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Working Paper

The Swiss "job miracle"

KOF Working Papers, No. 368

Provided in Cooperation with:

KOF Swiss Economic Institute, ETH Zurich

Suggested Citation: Siegenthaler, Michael; Graff, Michael; Mannino, Massimo (2014) : The Swiss "job miracle", KOF Working Papers, No. 368, ETH Zurich, KOF Swiss Economic Institute, Zurich, <https://doi.org/10.3929/ethz-a-010703460>

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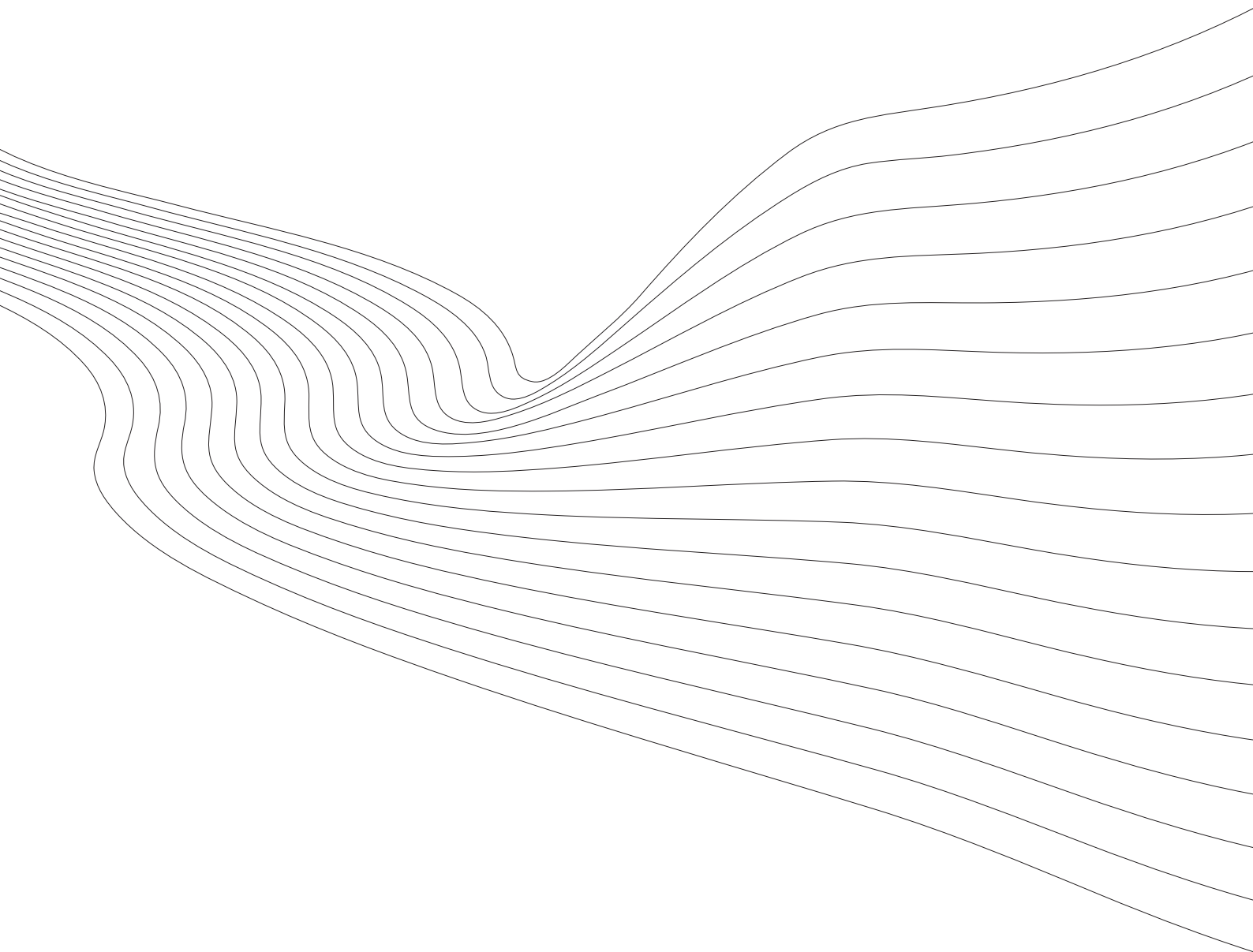
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KOF Working Papers

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The Swiss “Job Miracle”

Michael Siegenthaler*, Michael Graff* and Massimo Mannino[♣]

December 2014[♦]

Abstract

While Switzerland’s recent growth of employment was high in historical and international perspective, the reasons for this “job miracle” were not well understood. As the “miracle” was not anticipated by economic forecasters, it consequently resulted in systematic and persistent forecast errors. This paper shows that the “miracle” is related to a substantial increase in the labor intensity of economic activity. To this end, we present a number of stylized facts reflecting shifts and structural changes that affected the Swiss economy around 2000. Then, we discuss potential drivers of the “miracle” which are consistent with these facts. Finally, we demonstrate how they contribute to understand why, during the last ten years, forecasters systematically underestimated the growth of domestic employment. Finally, we highlight that immigration was not only a consequence of the “miracle”, but also an important cause, as it created additional jobs in Switzerland by raising local demand for goods and, most importantly, services.

JEL-Classification: C52, E24, J21, J61

Keywords: Labor market, Swiss job miracle, employment forecasts, free movement of persons, migration, local multipliers

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♦ We would like to thank Yngve Abrahamsen, Roland Aeppli, Aymo Brunetti, Daniel Lampart, Stefan Leist, George Sheldon, Jan-Egbert Sturm, Bernhard Weber, Ralph Winkler, Klaus Wohlrabe, Boris Zürcher and participants at the KOF Brown Bag Seminar, the 2012 CIRET conference, and the 2014 conference of the Swiss Society for Economics and Statistics for helpful comments and suggestions. We are particularly indebted to Bernhard Weber from the Swiss State Secretariat for Economic Affairs for his remarks and, last but not least, for providing us with real-time vintages of the Swiss Job Statistics.

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While Switzerland’s recent growth of employment was high in historical and international perspective, the reasons for this “job miracle” were not well understood. As the “miracle” was not anticipated by economic forecasters, it consequently resulted in systematic and persistent forecast errors. This paper shows that the “miracle” is related to a substantial increase in the labor intensity of economic activity. To this end, we present a number of stylized facts reflecting shifts and structural changes that affected the Swiss economy around 2000. Then, we discuss potential drivers of the “miracle” which are consistent with these facts. Finally, we demonstrate how they contribute to understand why, during the last ten years, forecasters systematically underestimated the growth of domestic employment. Finally, we highlight that immigration was not only a consequence of the “miracle”, but also an important cause, as it created additional jobs in Switzerland by raising local demand for goods and, most importantly, services.

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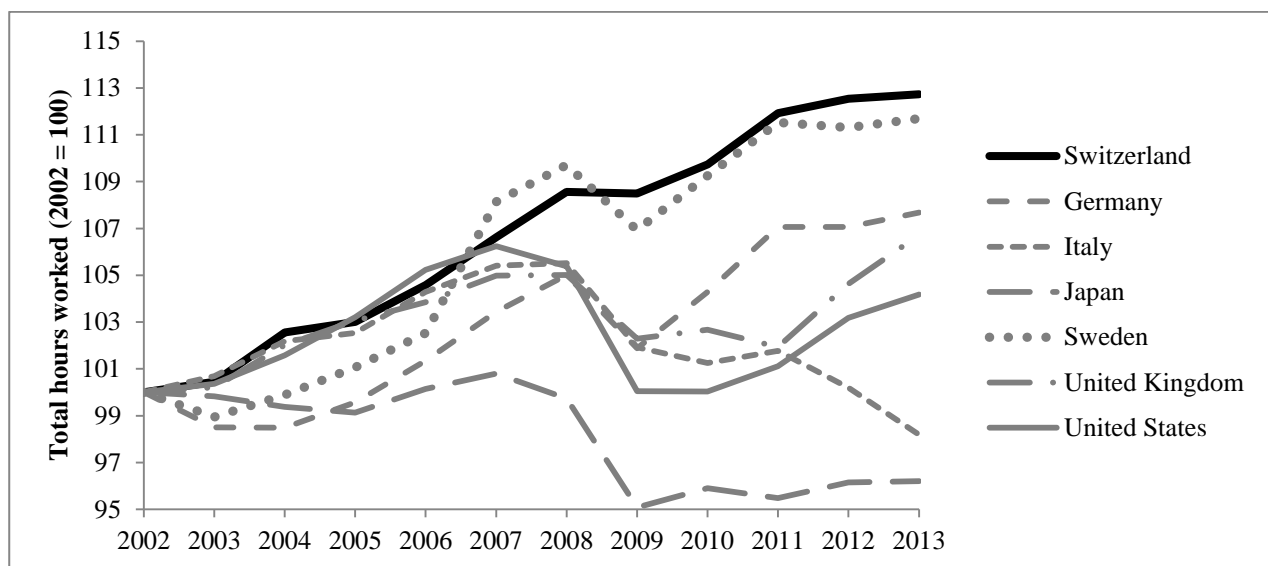
1 Introduction

Over the last ten years, Switzerland has experienced unusually pronounced employment growth. Between 2003 and 2013, the number of employees increased by 15.2 percent, from 4.2 to 4.8 million persons. This is not only high in a historical perspective, but also high in an international perspective, as Figure 1 shows. It compares Switzerland’s growth of total hours worked with the growth of hours worked in a selection of other developed countries. The figure reveals that Switzerland’s increase in hours worked was especially remarkable in the period between 2005 and 2011. From the countries considered, only Sweden displays similar long-term increases in employment in the period under consideration.¹ For instance, Germany, for which the recent surge in employment

¹ There are only four countries among the OECD countries with higher growth of total hours worked between 2002 and 2012: Australia, Israel, Luxembourg, and Mexico. Only Luxembourg and Australia have a level of development comparable to the one of Switzerland.

has been the subject of several studies,² had lower employment growth than Switzerland throughout the period analyzed. This Swiss “job miracle” of the last decade is all the more remarkable considering (i) that growth of GDP has not been impressively high in recent years,³ (ii) that Swiss firms’ competitiveness strongly decreased by a substantial and fast real appreciation of the Swiss franc of more than 15 percent of the real trade-weighted exchange rate between 2009 and 2011, and (iii) that certain countries, notably the US, have been marked by the opposite problem after the Great Recession: GDP growth without job growth.⁴

Figure 1: Evolution of total hours worked for selected OECD countries (2002–2013)



Source: OECD, own calculations.

Observers of Swiss economic activity did not foresee the “job miracle”. Indeed, as Graff et al. (2012) demonstrated, and as we will confirm in this paper, referring to a new reference series that is more valid to support the claim, the two most important forecasting institutions in Switzerland systematically and repeatedly underestimated the growth of the number of jobs. Why did this happen? It is a contribution of this paper to try to shed light on this question, i.e. we ask whether we can identify structural changes in the Swiss economy that are responsible for the forecast biases, but escaped the attention of the forecasters in real time. This analysis will also shed light on potential causes underlying the Swiss “job miracle”.

Our first step is to establish the most important characteristics and the unexpectedness of the Swiss “job miracle”. We then turn to an analysis of GDP growth in Switzerland, using a decomposition of

² See e.g. Dustmann et al. (2014) and the literature cited therein.

³ As a result, the growth rate of labor productivity in Switzerland between 2000 and 2010 was, in a historical perspective, unprecedentedly low (Siegenthaler, 2014).

⁴ See e.g. Freeman (2013).

growth into the contributions of capital deepening, growth of hours worked and labor productivity growth. This decomposition reveals that economic activity became remarkably more labor- and less capital-intensive around 2000. We show that these changes are also manifested in conditional correlations between investment, labor productivity and employment growth when analyzed with rolling window regressions. This finding is relevant because the latter series are generally applied to make employment forecasts. Given the findings from the two exercises, we work out four “stylized facts” characterizing the changes in Swiss GDP growth. Potential explanations of the “job miracle” in Switzerland should be consistent with these facts.

We then present six potential structural causes of the Swiss “job miracle”: (1) the continuous shift of the Swiss economy towards the service sector, (2) catch-up employment growth after a long and turbulent phase of economic stagnation in Switzerland in the 1990s, (3) the evolution of the price of labor relative to the price of capital, (4) a labor supply and labor cost shock due to the introduction of a free movement of persons regime with the EU and EFTA countries aligning labor supply with the skill-intensive labor demand of firms, (5) an increased attractiveness of Switzerland for foreign investors among others caused by substantially reduced taxes, and (6) jobs created in the wake of migration into Switzerland through local multiplier effects on domestic demand (Moretti 2010). Finally, we document the relevance of the stylized facts and some of these potential causes in accounting for the forecast errors. This analysis reveals the relevance of the identified factors, as we can explain the bias and more than 60 percent of the variation in the forecast errors in the KOF job growth forecasts.

