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No. 250
January 2010

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‘Baumol’s diseases’: the case of Switzerland

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Keywords: Baumol’s disease, productivity growth, Switzerland
JEL classification: C12; C23; O41; O47; O52

Abstract

Nordhaus (2008) has developed a testing strategy for what he calls ‘Baumol’s diseases’, by which name he designates a number of by-products of structural change that are unwanted from an economic policy perspective. He finds that the U.S. economy is strongly affected by the ‘diseases’. This paper applies Nordhaus’s testing methodology to Swiss data. The results suggest that – unlike the U.S. – Switzerland is not affected by the most serious of the ‘diseases’, namely the negative impact of structural change on economic growth.

1. Introduction

In 2005, I made an attempt to investigate the validity of William J. Baumol's famous model of 'unbalanced growth' (Baumol, 1967) for Switzerland (cf. Hartwig, 2005). I was able to show that the assumptions and predictions of Baumol's model are compatible with – respectively apparent in – Swiss macroeconomic data, yet my approach was purely descriptive. Unable to conceive an econometric testing framework at that time, I shelved this work.

Three years later, however, I came across a paper by William D. Nordhaus (Nordhaus, 2008), which provides the testing framework I had sought for. This renewed my interest in the question whether Switzerland suffers from what is usually called the 'cost disease' (or also 'Baumol's disease'). The present paper intends to answer this question based on Nordhaus's methodology.

For the sake of brevity, I will not address issues that Nordhaus has already resolved. These include the derivation of his analytical framework and econometric issues in the specification. Also, Nordhaus provides a thorough overview of the literature on 'Baumol's disease', so this can also be dispensed with here. What I intend to do in this paper is, first, to briefly restate Baumol's model formally in the next section. This is something that Nordhaus abstains from, but it will be helpful to deduce the undesirable consequences of structural change – Nordhaus calls them 'diseases' – Baumol's model predicts. Section 3 will explain the testing framework, and section 4 will discuss the data. The results for the tests of whether Switzerland suffers from 'Baumol's diseases' are presented in section 5 and compared with the benchmarks set by Nordhaus. Some notable differences between the Swiss and the U.S. results will surface. The last section offers some tentative explanations of why the Swiss results depart from those for the U.S. and discusses the relevance of the findings for economic policy.

2. Baumol's model of unbalanced growth

Baumol presents a model in which the economy is divided into a 'progressive' and a 'nonprogressive' – or 'stagnant' – sector. He assumes that labour productivity grows only in the progressive sector, while wages grow in both sectors at a rate set by the productivity growth in the progressive sector. Formally, this can be stated as:

$$Y_{1t} = aL_{1t} \qquad (1),$$

$$Y_{2t} = bL_{2t}e^{rt} \qquad (2),$$

$$W_t = We^{rt} \qquad (3),$$

with Y_1 and Y_2 as output in the two sectors at time t, L_1 and L_2 as quantities of labour employed in the two sectors, r as the (constant) growth rate of labour productivity in the progressive sector (2), W as the wage rate and a and b as constants.

This simple model has a couple of interesting implications which Baumol draws out. First, the 'cost disease': equations (4) and (5) show that costs per unit of output in the stagnant sector tend toward infinity while they stay constant in the progressive sector.

$$C_1 = W_t L_{1t} / Y_{1t} = We^{rt} L_{1t} / aL_{1t} = We^{rt} / a \quad (4),$$

$$C_2 = W_t L_{2t} / Y_{2t} = We^{rt} L_{2t} / bL_{2t} e^{rt} = W / b \quad (5).$$

Relative costs also tend toward infinity ($C_1/C_2 = be^{rt}/a$). Under 'normal' circumstances – that is when prices rise in proportion to costs and when demand is price-elastic – the stagnant sector will vanish. Baumol mentions craftsmanship, fine restaurants, and theatres as examples of establishments that have either disappeared or retreated to luxury niches as a consequence of customers' unwillingness to tolerate the price increases that would have been necessary to cover rising costs.

Yet, parts of the stagnant sector produce necessities for which the price elasticity is very low. Baumol calls attention to education and health care as prime examples. To show what happens in these industries as a consequence of unbalanced growth, Baumol assumes that the relation of real output of the two sectors remains unchanged as in (6):

$$(b/a)\ Y_1 / Y_2 = L_1 / L_2 e^{rt} = K \quad (6),$$

with $K = const$. If L (= $L_1 + L_2$) is the labour force, it follows:

$$L_1 = (L - L_1) K e^{rt} \qquad \Leftrightarrow \qquad L_1 = LKe^{rt} / (1 + Ke^{rt}) \quad (7)$$

and $$L_2 = L - L_1 = L / (1 + Ke^{rt}) \quad (8).$$

From (7) and (8) we learn that, over time, L_1 tends toward L and L_2 tends toward zero. The model thus predicts structural change in terms of a perpetual shift of both expenditures and employment toward the stagnant sector.

