2. The data

In order to study business cycles on a sectoral basis, only national accounts data broken down by sectors are used here. This is not at odds with the definition of Burns – Mitchel (1946) requiring the use of several time series of different origin for business cycle analysis. According to Harding – Pagan (2002), this requirement by Burns – Mitchel (1946) was due to a historical lack of economic data at frequency lower than a year, rather than a methodological condition.

The following quarterly time series are considered:

- Real GDP as the most comprehensive measure of production. This aggregate has been used in many studies on business cycles.

- Real gross value added (GVA) which is defined as GDP minus taxes on production (like VAT and excise duties) plus subsidies on production (mainly granted for agricultural production). This aggregate should exhibit stronger cyclical variations than GDP as production taxes and subsidies are empirically not necessarily related to production.

- Real gross value added excluding agriculture and forestry (GVAex for short) should show cyclical variations even more clearly than real gross value added and GDP. This is because agriculture and forestry are less driven by business cycle de-

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13 In this study, the word "real" refers to chained values with the year 2000 as the reference year.

14 For time series of older vintage, GVA does not include indirectly measured financial intermediation services (FISIM), which is discussed below.

15 This does not mean that they develop smoothly. But even if their intra-annual variability is higher than that of GDP, it is to be expected that this lies in part outside the business cycle frequency spectrum.
velopments than by weather conditions. Boehm (1998) provides clear empirical evidence for the better suitability of production series adjusted for this primary sector component.

- Real value added of manufacturing at market prices in a wider sense. This includes NACE\textsuperscript{16} C (mining and quarrying), NACE D (manufacturing) and NACE E (electricity, gas and water supply). As all these industries include goods producing activities, this is presumably the aggregate showing the largest cyclical variations. For Austria, separate data were available for all three components.

- Real value added at market prices for construction (NACE F).

- The sum of real value added at market prices of wholesale and retail trade (NACE G), hotels and restaurants (NACE H) and transport and communication (NACE I). Despite the relative heterogeneity of these branches, their total is used, as quarterly data are only available at this level of aggregation.

- The sum of real value added at market prices of financial intermediation services (NACE J) and real estate, renting and business activities (NACE K). Again, only their total is available. This aggregate is selected mainly because NACE K contains the production of business-related services, which is supposed to have risen in cyclical variation, recently. This assumption is based on the fact, that industry has outsourced a large number of services in the last decade and increasingly responds to cyclical bottlenecks in productive capacity by resorting to personnel service agencies instead of recruiting own staff. Consequently, it is to be expected that, while industrial output still shows substantial business cycle variations, value added

\textsuperscript{16} NACE (Nomenclature d'Activités des Communautés Européennes) is the harmonised framework for classifying branches contributing to GDP in EU member states.
should develop somewhat more smoothly and volatility rising in NACE K, instead.

All other economic activities like public administration, social services (containing education and health services) and other community, social and personal services (including culture, sports, etc.) are not considered separately as the production of these services is not assumed to be subject to business cycle variations. Nevertheless, such production is included in GVA and GDP figures.

According to the general view, the typical business cycle lasts from around 2 to 8 years\textsuperscript{17}. This calls for the use of economic time series covering some multiples of that time span in order to isolate cyclical frequencies and to identify a representative number of turning points for analytical purposes. Moreover, these series should be consistent so as to measure output over a long period in a similar way. Unfortunately, there have been several events which complicated the search for long and consistent time series, especially for euro area aggregates.

The process of European integration – moving towards a common economic policy in the Union – required a harmonisation of the national accounts framework. Member States have been obliged to compile their GDP data according to the ESA95 regulation. Several further regulations have been passed, focussing particularly on national accounts aggregates. This was necessary because gross national income constitutes the tax base of Member States’ contributions to the Union budget. Furthermore, certain development programmes are related to the income of regions or countries and the Stability and Growth Pact is explicitly linked to the development of real GDP.

