ECONOMIC IMPACT OF THE AUSTRIAN SOFTWARE INDUSTRY 2003

MANAGEMENT SUMMARY

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Version 2.31 / 21. Oktober 2003

1 Study Key Facts

This independent scientific study has been performed by Gottfried Haber and Michael Getzner, both Economics Department, University of Klagenfurt, Austria, and aims at estimating key data of the Austrian software sector and the macroeconomic effects originating from this industry.

2 Overview: Software Industry in Austria

The Austrian **software industry** (software developers and IT services providers) employs approximately **32,000 employees** (corresponding to 20,500 full time equivalents). **4,800 software developing enterprises** and **2,800 IT services providers** as well as other enterprises comprised by the term "software industry" produce an annual **net turnover** of approximately **EUR 5.5 bn**; the **packaged software industry** has a size of about **EUR 1.5 bn**.

Table 1: Austrian Software Sector Key Data (Aggregate)

Employees (persons)	32,000 persons
Employees (full time equivalents)	20,500 FTA
Total number of firms	8,000
→ included firms involved in software development	4,800 enterprises
→ included firms involved in IT services	2,800 enterprises
Net turnover	5.5 bn EUR
→ included packaged software	1.5 bn EUR
→ included IT services	3.4 bn EUR
→ included other software and services	0.6 bn EUR

Source: own research and calculations.

3 Differences in the Economic Impact of Different Types of Software

The term "software" includes different types of goods and services, which produce different macroeconomic effects (related to both directions of the production process – "upstream" and "downstream" effects).Thus, different multipliers on the aggregate economic level can be observed. The following categories of software are most relevant for the present discussion about software markets (but they are of course not mutually exclusive):

Packaged software (standard software): is usually closed source (the source code is not disclosed) and proprietary. Due to a high degree of standardization, packaged software exhibits low marginal cost of production and can (technically) easily be copied. Thus, large network effects can be observed, i.e. a higher number of users of the same piece of software increases the utility of the other present users. Moreover, economies of scale (increasing returns to scale, decreasing average cost of production) are important for this type of software. Widely used packaged software leads to implicit standards and creates high efficiency concerning the reuse of

knowledge and the qualification of employees. Packaged software exhibits characteristics related to those of physical goods, if copyright issues apply. As with other types of software, there is a possibility of market failure (supply of software might be insufficient), if there is no government intervention to protect intellectual property by providing for temporary limited monopolies. Thus, most western countries (including Austria) implemented legislation to protect intellectual property in order to support innovation in industries with high development expenses and rather low barriers to imitation of the final product (cf. pharmaceuticals, content industry [music], etc.).

Open source software: is provided for free in most cases and is subject to several different licensing models (GPL, BSD, LGPL, MPL, etc.), some of which prohibit commercial use while others do not. Generally, OSS is individual or highly customized software leading to characteristics of a service rather that those of a physical good. Usually, (customized or specific) OSS can not easily be used for different applications or has to be further customized to fit different needs, on the other hand constant elements need not be developed time and again but are available to the "community" as some kind of common knowledge. OSS is often applied to non-standard business processes, sometimes also for serving internet content (web servers). Depending on the specific OSS licence, different types of market failure may be observed: (a) lack of supply of high quality OSS for certain fields of application (GUI, end user tools) might arise, if licences are very strict (e.g. GPL) and prohibit commercial use; (b) excess supply of OSS could also be possible for certain market segments, because OSS related developers may take advantage of a free pool of code, for which the original developer did not receive an appropriate (financial) benefit, thus part of the development expenses can be "outsourced" producing distorting economic external effects. In several cases, even for OSS economic mechanisms come into effect, when OSS related firms sell (vertically) related goods and services (hardware, support, training, consulting, system integration, etc.).

On the aggregate level, observable macroeconomic effects originating from OSS are (apart from technical and quality issues, which are not treated in this analysis) generally lower than those related to packaged software. Main reasons are: (a) some part of OSS is developed for free, thus no economic transaction for this piece of software takes place (very similar to unpaid housework) and the economy is not stimulated by the demand for intermediary inputs or an increase in purchasing power; (b) customized software exhibits lower network effects than highly standardized packaged software; (c) customized software based upon OSS produces less demand for the intermediary outputs of other firms (but shows a higher demand for labour) than individual software based upon proprietary software.

4 Implications on Production and the Labour Market

A survey conducted among 550 experts of leading Austrian software and IT firms was used to cross-check the mapping of different types of software to different categories in official Austrian economic data. An input-output model of the Austrian

economy and an econometrically estimated model were used to calculate the economic effects of the software sector on the macroeconomic level. Due to the heterogeneity of the software market, the following figures are related either to the whole software industry or to the sub-segment "packaged software". Economic effects of OSS have to be considered being generally lower than the aggregate figures, due to the reasons outlined above.

The Austrian software industry has expenses of approximately **EUR 44,000** per employee per year (which is the **second rank** behind the R&D sector within all services related industries). **90 percent** of the **output** are sold to **other firms**, **9 percent to the public sector**, and **1 percent to private households** (which is also related to the high piracy rates). Between 1976 and 2000, the share of net value added in the software industry compared to GDP has been rising by about 1500 percent. The software sector accounts for about **4 percent** in the price index **of corporate investment** (with an increasing share over time).

Direct employment in the Austrian software sector is approximately **20.500 persons** (measured as full-time equivalents [FTA] – real employment measured as actual jobs is due to some part-time employees by **57 percent higher**). Industries, which act as suppliers, are stimulated by the software sector and produce **another 14.300 FTA** of employment ("indirect effects"). Direct and indirect effects lead to increased purchasing power on the aggregate level, which in turn stimulates all other industries as well ("secondary effects"), resulting in additional **29,900 FTAs**. This **sums up to 64.700 full-time equivalents** or **101.500 actual jobs**.

