, the data of the job statistics had to be strongly revised upwards all ten years when new benchmark figures from a business census became available. The FSO revised the statistics several times because of these conceptual insufficiencies. The resulting structural breaks and the *ex post* adjustments to the series cast doubt on the appropriateness of the medium-term dynamics that the series displays (an issue also discussed by Andrist (1989)).

This leaves us with the number of persons paying old-age insurance and the number of employed persons according to the employment statistics. Figure 9 shows the two series (and a third series, mostly covering employment in the industrial sector, which is discussed in section 2.6). Both series show the number of employees within Swiss borders. Although there are some differences in the underlying population and the concepts of the two statistics (cf. FSO, 1992, pp. 30–33), we observe a close correspondence in the levels of the two series.

For my analysis, I use the employment series in accordance with, e.g., the SNB (Andrist, 1989) or the GGDC, mainly because the employment statistics displays more reasonable short-run dynamics (FSO, 1992).[22] Using the em-

[21] Actually, Hartwig (2006) argues that from all available statistics on labor input it is the job statistic that best guarantees the consistency between nominator and denominator in an analysis of labor productivity.

[22] The responsiveness of the OASI time series to business cycle fluctuations are implausibly small and does not conform to other (reliable) data sources such as different migration

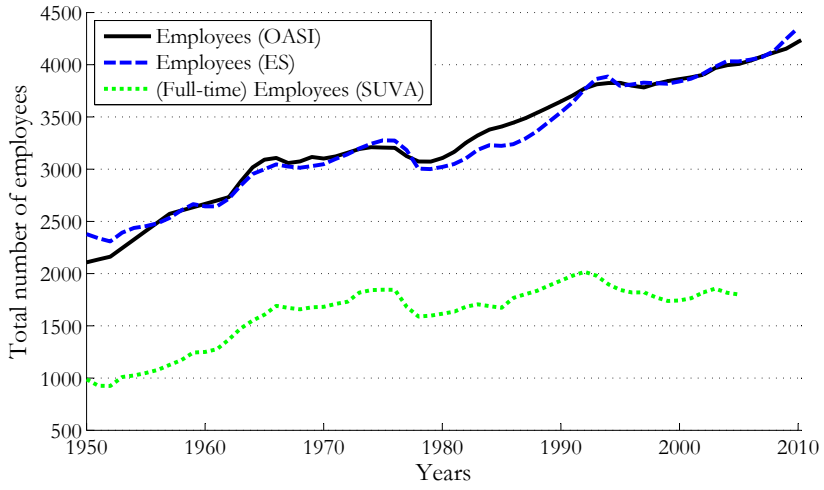

Figure 9: Correspondence between different employment series. *Sources: Employment statistics, OASI statistics, and SUVA five year reports*

ployment statistics is not unproblematic, though. First, the annual figures from 1948–1990 are, in principal, just elaborated interpolations of benchmark figures from four business censuses (1955, 1965, 1975, and 1985) and equally many population censuses (1950, 1960, 1970, 1980) (cf. FSO, 1980). Thus, the employment statistics, too, may not sufficiently mirror short- to medium-term fluctuations in employment—in particular because the interpolations have been made, *inter alia*, with the job statistics.
Second, also the employment statistics has undergone a major revision. Since 1991, it is largely based on data from the Swiss labor force survey (SLFS). The FSO claims that this did not lead to a structural break in the series. However, an attempt of the FSO to demonstrate the similarity of the old and the new method is only partially successful (cf. FSO, 1996, pp. 29–36). In 1991, also the underlying definition of employment statistics changed because it did not conform to the international standard. Until 1991, a person was considered as employed if she or he worked at least 6 hours per week. The problems arising from this change in the definition were discussed in the main text.

statistics or the statistic of the Swiss accident insurance fund (SUVA, cf. the third series in figure 9). This is most likely the result of the methodology employed to calculate the number of contributors to the OASI. Another reason for choosing the employment series is that there are no yearly figures on the number of persons contributing to the OASI before 1960.