Finally, it can be shown what happens to the GDP growth rate under these conditions. Let I be an index for real GDP which is calculated as a weighted average of the value added of the two sectors:

$$I = B_1 Y_1 + B_2 Y_2 = B_1 a L_1 + B_2 b L_2 e^{rt} \quad (9).$$

Then, if we insert (7) and (8) into (9) we get:

$$I = L(KB_1 a + B_2 b) e^{rt} / (1 + Ke^{rt}) = Re^{rt} / (1 + Ke^{rt}) \quad (10),$$

with $$R = L(KB_1 a + B_2 b) \quad (11).$$

Applying the quotient rule leads to:

$$dI/dt = R[re^{rt}(1+Ke^{rt}) - Kre^{2rt}]/(1+Ke^{rt})^2$$
$$= rRe^{rt}/(1+Ke^{rt})^2 \quad (12).$$

We can calculate the growth rate of real GDP as:

$$(dI/dt)/I = r/(1+Ke^{rt}) \quad (13).$$

It follows that, over time ($t \rightarrow \infty$), the GDP growth rate drops asymptotically to zero *ceteris paribus*.[1]

The model has six implications – some of them undesirable from an economic policy perspective (that's why Nordhaus calls them 'diseases') – which can be tested empirically.

1. *The cost and price disease*. The model implies that costs grow faster in stagnant than in progressive industries; and Baumol assumes that prices are set as a markup over costs. If we think of the 'cost explosion' in health care in most developed countries, for instance, we recognize why such a development would be politically undesirable.[2] To lend empirical support to the cost and price disease, we would need to find a statistically significant negative correlation between productivity growth and price growth across industries.
2. *The 'constant real share' hypothesis*. Baumol assumes that the relation of real output of the two sectors remains constant. This assumption has been rephrased as the 'real share maintenance' hypothesis (although, conceptually, the notion of 'real' output shares does not make much sense). Some scholars regard the constancy of the 'real share' of the services sector as a 'stylized fact' (Gundlach, 1994, ten Raa and Schettkat, 2001), others address it as the 'service paradox' (cf. Pugno, 2006) because, given the rise in relative service prices, one would expect a declining demand and a drop in the 'real share' of services. Empirically, if the 'real shares' in fact remain constant, there should be no significant correlation between productivity growth and real output growth across industries.
3. *Unbalanced nominal growth*. As a consequence of bullet points (1) and (2), there should be a significantly negative correlation between productivity growth and nominal output (value added) growth across industries. In this case, the share of progressive industries' value added in nominal GDP would drop.

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[1] *Ceteris paribus* here especially means that *L* remains constant. If *L* grows at the rate *n*, then *n* must be added at the right hand side of (13). Long-run stagnation then occurs for per-capita GDP.

[2] Hartwig (2008a) has used Baumol's model to investigate the 'cost explosion' in health care.

4. *Declining employment shares of progressive industries*. This is evident from eqs. (7) and (8) above. Across industries, the model predicts a significantly negative correlation between productivity growth and employment growth.
5. *Uniform wage growth.* Baumol assumes uniform wage growth across industries. Therefore, wage growth should not be correlated with productivity growth.
6. *The growth disease.* Baumol's model predicts that unbalanced productivity growth will lead to a decrease in the growth rate of overall GDP over time. This hypothesis can be tested as well.

3. Testing framework

For a Cobb-Douglas economy with cost minimization and markup pricing, and an 'almost ideal' demand side in the sense of Deaton and Muellbauer (1980), Nordhaus shows that the first five syndromes described in the previous section can be interpreted econometrically as reduced-form equations which – under certain assumptions Nordhaus draws out – can be written as:

$$\hat{x}_{it} = \gamma_{0i} + \gamma_1 \hat{a}_{it} + \gamma_2 D_t + \varepsilon_{it}^{p} \qquad (14),$$

where $\hat{a}_{it}$ is the growth rate (log difference) of productivity in industry i at time period t. $\hat{x}_{it}$ is a placeholder for different variables; it may stand for either real or nominal output growth, or price, wage or employment growth. D_t is a panel of fixed time effects, γ_{0i} are fixed industry effects, ε_{it}^{p} is a random disturbance, and γ_1 and γ_2 are coefficients. Eq. (14) can be estimated with pooled OLS. (EViews v.6 is used for the estimations.)

Testing the sixth (and probably most worrisome) syndrome – the negative impact of structural change on overall economic growth – requires a different approach. Nordhaus proposes a non-parametric test. Overall productivity growth is a weighted average of the industries' productivity growth rates, with the industries' shares in last year's GDP as weights.[3] If we track the shares over time, we can see whether the industries with low productivity growth gain weight or, alternatively, whether the GDP growth rate drops when more recent years are chosen as weighting (or base) years. If so, then the prediction of Baumol's model would be confirmed.

[3] In the U.S., geometrical means of the industries' value added shares in two adjacent years are used as weights.