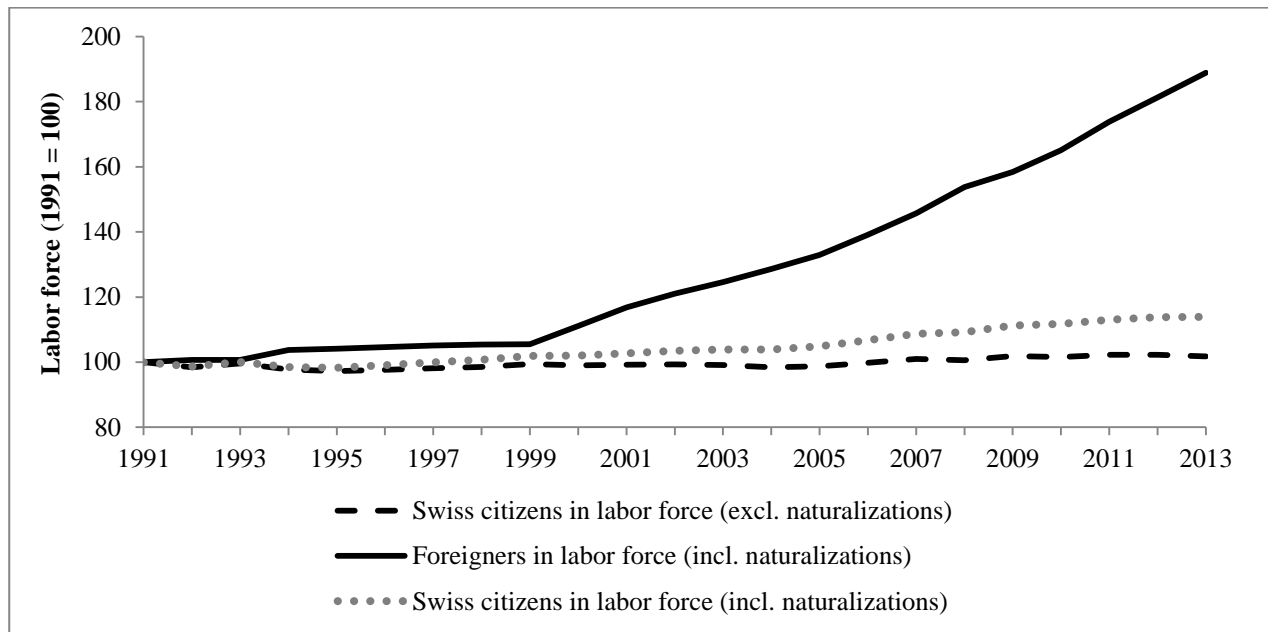
This analysis of the Swiss “job miracle” is relevant for at least three reasons. First, as we will show, wages alone cannot account for the Swiss “job miracle”. This warrants explanation, as wage moderation might probably be considered the natural candidate for explaining strong employment growth under relatively moderate GDP growth. Second, understanding the potential reasons for the Swiss “job miracle” helps to assess the reasons for the errors of forecasters. Third, understanding the Swiss “job miracle” is relevant to understand the recent immigration wave to Switzerland, which in turn is relevant because immigration has become an increasingly hot topic in Switzerland, with growing opposition among residents against free migration from EU/EFTA countries.⁵

Figure 2 illustrates the tight link between the “job miracle” and immigration to Switzerland. It shows an index of Switzerland’s labor force from 1991 to 2013, separately for Swiss nationals, Swiss nationals excluding naturalized foreigners, and foreign nationals including naturalized for-

⁵ These tensions culminated in February 2014 in the acceptance of a popular initiative aiming at restricting immigration, the so-called “Stop Mass Immigration Initiative” (see Abberger et al. 2014).

eigners.⁶ The figure shows that, when accounting for naturalizations, virtually the entire growth of the Swiss labor force between 1999 and 2013 is accounted for by the increase in the foreign labor force, which grew by 848,000 persons. 75 percent of the growth of the foreign labor force since 1999 can, in turn, be accounted for by net immigration of foreign nationals into the labor force. Finally, net immigration into the labor force *directly* accounts for 71.7 percent of total net migration to Switzerland.⁷

Figure 2: Index of labor force size, by nationality (1991–2013)



Source: Swiss Federal Statistical Office (FSO), own calculations.

The remainder of the paper is structured as follows. In the following section, we highlight important characteristics of the “job miracle” and demonstrate the extent to which forecasters have underestimated job growth. Section 3 takes a closer look at the structural changes in the nature of Swiss GDP growth that occurred around 2000. Section 4 provides a narrative account of the potential sources of the Swiss “job miracle”. Section 5 shows how the identified factors can account to explain the forecast errors of Swiss forecasters. Section 6 concludes.

⁶ Looking at the labor force instead of employment is feasible since the overwhelming part of the increase in the labor force is driven by growth of the number of employed persons. For instance, unemployment of foreigners in Switzerland grew by 43,000 persons from 1999 to 2013, while employment of foreigners increased by 458,000 persons in the same period.

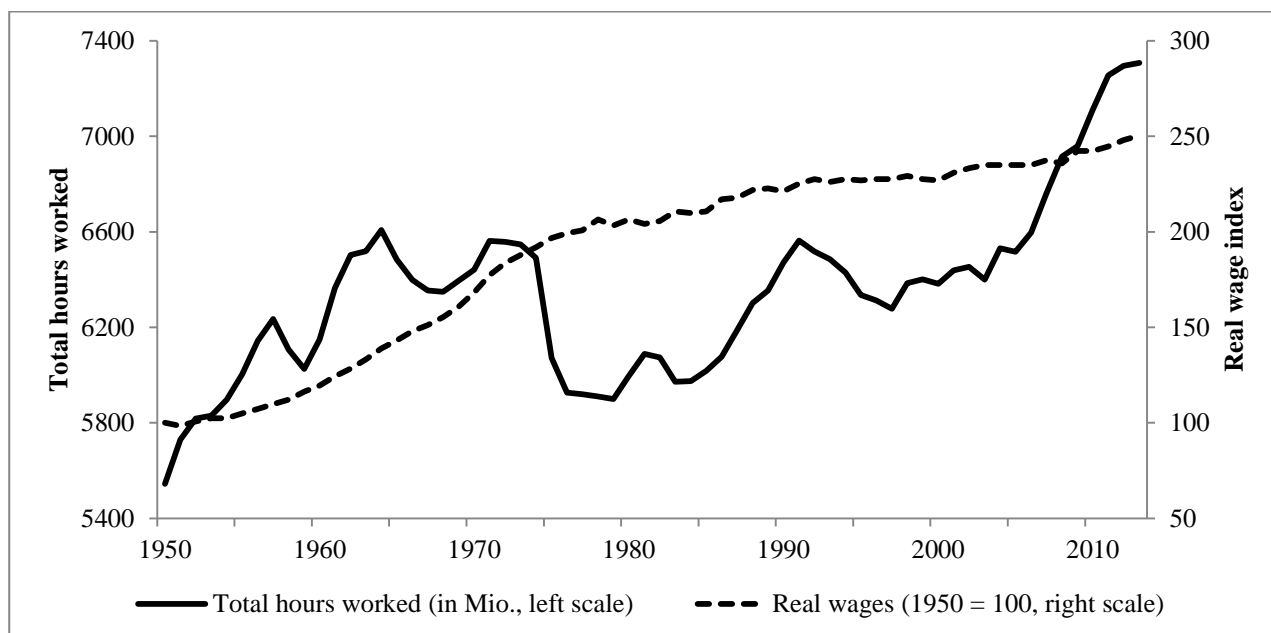
⁷ Between 1999 and 2013, the foreign labor force including naturalizations grew by 848 000 persons, while net immigration into the labor force amounted to 649,000 persons. Total net immigration to Switzerland in this period was 905,000 persons, which implies that only 256,000 immigrants cannot *directly* be accounted for by net immigration into the labor force. *Indirectly*, the importance of immigration to the labor force in accounting for immigration to Switzerland may even be more sizable, as part of the remaining immigrants may have been spouses (not entering the labor force) or children of work migrants.

2 The Swiss “job miracle” examined

2.1 The facts

The expression Swiss “job miracle” denotes the phenomenon that in the last decade total hours worked in Switzerland have grown substantially – and surprisingly. Figure 3 puts the Swiss “job miracle” into a historical perspective. It shows total hours worked and an index of real wages from 1950 until 2013.⁸ The hours worked series suggests that they began to grow in the late 1990s, after a long phase of decline. Growth of hours worked then surged around 2004 and has, until recently, followed a steep growth path.⁹ Indeed, Figure 3 shows that growth of hours worked in the latest period was as high as it had been in the early 1960s, despite the fact that average GDP growth was three percentage points less.

Figure 3: Total hours worked and real wages in Switzerland (1950–2013)



Source: Siegenthaler (2014) and FSO, own calculations.

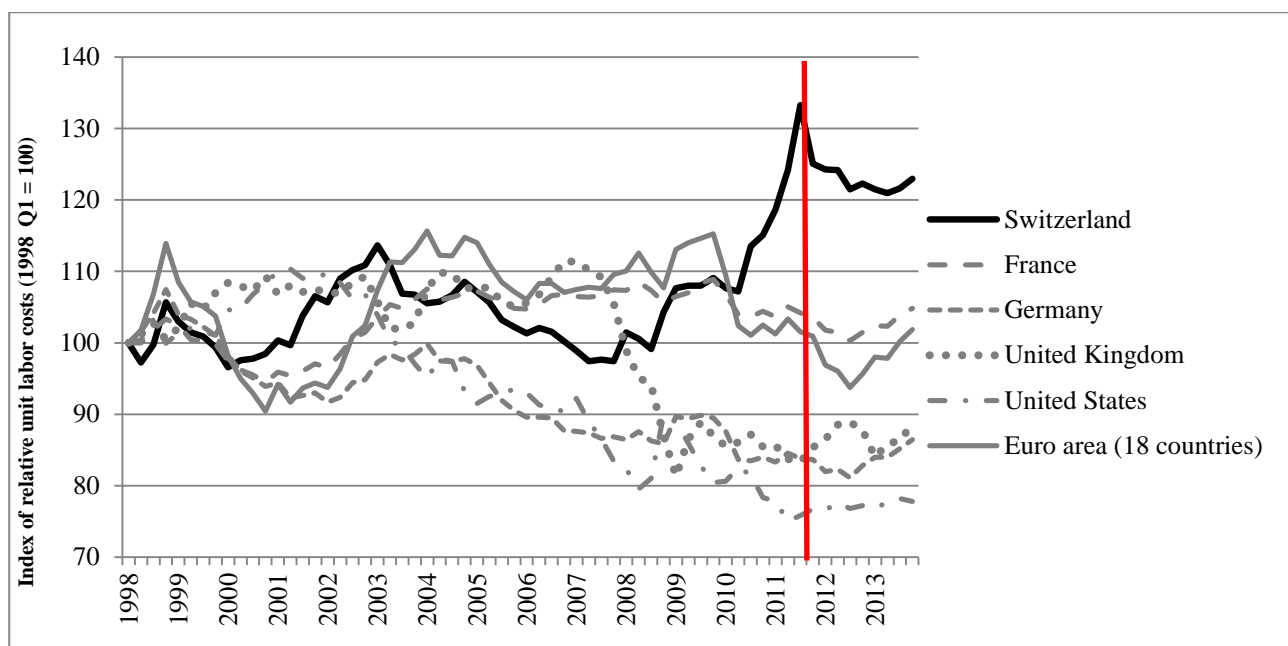
Three characteristics of the “job miracle” are especially noteworthy. First, wages alone cannot account for the “job miracle”. Figure 3 already presents evidence supporting this argument by showing that, according to the Swiss wage index, real wages grew at similar rates between 2004 and 2013 as in the two decades before. There is no apparent break in real wage growth around 2004, i.e.

⁸ The hours worked data are from Siegenthaler (2014), extrapolated up to 2013 using the official time series on total hours worked from the Federal Statistical Office (FSO). The real wage index shown is the Swiss wage index, also published by the FSO.

⁹ The exact timing of the surge in employment growth slightly depends on the series looked at. For instance, the surge occurs in 2003 according to the official hours worked series from the FSO. By contrast, growth of full-time equivalent jobs (as shown by the reference series in Figure 7) leveled off in 2005.

at the time employment begins to surge. Further evidence that wages cannot explain the “job miracle” is presented in Figure 4.¹⁰ It shows the evolution of competition-weighted relative unit labor costs for Switzerland, France, Germany, the United Kingdom, the United States and the Euro area (comprising its present 18 countries) from 1998–2013. The plotted time series relates a country’s unit labor costs to a weighted average of the unit labor costs of a country’s main competitors on its domestic market and its export markets, using respective trade shares as weights. It reflects the joint effects of changes in unit labor costs, labor productivities and nominal exchange rates on the price competitiveness of a country relative to its competitors; a decline in the index mirrors an increase in competitiveness.

Figure 4: Competition-weighted relative unit labor costs for selected OECD countries (1998–2013)



Source: OECD.

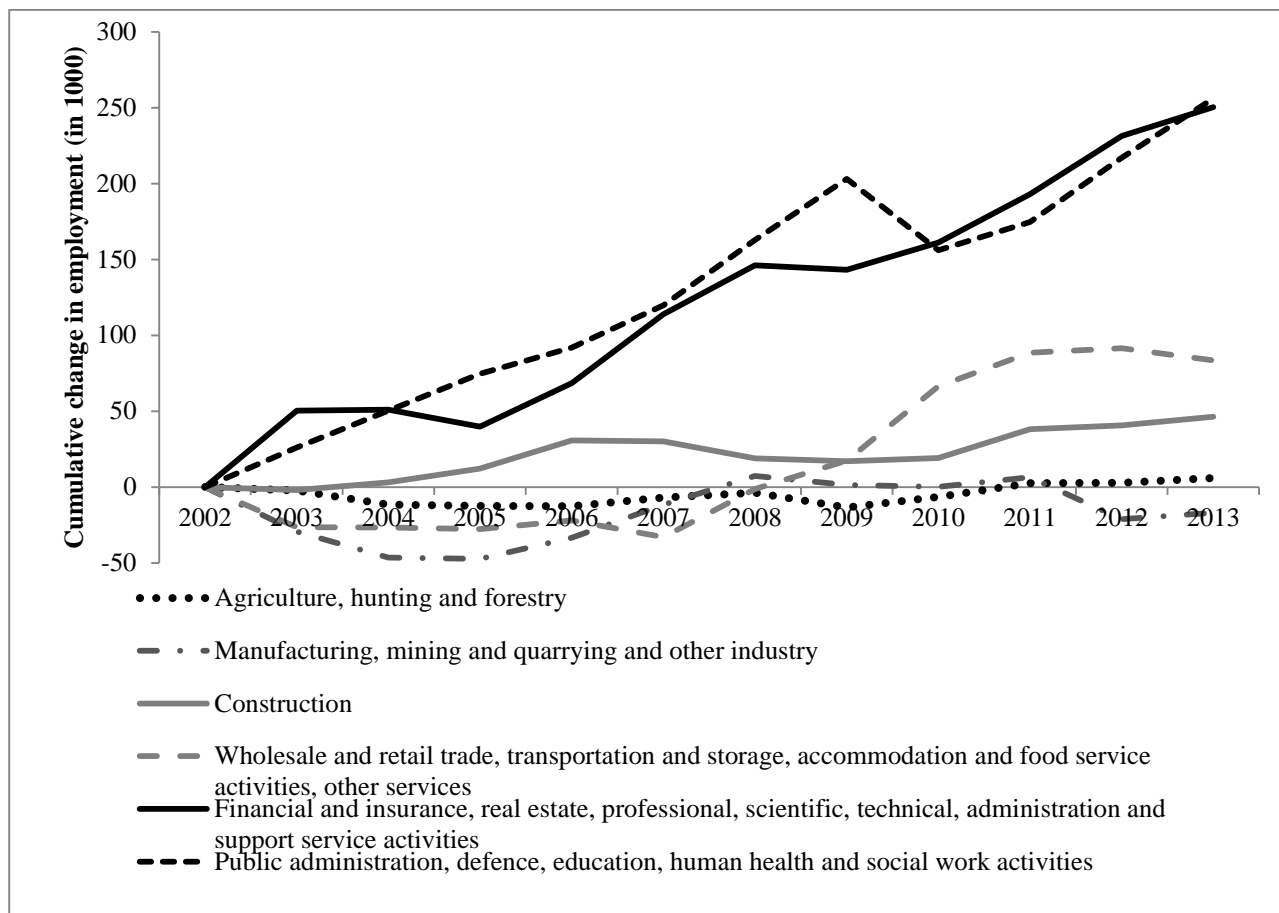
The time series for Switzerland shows no remarkable deviations from the other countries until about 2008. Henceforth, however, the index for Switzerland first rose pronouncedly and then stayed at outstandingly high levels, whereas it remained more or less constant, or dropped, for the other countries. Given this, conventional economic wisdom would expect that the loss in price competitiveness on international goods and services markets would depress Swiss employment. Along these lines, the improvement of labor market conditions in Germany over the last ten years, for example,