B Employment in the first sector 1950–2010

The main source to estimate the number of employees in the first sector in the 50s is the employment statistics. Using the newest data from the employment statistics and linking it to the growth rates of the vintage of 2007, I extrapolate employment in the first sector back to 1960. For the remaining years, I use a benchmark figure derived from a table in Schweizerische Bankgesellschaft (1987, p. 29) together with a conceptually similar figure from an older employment statistics. These sources imply that employment in the agricultural sector declined by 28.2 % from 1950–1960. I derive the number of employees in 1950 by linking this trend growth rate to the previously computed figure for 1960.
The two resulting benchmark figures for 1950 and 1960 are then interpolated using a related annual series that shows the number of cattle owners in Switzerland. Using this series is meaningful since most farmers in Switzerland were cattle owners and about 90 % of the employees in the first sector were farmers at the time. The FSO employed the same series to estimate the evolution of employment in the first sector 1960–1980 (FSO, 1980). The resulting series on the number of employees in the first sector can be derived from the data presented in Appendix F.

C Computing FTEs before 1991

As noted in the main text, the series on full-time equivalent jobs is unavailable prior to 1991 and FTEs cannot be directly calculated from the job statistics. However, we can base the analysis on the three series of the job statistics on the proportion of jobs that are "full-time" (90–100 % of the normal weekly working time), "part-time I" (50–89 %), and "part-time II" (0–49 %). The problem of this approach is that the exact activity levels *within* the three categories of the job statistics are unknown. Does, for example, an average "part-time I" job holder work 10 or 40 % of a full-time job? When properly accounting for conceptual differences, one can use the Swiss labor force survey (SLFS) to examine this question. Doing this shows that a "part-time I" job amounted to 67.2 %, and an average "part-time II" job to 26.4 % of a full-time job in 1991. Because the SLFS was not conducted before 1991, I fix the within-category activity levels for all the years prior to 1991 to these values. In other words, the new series on FTEs from 1950–1990 will only be affected if we observe shifts *between* the three categories of the job statistics. A second problem with the approach is that the job statistics was revised in 1991. The underlying concept and methodology changed. Although the

modifications did, conceptually, not affect the classification of jobs into the three categories full-time, part-time I and II, the distribution of jobs to the three category was considerably revised. Problematically, the quarterly data before 1991 were not updated. Only the figures of the business census 1985 were revised such that the fit to the new post-1991 data in a later publication (cf. FSO, 1998). Therefore, we can use the activity levels of the two business censuses (1985:3 and 1991:3) as benchmarks. We then interpolate these two benchmark figures using the old (i.e. unrevised) data from the job statistics. Finally, the first job statistics that contained figures about the three activity categories is the fourth quarter of 1983. Thus, we can use the quarterly growth rates between the third quarter 1985 and the last quarter in 1983 to extrapolate the benchmark figure of 1985 for two additional years.
Information on part-time employment before 1983:4 is rare. The sole sources of information on the activity levels of employees in Switzerland are different business and population censuses, just distinguishing between full- and part-time jobs or employees, respectively. Moreover, these population and business censuses use different definitions to distinct between full- and part-time jobs or employees. As there is no other information available, I nevertheless use these sources to extrapolate the three benchmark activity levels of 1983:4 (the shares of the three categories full-time, part-time I and II) back to 1950. Since there is no series that contains information on the relative changes between part-time I and part-time II jobs, I have to make the assumption that the relative weights of the categories remained constant over time. Using data from the business census 1985 as a reference, the ratio of part-time I jobs compared to part-time II jobs is fixed to 0.081/0.096 over the whole period prior to 1983:4.
1975:3–1983:4: The business census 1975 does not distinguish the two part-time categories from the job statistics, it just distinguishes full- and part-time jobs. Furthermore, in the census, a full-time job is defined as a job amounting to 70 % rather than 90 % of the normal weekly working time of a full-time job holder. According to this definition, the proportion of full-time jobs decreased by -4.03 % between 1975 and 1985 (FSO, 1988). I extrapolate the shares of full-time jobs of 1983:4 using this trend decrease. The shares of part-time I and part-time II jobs is then residually determined using the aforementioned ratio of 0.081/0.096.
1965–1975: The business census in 1965 uses another definition of a full-time job compared to the business census ten years later. According to the old definition, the amount of full-time jobs (defined as jobs with a workweek of 30 hours) declined from 94.48 % in 1965 to 89.41 % in 1975 (Eidgenössisches Statistisches Amt, 1967, 1977). As before, this trend growth rate implies a new benchmark value for 1965 for the share of full-time jobs. The series on

part-time I and part-time II work are again residually determined. Finally, I linearly interpolate the benchmark figures between 1965 and 1975.
1950–1965: Prior to 1965, the population census is the sole source of information on the share in part-time workers in the economy.[23] The population censuses mirror the well-known picture that part-time employment in Switzerland spread in the 60s: while the share in part-time employees in the second and third sector is fairly steady (rising from 3.28 % to 3.83 % between 1950 and 1960), it increases from 3.83 % to 11.21 % a decade later. I make use of the implied annual growth rates to linearly extrapolate the three series of full- and part-time work between 1950 and 1965.