4. Data

With respect to data availability, I'm in a less comfortable position than Nordhaus. His dataset covers 67 industries. The Swiss production account published by the Swiss Federal Statistical Office (OFS), on the other hand, distinguishes only 43 industries, one of which ('production of housing services by private households including homeowners' equivalent rent') is irrelevant for productivity analysis because, by assumption, production is carried out without labour input in this industry. The OFS has decided to publish industry productivity data only for what the Office calls the 'business sector', which means that no labour input data for the industry 'public administration' is publicly available. These data can be obtained, however, upon request from the Office.[4] There are also differences between total output and employment on the one hand and their 'business sector' counterparts on the other hand in the industries 'health and social work', 'activities of membership organizations' and 'recreational, cultural and sporting activities' due to the involvement of 'non-profit institutions serving households' (NPISH) in the production process in these three industries. However, the differences in productivity growth between the for-profit and the non-profit segments of these three industries seem to be negligible.[5] Therefore, I will look at the total economy and not just at the 'business sector' (which is what Nordhaus also does). The 42 industries are listed in the appendix.

The OFS publishes two different datasets on labour input. For the economy as a whole, labour input is measured as total hours worked. Unlike in the U.S., however, no hours worked data are available for the industry level. Labour input is therefore measured with full-time equivalents here. Also unlike in the U.S., no capital stock (or capital services) data are available for Swiss industries. Therefore, I cannot follow Nordhaus in distinguishing between labour productivity and total factor productivity. This study is solely concerned with labour productivity.

Regarding the time dimension, Nordhaus's dataset covers the period 1948-2001. The length of the observation period allows him to waive information inherent in the annual data and to calculate long-term averages, which, Nordhaus claims, is necessary in order to eliminate the impact of the business cycle on productivity. He estimates eq. (14) for the entire sample, 1948-2001, as a cross-section as well as with pooled cross-section and time series

[4] I would like to thank Mr. Gregory Rais from the OFS for providing these data to me.

[5] For 'health and social work', data availability allows for a comparison. Productivity growth in both segments is basically identical, except (curiously) in 1993.

data. For the latter estimation, he constructs four sub-periods with business cycle watersheds (1959, 1973, 1989) chosen as break points.

Swiss data on industry output (nominal and real), and prices currently cover the period 1990-2007 for 14 major industry groups and 10 individual industries. They cover the period 1997-2007 for the remaining 32 industries. Full-time equivalents are available for 1991-2007 for all industries. Wage data for all industries except ‘agriculture, forestry, hunting and fishing’ are available for 1993-2008. These periods are substantially shorter than Nordhaus’s. Therefore, it is probably not a good idea to waive the information content of the annual data (despite the problematic business cycle impact on productivity). Like Nordhaus, I will estimate eq. (14) for a cross-section of average growth rates over the period 1991-2007 (respectively 1997-2007). I will also construct four sub-periods in a similar way as Nordhaus does. Turning points of the Swiss business cycle during the period I look at were the years 1997, 2000 and 2003, so the four sub-periods are 1991-1997, 1997-2000, 2000-2003, and 2003-2007. Unlike Nordhaus, I will also estimate eq. (14) with annual data.

5. Results

5.1 Results for the cost and price disease

Baumol’s model predicts that industries with low relative productivity growth will exhibit high relative price increases. This hypothesis will be tested, applying the testing framework described in section 3 to Swiss data. Beforehand, it must be decided which prices to look at. In principle, one could either choose gross output deflators or value added deflators. Nordhaus argues in favour of using value added data because value added allows better than gross output for tracking the industrial source of technological advances that lead to productivity growth. I will follow this lead.

Table 1 distinguishes between estimates for the full sample of 42 industries, the 14 major industry groups, and a pool of 24 industries whose output Nordhaus regards as well-measurable. (These industries – mainly belonging to the industry group ‘manufacturing’ – are denoted with an asterisk in the appendix.) The table shows that for the full sample of industries, the coefficient for productivity growth is significantly negative (at the 1% level) for the cross-section of average growth rates, the pooled estimation with four sub-periods, and the pooled estimation with annual data. For the 24 well-measured industries however, the coefficient is only significant when estimated with annual data, but not so when the time-dimension consists of four sub-period average growth rates. (No cross-section estimate is given due to insufficient degrees of freedom.) For the 14 major industries, I do the estimation only with annual data. Again, the coefficient is negative, but insignificant.

<Insert Table 1 around here>

Overall, these results yield evidence in favour of the cost and price disease. In the largest sample, industries with low relative productivity growth show significantly higher than average price growth. This finding is in line with Nordhaus's result for the U.S. Note, however, that my coefficients are much lower that those found by Nordhaus. On average, the absolute value of Nordhaus's coefficients is only slightly below one, which prompts him to state that "consumers capture virtually all the gains from technological change" (Nordhaus, 2008, p. 10). This seems to be quite different in Switzerland, where the coefficient for productivity growth is below 0.2 on average in absolute terms.[6] I will get back to this point below.

5.2 Results for the 'constant real share' hypothesis

Table 2 shows that Swiss data clearly reject the 'constant real share' hypothesis. Industries with high productivity growth grow faster on average than industries with low productivity growth. The coefficients are statistically significant at the 1% level in all six estimations. If the progressive industries grow faster than the stagnant industries, then their 'real share' will rise; and this is a palliative against 'Baumol's diseases'.

<Insert Table 2 around here>

My test results for the 'constant real share' hypothesis are very similar to those reported by Nordhaus. He also finds statistically significant positive coefficients when regressing U.S. real industry gross value added growth on productivity growth. (In fact, the 'constant real share' hypothesis is the only assumption/implication of Baumol's model that Nordhaus rejects.) Even in their magnitude (between 0.60 and 0.66 on average), my coefficients are similar to those estimated by Nordhaus. His average for the coefficients is 0.67 (both weighted and unweighted).