¹⁰ Also the evolution of Switzerland’s labor share of income suggests that wages cannot account for the “job miracle”. Since 2008, labor’s share has *increased*, which is in contrast to what is observed in almost all other developed countries in which labor’s share has decreased. More generally, Switzerland stands out as one of the very few developed countries with an almost constant labor share over a long period of time (see Siegenthaler and Stucki, 2014 and Graff and Siegenthaler, 2014).

is frequently attributed to wage restraint and the resulting export boom.¹¹ The same can obviously not be claimed for Switzerland, especially not since 2008 when employment growth has been particularly substantial. While part of the first half of the “job miracle” may partly be a result of the evolution of wages, the job growth after 2008 must have other reasons.¹²

A second characteristic of the “job miracle” is that most new jobs were created in the service sector. Figure 5 gives an overview of the industries which account for the change in employment observed between 2002 and 2013.

Figure 5: Cumulative change in employment by industry (2002-2013)



Source: FSO.

The figure shows the cumulative change in the number of employees in six different economic sectors. As is evident from the figure, market-oriented, knowledge-intensive private sector service industries (straight black line) as well as public sector industries account for the largest part of the

¹¹ Dustmann et al. (2014) also contains a graph similar to our Figure 4 (though without Switzerland), which inspired us to look at these time series.

¹² Burda and Hunt (2011) also emphasize German wage restraint. Apart from this, they argue that labor market flexibility, which allowed adapting the “labor intensity margin” helped to limit layoffs during the Great Recession. A similar point could be made relating to Switzerland, but our focus is not on the modest effects of the Great Recession on the Swiss unemployment rate, but rather on the high growth of full time equivalent employment over the last ten years.

“job miracle”. Other sectors contributing positively to the “job miracle” were the construction sector and, since 2007, also other service industries (especially wholesale trade and transportation). On the other hand, employment in manufacturing and agriculture stagnated throughout.

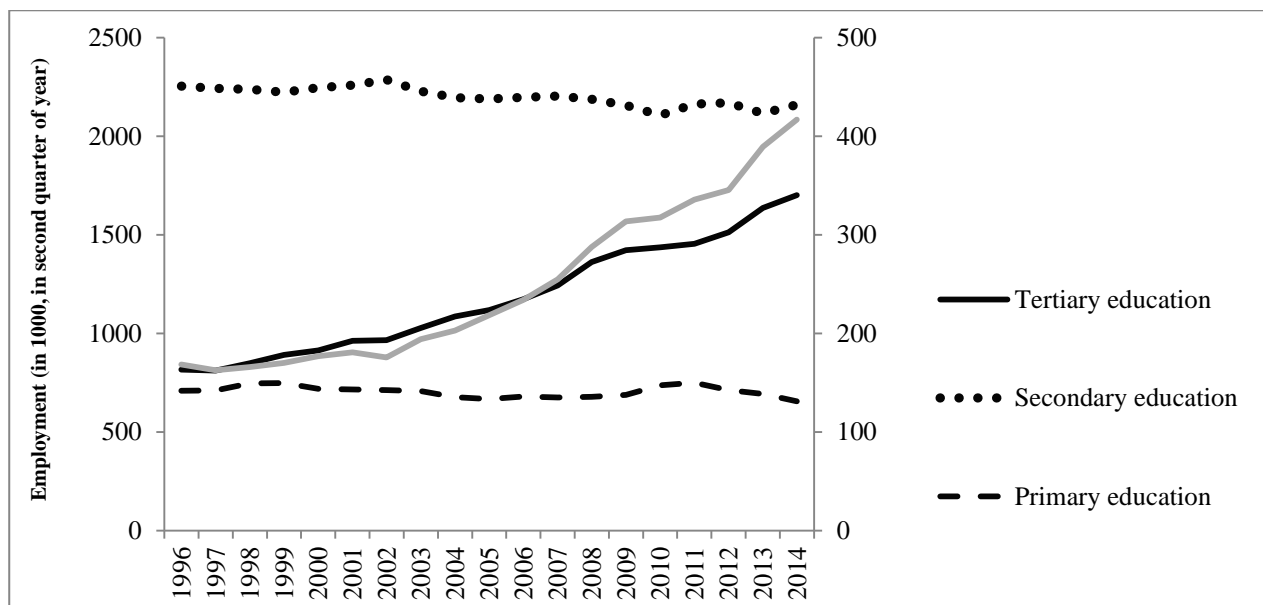
The fact that part of the “job miracle” arose in industries with a high share of state involvement raises the concern that the “job miracle” represents an inefficient and non-sustainable shift of the Swiss economy, leading to depressed productivity growth. A closer inspection of the sources of the public sector employment growth, however, qualifies this simplistic view. Rather, its increase may to a large extent be explained by structural and desired changes in the economy. In fact, given the areas in which public sector employment growth occurred, a substantial part of the state sector growth appears to be demand-driven.¹³ Factors that potentially explain the state sector growth are population growth, demographic ageing, the shift of Switzerland towards a knowledge economy, increased demand for health care, and a growing labor force participation of women.

The third important element of the Swiss “job miracle” is that the new jobs are nearly entirely filled by workers with high observed skills. Figure 6 illustrates this point by showing the number of employees in Switzerland according to their highest educational attainment. In particular, as Figure 6 shows, the number of tertiary employees in Switzerland increased by 736,000 between 2002 and 2014. In the same period, the number of non-tertiary educated employees declined.

The shift towards high-skilled employment growth around 1998 when measured in terms of formal educational attainment are also apparent when looking at the educational credentials of incoming immigrants over time (see SECO et al. 2014). However, the evolution in the skill composition of foreign workers is not identical to the evolution of the total stock of employees. To illustrate this, Figure 6 also contains the number of tertiary educated foreign employees in Switzerland. The comparison shows that employment of high-skilled foreigners grew less than high-skilled employment of the total stock of workers in the late 1990s and early 2000s. This changed around 2002. Since then, employment of foreign workers has contributed to increase the composition of Switzerland’s workforce in terms of observed educational qualifications.

¹³ First, around one fifth of the growth of the public sector between 2002 and 2013 is accounted for by employment growth of education according to the Job Statistics. More disaggregated data from the business censuses suggest that an increase in jobs in Kindergartens, primary schools, secondary schools and especially universities nearly entirely accounts for the increase in employment in this sector. Second, approximately one third of the state sector growth occurs in residential care and social work activities. The largest part of the job growth in these areas arises in old age and care homes (especially for disadvantaged) as well as child- and daycare centers. Third, another third of the public sector growth arises in health care, in which the number of jobs in general and specialty hospitals, but also the number of medical specialists increased.

Figure 6: Employees in Switzerland by highest educational attainment (1996–2014)



Source: FSO.

2.2 Systematic bias in recent Swiss job growth forecasts

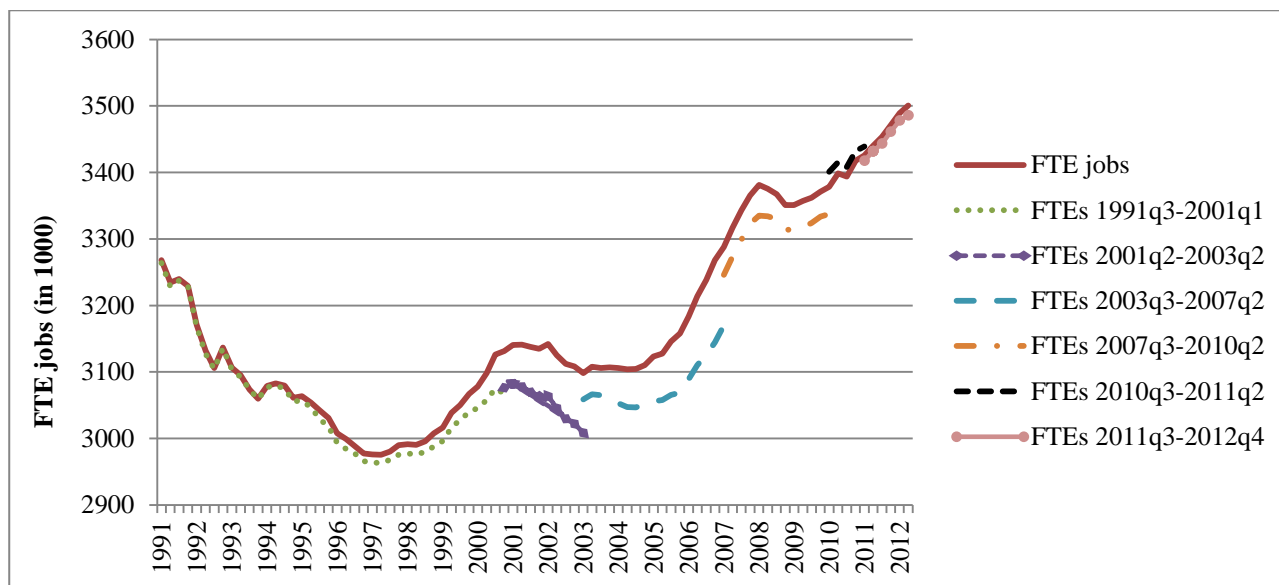
The strong job growth in Switzerland since 2002 was not anticipated. To the contrary, it took observers of economic activity by surprise. In fact, the two most prominent institutions to deliver forecasts of employment growth in Switzerland – the KOF Swiss Economic Institute at ETH Zürich (KOF) and a group of experts under the guidance of the State Secretariat for Economic Affairs (SECO) – delivered systematically downward biased employment outlooks for an extended period, as Graff et al. (2012) have shown.

In this context, it is important to notice that the series that both KOF and SECO aim to forecast is the seasonally adjusted full time equivalent jobs (FTE) series according to the Swiss Job Statistics, and that in the relevant period, this target series underwent several revisions. These revisions almost always led to an upward correction of previously published figures. Graff et al. (2012) evaluated Swiss job forecasts referring to the latest available vintage of the Job Statistics, which is not an entirely fair benchmark.¹⁴

Figure 7 provides an illustration of this. It shows that in the period under consideration, the Swiss Federal Statistical Office (FSO) revised the FTE jobs series in 2001, 2003, 2007, 2010 and 2011.

¹⁴ The forecasts aimed at the reference series at hand. When the forecasts were made, the forecasters could not know that the level and the trend of their reference series would be considered inappropriate in hindsight and would later be revised upwards due to the FSO sampling procedure. We are grateful to Benjamin Weber for directing our attention to this point.

Figure 7: Reference series: full-time equivalent jobs in Switzerland (1998–2012)



Source: FSO.

The solid line, spanning the whole period from 1991 to 2012, is the latest vintage of FTE jobs, which was used as benchmark in Graff et al. (2012). The shorter series are the different vintages of the Job Statistics. Clearly, the latest series lies above most of the previously published vintages, sometimes up to 3 percent. More importantly, also the growth rates of the latest series lie above the growth rates of the old series.¹⁵ Since the old vintages reflect the target that forecasters were aiming at in real time, we construct a synthetic reference series, based on a spline of the six different vintages of the Job Statistics shown in Figure 7, and replicate the forecast evaluations of Graff et al. (2012). As in the earlier study, the evaluation is made with reference to quarter-on-quarter growth rates rather than numbers of FTE jobs.¹⁶ When we move from one to another reference series, we refer to the growth rates (but not the levels) of the *revised* series.¹⁷

¹⁵ The breaks and shifts in the series have, in general, no conceptual explanation, i.e. are not due to changes in definitions or concepts applied. The exception is the shift in 2010, which was due to a revision in the industry classification. The other revisions, however, resulted from ex post adjustments undertaken to smooth the breaks in the corresponding vintages. These, in turn, resulted from the fact that the universe from which firms were sampled to participate in the Job Statistics regularly proved to be unrepresentative for the actual universe of firms in Switzerland. This prove came as soon as the FSO conducted a new Business census in order to update its universe of firms. In order to fit the old series to the new (and generally higher) benchmark of the census, the FSO increased the trend growth rate of the old vintage. At the same time, the cyclical pattern of the old vintage was imposed on the new series. This explains why the newer series in Figure 7 has cyclical patterns similar to the older vintages, while the trend growth and the levels of the series are different.

¹⁶ The reason is that it proved difficult to identify when exactly the forecasters switched to the new benchmark numbers. This implies that despite our efforts to construct a synthetic reference series, we might evaluate forecasts using a wrong benchmark series at the transition points. As in Graff et al. (2012), we thus evaluate the forecasts referring to quarter-on-quarter growth rates, since the growth rates of the series are less affected by the benchmark revisions than the level of the series.

¹⁷ For example, we evaluate the forecasts made in the third quarter of 2007 with the growth rates from the revised series published posterior to the fourth quarter of 2007.