D Construction of sector-specific series of normal weekly working time

In this section, I expose how separate series of normal weekly working time for each economic sector are constructed. As mentioned in the main text, the NW statistics only provides, until 1973, figures on *actual* hours worked by blue-collar workers covered by the factory act (*Fabrikgesetz*) aiming at protecting workers. Hence, since the figures contain overtime work and exclude white-collar workers and the third sector, they might over- or underestimate average *normal* hours worked per week in the economy. Moreover, the method of data collection for the series changes in 1973. Until 1972, the NW statistics relies on a specific questionnaire sent to employers. From 1973 onwards, the basis of the series are accident reports sent to the Swiss accident insurance fund and filled out by employers. These changes lead to a structural break in the series. The approach followed to estimate a series on normal weekly working time in the second and third sector is thus to use reliable benchmark figures from the business censuses 1955 (Eidgenössisches Statistisches Amt, 1962, pp. 88–113) and 1965 (Eidgenössisches Statistisches Amt, 1968, p. 199) that are subsequently inter- and extrapolate, and to use the data from the NW statistics only after 1973. For the agricultural sector,

[23] It might be seen as problematic that I change from the business to the population census to construct the series, most of all because the underlying population concept of the two statistics is different (working resident population versus jobs) and second because the sample collection dates differ (December versus September). Note, however, that these problems mostly affect the levels of the series rather than changes over time. Furthermore, according to the population census of 1970, 88.79 % of the employees were full-time workers (Eidgenössisches Statistisches Amt, 1974, p. 282). This is close to my estimate of 88.25 % in 1970—computed, as explained, by interpolating figures from the business census.

an own series is constructed for the entire period examined.

- Normal weekly working hours in the second sector (1950–1972): Pertaining weekly working times in manufacturing, the benchmark figures of the business censuses (i.e., of 1955:3 and 1965:3), and the third benchmark (the first value of the new NW statistics in 1973) are interpolated using the old NW statistics.[24] Moreover, the growth rates of the old NW statistics are used to extrapolate the quarterly figures before 1955:3. The approach requires averaging individual figures on weekly working times in manufacturing and construction because the NW statistics does not provide an aggregate figure for the whole second sector. I thus weight the two series using (linearly interpolated) employee shares according to the population censuses of 1950 and 1960, and, after 1960, according to data from the employment statistics.

- Normal weekly working hours in the third sector (1950–1972): The approach followed here is identical to the one for manufacturing. Hence, the series is constructed by using the benchmark figures from the business censuses 1955 and 1965 and the first figure from the NW statistics. These benchmarks are then intra- and extrapolated by using a related series.
  How is this related series constructed? It consists of two parts: a series on normal weekly working time in the public sector, and a similar series for the rest of the third sector. Pertaining to the former, I use statutorily regulated working times of blue- and white-collar state workers. The basis for the calculations of working times in market services are regulations about working times in collective agreements. These regulations are compiled in a series of publications of the FSO (*Lohnsätze und Arbeitszeiten in den Gesamtarbeitsverträgen*).
  Averaging the figures from these labor agreements, however, is tricky because the agreements sometimes cover just a four-, three-, or a complete two-digit industry, apply to the whole or just a part of the workforce of an industry, and hold for specific regions, cantons, or the whole Swiss territory. For the branches wholesale, retail business, hospitality,

[24] We exempt construction because, in this branch, the benchmark figures from the business censuses indicate weekly working times *in summer*. Because the workload in construction reaches its peak in this season, the figures are not representative for the whole year. As I cannot properly account for seasonality effects, I choose to stick to the old NW series for this branch and just add 0.82 % to all figures prior to 1973. This is the mean difference in the duration of the normal workweek between the old and the new NW statistics for the years 1973–1976 for which we possess both series.