The figures for the packaged software market segment are: **Direct employment** of **6,100 FTAs**, **indirect employment** (effects related to the supply chain) of **4,500**, and **secondary employment** (effects caused by purchasing power increases) of **7,000 add up to 17,600 full-time equivalents** in the whole economy (corresponding to **27,600 actually employed persons**).

Remark: These figures only include the production effects of software, „application effects" (the use of software in other companies) is not included. Figures including these aspects are stated below).

The share of **licence expenses** as a proportion of total IT expanditure (TCO – total cost of ownership) of average Austrian companies (in the whole economy) is around **4 to 5 percent**, **HR expenditure** amounts to **60 to 65 percent**, expenditure caused by **technical difficulties** is about **20 to 25 percent**. **Hardware** expenditure is about **5 percent**, **training expenditure** also approximately amounts to **5 percent**. Thus, there is no evidence that the Austrian figures might significantly deviate from the European average.

Training of IT personnel approximately amounts to a one month's salary. Concerning labour market policies, the quickly changing knowledge and qualification profiles for highly-skilled IT employees suggest an improvement at the level of basic IT knowledge as an objective, which is empirically identified as producing benefits for most employees and currently unemployed. On the other hand, highly specific IT training for IT professionals should be done by the employers. Due to the low market penetration of OSS in client applications and typical office applications, there is no

need for the labour market agency (Arbeitsmarktservice - AMS) to specifically promote OSS tools in their training activities.

Widely used (software) technologies (as is the case with some packaged software products) have to be regarded as some kind of intellectual **capital stock** in the economy consisting **of knowledge and skills** of the employees. Sudden forced interventions of the public sector (as publicly discussed with respect to OSS) would prove to be counterproductive and would either lead to (a) a mismatch on the labour market (if supplied skills cannot be absorbed by actual market demand) or (b) in the case of a "successful" intervention this would invalidate present skills of present employees and thus put heavy stress on the labour market for middle-aged and older employees. These severe "de-qualification" effects (along with the reduction of positive network effects) have to be taken into account when analysing the possible benefits of a "diversity" of software solutions for common tasks with respect to the labour market.

5 Multipliers

With respect to the current level of activity of the software industry in Austria, average **production multipliers** for **packaged software** are **1:4.5 for employment** (effect of 1 new job in the software industry for all other industries due to indirect and secondary effects) and **1:3.2 for value added** (effect of 1 additional EUR of value added in the software industry for the value added produced in all other sectors in the economy). For **"non-packaged" software**, the multipliers are **1:5.1 for employment** and **1:2.2 for value added**, respectively. These effects only originate from the economic activity of the software industry. If application effects are taken into account, substantial additional multipliers can be observed, which depend on the degree of standardisation and market penetration of the product (higher degrees of standardisation and higher market penetration lead to higher multipliers). For **standard software**, the **application multipliers** amount to **up to 1:35 for employment** and **1:8 for value added**; for **individual or highly customized software** the upper values for the multipliers are **1:3 for employment** and **1:2 for value added**.

If all effects are considered (production effects and application effects due to productivity and growth effects) the **packed software industry** with a **size of about 0.37 percent of GDP** is **directly and indirectly related with 4.2 percent of total Austrian GDP**. Thus, the **implicit total multiplier for packaged software is 1:11** for value added. (No exact figures can be given for "non-packaged" software as this market segment is too heterogeneous, but the total implicit multiplier would be much lower).

6 Conclusions for Austrian Economic Policy

The results found in this analysis show that the software market is generally subject to specific economic characteristics, which are generally regarded as „**market**

failure". The fact that software can **easily be reproduced** ("copied") and the presence of **positive network externalities** (benefits for users due to the fact that other users use the same software) all together with high development expenses are main reasons. In the field of "proprietary" software, the public sector reduces that type of market failure by granting rights protecting intellectual property (copyright) and thus providing for the fact that people can be excluded from the use of software if they do not pay for it (which is the default case for "regular" goods and services). By definition, OSS does not take advantage of this benefit. To decide upon a recommendation on the policy towards OSS and proprietary software, two alternative scenarios have to be taken into account:

(a) If OSS is technically (by the development model) and economically (in terms of the business model) better than non-OSS, no active support of the public sector is necessary, because the better technology would win the market without any intervention. (b) If there is a lack of supply of OSS-based software due to market failure, economic theory suggest solving that issue by government intervention, which in turn would be the benefit of the protection of intellectual property and would transform OSS into proprietary software, thus removing the point for government intervention! Any other forms of transfer payments to the suppliers would not make any economic sense, as positive network externalities are even bigger for technologies with a high level of market penetration (currently non-OSS software in most cases).

Further government intervention in favour of one or the other software paradigm (or sometimes even "religion") is not either necessary or even reasonable and would lead to less market efficiency. For investment decisions of the public sector, the standard cost/benefit aspects and technical aspects should be the reasons to choose a specific software solution, just as this is the case for private companies. Distortions of competition (due to explicit "ideological" preferences) would hamper market forces and would probably not be very effective, especially in the case of OSS: (a) if OSS is completely non-commercial, economic incentives would not make much sense due to the lack of economic motivation of the developers and (b) if OSS is commercial (due to vertical integration or "liberal" licences), there is no theoretical justification for a support of this business model and the government intervention would result in excess supply of OSS.

On the other hand, the importance of **open standards** and **open interfaces** should be stressed in order to enable the market forces to "regulate" the market by competition (the "invisible hand" in the terminology of economics).

7 Contact

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