Table 1 provides an evaluation of the KOF forecasts using the new reference series. KOF published forecasts regarding both FTE jobs twice a year (in the first and third quarter) until the third quarter of 2007. Since then, forecasts of FTE jobs are published on a quarterly basis. This yields 41 nowcasts overall. The table shows the root mean squared error (RMSE), the mean error (ME), and the mean absolute error (MAE) as well as the R^2 of these forecasts, i.e. the shares of variation in the reference series explained by the quarterly forecasts. The table illustrates that KOF faced substantial difficulty to nowcast and forecast FTE job growth. In particular, the mean error of the KOF nowcast is 0.13 percentage points. This implies a substantial bias of the nowcasts, since FTE jobs grew on average 0.18 percent from one quarter to another over the sample period according to our reference series. As could be expected, the mean errors are larger for the one-to four-quarter-ahead forecasts, although the differences are not too pronounced. Generally, the table illustrates that the KOF employment forecasts have been inaccurate, even for nowcasts and short forecast horizons. While the R^2 exceeds 40 percent for the nowcasts, it already drops to 25 percent for the one-quarter-ahead forecasts, and at a three quarters horizon, it is practically down at zero.

Table 1: Accuracy statistics of the KOF full-time equivalent job forecasts

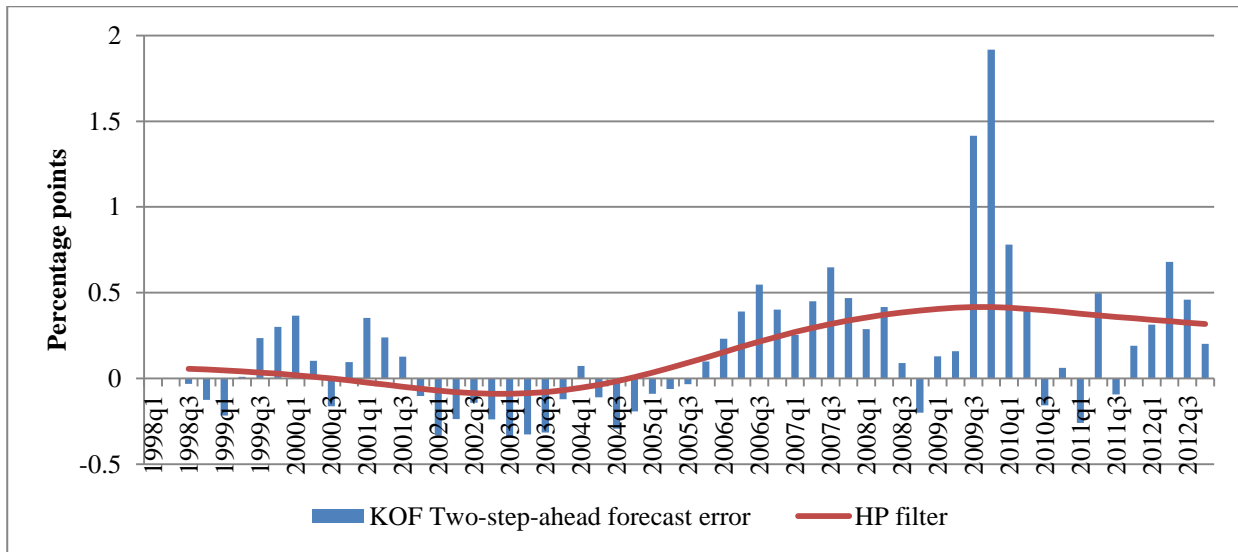
Statistic	t+0	t+1	t+2	t+3	t+4
RMSE	0.33	0.42	0.50	0.53	0.48
ME	0.13	0.18	0.19	0.19	0.16
MAE	0.25	0.33	0.35	0.40	0.37
R-squared	0.43	0.25	0.12	0.02	0.00

Notes: $t+h$ denotes forecasts for quarter h , i.e. $t+0$ represents nowcasts and $t+1$ one-quarter-ahead forecasts. The forecast accuracy statistics was computed by using quarterly growth rates. The sample comprises 41 observations for nowcasts.

The systematic bias in the KOF job growth forecasts is illustrated by Figure 8, which displays the KOF two-step-ahead forecast errors and, to ease the interpretation, a Hodrick-Prescott (HP) low-pass filtered series. The HP-trend shows that the positive bias in the KOF forecasts arises around 2005 and remains fairly stable over the rest of the sample period. Indeed, from mid-2005 onward, KOF overestimated job growth only four times, but underestimated it 25 times. The same picture emerges regarding the KOF forecasts over a different time horizon.

However, the KOF forecasters were not the only ones to be repeatedly surprised by job growth in Switzerland. The same applies to the other important forecasting institution in Switzerland, the SECO. Its job growth forecasts are published quarterly, relating to FTE jobs in the *current* year. They are available from the third quarter of 2001 onward and can thus be compared with the reference series from 2001q3 until 2012q4.

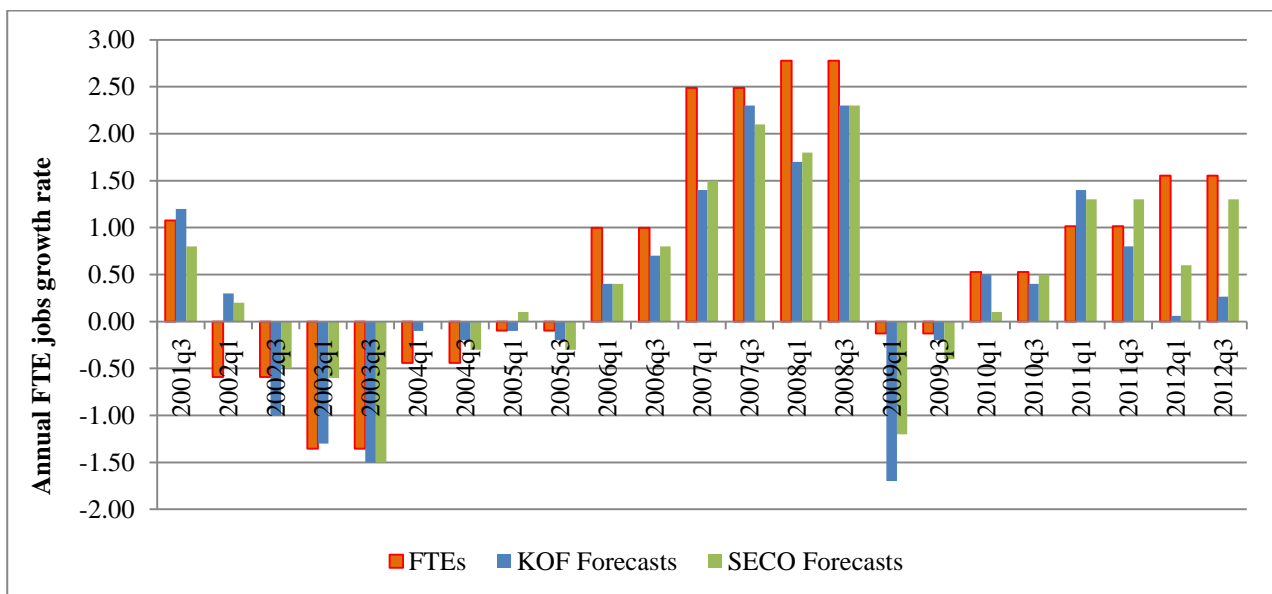
Figure 8: KOF two-step-ahead forecast errors and HP filtered series ($\lambda = 1600$)



Source: KOF, own calculations.

Figure 9 shows the SECO forecast of annual growth of FTE jobs made in the first and the third quarter of the respective year. To make them comparable with the KOF forecasts, the KOF forecasts and the reference series are expressed in terms of annual growth rates, too. The figure demonstrates that the SECO started to substantially underestimate the growth of FTE jobs from about 2005 onward, too. Moreover, the size of the negative forecast error is most pronounced for the Great Recession years. Whilst both KOF and SECO then forecasted a substantial decline of FTE jobs in Switzerland, in fact the number of FTE jobs remained almost constant.

Figure 9: Synthetic reference series together with KOF and SECO forecasts of Swiss FTE job growth (2001–2012)



Source: KOF, own calculations.

Overall, the new reference series used in this paper does not reverse the finding of Graff et al. (2012). Job growth forecasts in Switzerland had a substantial negative bias during a considerable period of time.

3 The shift towards labor-intensive GDP growth

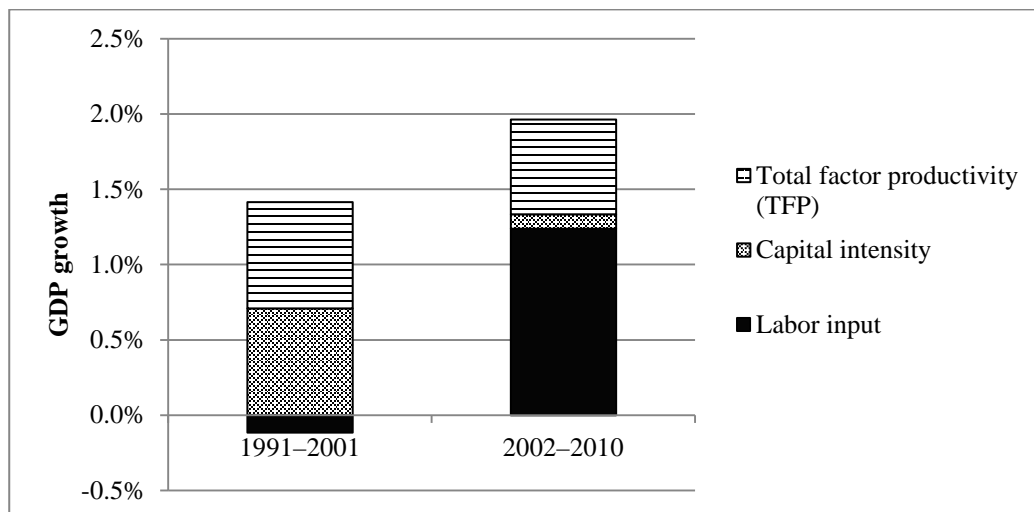
The *systematic* negative bias in recent job growth forecasts suggests a structural break in the evolution of job growth which escaped the forecasters' attention. Indeed, in the transition to the new millennium the nature of GDP growth in Switzerland changed. An illustrative way to show this change is to refer to the standard neoclassical decomposition of the growth of real GDP (Y) into the contributions of real capital (K), labor (measured in total hours worked, L), and total factor productivity (A)

$$\Delta y_t = (1 - s_L) \Delta k_t + s_L \Delta l_t + \Delta a_t, \quad (1)$$

where lower case letters denote variables expressed in logs, s_L stands for the labor share of total income (Y) and the annual periodicity is indicated by the subscript t .

Figure 10 plots the results of this growth accounting decomposition, as published by the FSO, for the periods up to and since 2002.

Figure 10: Decomposition of Swiss annual GDP growth before and after the introduction of the free movement of persons between Switzerland and the European Union



Source: FSO.

The striking message from the decomposition is that while capital accumulation accounted for half of GDP growth in the 1990s, its absolute and in particular its relative contribution to GDP growth in the second period was clearly smaller. Conversely, while growth of labor input contributed negatively to

GDP growth in the 1990s, it was the main driver of GDP growth after 2002.¹⁸ In addition to this, the more detailed decomposition by Rudolf and Zurlinden (2010) for the period 1991 to 2006 shows that the FSO decomposition still *underestimates* the contribution of labor, especially in the second period. In particular, the two authors additionally decompose Δa , which reflects overall total factor productivity (TFP) growth, into the contributions of the increases in the quality of labor and capital. Their results suggest that a substantial part – about one half in the period from 2000 to 2006 – of TFP growth depicted in Figure 10 can actually be attributed to increases in the quality of labor.

Overall, the growth decompositions show that in the period between 1998 and 2002 economic activity in Switzerland has become more labor-intensive. In fact, similar decompositions by the OECD (2013, p. 25) show that the labor intensity of Switzerland’s GDP growth between 2007 and 2011 is remarkable even in an international perspective.¹⁹ Moreover, growth turned from more labor productivity driven (intensive growth) to more reliant on a predominantly quantitative expansion of labor inputs (extensive growth).

Did these structural changes in the nature of GDP growth also affect the series that are actually used to produce job growth forecasts? To examine this question, we run rolling window regressions of quarterly growth of FTE jobs of the following form:

$$\Delta l_t = \beta_0 + \beta_1 \Delta(y_t/l_t) + \beta_2 (I_t/Y_t) + e_t . \quad (3)$$

The purpose of the regressions is to examine whether there are changes in the contemporaneous partial correlations between FTE job growth (Δl_t), the growth of average labor productivity (defined as growth of GDP per FTE job, i.e. $\Delta A_t = \Delta(Y_t/L_t)$) and the investment rate, i.e. the ratio of investment into machinery, equipment and buildings to GDP. If, as suggested by the growth decompositions, the relationships between the growth of employment, productivity and capital changed over time, we should expect that the partial correlations between the variables are unstable in rolling window regressions.

Figures 11 and 12 plot the point estimates of β_1 and β_2 , respectively, referring to a rolling window of 30 quarters.²⁰ The horizontal axis shows the respective end date of the rolling window. The first figure illustrates that, conditional on the investment rate, job growth and average labor productivity

¹⁸ Qualitatively, this finding does not depend on 2002 as the exact year of the sample split. The results are similar for 2000 or even 1998.

¹⁹ Indeed, in the period from 2007 to 2011, Switzerland is the country with by far the largest positive contribution of labor input to GDP growth among all 18 OECD countries considered in the publication, while the contribution of capital is only average.

²⁰ The choice of 30 quarters ensures that each window contains at least two phases of the business cycle in the period examined. The results, however, do not qualitatively depend on this choice.

growth were negatively associated throughout the 1990s. The coefficient then increases in two relatively clear-cut steps, and becomes positive. These findings suggest that the apparent trade-off between labor productivity and job growth, which characterized the 1990s, disappeared around 2000.²¹ Has aggregate productivity growth in Switzerland become less labor-saving?