and cleaning (according to the industry classification of the business census 1975), the collective labor agreement covered nearly the whole labor force in Switzerland. In other branches, several collective labor agreements were just for a three or four-digit industry (and mostly covered just a part of the labor force of the industry.) I declared them representative for the whole three- or four-digit industry nevertheless. This assumption enabled me to average the figures from the different sub-industries using weights derived from employee shares in the business censuses 1955, 1965, and 1975.[25]
The weight of the new state worker series in the average series for the whole third sector is then derived from an annual series from the statistical yearbooks of Switzerland, showing the total amount of state workers in Switzerland. The number of state workers can then be related to the total amount of employees in the third sector which allows averaging the two series of market and public services.

- Normal weekly working hours in the second and third sector (1973–2010): Another advantage of the approach followed is that we do not have to deal with the structural break in the NW statistics of 1973. We can just link the two newly constructed pre-1973 series to the respective series of the NW statistics. Note that the NW statistics after 1973 covers the whole and most of the third sector. However, the NW statistics suffers from another structural break in 1984. Its effects can be examined because the old as well as the new NW statistics were released for the years 1984–1987 (cf. for the old series: *Die Volkswirtschaft*, various issues). For the four years, weekly working times in the second and third sector are on average 0.29 hours higher in the new release than in the old vintage. Where does this difference come from?
  First, half of the difference is due to a simple weighting effect. This effect arises because the new NW statistics weights industry-level aggregates using constant employment weights. Naturally, an aggregation error arises if there are differences in the dynamics of weekly working times across industries while their weights are held fixed. Apparently, the dynamics of weekly working hours differ mainly between the second and the third sector, while they are remarkably similar *within* sectors. The obvious solution to the problem is thus to recompute aggregate

[25]Note that my weighting is internally consistent since we mainly observe the changes within the same agreements over time. Furthermore, due to amount of agreements involved in the calculation, the results are not significantly different if any agreement was weighted equally. The calculations can be received from the author upon request.

figures using dynamic weights, i.e. weights that represent each sectors' share in total employment in each year. I do this for the old as well as the new series with employee shares derived from the employment statistics.[26]

Second, the major part of the remaining difference is due to the complete exclusion of part-time workers in the post-1984 statistics. Prior to 1984, the NW statistics also included part-time employees working more than 25 hours weekly. Because we aim at estimating a series on weekly working times of *full-time* employees, the old vintage, therefore, is likely to underestimate normal working time as we aim to measure it. Because part-time work is a phenomena that spread in the 60s, I choose to sequentially close the remaining gap between the old and the new series by slightly increasing each figure from 1965–1983.

- Normal weekly working hours in the first sector (1950–2010): Data on (normal) weekly working hours covering the whole agricultural sector is particularly rare. Even the current NW statistics only contains data on working times in horticulture and forestry. The sole sources providing the information for the whole first sector are the two population censuses of 1980 and 1990, and since 1991 the work volume statistics. According to the latter statistics, the normal weekly working time in the sector dropped substantially between 1991 and 2010: from (very high) 55.3 to 45.8 hours. However, there are reasons to doubt that these values—derived from data from the household survey SLFS—are appropriate. Particularly, some of the large values in the first years are driven by very large average weekly working times of foreign employees in the sector (nearly 60 hours a week in 1991). Considering the sample size in the first years of the SLFS (16 000 people) and the few foreign employees in the first sector, the large values might be driven by one or two outliers. This conjunction is confirmed by the fact that the series for this group of workers displays large year to year changes. Finally, also data from the population census of 1990 indicate that the statistics overstates working times in the first years of its publication.

  Therefore, I build a series under the following conventions: I *assume*—guided by Andrist (1989)—that the working time in the first sector was 55 hours per week in the 60s, then gradually decreased to 52.53 hours in 1980 (which is the benchmark figure computed with data from

[26]Naturally, it would be preferable to re-weight the sectoral figures as well. Yet, re-weighting on two-digit industry-level might be a cure worse the disease due to the limited amount of consistent employment data on disaggregated level before 1985.

the population census 1980, FSO (1985, p. 199)), and subsequently to 51.32 hours in 1990 (which is the benchmark figure computed with data from the population census 1990, FSO (1993, p. 146)). Since 1991, the figures from the work volume statistics are used, but only those for Swiss workers.