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[6] Following Nordhaus, I report two summary statistics at the bottom of the table. The 'weighted' statistic weights each coefficient with the number of observations. The 'unweighted' statistic weights each equation equally.

5.3 Results for nominal growth

The results given in Table 3 trivially reflect Tables 1 and 2. The coefficients on nominal value added should be equal to the sum of the coefficients on price and output. Small deviations from that identity might occur, but if we look at the weighted average, for instance, we see that the identity exactly holds (0.496 = –0.161 + 0.657). The coefficients in Table 3 are all positive and mostly significant at the 1% level (except in the estimation with only cross-sectional data), which means that industries with high relative productivity growth on average increase their share in nominal GDP. This is contrary to what Baumol's model predicts and also contrary to Nordhaus's finding for the U.S.

<Insert Table 3 around here>

The reason for this difference between Switzerland and the U.S. obviously lies in the very different behaviour of prices. In both countries, industries with strong productivity growth advance faster in real terms, yet in the U.S., the reduction of relative prices in these industries outweighs the positive effect of productivity growth on real value added so that the overall effect of productivity growth on the progressive industries' nominal value added share is negative. In Switzerland, on the other hand, the progressive industries reduce their relative prices only slightly. Therefore, they are able not only to increase their 'real' output shares, but also their shares in nominal GDP.

5.4 Results for employment shares

Baumol's model predicts declining employment shares of progressive industries. Table 4 shows that this prediction is strongly supported by Swiss data. All six estimated coefficients are significantly negative at the 1% level, which means that industries with above-average productivity growth have below-average employment growth. Therefore, over time, the share of these industries in total employment falls. Nordhaus finds the same pattern for the U.S. His estimates for the coefficients are a bit lower in absolute value – between -0.26 and -0.28 on average – than those found for Switzerland.[7]

<Insert Table 4 around here>

[7] Nordhaus notes that his results are robust to adding wage growth as a control variable. The same is true for my estimates.

5.5 Results for wage growth

Baumol assumes uniform wage growth across industries; therefore, wage growth should not be correlated with productivity growth. Table 5 shows that the evidence on this hypothesis is mixed in Swiss data. Four coefficients are significantly positive at the 10% level or better, two are insignificant. One coefficient is even negative. These results are remarkably similar to those reported by Nordhaus for the U.S., who also finds small positive and negative coefficient values, depending on the sub-sample. His average unweighted and weighted coefficients are 0.017 and -0.001, respectively, which comes very close to the Swiss values reported in Table 5. In any case, even if the coefficients may be regarded as statistically significant, they are too small to be economically significant. Even the highest estimate only suggests a 0.033 percentage point increase in wage growth per percentage point increase in productivity growth. Therefore, we can conclude that the evidence on Swiss wage growth is in line with the predictions of Baumol's model.

<Insert Table 5 around here>

5.6 Results for the growth disease

Nordhaus suggests testing the growth disease hypothesis by weighting the growth rates of the industries' volume indices of value added with their value added shares in nominal GDP in alternative years. If the stagnant industries gain weight – as Baumol's model suggests – then the overall GDP growth rate should be higher if earlier years are used as weighting (or base) years. In other words, Baumol's model predicts that updating the base year leads to a drop in the overall GDP growth rate. Nordhaus finds exactly this pattern in U.S. data.

Table 6 shows, however, that in Swiss data we find the opposite pattern. Updating the base year generally raises the overall GDP growth rate, which means that the more productive industries gain weight over time.[8] This result could have been anticipated from section 5.3, where the positive correlation between productivity growth and nominal value added growth has already been shown. Unlike the U.S., Switzerland is thus not affected by 'Baumol's growth disease'.

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[8] To make perfectly clear what is done here: 2000, for instance, means that for each year 1991-2007, the growth rates of real value added of the major industry groups are summed together to the overall GDP growth rate using the share of the respective industry group in nominal GDP in the year 2000 as weights. The 18 available weighting years (1990-2007) yield 18 alternative time series (quantity indices) for real GDP. The right column of Table 6 reports the average growth rates (geometrical means) for these 18 series over the period 1990-2007.

<Insert Table 6 around here>

6. Discussion

Overall, the evidence on whether Switzerland is affected by 'Baumol's diseases' is mixed. In line with the predictions of Baumol's model of unbalanced growth, relative prices rise in stagnant sectors; and sectoral wage growth is largely independent of sectoral productivity growth. Also in line with the model, the employment share of the stagnant part of the economy rises. On the other hand, the 'constant real share' hypothesis is rejected. Progressive industries increase their 'share' in real GDP, and because this volume effect is stronger than the decline in their relative prices, progressive industries also increase their share in nominal GDP in Switzerland. This is the opposite of what Baumol's model predicts, and it is also the opposite of what Nordhaus (2008) finds for the U.S. On average, expenditures do not shift toward the stagnant industries in Switzerland, thus there is no all-round 'cost disease' in this country. Also, Switzerland does not suffer from the 'growth disease', as the more productive industries gain weight over time instead of losing weight.