Figure 11: Partial correlation between job and labor productivity growth (1995–2013)

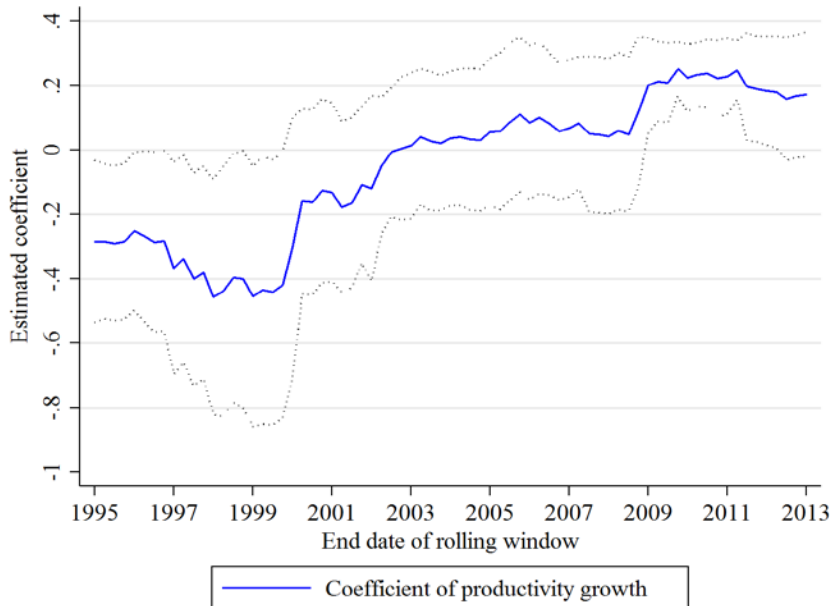


Figure 12: Partial correlation between job growth and the investment rate (1995–2013)



²¹ A similar pattern emerges if we correlate hours worked and TFP growth using the data underlying Figure 10. The correlation between TFP growth and growth of hours worked is -0.40 from 1991 to 2001. From 2002 to 2010, conversely, the correlation is 0.47 .

Figure 12 shows that, for any given labor productivity growth rate, the investment rate and job growth appear to have become more positively associated, i.e. we observe more employment growth for any given investment rate, holding productivity growth constant. These results are consistent with the view that the employment intensity of investment has increased. Overall, the figures indicate that the shifts in the way the Swiss economy grows are reflected in the times series with which employment forecasts are made.

Considering the results presented so far, any explanation of the Swiss “job miracle” should be consistent with the following four stylized facts characterizing the main changes in the labor market that occurred between 1997 and 2005:

1. A trend towards a higher labor-intensity and a lower capital-intensity of economic activity
2. The disappearance of the trade-off between productivity and job growth
3. A rise in the employment intensity of investment
4. A shift in labor demand towards higher skills

4 Which factors explain the “job miracle”?

Which factors explain the Swiss “job miracle”? Indeed, any factor leading to a dynamic economic development in Switzerland may have contributed to the Swiss “job miracle”. Yet, it is not our aim to concentrate on factors that have positively contributed to Switzerland’s GDP growth in recent years.²² Rather, we focus on factors that explain the “job miracle” and that are consistent with the four stylized facts. In particular, we highlight factors that may explain a more labor- and less capital-intensive economic development for a given growth rate of GDP. We thereby do not limit our focus to the period after 2003 in which the “job miracle” begun. The reason is that many changes observed in Switzerland’s economic development in the 2000s represent continuations or, in many cases, intensifications of trends that become apparent already since the end of the long economic stagnation phase in Switzerland of the 1990s, i.e. around 1997. Understanding the “job miracle” hence necessitates understanding the drivers of job growth since 1997. There are, in our view, six such drivers.

²² Factors, which are therefore omitted from the analysis but may be important in explaining part of the “job miracle” are, among others: the bilateral trade agreements with the EU/EFTA states enacted in 2002 (especially the agreement lifting technical barriers to trade between Switzerland and the EU/EFTA countries), the dynamic growth in certain important export regions in recent years (e.g. Germany), or the high human capital of the labor force in Switzerland.

4.1 The shift towards service sector

The *first* driver of job growth since 1997 contributing to explain the stylized facts is a continuous shift in labor demand towards the service sector. Especially since 1997, employment in the financial sector, in information and communication, in education and in administrative and support service activities increased disproportionately compared to other sectors. As mentioned above, particularly important service industries accounting for the increase in jobs are health and social care. The causal factors underlying these shifts towards the service sector are likely to be similar as in other developed countries. Thus, they may be related (i) to the present comparative advantages of highly developed countries, amongst them Switzerland, in the provision of knowledge-intensive services, (ii) to a structural shift of demand toward services, in particular education and health care, or (iii) to Baumol's cost disease.²³ The shift towards the service and in particular the state sector is consistent with an increase in the labor intensity of GDP growth and with reduced aggregate productivity growth (due to shifts towards sectors with below-average labor productivity or because labor productivity growth in service sectors is consistently underestimated e.g. because of problems to separate quality from price changes). However, as a continuous phenomenon, it cannot explain the Swiss "job miracle".

4.2 Catch-up employment growth

The *second* major driver of job growth since 1997 is the fact that employment *caught up* after of a long phase of economic stagnation in Switzerland in the 1990s in which employment had stagnated but substantial restructuring had taken place. During this phase, unprofitable firms went bankrupt, employment in the industrial sector decreased strongly, firms intensified the implementation of new technologies, and the export-oriented economy concentrated on goods and services in which firms had comparative advantage.²⁴ One consequence of this restructuring process was that economic activity during the 1990s recession was characterized more by physical and human capital deepening than by an expansion of employment, as Figure 10 illustrates. Indeed, firms reduced overall labor input quite substantially. The second consequence was a more human capital-intensive economy and a changed occupational structure after the recession,²⁵ characterized by a substantially increased skill-intensity of labor demand.²⁶ As soon as the economy began to recover around 1997, firms began to recruit workers which fit to their new, more skill-intensive labor demand. Employment prospects

²³ This refers to a situation where wages in certain sectors are rising despite stagnant labor productivity to keep up with the typical wage increase in the affected economy; see Hartwig (2010) for an examination of this question relating to Switzerland.

²⁴ See Lampart (2006), Frick and Lampart (2007) and Siegenthaler (2014).

²⁵ See Sheldon (2005).

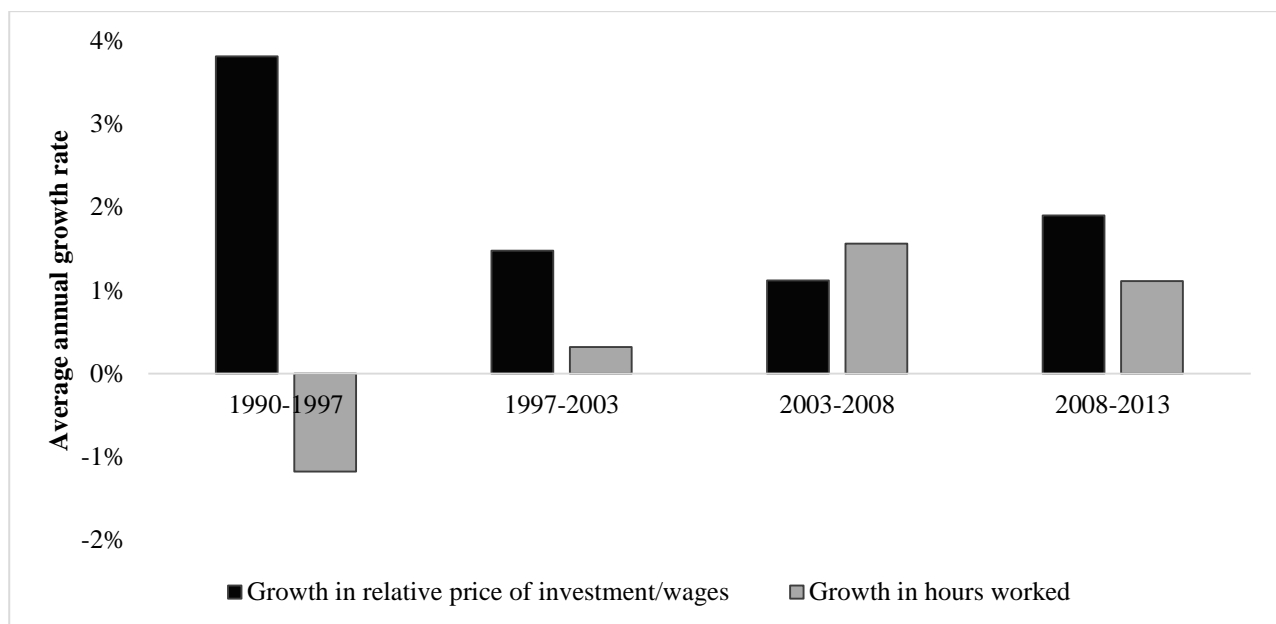
²⁶ See Puhani (2003 and 2005) and Bolli and Zurlinden (2009).

for skilled Swiss workers became increasingly bright.²⁷ The employment growth observed in Switzerland from 1997–2001 hence mainly represents a catch-up phase in which firms hired the workers which they had been reluctant to engage during the recession.

4.3 Moderate increase in the price of labor relative to capital

The *third* driver of the “job miracle”, until approximately 2007, may have been the evolution of the price of labor relative to the competing factor, capital. In other words: although wage restraint does not account for the “job miracle”, wages may have played a role in the first half of the “job miracle”.²⁸ The argument is simple: if the price of labor grows disproportionately strong relative to the price of capital, this gives an incentive for firms to invest into capital rather than labor, leading to a negative effect of the growth of the relative factor price on employment growth. Figure 13 illustrates that Swiss data display the expected negative association between relative factor price and hours worked growth arising from this reasoning. It plots the average annual growth rates of the relative factor price²⁹ and total hours worked for four periods since 1990.

Figure 13: Average annual growth rates of the relative price for labor (ratio of wage index relative to implicit deflator of private domestic machinery and equipment investment) and hours worked (1990–2013)



Source: National Accounts and FSO.

²⁷ In 1997, university graduates were 1.7 times over-represented among the registered unemployed. In 2000, the fraction had decreased to 0.7. See Frick and Lampart (2007).

²⁸ The view that wages played a role in the first half of the “job miracle” is supported by Figure 4. Between 2003 and 2007, the relative competitiveness of Switzerland increased, as unit labor costs increased less than the unit labor costs of its main competitors. This is likely to have spurred export growth.

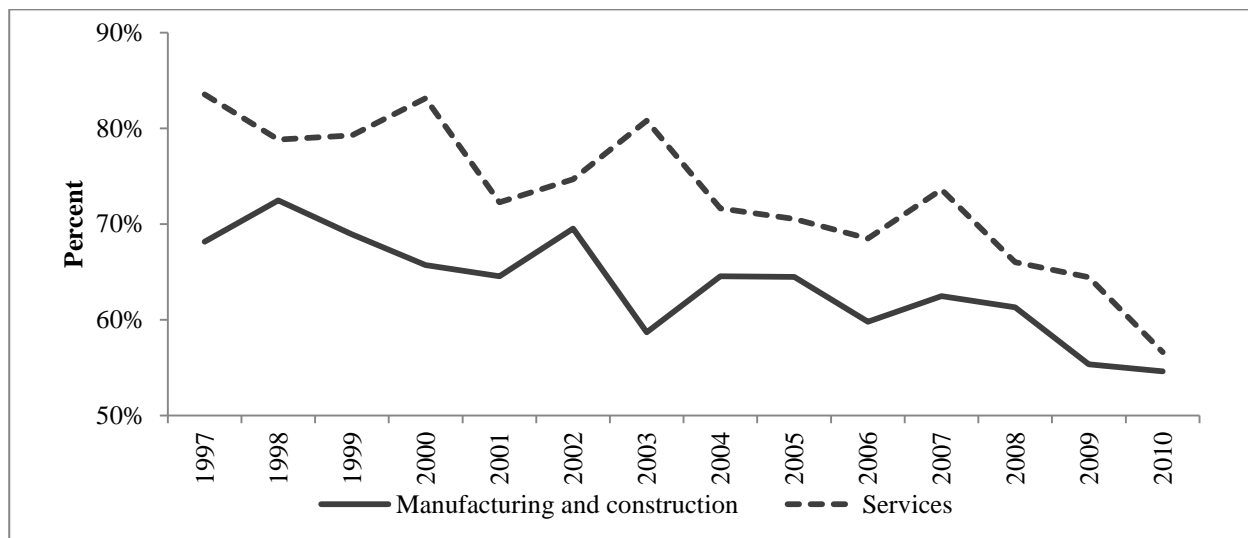
²⁹ The relative factor price is computed as the Swiss wage index relative to the deflator of gross private investment in machinery and equipment, taken from the national accounts.

The figure shows that between 1990 and 1996, wages grew substantially while the price of investment goods substantially declined. As Lampart (2006) argues, the strong growth of the price of labor relative to capital in that period may have increased firms' reluctance to hire personnel during the recession and constituted a strong incentive to invest into labor-saving technologies.³⁰ The converse argument may hold for the period after the recession. Since 1997, the growth rate of the price of labor relative to capital decreased until it reached a minimum between 2003 and 2008. The distinctively slower increase of the relative price for labor after 1997 reduced the impetus from relative factor prices to invest in labor-saving capital and technology, and therefore may have led to job growth.

This mechanism is not only consistent with the increase in the labor intensity of economic growth after 1997, but also with the fact that firms in Switzerland decreasingly aim at saving labor costs when investing.

Figure 14 illustrates this by showing the relative importance of the investment motive to reduce labor costs relative to the aim to reduce input costs in general, distinguishing between firms in the manufacturing and construction and firms in the service sector.³¹

Figure 14: Share of firms reporting that reducing labor costs is one of their investment motives in relation to the share of firms stating that one of their motives is to reduce labor, energy, or material costs (1997–2010)



Source: KOF investment surveys.

³⁰ Such a negative relationship would be predicted by models of directed technical change such as the one presented by Acemoglu (2003). In these models, relative supply and relative prices of factors influence firms' technology adaption and their direction of innovation. Following a similar kind of argument, Passoa and van Reenen (2014) explained the recent slowdown in productivity growth in the UK by declining real wages, increased real wage flexibility and increasing costs of capital, incentivizing firms to invest into labor instead of capital.

³¹ We construct this accordingly because the surveyed firms can tick more than one motive and the number of multiple answers increases over time.

