# Constructing Historical Euro Area Data*

Heather Anderson*, Mardi Dungey+, Denise Osborn#
and Farshid Vahid*

* Australian National University and CAMA
+CERF, University of Cambridge and CAMA
#University of Manchester and CAMA

April 2006

**Abstract**

The conduct of time series analysis on the Euro Area currently presents problems in terms of availability of sufficiently long data sets. The ECB has provided a dataset of quarterly data from 1970 covering many data series in its Area Wide Model (AWM), but not for a number of important financial market series. This paper discusses methods for producing such backdata and in the resulting difficulties in selecting aggregation methods. Simple applicaiton of the AWM weights results in orders of magnitude difference in financial series. The use of different aggregation methods across series induces relationships. The effects of different possible methods of constructing data are shown through estimation of simple Taylor rules, which result in different weights on output gaps and inflation deviation for what are purportedly the same data.

**Keywords:** Euro area, data aggregation, Taylor rule
**JEL classification:** C82, C43, E58

---

*Author contact details: Anderson: heather.anderson@anu.edu.au; Dungey: m.dungey@cerf.cam.ac.uk; Osborn: denise.osborn@manchester.ac.uk; Vahid: farshid.vahid@anu.edu.au. This research is supported by ARC Linkage Grant LX0561266.

# 1 Introduction

Time series analysis of macroeconomic behaviour for the Euro Area requires some serious attention to historical data. The common Euro currency has existed only since the beginning of 1999, but the period since then clearly does not provide sufficient observations to enable most types of macroeconomic analyses to be undertaken for the Euro Area. Such analyses are obviously required for the conduct of monetary policy by the European Central Bank (ECB), and a number of studies have estimated Euro Area monetary policy reaction functions over historical periods, see Sauer and Sturm (2006) inter alia. Further, there is evidence that the formation of the Euro Area has affected international financial relationships, for example Ehrmann and Fratzcher (2005) and Kim, Moshirian, and Wu (2005), and an appropriate analysis of these changes requires appropriate historical measures of Euro Area series.

The issue of construction of appropriate data for the Euro Area is a deep one, involving the history of European monetary integration. Although there is no clear date that unambiguously marks the beginning of monetary integration for Europe, the establishment of the European Economic Community in 1958 brought the European Monetary Agreement into force, this was a "code of conduct" that included maintenance of exchange rates and limited fluctuations in rates to a specified band against the US dollar (Ungerer, 1997, pp.29-30). Other milestones on the route to the Euro were the beginning of operation of the European Monetary System (EMS) in March 1979, the beginning of stage one of the European Monetary Union in 1990, the signing of the Treaty on European Union (the "Maastricht Treaty") in 1992 and the 1998 events of eleven countries[1] meeting the conditions for admission to the Euro Area and the establishment of the ECB (Scheller, 2004).

[1] These excluded Greece, which became the twelth member of the Euro Area in January 2001.

The route to monetary integration was, however, not always smooth, with the EMS crises of 1992 and 1993 marking a period of considerable uncertainty about the prospects for continued movement towards monetary integration (Ungerer, 1997, pp.260-271). Further, the countries participating in the European Exchange Rate Mechanism (ERM) changed over time. For example, Spain joined the ERM in 1989, while Austria did not become a member until 1995 despite the fact that it had pegged its currency to the Deutschmark from the 1970s. Further, the UK (a Euro Area non-member) joined the ERM in 1990 but withdrew during the September 1992 EMS crisis, while Italy also withdrew from the ERM during this crisis and rejoined only in 1996 (see Ungerer, 1997, pp.301-306). Therefore, although the adoption of the Euro currency can be seen as the culmination of monetary integration in Europe, the transition was long and, indeed, sometimes rocky.

In recent years a literature has emerged tackling aggregate European economic behaviour using sample periods from 1970 onwards. However, an important question prior to analysis is how to construct, from national aggregates, appropriate economic series representing the Euro Area. The most common approach is simply to aggregate across the twelve countries that currently constitute the Euro Area. However, as discussed in more detail in the next section, this assumes an economic homogeneity across these countries that did not exist over this historical period. Further, it does not reflect the ERM crises and the changing monetary policies of countries that are now members of the Euro Area. In this paper, we discuss approaches adopted to date for aggretation to the Euro Area and propose an alternative method. We then illustrate the importance of the aggregation method in the context of an analysis of Euro Area monetary policy based on the so-called Taylor rule (Taylor 1993, 1999).

Construction of historical data is, by its nature, a backward-looking exercise. Nevertheless, historical data plays a crucial role in the development and analysis of economic policy, so that its construction is also important for future economic progress, see for example the discussion of data formation in ECB (2001: p.35). For the Euro Area this point is particularly pertinent at the present time. The ten new members who joined the European Union in 2004 (the so-called "accession countries") are committed to joining the Euro Area when they meet the converence requirements imposed on the original member countries. Therefore, the question of how to construct appropriate data for an expanded Euro Area will arise again as and when these countries meet the criteria.