What enables Switzerland to avoid the cost and growth diseases? To answer this question, we have to take a closer look at the sectoral productivity growth rates. Although Baumol sometimes calls special attention to education and health care as prime examples of stagnant services, the stagnant sector (as Baumol describes it in his 1967 paper) has generally been identified with the whole services sector (cf. Triplett and Bosworth, 2003, 2006) or even with all non-manufacturing industries (i.e. including agriculture, mining and quarrying, and construction, cf. Hartwig, 2008b). If we take a look at Swiss sectoral productivity growth in Figure 1, we notice that there are three other major industry groups with a productivity growth that is comparable to – or even higher than – productivity growth in manufacturing. Apart from 'mining and quarrying', which is a very small industry in Switzerland (mainly gravel quarrying), these are important service industries, namely 'transport and communication' and 'financial intermediation and insurance'. The disaggregated data (available from 1997 on) show that in the industry group 'transport and communication', the whole productivity growth comes from communication (+11.2% per year on average over the period 1997-2007). Productivity in transportation has grown only moderately (+0.5% per year). In the industry group 'financial intermediation and insurance', on the other hand, both sub-industries contribute to the strong productivity growth, with the average growth rate in insurance over the period 1991-2007 being even a bit higher (+4.6% per year) than in financial intermediation (+3.8% per year).

<Insert Figure 1 around here>

From the vantage point of Baumol's model, strong productivity growth in service industries comes as a surprise because Baumol regards productivity growth to be the result of technological innovation which manifests itself in new capital goods. Therefore, he confines it mainly to manufacturing. If we think of communication, however, we notice that this is also an industry where capital goods (e.g. in the form of landline and mobile phone networks) play a crucial role in the delivery of the services. A couple of additional effects contributed to the boost in productivity growth in communication during the observation period. Up to 1998, the Swiss telephone market was a government monopoly. When the market was liberalized in that year, a number of new enterprises were able to take root in the landline market (although the 'last mile' is still in the hands of former monopolist *Swisscom*). Mobile phones, which were a luxury item before 1997, quickly became affordable for everybody so that there was a huge expansion in quantities at falling prices. Finally, emerging competition – originally there were three competitors to *Swisscom* in the mobile phone market, two of which later merged – led to a reduction in full-time equivalents (by 12% between 2000 and 2007) in this industry. All these effects raised productivity growth. In the years to come, productivity growth in telecommunication, although it can be expected to continue due to the ongoing technological progress, is likely to recede as these extraordinary effects will gradually phase out.

In 'financial intermediation and insurance', productivity growth is not only hard to measure; value added is also quite independent of labour input here. To sell ten stocks costs about as much effort as to sell ten thousand stocks, yet the value added (including the gross operating surplus) of the two actions will be significantly different. This is true both for nominal and real value added since the wage indices that are normally used to deflate nominal value added in banking need not be correlated with the price trends in the financial markets. For these reasons, productivity in financial intermediation tends to rise and fall with the market. This means that the high average productivity growth in financial intermediation over the period 1991-2007 (+3.8% per year) reflects above all the mostly favourable market conditions during that period.[9] What can happen to banks' productivity when a financial markets bubble bursts could be observed in 2001, when labour productivity in the Swiss financial intermediation industry dropped by 21% (followed by another 8% drop in the next year). Unfortunately, something very similar (or worse) is in the offing for the years after

[9] The same is true to some extent for insurance also since insurers are also active in financial markets (think of credit default insurance, for instance).

2007. Should Figure 1 be redrawn in two or three year's time, the bar for 'financial intermediation and insurance' would turn out to be substantially shorter.

Important as it was to show in what respects productivity growth in Swiss industries departs from the predictions of Baumol's model, the main reason why Switzerland has been immune to the cost and growth diseases lies elsewhere. It has been shown in section 5.2 that the progressive industries increase their 'real share'. The industries with the steepest increase in their 'real share' (calculated as the share of deflated industry value added in total deflated gross value added, although this is problematic, see above) are, not surprisingly, financial intermediation, communication, insurance, and manufacturing (the exact values are given in Table 7). There is only one other major industry group whose 'real share' has risen, which is 'health and social work'. That progressive industries increase their 'real share' is not unusual, and it accords with the U.S. pattern found by Nordhaus. What does not accord with the U.S. picture, however, is the pricing pattern. Prices in communication and insurance have dropped, but not nearly to the same extent as productivity has risen (see Table 7). Prices in manufacturing and financial intermediation have increased despite strong productivity growth (although, as was mentioned, for financial intermediation severe measurement problems exist). It will be remembered that Nordhaus suggests that the U.S. consumers capture almost all the gains from technological progress through lower prices. This is, as it seems, not the case in Switzerland. Since wages also do not respond much to productivity growth (see section 5.5), profit receivers are probably the main beneficiaries of technological progress.[10]