E Harmonization and extrapolation of the series of overtime hours granted

As mentioned in the main text, the series of granted overtime hours has a structural break in 1979. In particular, the underlying population changed from blue-collar workers in the industrial sector to all employees in the nonagricultural economy. This change poses a problem because the SECO did not publish the aggregate figure (number of overtime hours granted) but just a normalized one, i.e., the series was published *per* week and blue-collar worker in the second sector until 1979, and afterwards, per week and employee in the nonagricultural economy.

Because the figures according to the old reference group were still released after 1979, the effects of the change can be examined. This examination shows that granted overtime was after 1979 nearly exclusively done by blue-collar workers in the second sector. Thus, the effect of the structural break in 1979 is relatively minor: it leaves the nominator of the series more or less unchanged (i.e., the amount of overtime hours did not fundamentally change although the statistics enlarged its scope) while the denominator of the series increases (the reference population is larger). Consequently, the two released series are harmonized by dividing the old figures by a larger denominator, i.e., by using employment of the second and third sector instead of just blue-collar workers of the second sector.

Since my approach requires that the series covers the years 1950–1990 while the original series of "granted" overtime only covers 1966–1986, I need to extrapolate the series in both directions. Concerning the years 1987–1990, the extrapolation of the series is achieved by predicting (quarterly) overtime hours granted using a model that has current and 5 lags of real GDP growth as explanatory variables. To extrapolate the figures at the other end of the series, I use the growth rates of a very similar series on overtime hours granted to firms amenable to the factory act. The series is put together in Kaufmann (1960, pp. 56–60) and was later on published by the BIGA. The discussion in (BIGA, 1969) basically confirms the validity of this extrapolation.

F Data

The following pages contain the data series put together. Excel files of the series are provided under http://www.kof.ethz.ch/en/publikationen/p/kof-working-papers/.

Normal weekly working time of full-time employed persons in Switzerland (1950-2010)*

	Sector 1	Sector 2	Sector 3	Total
1950	*55.00*	47.62	49.21	49.80
1951	*55.00*	47.80	49.19	49.73
1952	*55.00*	47.70	49.16	49.58
1953	*55.00*	47.76	49.08	49.48
1954	*55.00*	47.80	48.99	49.39
1955	*55.00*	47.78	48.88	49.29
1956	*55.00*	47.78	48.66	49.17
1957	*55.00*	47.71	48.43	49.03
1958	*55.00*	47.14	47.76	48.51
1959	*55.00*	47.01	46.86	48.09
1960	*55.00*	46.44	46.41	47.67
1961	54.87	46.18	46.24	47.38
1962	54.75	45.92	45.97	47.05
1963	54.62	45.87	45.90	46.90
1964	54.50	45.79	45.73	46.72
1965	54.37	45.39	45.69	46.47
1966	54.25	45.37	45.47	46.32
1967	54.12	45.19	45.60	46.27
1968	54.00	45.15	45.49	46.14
1969	53.87	45.23	45.57	46.16
1970	53.75	45.22	45.65	46.15
1971	53.62	45.19	45.59	46.08
1972	53.50	45.15	45.38	45.92
1973	53.38	45.19	45.17	45.80
1974	53.26	45.07	45.05	45.67
1975	53.13	44.66	44.98	45.47
1976	53.01	44.61	44.87	45.39
1977	52.89	44.66	44.70	45.30
1978	52.77	44.58	44.63	45.20
1979	52.65	44.38	44.39	44.97
1980	52.53	44.24	44.10	44.73
1981	52.40	44.20	44.06	44.66
1982	52.28	44.05	43.92	44.51
1983	52.16	43.58	43.65	44.17
1984	52.04	43.47	43.40	43.96
1985	51.92	43.40	43.30	43.85
1986	51.80	42.97	43.20	43.61
1987	51.68	42.78	42.80	43.27
1988	51.56	42.39	42.60	42.97
1989	51.44	42.21	42.40	42.75
1990	51.32	42.19	42.25	42.61
1991	52.01	42.03	42.13	42.50
1992	52.10	41.89	42.01	42.38
1993	51.80	41.75	41.93	42.29
1994	50.55	41.78	41.93	42.23
1995	47.35	41.78	41.94	42.11
1996	47.39	41.72	41.94	42.11
1997	47.58	41.74	41.97	42.16
1998	48.34	41.64	41.97	42.16
1999	45.80	41.58	41.93	42.01
2000	48.20	41.54	41.87	42.05
2001	46.46	41.46	41.81	41.89
2002	44.65	41.44	41.76	41.78
2003	44.49	41.39	41.77	41.78
2004	44.24	41.39	41.68	41.70
2005	43.94	41.41	41.68	41.69
2006	44.19	41.41	41.68	41.70
2007	44.08	41.40	41.68	41.69
2008	43.44	41.35	41.66	41.65
2009	43.86	41.34	41.67	41.66
2010	43.86	41.35	41.71	41.70