4.4 Free movement of persons

The *fourth* driver of the Swiss “job miracle” was the introduction of free movement of persons (FMP) between Switzerland and the EU/EFTA, which was gradually introduced from June 2002 onwards. For Switzerland, the move towards a less restrictive migration regime came at the right moment, as it alleviated skill shortages that may else have substantially hindered employment growth. Around 1997, when demand for skilled labor rapidly increased, it became apparent that the supply of skills of Swiss workers had not kept pace with demand (Sheldon, 2005). The shift towards more skill-intensive production (driver 1) and the catch-up effect after the long recession (driver 2) were hence hampered by an increasing shortage of skilled workers (Siegenthaler, 2014).³² Mitigating this skill shortage was one of the most important economic effects of introduction of free movement of persons, as it allowed Swiss firm to recruit skilled workers from the EU and EFTA without limits through completely abolishing previous administrative and quantitative restrictions on immigration.³³ Indeed, *if* free movement of persons alleviated skill shortages in Switzerland, the treaty may not only have been beneficial for employment of low-skilled workers because low-skilled workers are thought to be imperfect substitutes for high-skilled workers in production³⁴, but also because reducing labor shortages probably contributed to higher productivity growth in firms that would otherwise not have taken place.

There are two pieces of evidence that the free movement of persons was indeed vital in alleviating skill shortages for Swiss firms. A first sign in favor of this argument is the scale and skill composition of persons from EU/EFTA states immigrating into Switzerland after 2002 compared to the periods before. Immigration of high-skilled workers surged after 2002 (see also Figure 6), and while it is unclear whether the FMP had a positive effect on the *skill composition* of immigrating workers, it seems very likely that it had a positive effect on the *quantity* of skilled workers immigrating to Switzerland.³⁵ Evidence along these lines is provided by a recent indebt account by Bolli et al. (2014) who show that the FMP exerted a substantial positive influence on gross and net immigration to Switzerland. Since many immigrants from EU countries within their sample period were highly skilled and came for work reasons (e.g., more than half of all immigrants already have a job when immigrating to Switzerland), their results are also highly suggestive of a positive effect of the change in the migration regime on employment of skilled workers in Switzerland. A second set of evidence

³² In the survey of the Job Statistics the share of firms reporting shortages of workers with at least an apprenticeship increased from 15.6 percent in 1995 to 36.1 percent in 2001. The share of firms reporting a shortage of workers with less education than a completed apprenticeship was always below 4 percent.

³³ See Rudolf and Zurlinden (2010) and Basten and Siegenthaler (2013).

³⁴ See Gerfin and Kaiser (2010) and Müller et al. (2013).

³⁵ Can et al. (2013) recently made a similar point.

in favor of the view that the FMP lifted skill shortages comes from the studies examining the effects of the recent immigration wave on the labor market situation of residents. These studies generally find that recent immigrants from the EU/EFTA had no adverse employment effects on residents. Rather, their results support the view that immigrants mainly plugged gaps in the resident workforce and filled vacancies that might otherwise not have been filled, as skills of immigrants appear to have been largely complementary to the skills of the resident labor force.³⁶

Along with limiting skill shortages, the FMP decreased unit labor costs of skilled workers, as it tended to lower (or at least to reduce the increase of) wages of high-skilled workers.³⁷ Moreover, it reduced recruitment costs through administrative facilitations in recruiting foreign workers. This moderation of growth of costs of employing skilled workers may have stimulated employment growth for skilled workers. Moreover, as we have argued discussing the evolution of relative factor prices (driver 3) and in line with studies examining the effect of immigration on productivity and capital adoption³⁸, the availability of adequately skilled labor and the wages demanded may exert an influence on the nature of capital goods investments and choices of technology. Through increasing the supply and reducing the costs of skilled workers, the FMP regime may have reduced the stimulus to adapt labor-saving technologies or to offshore tasks, thus preventing firms to shift towards capital goods or foreign workplaces replacing employment in Switzerland. Through this mechanism, the FMP may be part of the explanation why labor relative to capital costs have grown only moderately between 2003 and 2007 (recall Figure 13) and why the relative competitiveness of Swiss exporters increased during this period (see Figure 4), and it may thus contribute to explain the increase in the labor intensity of growth since 2002.

4.5 Increasing attractiveness of Switzerland for foreign firms

The *fifth* driver of the Swiss “job miracle” is the fact that Switzerland became increasingly interesting for foreign investors in general and as location for a firm’s headquarter or an affiliate in particular. Indeed, as becomes evident in Figure 15 using data from the foreign direct investment (FDI) statistics from the Swiss National Bank (SNB), the capital stock of foreign firms in Switzerland at the end of each year began to increase substantially around 2005, implying that inward FDI to Switzerland surged in this period. The main series to look at is the series for European-owned firms (straight black line) because it is only marginally affected by the extensions of the country coverage in the SNB data, which are present in the overall series (dotted red line). Both series, however, share the same general

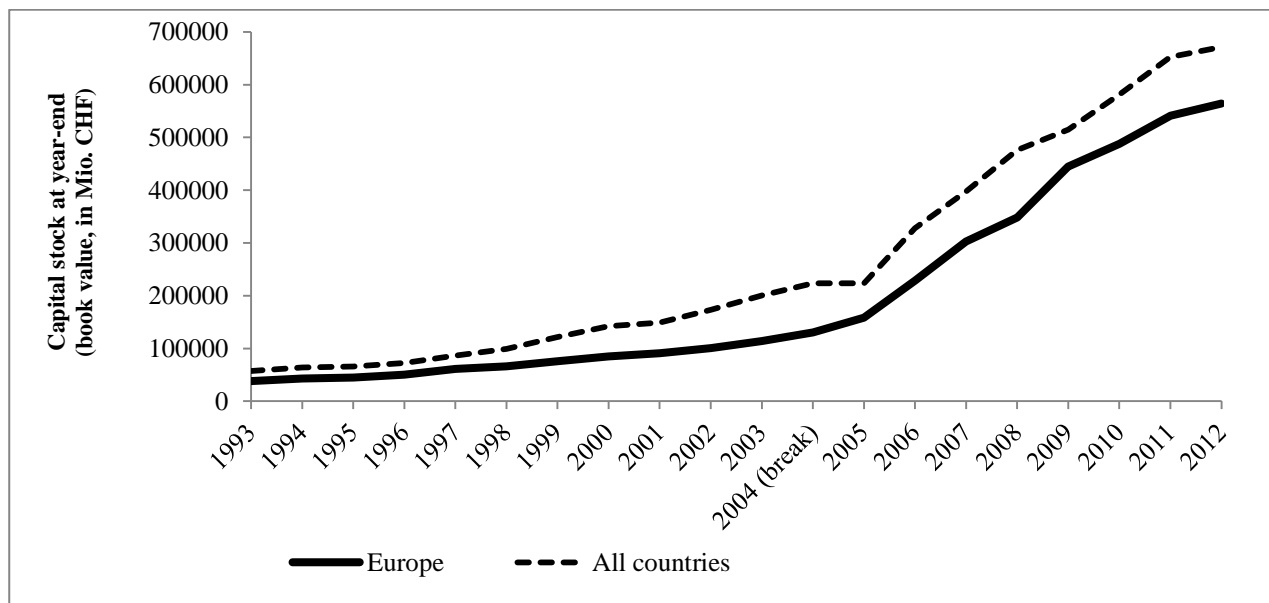
³⁶ See Can et al. (2013), Basten and Siegenthaler (2013); Favre (2011) and Müller et al. (2013).

³⁷ See Favre (2011), Müller et al. (2013) and Basten and Siegenthaler (2013).

³⁸ See, e.g., Peri (2012) and Lewis (2011).

pattern: inward FDI to Switzerland display a trend break around 2005 and subsequently grow at a higher rate.

Figure 15: Capital stock of foreign firms in Switzerland (European only and total)



Source: SNB.

The figure raises two questions in our context: What drove the surge in inward FDI around 2005? And did it contribute to the Swiss “job miracle”? The answer to the first question is simpler than the one to the second. Switzerland’s inward FDI is disproportionally driven by the location of research and development (R&D) units and holding, management, or principal headquarters in the country.³⁹ In line with the general Swiss “tax haven” strategy, an important reason for the number of headquarter locations in Switzerland is that national and especially cantonal policies have promoted them in recent years, mainly by significantly lowering corporate taxes for multinational firms, but also other taxes. Also the FMP may have contributed in making Switzerland more attractive for investors through making the supply of labor more elastic and lifting previous restrictions on hiring skilled foreign workers. Indeed, a survey by SwissHoldings (2009) among Swiss multinationals finds that “availability of skilled manpower” along with taxes are the most important factors for their location choice for their headquarter (1993–2012).

What were the employment effects of these inward FDI? Unfortunately, appropriate data to tackle this question are not available. According to data from the SNB, the number of employees in foreign

³⁹ See Ernst & Young (2013). Multinational firms such as Accenture, Adecco, Burger King, C&A, Chiquita, eBay, Gillette, Glencore, General Motors, Google, Hewlett Packard, Kühne & Nagel, McDonald’s, Merck Serono, Kraft, Oracle, Orascom, Philip Morris, Procter & Gamble, Unilever, and Yahoo (re-) located their (regional) holding, management, or principal headquarter to Switzerland.

owned firms increased by 143,000 persons from 2003 to 2012, representing a growth of 45.9 percent. These data thus suggest a substantial contribution of inward FDI to employment growth in Switzerland. At the other end of the scale, a study by Ecoplan (2013) estimates that in recent years the relocation of firms to Switzerland only created about 1,800 domestic FTE jobs annually. While the former statistics overstates the actual employment effects of inward FDI and headquarter locations in Switzerland,⁴⁰ the figures cited in the Ecoplan (2013) study are likely to underestimate the actual effect of foreign business settlements on total employment in Switzerland by orders of magnitudes, as the data insufficiently covers the actual growth of the relocated firms in the years *after* the settlement.⁴¹ It is indeed not improbable to assume that firms relocating to Switzerland 2008–2012 directly created up to 7,200 new full-time equivalent jobs annually.⁴² Data from the *Orell Füssli Wirtschaftsinformationen*, a private company analyzing movements in the Swiss commercial registry (*Handelsregister*), point into a similar direction. The main advantage of this company’s data is that they contain information on the owner of newly registered firms, which is merged from an extensive personal register. According to these data, 12,400 new firms with a foreign owner registered in Switzerland in 2013, creating an estimated number of 28,600 new jobs in their first year.⁴³ These numbers imply that in 2013 40 percent of all new firms in Switzerland are registered by foreigners (increasing from 22 percent in 2000).⁴⁴ Data for 2011 show a similar amount of jobs created by firms with a foreign owner: 37,600 new jobs in 11,400 new firms.

There are two further reasons why it is likely that firm locations and inward FDI are quantitatively important factors in explaining the Swiss “job miracle”. The first reason is presented in Figure 16, which plots an overall index of tax burden in the main municipality of each Swiss canton in 2001 (as published by the Swiss Federal Tax Administration STA) against the number of jobs created by new (*ex nihilo*) businesses in a canton 2001–2012, expressed relative to the canton’s initial job number.

⁴⁰ The job growth reflected by the SNB data may also reflect mergers and acquisitions of Swiss by foreign firms, where the effects on total employment are ambiguous.

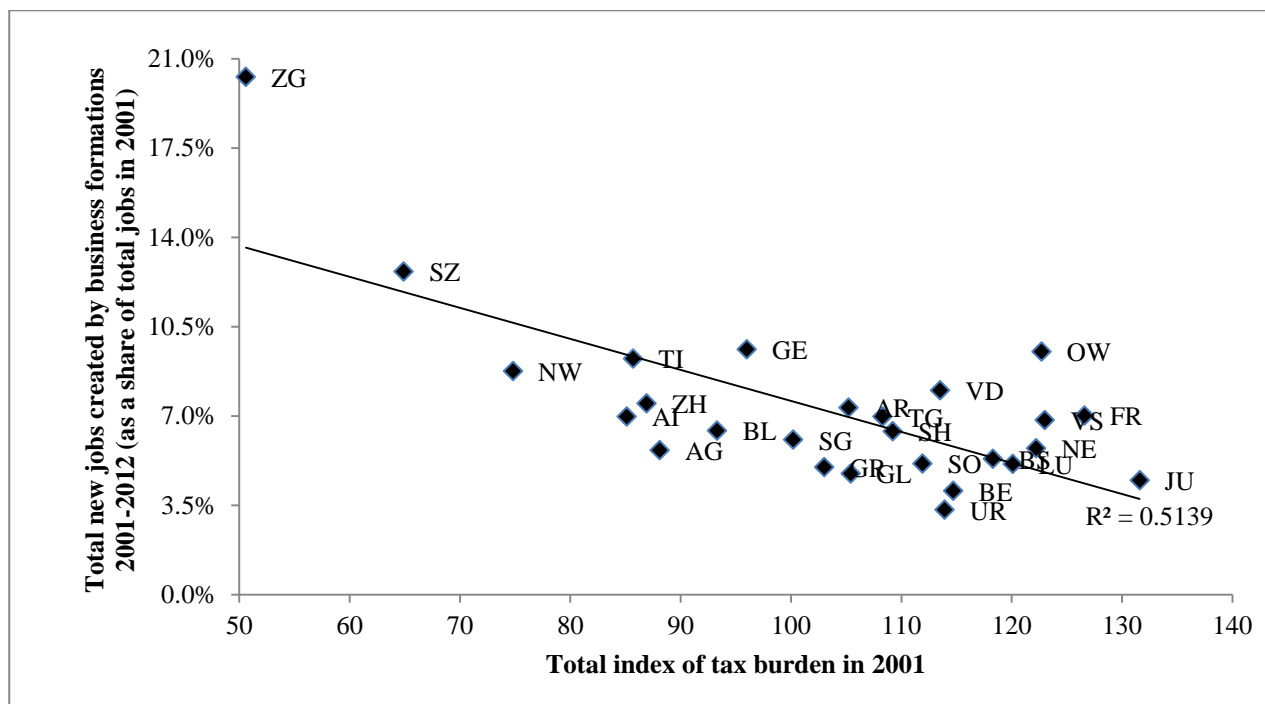
⁴¹ The numbers in the study are taken from official data of the *Konferenz der Kantonalen Volkswirtschaftsdirektoren* (VDK) about settlements of foreign firms. However, the VDK data only count inflows of firms which came to Switzerland *with support of institutions from the national and cantonal location promotion*. Other firms that relied on the help of banks or consultants are not covered by the survey. Furthermore, the VDK data reflect only full-time jobs created in the *first year* when a firm registers in Switzerland. Data from the cantons Geneva and Vaud suggest that the number of FTE jobs in the newly settled establishments increases by factor 3.6 in the following four years (SwissHoldings, 2009). On the other hand, the data does not contain *outflows* of previously located firms. Yet, there is limited evidence that such outflows were numerous at the time under consideration. Overall, the data is likely to substantially underestimate the net effect of business settlements on employment in Switzerland, especially if multiplier effects are considered (see below).