<Insert Table 7 around here>

The bottom line of Table 7 shows the development of the share of nominal industry value added in overall nominal gross value added for the five industries. Manufacturing and 'health and social work' are relatively 'well-behaved' industries from the point of view of Baumol's model. Manufacturing has high productivity growth at low relative price growth so that despite an increase in its 'real share', the nominal share – which serves as weight for the summation of the industries' productivity growth rates to overall productivity growth – declines. If all progressive industries would behave like manufacturing, then Switzerland (like the U.S.) would show symptoms of the growth disease. 'Health and social work', on the other hand, is a relatively typical example of a stagnant industry. (I say 'relatively typical' because

[10] Nevertheless, the share of wages in Swiss GDP rises over time according to OFS data. This is puzzling (cf. also Hartwig, 2008c).

the ‘real share’ of this industry rises; and we’ve seen in section 5.2 that this is atypical for a stagnant industry.) Driven by both quantity and price expansion, the nominal share of ‘health and social work’ in gross value added rises, which, if not counteracted, would result in the cost and growth diseases. There are counterweights, however, namely the three industries communication, insurance and – above all – financial intermediation. These three industries with strong productivity growth have managed to increase their nominal share – and thus their weight – which held up overall GDP growth.

To conclude, it is appropriate to raise the question in which way the results might be relevant for economic policy. An important finding from the policy point of view seems to be the relative modest responsiveness of relative prices to advances in productivity. That Swiss prices are relatively high in international comparison – and downward-rigid – is much discussed (and deplored) in this country. For some time already, the government has blamed the lack of competition in the domestic market for the undesirable pricing patterns; and it had explicitly declared the advancement of competition to be the single most important policy goal for the legislative period 2004-07. By fostering competition, the government claimed, it would also be possible to raise the growth rate of overall GDP (cf. EVD, 2002).

While my results support the notion that the competitive pressures on Swiss firms to pass on productivity gains to consumers in the form of lower prices have been rather small, the assertion that GDP growth could be raised by fostering competition needs a second thought. The reason why the U.S. economy is affected by ‘Baumol’s growth disease’ is that the progressive industries in the U.S. lose ‘weight’ (nominal value added shares). If the progressive industries in Switzerland had been forced to reduce their relative prices as strongly as their U.S. counterparts, their nominal shares in GDP would have dropped also. Only if an increase in demand had overcompensated for the drop in relative prices, a decline in their nominal shares could have been avoided. This, however, is not very probable.[11] A drop in the nominal shares of progressive industries like communication or financial intermediation would be tantamount to a drop in the weight their high real value added growth has received so far when summing up the sectoral growth rates to the overall GDP growth rate. Of course, there may be positive second-round effects of increased competition. A focus on the first-round effects, however, suggests that it is precisely the lack of competition in Switzerland that has spared the country the fate of ‘Baumol’s growth disease’.

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[11] If the firms in the progressive industries had expected demand to be highly price-elastic, they would have lowered prices already in order to raise their profits. Nordhaus (2008, p. 20), for his part, notes: “Because demand is on average price-inelastic, stagnant industries have experienced rising nominal shares”.

Acknowledgements

I would like to thank Yngve Abrahamsen and Bernd Schips for their thoughtful comments on earlier versions of this paper. The usual disclaimer applies.

References

Baumol, W. J. (1967): Macroeconomics of unbalanced growth: the anatomy of urban crisis, *American Economic Review* 57(3), 415–426.

Deaton, A., Muellbauer, J. (1980): An almost ideal demand system, *American Economic Review* 70(3), 312–326.

EVD [Eidgenössisches Volkswirtschaftsdepartement, Swiss Ministry of Economics] (2002): Der Wachstumsbericht. Determinanten des Schweizer Wirtschaftswachstums und Ansatzpunkte für eine wachstumsorientierte Wirtschaftspolitik [The growth report. Determinants of Swiss economic growth and strategies for a growth-oriented economic policy], Bern.

Gundlach, E. (1994): Demand bias as an explanation for structural change, *Kyklos* 47(2), 249–267.

Hartwig, J. (2005): Sind unsere gesamtwirtschaftlichen Probleme überhaupt lösbar? [Are our economic problems resolvable at all?], KOF Working Paper No. 112, Zurich.

Hartwig, J. (2008a): What drives health care expenditure? – Baumol's model of 'unbalanced growth' revisited, *Journal of Health Economics* 27(3), 603–623.

Hartwig, J. (2008b): Productivity growth in service industries – are the transatlantic differences measurement-driven? *Review of Income and Wealth* 54(3), 494–505.

Hartwig, J. (2008c): Trying to assess the quality of macroeconomic data – the case of Swiss labour productivity growth as an example, *Journal of Business Cycle Measurement and Analysis* 4(1), 37–61.

Nordhaus, W. D. (2008): Baumol's diseases: a macroeconomic perspective, *The B.E. Journal of Macroeconomics* 8(1) (Contributions), Article 9.

Pugno, M. (2006): The service paradox and endogenous economic growth, *Structural Change and Economic Dynamics* 17(1), 99–115.

ten Raa, T., Schettkat, R. (2001): Potential explanations of the real share maintenance of the services, in: ten Raa, T., Schettkat, R. (eds.): *The Growth of Service Industries. The Paradox of Exploding Costs and Persistent Demand,* Cheltenham: Edward Elgar, pp. 29–41.