Sources: NW statistics (harmonized), work volume statistics, and own calculations

Components of absences from work in Switzerland (1950-2010)*

	Absences because of military service	Absences because of civil defense	Absences because of civil service	Absences because of short-time work	Absences because of labor conflicts	Absences because of accident	Estimated other absences from work
1950	24.64	0.00	0.00	0.00	0.03	27.70	57.13
1951	24.64	0.00	0.00	0.00	0.05	27.21	56.88
1952	30.34	0.00	0.00	0.00	0.06	28.48	56.87
1953	24.77	0.00	0.00	0.00	0.32	27.77	56.47
1954	26.40	0.00	0.00	0.00	0.13	27.67	56.53
1955	25.58	0.00	0.00	0.00	0.01	28.05	56.35
1956	24.66	0.00	0.00	0.00	0.01	26.48	56.01
1957	20.96	0.00	0.00	0.00	0.00	26.78	55.54
1958	24.92	0.00	0.00	0.00	0.01	26.90	55.08
1959	23.69	0.00	0.00	0.00	0.01	25.69	54.29
1960	22.80	0.00	0.00	0.00	0.00	26.55	53.83
1961	23.02	0.00	0.00	0.00	0.00	27.55	53.40
1962	24.95	0.00	0.00	0.00	0.01	29.39	52.81
1963	26.03	0.00	0.00	0.00	0.26	27.89	52.33
1964	25.81	0.00	0.00	0.00	0.02	26.43	52.33
1965	26.49	0.00	0.00	0.00	0.00	27.83	51.93
1966	26.53	0.10	0.00	0.00	0.00	25.71	51.58
1967	26.16	0.20	0.00	0.00	0.01	23.64	51.13
1968	26.77	0.34	0.00	0.00	0.01	24.35	50.98
1969	26.10	0.64	0.00	0.00	0.00	26.26	50.71
1970	25.06	0.71	0.00	0.00	0.01	26.93	50.46
1971	24.17	0.91	0.00	0.00	0.03	26.67	50.66
1972	23.54	1.11	0.00	0.00	0.01	25.56	50.11
1973	22.77	1.18	0.00	0.00	0.00	27.92	49.70
1974	23.06	1.32	0.00	0.00	0.01	26.79	49.53
1975	24.62	1.51	0.00	6.10	0.01	26.14	49.29
1976	27.02	1.53	0.00	8.14	0.07	26.49	49.81
1977	27.37	1.65	0.00	1.74	0.02	25.30	49.47
1978	28.07	1.74	0.00	1.52	0.02	24.72	49.04
1979	27.43	1.88	0.00	1.96	0.01	25.91	48.65
1980	26.56	1.86	0.00	0.38	0.02	27.48	48.44
1981	26.62	1.86	0.00	1.12	0.00	26.15	48.18
1982	26.83	2.11	0.00	6.05	0.00	27.29	48.15
1983	27.01	2.06	0.00	7.86	0.01	31.64	47.64
1984	26.91	2.58	0.00	2.36	0.00	22.50	47.19
1985	26.22	2.69	0.00	0.53	0.00	22.25	46.73
1986	26.02	2.74	0.00	0.47	0.00	22.21	46.45
1987	25.03	2.53	0.00	0.86	0.00	24.93	46.36
1988	24.21	2.29	0.00	0.77	0.00	24.48	46.11
1989	22.99	2.60	0.00	0.13	0.00	24.12	45.57
1990	21.06	2.64	0.00	0.16	0.01	24.12	45.21
1991	19.26	2.40	0.00	3.11	0.00	25.10	45.07
1992	18.29	2.20	0.00	5.77	0.00	24.61	45.40
1993	17.71	1.87	0.00	7.42	0.00	23.57	45.47
1994	16.22	1.63	0.00	4.04	0.04	22.42	45.08
1995	12.48	1.65	0.00	2.06	0.00	22.30	44.48
1996	12.24	1.72	0.02	2.78	0.02	21.32	44.47
1997	11.78	1.55	0.09	1.57	0.00	20.20	44.29
1998	11.44	1.36	0.18	0.82	0.07	18.83	44.64
1999	11.53	1.27	0.28	0.71	0.01	19.89	44.83
2000	10.85	1.24	0.36	0.17	0.01	20.10	44.43
2001	10.82	1.27	0.36	0.52	0.05	20.02	43.90
2002	10.55	1.19	0.48	1.86	0.05	21.47	43.74
2003	10.93	1.12	0.55	1.97	0.02	22.36	43.70
2004	8.91	0.62	0.55	0.76	0.10	21.43	44.36
2005	10.10	0.49	0.55	0.51	0.00	21.40	44.03
2006	10.29	0.60	0.55	0.19	0.02	20.87	43.66
2007	10.40	0.78	0.57	0.09	0.02	19.54	43.53
2008	9.90	0.76	0.62	0.22	0.03	19.03	43.65
2009	9.93	0.82	0.83	6.78	0.00	20.92	43.83
2010	9.97	0.85	1.37	2.54	0.00	*18.00***	44.27