⁴² These figures are calculated assuming that the number of jobs created by firms not covered by the VDK data is equal to the number of jobs lost because firms left Switzerland in a given year, and that the experiences from the cantons of Geneva and Vaud about the evolution of jobs in the establishments in the four years after settlement can be generalized.

⁴³ The number of new jobs created by the business formations is either taken from company records and reports, the webpage, or an estimate based on firm characteristics (e.g. industry affiliation).

⁴⁴ The figures also suggest that foreigners are strongly overrepresented among entrepreneurs, as foreign nationals make up only 23 percent of the resident population.

Figure 16: The relationship between the total tax burden in 2001 and the number of jobs created by new business formations, ex nihilo (2001–2012)



Sources: FSO and FTA.

Two noteworthy findings emerge from the figure. First, new firms’ job creation was sizable in certain cantons. In the canton of Zug, new firms created jobs equivalent to one fifth of total employment in 2001, despite the fact that the data only count jobs created in the first year of the firms’ existence. Second, the figure provides evidence consistent with the view that a lower tax burden increases job creation due to new businesses in Switzerland. The substantial reductions in the overall tax rates on labor income and wealth in several cantons since 2000⁴⁵ are therefore likely to have spurred job growth in certain cantons by attracting new firms.

The second further reason why we believe inward FDI are an important factor of the Swiss “job miracle” is because the calculations so far do not account for multiplier effects of inward FDI and headquarter locations on incumbent firms. Multiplier effects from inward FDI or business relocations may result from agglomeration economies, through knowledge spillovers to incumbent firms,⁴⁶ through induced effects such as added consumption through the income generated for workers and capital owners as well as through indirect effects such as increased local demand for intermediate inputs, investment goods and domestic demand related to infrastructure, consulting, R&D and fi-

⁴⁵ For instance, data from the Swiss Federal Tax Administration FTA show that, between 1999 and 2012, the tax burden on an accumulated wealth of 1,000,000 Swiss francs was on average lowered by 28 percent in the cantons’ main municipalities. Similarly, the tax burden on a labor income of 100,000 Swiss francs was on average decreased by more than 13 percent. In some cantons, the reductions on either income amounted to more than 40 percent.

⁴⁶ See Moretti (2011).

nancial services. Multiplier effects can be substantial, although the literature is so far not conclusive about their size. For instance, a study by OSEC (2008) estimates that a typical headquarter in Switzerland creates 100 jobs in the medium term, and indirectly creates up to 350 to 400 full-time jobs in other firms. Although it is likely that these figures represent an upper bound of the true local multiplier,⁴⁷ also econometrically convincing recent evidence by Greenstone et al. (2010) suggests that business settlements may substantially add to employment in other local firms through spillover effects.⁴⁸

4.6 Second-round effects of immigration on local employment in non-tradables

Spillovers on local employment may be particularly sizable when attracting foreign businesses. But they also arise when an incumbent firm creates a new job and fills it with a worker which then immigrates to a local labor market. The immigrant increases demand for goods and services produced or provided locally in sectors such as construction, personal services, retail sales, education, or transportation. Thus, whenever job growth caused by the first five drivers led to immigration, a demand multiplier was likely to have led to the creation of additional jobs locally. This multiplier effect of immigration on local employment is the sixth driver of the “job miracle”.

We study the size of the “local multiplier” in Switzerland applying a theoretical and empirical framework developed by Moretti (2010). He analyzes local multipliers in US cities and finds that every time a new job in a city’s *tradables* sector is created, 1.6 additional jobs are created in this city’s *non-tradables* sector. At the same time, the local multiplier in the *tradables* on the number of jobs in other firms *in the tradables industry* is not significantly different from zero.

To study the size of the long-run *cantonal* multiplier in Switzerland, we follow Moretti (2010) and estimate a set of OLS and instrumental variable (IV) regressions relating cantonal employment growth in the non-tradables to employment growth in the tradables sector. The data are taken from the Swiss Wage Structure Surveys 1996, 1998, 2004, and 2010. The regressions take the following form:

$$\Delta N_{ct}^{NT} = \alpha + \beta \Delta N_{ct}^T + \tau_t + \varepsilon_{ct}, \quad (4)$$

⁴⁷ Delbiaggio and Egli (2012), for instance, estimate local multipliers based on four case studies and suggest that, abstracting from agglomeration effects, one job created in a new establishment creates between 0.01 and 0.88 additional jobs through indirect and induced effects in other firms. See also Haskel et al. (2007) for recent evidence on the spillover effects of inward FDI on local firms.

⁴⁸ The authors compare the evolution of productivity (measured in terms of total factor productivity TFP) and employment in existing US firms located in counties, in which a new manufacturing plant actually opens up, with the evolution of TFP and employment in firms located in counties which were close to attracting the firm but failed. They estimate that the productivity gain of attracting the new plant is as high as 12 percent, and that the employment gain is 8 percent in *incumbent* firms.

where ΔN_{ct}^{NT} represents growth of employment in the non-tradables sector in canton c from period $t-1$ to t , and ΔN_{ct}^T represents the corresponding employment growth in the tradables sector.⁴⁹ We refer to two observations per canton, representing employment growth over the two seven-year period 1997–2004 and the six-year period 2004–2010.⁵⁰ Note that τ_t accounts for period effects equally affecting employment growth in all cantons in the two time periods. Similarly, all time-invariant factors equally affecting cantonal employment growth in both periods are accounted for since the regression is in first differences. As ΔN_{ct}^N and ΔN_{ct}^{NT} may both be driven by common omitted third factors such as changes in regional labor supply or cantonal policies, Moretti (2010) proposes to instrument tradables job growth using a shift-share instrumental variable (IV). The strategy amounts to exploiting nationwide growth of employment in detailed tradables (two-digit) industries j ,⁵¹ and to translate these national *shifts* in industry employment growth into cantonal labor demand shocks by multiplying them with the beginning-of-period *share* of industry j in total tradables employment in the canton c . The idea is that different cantons are differently affected by nationwide industry-specific shocks to tradables, depending on the beginning-of-period industry composition of the tradables sector. The instrument for the growth of tradables employment in canton c is then calculated by summing up the predicted cantonal employment changes across the j industries.⁵²

The local multipliers received from estimating the model of Equation 4 by OLS and IV are shown in Table 2. Inference is robust to clustering on the cantonal level. The first column illustrates that a 10 percent increase in tradables employment in a canton increases employment in the tradables sector by 5 percent. Since the number of non-tradables jobs exceeds the number of tradables jobs in Switzerland by factor 1.4 given our sector definition, this estimate implies that an additional job in the tradables sector creates 0.68 additional jobs in the non-tradables sector, as follows from the second-last row of Table 2. This estimate would imply that the cantonal multiplier is lower than the city-level multiplier in the US but exceeds the regional multiplier in Sweden of around 0.5, as estimated by Moretti and Thulin (2013).

⁴⁹ Similar as Sachs and Shatz (1996), we proxy the tradables sector by all manufacturing industries plus electricity and water supply, as well as certain business services (banking, insurance, information and communication technologies, real estate, R&D, and business-related services). The tradables sector hence consists of NACE rev. 1.1. industries 10–37, 65–67, 70 and 72–74. The remaining service sector industries comprise the non-tradables sector.

⁵⁰ We pool the wage structure surveys in 1996 and 1998 in order to have sufficiently many observations per canton to build cantonal employment counts. This seems particularly relevant for the strength of the instrument.

⁵¹ We have redone the analysis building the instrument on the three-digit level of the industrial classification with very similar results.

⁵² More formally, for the period 1997–2003, the instrument is $\sum_j w_{jc} \Delta N_{jt}^T$, where w_{jc} represents the employment share of industry j in total tradables employment in canton c in 1997, and ΔN_{jt}^T is the Swiss-wide growth of employment in detailed tradables industry j .

Table 2: OLS and IV regression estimates of cantonal multipliers on employment in non-tradables industries (1997–2010)

VARIABLES	(1) FD	(2) FD	(3) FD IV	(4) FD IV	(5) FD	(6) FD IV Imm.	(7) FD Imm.
ΔN_{ct}^T	0.498*** (0.140)	0.424*** (0.102)	0.637*** (0.102)	1.042*** (0.263)		1.964*** (0.435)	
ΔHS_{ct}^T					0.282 (0.207)		
ΔLS_{ct}^T					0.109 (0.210)		
ΔI_{ct}^T							0.330*** (0.086)
ΔR_{ct}^T							0.306 (0.199)
Observations	52	52	52	52	52	52	52
R^2	0.231	0.311	0.237	-0.027	0.259	-0.003	0.419
Period effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weights	No	Yes	Yes	No	Yes	Yes	Yes
Jobs per trad. job	0.678	0.597	0.898	1.420		0.248	
F stat. first stage			8.393	14.54		8.393	

Cluster-robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Dependent variable in Columns 1–5 is growth of employment in the non-tradable sector

Dependent variable in Column 6+7 is growth of employment of immigrants in the non-tradable sector

Columns 2–4 illustrate that the finding of a positive cantonal multiplier of tradables employment growth is robust. In the second column, the cantonal observations are weighted according to total (tradables and non-tradables) cantonal employment in $t-1$ (applying WLS regressions). The estimated cantonal multiplier decreases to 0.6 in this specification.

In the third column, the cantonal multiplier is instrumented using the shift-share instrument proposed by Moretti (2010). This leads to an increase in the estimated multiplier compared to the corresponding WLS estimate of the second column. The cluster-robust F-statistics of the first stage is 8.4, hence not exceeding the rule of thumb value of 10. Weak instruments may hence be a concern in this specification. The IV estimate of the local multiplier suggests that 0.9 additional non-tradables jobs are created per tradables job created in a canton. In the fourth column, we slightly refine the shift-share instrument following a suggestion by Moretti and Thulin (2013). In particular, in order to purge the influence of the cantonal employment change in an industry on the nationwide employment change in that industry from the instrument, we subtract the industry’s cantonal employment change from the nationwide employment change in the industry. This refined instrument is not strong enough if we weight observations according to cantonal employment. However, it works well if the weights

are omitted, probably because down-weighting of small cantons strongly reduces the predictive power of the instrument. Therefore, the fourth column shows an estimation applying the refined instrument in an unweighted regression. The estimated cantonal multiplier further increases in this specification to 1.4, thus reaching levels as high as the city-level multiplier in the US estimated by Moretti (2010).

Column 5 of Table 2 redoes the WLS regression of the second column but splits up the employment growth in the tradables sector into employment growth of high- and of low-skilled employees, defining high-skilled employees as those earning an above-median monthly salary in the respective survey wave. This estimation provides some evidence that it is mainly high-skilled (ΔHS_{ct}^T) and not low-skilled (ΔLS_{ct}^T) tradables employment growth in the cantons that spills over to the non-tradables sector, which is similar to the findings by Moretti (2010) and Moretti and Thulin (2013). The larger multiplier from high-skilled tradables employment growth is to be expected due to the higher income commanded by high-skilled employees. However, it is to note that support for this relation is relatively weak in our case, as the results are statistically not ensured and may be subject to endogeneity. The corresponding IV estimations suffer from multicollinearity and weak instruments.⁵³

In Columns 1–5 of Table 3, we make the same analysis in order to study the cantonal multiplier among tradables industries. We thus randomly select half of the tradables industries and estimate their local multiplier on the other half of the tradables industries. These estimations are in line with Moretti (2010) and Moretti and Thulin (2013) and suggest that the local multiplier among tradables is relatively low (around 0.2). Indeed, our point estimates are not always statistically significantly different from zero. According to Moretti’s model, the reason behind the lower multiplier between tradables industries is that additional jobs in the tradables sector increase demand for other local firms in the tradables industry only if value chains are localized or agglomeration economies (i.e. local productivity spillovers) exist. Otherwise, the initial employment increase in tradables puts upward pressure on local wages for workers in the tradables sector, which tends to reduce employment growth in other firms in the tradables industry.

⁵³ Moreover, although this seems theoretically less favorable compared to using wages, we also split the sample according to highest educational attainment of employees, i.e. by defining high-skilled employees as those employees with at tertiary degree. The evidence is inconclusive in this case.

Table 3: OLS and IV regression estimates of cantonal multipliers on employment in tradables industries, 1997–2010

VARIABLES	(1) FD	(2) FD	(3) FD IV	(4) FD IV	(5) FD	(6) FD IV Imm.	(7) FD Imm.
ΔN_{ct}^T	0.124 (0.172)	0.280* (0.140)	0.460** (0.197)	0.250 (0.491)		1.660** (0.656)	
ΔHS_{ct}^T					0.296 (0.293)		
ΔLS_{ct}^T					-0.061 (0.324)		
ΔI_{ct}^T							0.572* (0.319)
ΔR_{ct}^T							-0.312 (0.694)
Observations	52	52	52	52	52	51	51
R^2	0.180	0.169	0.140	0.171	0.162	-0.017	0.179
Period effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weights	No	Yes	Yes	No	Yes	Yes	Yes
Jobs per trad. job	0.127	0.264	0.433	0.256		0.109	
F stat. first stage			7.035	5.496		6.844	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Dependent variable in Columns 1–5 is growth of employment in the tradable sector

Dependent variable in Column 6+7 is growth of employment of immigrants in the tradable sector

Overall, the estimated cantonal multipliers suggest that jobs created in the tradables sector create additional jobs in the non-tradables sector of the canton, while they only lead to relatively few additional jobs in the local tradables sector. How do these cantonal multipliers relate to the national multiplier? The theoretical framework of Moretti (2010) gives important clues. On the one hand, the locally measured multiplier for tradables job growth on tradables is a lower bound for the national multiplier, because the demand effects of an additional job in a specific canton benefits firms in other cantons as well, owing to the national product market of tradables. On the other hand, the local estimate of the multiplier of tradables on non-tradables is likely to constitute the upper bound of the national multiplier, because labor is more mobile at the local than at the national level. In the extreme case of completely inelastic labor supply at the national level, any job created locally would result in a job loss elsewhere.