Triplett, J. E., Bosworth, B. P. (2003): Productivity measurement issues in services industries: ‘Baumol’s Disease’ has been cured, *Federal Reserve Bank of New York Economic Policy Review*, September, 23–33.

Triplett, J. E., Bosworth, B. P. (2006): Baumol’s disease has been cured: IT and multifactor productivity in U.S. service industries, in: Jansen, D. W. (ed.): *The New Economy and Beyond: Past, Present, and Future*, Cheltenham: Edward Elgar, pp. 34–71.

Appendix: Industry definition

Industries correspond to the NACE codes (Version 4 Rev. 1 1993), in Switzerland known as NOGA (Nomenclature générale des activités).

<u>All 42 detailed industries</u>

(An asterisk denotes that the industry roughly corresponds to one of Nordhaus's 'well-measured industries')

Agriculture, forestry, hunting and fishing*
Mining and quarrying*
Manufacturing of food products; beverages and tobacco*
Manufacture of textiles*
Manufacture of wearing apparel; dressing and dying of fur*
Manufacture of leather and leather products*
Manufacture of wood and wood products*
Manufacture of pulp, paper and paper products*
Publishing, printing and reproduction of recorded media*
Manufacture of refined petroleum products, chemicals and chemical products*
Manufacture of rubber and plastic products*
Manufacture of other non-metallic mineral products*
Manufacture of basic metals*
Manufacture of fabricated metal products*
Manufacture of machinery and equipment*
Manufacture of office machinery, computers, electrical machinery and apparatus n.e.c*
Manufacture of radio, television and communication equipment and apparatus*
Manufacture of medical, precision and optical instruments, watches and clocks
Manufacture of motor vehicles, trailers and semi-trailers*
Manufacture of other transport equipment*
Manufacture of furniture; manufacturing n.e.c.*
Recycling
Electricity, gas and water supply*
Construction
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
Wholesale and retail trade*
Hotels and restaurants
Land transport; transport via pipelines; water transport; air transport*
Supporting and auxiliary transport activities; activities of travel agencies
Post and telecommunication*
Financial intermediation
Insurance
Real estate activities
Renting of machinery and equipment and of personal and household goods; other business activities
Computer and related activities
Research and development
Public administration and defence; compulsory social security
Education
Health and social work
Sewage and refuse disposal

Activities of membership organizations; recreational, cultural and sporting activities
Other service activities; private households with employed persons

<u>14 industry groups</u>

Agriculture, forestry, hunting and fishing
Mining and quarrying
Manufacturing
Electricity, gas and water supply
Construction
Wholesale and retail trade; repair of motor vehicles and motorcycles and personal and household goods
Hotels and restaurants
Transport, storage and communication
Financial intermediation and insurance
Real estate, renting, business activities and R&D
Public administration and defence; compulsory social security
Education
Health and social work
Other community, social and personal service activities

Table 1: Impact of productivity growth on price growth

	dlog(p)	
	Coefficient	No. of obs.
dlog(prod)		
All 42 industries		
cross section	–0.405*** (0.067)	42
4 sub-periods	–0.156*** (0.059)	136
annual data	–0.221*** (0.032)	480
24 well-measured industries		
4 sub-periods	–0.086 (0.067)	75
annual data	–0.127*** (0.029)	258
14 industry groups		
annual data	–0.054 (0.032)	224
Summary statistics		
weighted	–0.161	
unweighted	–0.175	

p = industry price level (deflator of gross value added),
prod = industry productivity level (gross value added per full-time equivalent)
Standard errors are in parenthesis. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Estimates for constant terms not shown.

Table 2: Impact of productivity growth on real gross value added growth

	dlog(rgva)	
	Coefficient	No. of obs.
dlog(prod)		
All 42 industries		
cross section	0.518*** (0.145)	42
4 sub-periods	0.507*** (0.063)	136
annual data	0.690*** (0.028)	480
24 well-measured industries		
4 sub-periods	0.453*** (0.089)	75
annual data	0.636*** (0.040)	258
14 industry groups		
annual data	0.796*** (0.034)	224
Summary statistics		
weighted	0.657	
unweighted	0.600	

rgva = real industry gross value added,
prod = industry productivity level (gross value added per full-time equivalent)
Standard errors are in parenthesis. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Estimates for constant terms not shown.

Table 3: Impact of productivity growth on nominal gross value added growth

	dlog(ngva)	
	Coefficient	No. of obs.
dlog(prod)		
All 42 industries		
cross section	0.091 (0.144)	42
4 sub-periods	0.356*** (0.074)	136
annual data	0.469*** (0.038)	480
24 well-measured industries		
4 sub-periods	0.368*** (0.101)	75
annual data	0.509*** (0.046)	258
14 industry groups		
annual data	0.742*** (0.049)	224
Summary statistics		
weighted	0.496	
unweighted	0.423	

ngva = nominal industry gross value added,
prod = industry productivity level (gross value added per full-time equivalent)
Standard errors are in parenthesis. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Estimates for constant terms not shown.