* In hours per full-time employed person and year

** Estimation (not yet all data available)

Sources: various, see main text

Components of estimated volume of work in Switzerland (1950-2010)

	Normal weekly working hours[1]	Workdays per year	Weeks of vacation per year[1]	Normal workweeks per year	Normal hours of work[1]	Annual hours of absences from work[1]	Annual hours of overtime work[1]	Total hours worked per full-time employee	Full-time employees[2,3]	Full-time employees sectors 2 & 3[2]	*Total hours worked*[4]	Total hours worked per employee[5]
1950	49.80	256	1.32	49.88	2484	109	71	2445	2244	1750	*5487*	2377
1951	49.73	256	1.37	49.73	2473	109	74	2439	2325	1835	*5670*	2370
1952	49.58	257	1.43	49.87	2473	116	74	2431	2368	1882	*5757*	2362
1953	49.48	256	1.48	49.62	2455	109	74	2419	2384	1912	*5769*	2350
1954	49.39	257	1.54	49.76	2458	111	74	2421	2410	1955	*5836*	2351
1955	49.29	257	1.70	49.70	2450	110	76	2416	2459	2019	*5940*	2345
1956	49.17	257	1.77	49.53	2435	107	76	2404	2529	2103	*6080*	2333
1957	49.03	256	1.85	49.25	2415	103	75	2386	2586	2175	*6170*	2315
1958	48.51	257	1.93	49.37	2395	107	70	2358	2564	2165	*6044*	2286
1959	48.09	256	2.02	49.08	2361	104	70	2326	2563	2173	*5963*	2256
1960	47.67	256	2.11	49.09	2340	103	73	2310	2634	2253	*6085*	2239
1961	47.38	256	2.20	49.00	2322	104	74	2292	2745	2377	*6291*	2212
1962	47.05	256	2.29	48.81	2296	107	72	2261	2839	2486	*6419*	2173
1963	46.90	255	2.39	48.51	2275	107	71	2239	2870	2538	*6426*	2143
1964	46.72	256	2.50	48.70	2275	105	71	2242	2903	2586	*6506*	2136
1965	46.47	256	2.61	48.59	2258	106	70	2221	2871	2570	*6377*	2108
1966	46.32	256	2.78	48.42	2243	104	69	2208	2851	2562	*6296*	2089
1967	46.27	255	2.96	48.04	2223	101	67	2189	2858	2572	*6257*	2065
1968	46.14	256	3.06	48.04	2217	102	67	2181	2867	2597	*6254*	2052
1969	46.16	255	3.14	47.76	2205	104	68	2169	2906	2647	*6304*	2035
1970	46.15	254	3.26	47.54	2194	103	71	2161	2939	2687	*6352*	2021
1971	46.08	256	3.29	47.81	2203	102	70	2171	2983	2739	*6475*	2024
1972	45.92	254	3.36	47.44	2179	100	69	2147	3016	2778	*6474*	1996
1973	45.80	253	3.42	47.18	2161	102	70	2129	3038	2809	*6467*	1974
1974	45.67	253	3.45	47.15	2153	101	67	2120	3027	2801	*6416*	1960
1975	45.47	253	3.47	47.13	2143	108	59	2094	2866	2649	*6002*	1931
1976	45.39	256	3.49	47.71	2166	113	58	2111	2780	2566	*5868*	1944
1977	45.30	255	3.51	47.49	2151	106	59	2105	2788	2579	*5869*	1936