This paper proceeds as follows. Section 2 discusses the current means by which data have been constructed for use in Euro area research. Section 3 proposes some alternative methods, based around convergence towards the weights of the ECB's Area Wide Model. These methods are applied to exchange rates, interest rates, equity indices and inflation. In Section 4 the consequences of using the alternative data combinations are explored in estimation of a simple Taylor rule. Section 5 concludes.

# 2 Current Methods for Constructing Euro Area Data

The basic methodology used to create a Euro Area series is to take a weighted average of national data. A specific method can, therefore, be regarded as a particular choice of weights, where the weights are a function of the underlying national price levels, volume and exchange rates.

In this section we first outline the current methodologies for constructing Euro Area data and then discuss comparisons of these data. Finally, we consider appropriate uses of Euro Area data.

## 2.1 Methodologies

There are five main existing methodologies for constructing Euro Area data used in recent literature, which are outlined below.

*The Area Wide Model Database (AWM)*

The ECB has provided one solution to the data problem in the provision of its historical Area Wide Model (AWM) database, detailed in Fagan, Henry and Mestre (2005). This database provides quarterly measures relating to the Euro Area for most real economic variables, backdated to 1970. The methodology adopted is to use a constant set of weights for each of the twelve current member countries of the Euro Area, with a weighted aggregate formed by applying these weights to the national (log) levels data for each variable. In all cases but inflation the aggregation weights are based on 2001 real GDP weights adjusted for purchasing power parity (PPP), that is the weighting system depends on constant real exchange rate weights. In the case of inflation the Harmonised Index of Consumer Prices (HICP) has its own set of annually time-varying weights which are drawn from "household final monetary consumption expenditure" in each country (European Commission, 2004). By aggregating using constant weights (except for HICP), the AWM method preserves the growth rates of overall variables.

The AWM database is becoming the benchmark Euro Area data used for academic and central bank based research. As its name implies, this is the source of data for the area-wide model (Fagan et al., 2005) used for forecasting and policy analysis within the ECB (Dieppe, 2005). The database is also used in a number of money demand and inflation studies (including Gerlach and Svensson, 2003, Coenen and Vega, 2001, Jansen 2004), to calibrate a New Keynesian model of the Euro area (Casares, 2006) and in recent DSGE models of the Euro area (Smets and Wouters, 2003, 2005) and of Germany embedded in the Euro area (Pytlarczyk, 2005). Additionally, Garnier and Wilmhelmsen (2005) use the AWM database to consider the natural real interest rate and output gap, it plays some role in the construction of leading indicators for Europe in Banerjee, Marcellino and Masten (2005) and it provides the indicator of European activity in Giannone and Riechlin (2004).[2]

[2] As one would expect the AWM approach and database are used in a number of ECB

The AWM database has now aquired a benchmark status, but this may be problematic for some policy analyses, as discussed below.

*Eurostat Data*

Eurostat compiles data on many Euro Area aggregates. These data are constructed by transforming the national aggregates into the common currency of either the Euro, or prior to that the ECU, and aggregating in the common currency. This has the advantage of retaining the integrity of the national accounts, which the AWM method does not, although clearly exchange rate fluctuations play a role. The Eurostat database is available only from the 1990s, although some studies have applied the same methodology to national datasets to extend the data back into the 1980s. The Eurostat data has been used in the macro model of the Euro economy produced by French researchers documented in Beffy et al (2003) and in a study of core inflation for the Euro Area by Hahn (2001) who backcast the data using OECD growth rates as a guide.

*Beyer, Doornik and Hendry*

Beyer, Doornik and Hendry (2001) aggregate variables in growth rates to avoid problems associated with exchange rate fluctuations which arise in levels aggregation, such as the Eurostat data in nominal exchange rates or the AWM data with real exchange rates. Additionally they implement a time varying weight methodology in order to ensure consistency between movements in components of the area wide aggregate and the behaviour of the aggregate - for example so that "the aggregate of the deflators corresponds to the deflator of the aggregates" to paraphrase Beyer et al (2001, p.F103). The time varying weights in their construction of GDP (M3) are given by the share of GDP (M3) in the previous period valued in current ECU. Although this approach is applied in a study of money demand in Artis and Beyer (2004), it does not appear to have been widely adopted.

---

working papers such as Fabiani and Morgan (2003), Gerlach-Kristen (2003) and those based on the Smets and Wouters (2005,2003) model.

*OECD Data*

The OECD data for the Euro Area is compiled using fixed GDP weights PPP adjusted, but this set of weights differs from those used in AWM. The OECD data are available from 1970. This data has not received extensive use in the literature, probably because the methodology is similar to that of the AWM but the data coverage is less extensive, for example see Gerlach and Schnabel (2000).

*German data*

Some researchers have suggested that the use of synthetic European data prior to the common currency is inappropriate because that data process is not representative of any sort of meaningful economic process. Instead they suggest that Germany was the economy most representative of Europe. Additionally, Germany had the least adjustment to the convergence criteria of the Maastricht Treaty so that its data process is undistorted by policies designed to result in meeting those conditions - a similar argument to the policy of continuity described in Corsetti and Pesenti (1999).