\textsuperscript{17} Burns – Mitchell (1946) defined it as phases between 6 and 32 quarters, Harding – Pagan (2002) between 5 and 32 quarters and there are several studies which take a time span between 8 and 32 quarters as a reference.
The ESA95 itself – being the European version of the United Nations SNA93 – marks a massive change in the interpretation of what has to be recorded as output. Most prominently, computer software was included into output, whereas it was not covered by the definition of production before.

More generally, national accounting is still far from being a static framework of recording production. Recently, all EU Member States had to change over from a fixed base year for price adjustment in national accounts to one of taking the previous year as the base. The re-allocation of indirectly measured financial services (FISIM) was a further big change. These services, provided mainly by banks, are implicitly paid for by the difference in interest rates between loans and deposits. Until recently, they were by convention treated entirely as intermediate consumption by enterprises and therefore not included in GDP. Nowadays, FISIM have to be split up into components of private, government and intermediate consumption, exports and imports.

Revisions – introducing all the statistical innovations referred to – undermined a backward calculation of national accounts data far enough for business cycle analysis. In order to generate longer time series, data sets had to be chained backward.

For Germany, consistent seasonally adjusted national accounts time series on a quarterly, as well as on a yearly basis, only go back until 1991. In order to restore data for the period before reunification, seasonally unadjusted data covering only West-Germany but describing a similar sectoral disaggregation have been used for chaining. Thereby, it is implicitly assumed, that the

18 The result is a host of time series of two years' length. In order to construct longer time series, growth rates are calculated and chained up using a specific period as reference in order to get long time series in absolute values. Therefore, this method is called "chaining" or "chain-linking".

19 These data have been downloaded form the Federal German Statistical Office website, see www.destatis.de.
cyclical variations for West Germany before 1991 exhibit the same turning points as for the new re-united German economy. Whereas this assumption seems warranted for the turning points, it is probably less so for the amplitudes of these variations. Since planned economies, like the former East Germany, are expected to show smaller cyclical variations, the coefficient of variation for the sum of both areas should be lower than the one produced by chaining. This has to be borne in mind for an appropriate interpretation of business cycle variations. Nevertheless, data have been chained backward as has been done by Fagan – Henry – Mestre (2001) for the whole euro area, after a seasonal adjustment procedure.

Due to the German reunification, data for the whole euro area also dated back only until 1991. Unlike for Germany, no data – neither annual nor quarterly – were available on a sectoral basis for the euro area. Only a seasonally-adjusted series for total GDP, made available by the Euro Area Business Cycle Network (EABCN) and reaching from the beginning of 1970 till the fourth quarter of 2003, entered the data set. Using the latest euro area GDP data, this series has been extended until the second quarter of 2005.

For Austria three data sets have been used to construct quarterly sectoral time series reaching back to the beginning of 1976. The first are annual national accounts data starting 1976, the second quarterly national accounts series reaching back to the first quarter of 1988 which are consistent with the respective annual figures. For chaining back quarterly figures before 1988, national accounts data of an earlier vintage – showing a similar sectoral definition – have been used as a third data set. In order to retain business cycle variations of the annual time series, the process of chaining quarters took account of these annual totals. The method applied

is based on the Chow-Lin approach\textsuperscript{21}, where the earlier quarters were taken as an indicator for distributing annual totals. With this method, sectoral quarterly time series summing up to annual totals have been produced.

The restriction to only sectoral national accounts data does not provide insight into the sources of the business cycle phenomenon, which lies outside this study. Instead, the focus is on transmission mechanisms between sectors i.e. their lead and lag structure, their cyclical variation and their dependence on euro area and German aggregates. Shocks which can potentially explain business cycle variations (like changes in oil prices or exchange rates) are not considered as they are assumed to hit all observed regions or their effect will be transmitted by the cyclical variation from one region to the other over time\textsuperscript{22}.

\textsuperscript{21} See Chow – Lin (1971).

\textsuperscript{22} Artis – Zhang (1999) found empirical evidence that there is a connection between exchange rates and the transmission of business cycles across national frontiers.