1978	45.20	254	3.53	47.17	2132	105	60	2087	2812	2608	*5868*	1917
1979	44.97	253	3.57	47.03	2115	106	57	2066	2839	2637	*5865*	1895
1980	44.73	254	3.72	47.08	2106	105	57	2058	2900	2701	*5970*	1886
1981	44.66	254	3.89	46.91	2095	104	56	2047	2965	2770	*6070*	1873
1982	44.51	256	4.06	47.04	2093	110	55	2038	2976	2784	*6064*	1862
1983	44.17	255	4.10	46.90	2071	116	54	2009	2971	2781	*5969*	1833
1984	43.96	254	4.13	46.67	2052	102	54	2004	2982	2797	*5974*	1817
1985	43.85	253	4.17	46.33	2032	98	54	1987	3029	2846	*6020*	1795
1986	43.61	253	4.19	46.31	2019	98	53	1975	3077	2903	*6077*	1771
1987	43.27	254	4.22	46.58	2016	100	55	1971	3140	2973	*6190*	1761
1988	42.97	255	4.24	46.66	2005	98	56	1963	3210	3052	*6302*	1747
1989	42.75	253	4.25	46.35	1981	95	58	1944	3269	3120	*6354*	1716
1990	42.61	252	4.27	46.13	1966	93	59	1931	3351	3208	*6470*	1693
1991	42.50	252	4.28	46.12	1960	95	50	1915	3428	3292	*6564*	1671
1992	42.38	255	4.32	46.58	1974	96	51	1929	3379	3245	*6518*	1679
1993	42.29	256	4.35	46.75	1977	96	55	1935	3351	3213	*6486*	1688
1994	42.23	254	4.38	46.42	1960	89	55	1926	3339	3207	*6430*	1679
1995	42.11	252	4.47	45.93	1934	83	47	1898	3337	3203	*6335*	1651
1996	42.11	253	4.59	45.91	1933	83	46	1897	3328	3187	*6312*	1645
1997	42.16	252	4.62	45.68	1926	79	47	1893	3316	3171	*6278*	1638
1998	42.16	254	4.66	46.04	1941	77	51	1915	3335	3190	*6385*	1650
1999	42.01	256	4.70	46.40	1949	79	51	1922	3331	3187	*6401*	1644
2000	42.05	253	4.66	45.94	1932	77	48	1902	3355	3216	*6382*	1620
2001	41.89	252	4.74	45.56	1909	77	47	1878	3428	3297	*6439*	1605
2002	41.78	252	4.79	45.51	1902	79	46	1868	3455	3326	*6454*	1593
2003	41.78	252	4.82	45.48	1900	81	47	1867	3428	3302	*6400*	1585
2004	41.70	256	4.84	46.26	1929	77	48	1900	3436	3315	*6530*	1606
2005	41.69	254	4.88	45.92	1915	77	47	1884	3458	3337	*6516*	1591
2006	41.70	252	4.88	45.52	1898	76	46	1868	3531	3409	*6597*	1578
2007	41.69	252	4.90	45.40	1893	75	47	1865	3626	3500	*6762*	1575
2008	41.65	253	4.93	45.57	1898	74	47	1870	3697	3570	*6915*	1580
2009	41.66	254	4.96	45.74	1906	83	51	1873	3715	3595	*6959*	1580
2010	41.70	256	4.94	46.16	1925	59	57	1922	3742	3617	*7193*	1622

[1)] Per full-time employed person

[2)] Working more than 6 hours a week

[3)] In 1000 full-time equivalents

[4)] In million hours

[5)] = Annual actual volume of work / employed person (according to the employment statistics)

Sources: Various, see main text