Table 4: Impact of productivity growth on full-time equivalents growth

	dlog(fte)	
	Coefficient	No. of obs.
dlog(prod)		
All 42 industries		
cross section	–0.422*** (0.145)	42
4 sub-periods	–0.511*** (0.065)	136
annual data	–0.310*** (0.028)	480
24 well-measured industries		
4 sub-periods	–0.562*** (0.092)	75
annual data	–0.364*** (0.040)	258
14 industry groups		
annual data	–0.204*** (0.034)	224
Summary statistics		
weighted	–0.344	
unweighted	–0.396	

fte = number of full-time equivalents,
prod = industry productivity level (gross value added per full-time equivalent)
Standard errors are in parenthesis. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Estimates for constant terms not shown.

Table 5: Impact of productivity growth on wage growth

	dlog(w)	
	Coefficient	No. of obs.
dlog(prod)		
All 42 industries		
cross section	0.033* (0.016)	41
4 sub-periods	0.016** (0.008)	132
annual data	0.001 (0.006)	446
24 well-measured industries		
4 sub-periods	0.022** (0.010)	71
annual data	–0.001 (0.007)	238
14 industry groups		
annual data	0.021*** (0.007)	182
Summary statistics		
weighted	0.008	
unweighted	0.015	

w = nominal wage index,
prod = industry productivity level (gross value added per full-time equivalent)
Standard errors are in parenthesis. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Estimates for constant terms not shown.

Table 6: Average Swiss fixed-weight real GDP growth with different base years

Base year	Average GDP growth rate (1990-2007)
2007	1.62%
2006	1.58%
2005	1.55%
2004	1.56%
2003	1.55%
2002	1.51%
2001	1.49%
2000	1.55%
1999	1.52%
1998	1.53%
1997	1.50%
1996	1.43%
1995	1.35%
1994	1.36%
1993	1.37%
1992	1.29%
1991	1.25%
1990	1.22%

Figure 1: Average annual growth of labour productivity in Swiss major industry groups, 1991-2007 (in %)

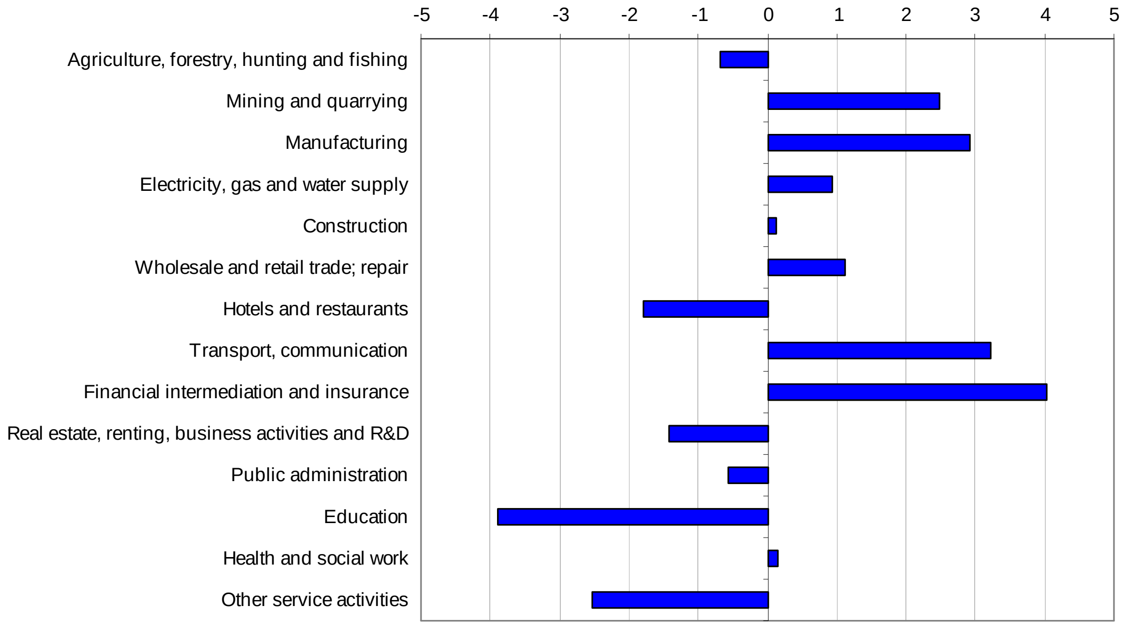

Table 7: Some key figures for five Swiss industries

	Manufacturing	**Communication**	**Financial intermediation**	**Insurance**	**Health and social work**
'Real share'	18.8% (1990) 20.1% (2007)	1.4% (1997) 3.2% (2007)	5.8% (1990) 9.5% (2007)	1.7% (1990) 3.1% (2007)	5.3% (1990) 6.3% (2007)
Productivity	+2.9% p.a.	+11.2% p.a.	+3.8% p.a.	+ 4.6% p.a.	+0.1% p.a.
Prices	+0.5% p.a.	–5.3% p.a.	+3.5% p.a.	–0.9% p.a.	+1.5% p.a.
Nominal share	21.2% (1990) 20.0% (2007)	2.2% (1990) 2.7% (2007)	3.8% (1990) 9.2% (2007)	3.5% (1990) 4.5% (2007)	4.9% (1990) 6.1% (2007)