In Switzerland, however, labor supply at the national level is of course elastic. Firms have always been able to recruit workers from abroad, and increasingly easily so due to free movement of persons. This implies that jobs created in the tradables sector may lead to immigration. This mechanism is

studied in Columns 6 and 7 of Tables 2 and 3. The outcome variable considered in these regressions is growth of cantonal employment of recent immigrants in the non-tradables sector (Table 2) or tradables sector (Table 3).⁵⁴ Both estimations instrument tradables employment growth applying the same IV as in the respective third column. They indeed provide evidence in favor of the notion that tradables job growth fuels immigration. In particular, they suggest that 10 jobs created in a canton's tradables industry attract 2.5 immigrants into the canton's non-tradables and one immigrant into the canton's tradables sector.⁵⁵

Finally, the last column presents WLS regressions of the same dependent variable, splitting employment growth in the tradables sector into the contributions of recent immigrants (ΔI_{ct}^T) and residents (ΔR_{ct}^T). The estimate in the seventh columns of Table 2 implies that a 10 percent growth of employment of recent immigrants in the tradables sector increases employment of immigrants in the non-tradables sector by 3.3 percent. The estimated elasticity for residents has a similar size but is not statistically significant. To interpret these results, it is important to note that an increase by 10 jobs represents a much larger *relative* increase in employment for recent immigrants than for residents. The estimated elasticity indeed implies that 10 additional jobs filled by immigrants in a canton's tradables sector create 6.6 additional jobs for immigrants in the canton's non-tradables sector, as there are twice as many recent immigrant employees in non-tradables compared to tradables industries. Thus, job creation in Switzerland based on immigrant inflows is likely to have triggered further immigration.

5 Explaining the job growth forecast errors

This section examines how far the observed shifts and structural changes affecting the Swiss economy summarized in the stylized facts and certain of our suggested explanations for them can explain why forecasters underestimated the recent surge of job growth in Switzerland. To this end, we run a set of OLS regressions of KOF's one- and two-step-ahead *forecast errors* in FTE job growth, respectively, on potential explanatory variables, i.e. we run the following regressions, where $e_{t+h,t}$ represents the forecast error for horizon $t + h$ and X_t a vector of explanatory factors:

$$e_{t+h,t} = \gamma_0 + \gamma_1 X_t + c_t. \quad (4)$$

⁵⁴ Since the data set does not contain a variable indicating where employees were born, the sample is split according to residency permits. Foreign nationals with a C-permit and cross-border commuters are thereby not treated as immigrants. All other permit categories are treated as recent immigrants.

⁵⁵ The latter result is not dependent on the specific random choice of tradables industries used in Table 3.

The regression statistics are shown in Tables 4 and 5 for the one- and two-quarters-ahead forecasts, respectively.

Table 4: Determinants of the one-quarter-ahead forecast errors (OLS regressions)

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Δ GDP, $t + 1$ forecast error	0.32** (0.10)	0.30** (0.07)	0.29** (0.06)	0.27** (0.08)	0.29** (0.07)	0.26** (0.07)
Free movement of persons (stepwise)		0.38** (0.10)	0.43** (0.11)	0.42** (0.09)	0.32* (0.17)	0.52** (0.14)
Δ Pot. labor force, $t + 1$ forecast error			1.39 (0.83)			1.45** (0.58)
Δ Productivity, $t + 1$ forecast				0.49** (0.17)		0.52** (0.16)
Investment/GDP, $t + 1$ forecast					-0.03 (0.07)	0.02 (0.06)
Constant	0.18** (0.05)	-0.07 (0.07)	-0.14 (0.09)	-0.09 (0.07)	-0.03 (0.13)	-0.19* (0.10)
Observations	40	40	40	40	40	40
R^2	0.29	0.46	0.51	0.59	0.46	0.65

Robust standard errors in parentheses

** $p < 0.05$, * $p < 0.1$

Dependent variable is the one-step ahead forecast error in quarter-on-quarter growth of FTE jobs

Table 5: Determinants of the two-quarters-ahead forecast errors (OLS regressions)

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Δ GDP, $t + 2$ forecast error	0.27** (0.09)	0.26** (0.08)	0.22** (0.06)	0.21** (0.05)	0.22** (0.06)	0.18** (0.04)
Free movement of persons (stepwise)		0.39** (0.14)	0.48** (0.15)	0.30** (0.12)	0.20 (0.20)	0.31** (0.14)
Δ Pot. labor force, $t + 2$ forecast error			2.12** (0.97)			1.56** (0.46)
Δ Productivity, $t + 2$ forecast				0.90** (0.17)		0.83** (0.15)
Investment/GDP, $t + 2$ forecast					-0.08 (0.11)	-0.03 (0.07)
Constant	0.20** (0.07)	-0.07 (0.10)	-0.20* (0.11)	-0.00 (0.10)	0.06 (0.17)	-0.06 (0.11)
Observations	39	39	39	39	39	39
R^2	0.17	0.29	0.40	0.63	0.31	0.68

Robust standard errors in parentheses

** $p < 0.05$, * $p < 0.1$

Dependent variable is the two-step ahead forecast error in quarter-on-quarter growth of FTE jobs

Given our discussion of the shifts and structural changes of the Swiss economy, it firstly can be expected that a major part of the bias in the forecasts results from an underestimation of the *labor-intensity* of GDP growth, and not from an underestimation of GDP growth *itself*. We thus regress the forecast errors of the growth rate of FTE jobs on the forecast errors of the growth rate of GDP.

Not surprisingly, looking at Table 4, the estimated coefficients show that there is a positive correlation between the GDP and the employment forecast errors, i.e. KOF underestimated job growth whenever it underestimated GDP growth and vice versa. More importantly, however, accounting for the GDP forecast errors does not eliminate the downward bias in the forecast of FTE job growth, as can be seen from the statistically significantly positive regression constant. These results thus imply that job growth was consistently underestimated for any given growth rate of GDP.

Moreover, arguing that the introduction of free movement of persons with the EU/EFTA was a major cause of structural change, the bias in the forecasts may chronologically coincide with the introduction of FMP. Column 2 confirms this hypothesis. In particular, we add a regressor that is constructed to mirror the three steps in the gradual introduction of FMP with the EU-15/EFTA countries (i.e. the old EU member and the three EFTA countries).⁵⁶ This variable turns out to be statistically significant and it completely eliminates the bias in the job growth forecast.

Column 3 examines the related hypothesis that the forecasts in recent years underestimated population growth and accordingly also employment growth. We examine this hypothesis by comparing the factual with the forecasted growth rates of *the potential labor force*. This is the KOF forecast of the part of the working age population (i.e. the Swiss population aged between 20 and 64 years) which may potentially be willing to participate in the labor market. Indeed, KOF repeatedly underestimated population and, along with this, potential labor force growth.⁵⁷ The resulting forecast errors are added as explanatory variable. Column 3 shows that this regressor has the expected positive relationship to the forecast errors of job growth: the larger the underestimation of population growth, the larger the job growth forecast errors.

Now recall the evidence presented in Figure 11, which implies that productivity and employment growth have become positively associated in the course of the 2000s while they were negatively

⁵⁶ The variable is coded as zero from the beginning of the time series. It takes the value of 1/3 in June 2002, when a limited free movement regime became effective. In mid-2004, the value increases to 2/3, since several limitations to free movement were eliminated. With all barriers to immigration fully lifted in June 2007, the value is set to 1.

⁵⁷ Forecasts of the quarter-on-quarter growth rate of this measure lay approximately 15 percent below the realized rate over the whole sample. Since growth of the working age population of Swiss residents can be accurately predicted by considering age cohort effects, a bias in the forecast errors of this variable must be mostly attributed to wrong assessments of the net immigration of workers.

associated before. The structural break could imply that forecasters may have thought that there exists a negative trade-off between productivity and job growth, but this trade-off was actually not present anymore. If this were the case, one could use the *actual* labor productivity growth *forecast* of KOF in order to explain the *forecast error* in FTE job growth. Column 4 shows that there is indeed a strong *positive* association between the KOF forecasts of average labor productivity growth and the forecast errors relating to the growth of jobs. This implies that whenever predicted labor productivity growth was high, KOF's underestimation of job growth ended up being particularly sizable. These results suggest that the forecasters indeed failed to perceive the structural change in the association between productivity and job growth.⁵⁸

Going back to Figure 12 (above) also shows that the association between investment and job growth may have become more positive. Following the same reasoning as with the labor productivity forecasts, one may thus use actual KOF forecasts of the investment rate in order to explain the forecast error in job growth. Yet, Column 5 demonstrates that the forecast of the investment rate cannot explain the forecast errors in job growth above what is accounted for by the GDP forecast errors.

Finally, Column 6 reports the regression with all explanatory variables added simultaneously. The important message from this regression is that we can explain most of the bias as well as roughly two thirds of the variation in the one- and two-step-ahead forecast errors of job growth in the period under examination.

Moving on to Table 5, which replicates the regression reported in Table 4 after extending the forecast horizon from one to two quarters, we find very similar results. In qualitative terms, within the range of short term forecasting, the outcome is hence robust to the chosen forecasting interval. We are therefore confident to have identified some key factors and relationships that escaped the attention of the forecasters in real time.

6 Concluding remarks

There are, in our view, six factors which caused the Swiss “job miracle” and the shift towards more labor intensive growth. Whilst we discussed these drivers separately, they are of course interrelated. Indeed, it is evident from the discussion that some of the certain are likely to have been mutually reinforcing. In line with this, the six drivers did not necessarily affect employment growth simultaneously; some of them worked sequential. Most importantly, the ongoing shift towards the service

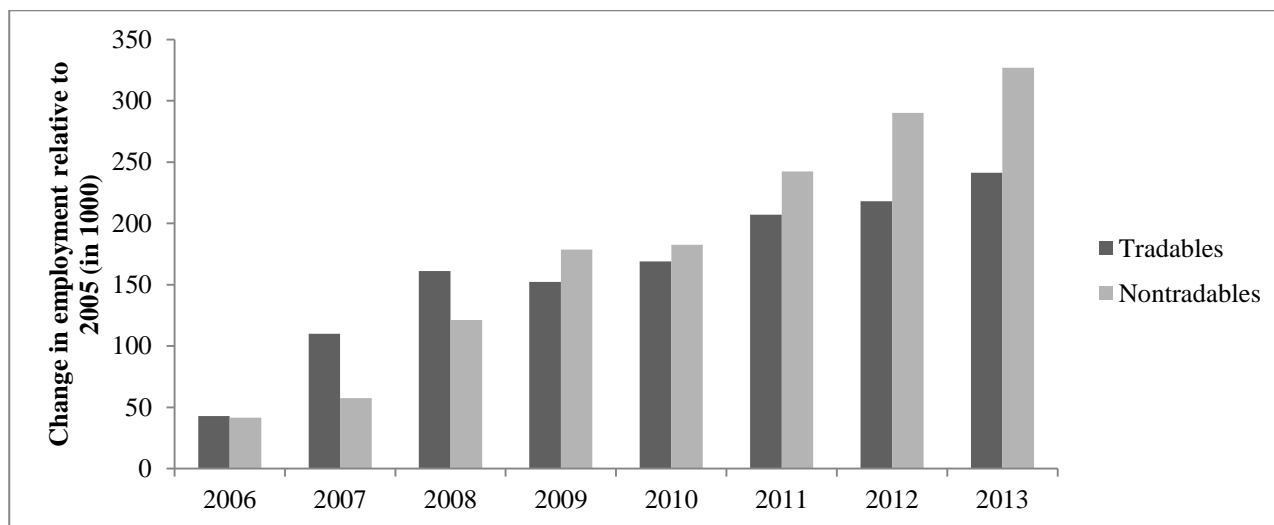
⁵⁸ Since the regression intercept should represent the mean forecasting error, we normalize forecasted productivity growth to have a mean of zero over the whole sample period before running the regression shown in Column 5. The same applies to the investment rate.

sector and the catch-up employment growth as a result of the long recession of the 1990s clearly preceded the other changes related to the Swiss labor market. The free movement of persons then accelerated and magnified these ongoing changes by aligning labor supply to labor demand and by reducing recruitment and unit labor costs for skilled workers. In fact, considering the regulatory changes that went along with it, the FMP had effects similarly to reductions in employment protection, with the outcome of a more flexible Swiss labor market. The combined effects of the FMP, however, did not manifest themselves rapidly in aggregate employment figures, partly because Switzerland's economy stagnated from 2001 to 2003, and partly because the introduction of the free movement regime occurred stepwise.

Especially from 2005 onward, employment of skilled workers in knowledge-intensive, export-oriented sectors in Switzerland surged. The major reasons were an increasing demand in Switzerland's main export markets, a moderate growth of relative unit labor costs as the price of labor relative to capital at that time grew only moderately, and a substantial reduction in the overall tax burden for companies, making Switzerland more attractive to foreign investors. Figure 17 illustrates the surge in employment of tradables industries by showing the cumulative change in employment in Switzerland from 2005 onward, separately for tradables and non-tradables industries. The figure shows that in the years 2005 to 2008 the growth of foreign employment in tradables industries substantially exceeded the growth of foreign employment growth in non-tradables industries in absolute terms (and even more in relative terms). Since the associated increase in demand for skilled workers could not be met with resident workers and since the free movement of persons enabled it, the surge in employment in these industries led to immigration of skilled workers. This immigration of skilled workers fuelled the local economy through creating demand for local goods and services. Our estimates of the cantonal multipliers suggest that each additional job created in a canton's tradables sector led to the creation of around one additional job in a canton's non-tradables sector. This increase in labor demand in non-tradables was again partly met by recruiting foreigners.⁵⁹ Indeed, as Figure 17 illustrates, the increase in non-tradables employment from 2008 to 2009 was the main reason why aggregate employment in Switzerland did not decline in 2009. Our analysis thus suggests that the effects of preceding immigration serving the tradables industries on domestic demand was the prime source of the exceptional performance of the Swiss labor market during the Great Recession.

⁵⁹ Evidence in favor of the idea that tradables employment growth led non-tradables employment growth throughout the job miracle is also provided by Ecoplan (2013), which looks at gross immigration of employees by NOGA sections (NACE, rev. 2) over the period from 2002 to 2012. It is shown that the manufacturing, information and communication technologies sectors, and in particular professional, scientific and technical activities contributed to the increased immigration in the three years after the recession of 2003. On the other hand, immigration into the sectors construction, wholesale and retail trade, transportation, storage, accommodation and personal services did not surge before 2006.

Figure 17: Cumulative change in employment relative to 2005 in tradables and non-tradables industries, 2005–2013



Source: FSO, own calculations.

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