Bruggeman and Lutkepohl (2004) argue that the move to the Euro can be treated analogously to the reunification of West and East Germany, by treating it as a structural break appropriately represented by a dummy variable. They use this approach to splice German and European data employed in a small VAR model of M3, GDP and the long term interest rate, finding little evidence of changes in parameters or impulse responses. However, they admit the longer German period (from 1975 to 1998) may dominate the European data period (1999 to 2002). Similarly, in Bruggeman and Lutkepohl (2005), they apply this approach to tests of uncovered interest parity and the rational expectations hypothesis in Europe and find support for these hypotheses in contrast to studies with other European data sources. One aspect of particular note is the authors' focus on consistency of treatment across the different aggregations represented by German unification and European monetary union. In the same vein but with a different outcome, Pytlarcyzk

(2005) generates consistency of methodology across these breaks by applying the AWM methodology to generate pre-unification German data.

A further study using the concatenation of German and European interest rates by Ehrmann and Fratzcher (2005) finds a significant break in the relationship between European and US financial markets with the advent of the EMU. However, serious doubts about the strength and validity of this result must be raised by the coincidence of the event with the change in the data series used to test for the significance of the said event.

*Other Methods*

It is unusual to use different types of aggregation for different series within the same study, but Artis and Beyer (2004) argue that the assumption of optimisating agents renders aggregated interest rates as problematic. Consequently they adopt German interest rates as "the rate offering the maximal safe return adjusted for risk", in conjunction with aggregated Euro Area series for GDP, M3 and inflation. Similarly, in their monetary policy study for the EMU area, Gerlach and Smets (1999) use aggregated series for the output gap and inflation, in conjunction to German overnight interest rates, justifying the latter as representing the policy stance. A number of authors have also used averaging of constituent country series to provide backdata, for example, interest rates in Ullrich (2003), and either a weighted or unweighted set of interest rates in Gerlach and Schnabel (2000), which is not totally clear from the text.

## 2.2 Dataset Comparisons

As illustrated by Hong and Beilby-Orrin (1999), different weighting assumptions result in different relationships between variables. In particular, not only are the different aggregations not perfectly correlated, but it is possible for different weighting structures to induce a positive move in one aggregated total compared with a negative move in an alternate, despite both being based on the same underlying national data.

There are, howeber, only a small number of studies that provide some sensitivity analysis to the use of alternative historical data series prior to the Euro. Hong and Beilby-Orrin (1999) consider four potential methods of constructing Euro Area data, with this contribution obviously made at a relatively early stage of discussion of these issues. They present a range of descriptive statistics for series generated by the alternative methods and discuss the importance of the relatively substantial differences between them. Moneta (2005) constructs the Euro area yield curve from national data, which is then compared to data compiled with the AWM method, showing remarkably small differences. Likewise only small differences in the dating of business cycles are noted when using the AWM data compared with the Eurostat data in Artis, Marcellino and Proietti (2002). However, the graphical comparison made by Beyer et al (2001) indicates some substantial differences between nominal and real GDP and M3 series generated using their aggregation methodology compared with the corresponding aggregates constructed by the OECD and the ECB.

The most substantial study of the impact of the aggregation method is that of Bruggeman, Donati and Warne (2002) in the context of money demand in the Euro Area. They use a VECM with six variables and consider particularly the elasticities of money demand with respect to output and the short term interest rate. Two datasets are used. The first is constructed by converting national data to Euros at the irrevocable exchange rates (which are the fixed conversion rates of 31 December 1998) and then aggregating, which is similar to the Eurostat approach. The second is the AWM database. While the figures provided do not indicate substantive differences between the values of the individual series, with the greatest divergence early in their sample period, namely between 1980 and 1983, the results are informative concerning the sensitivity of the outcomes to the particular dataset used. The frist dataset implies two cointegrating vectors and a relatively well behaved model with parameter constancy for the elasticities of interest. The VECM for the AWM dataset however, has up to three cointegrating vectors, with the third being somewhat difficult to interpret, has instances of explosive eigenvalues and is not entirely satisfactory. These results point strongly to the conclusion of Hong and Beilby-Orrin (1999) that researchers looking to European data need to consider what data suits their purpose. No one data set is likely to satisfy all research needs.

## 2.3 Appropriate Uses of Euro Area Data

The task to which the data set is to be put is of critical importance in determining an appropriate method of data construction for the historical period before the introduction of the Euro. Thus, the studies of Gerlach and Smets (1999) and Artis and Beyer (2004), which both opt for German interest rates to represent the financial sector, rationalize their use of "mixed" data. Eickmeier (2005) uses the AWM aggregates as possible explanators for Euro wide factors extracted from national level economic data using dynamic factor models, although these aggregates do not turn out to be particularly successful as explanatory variables. Many studies consider the stability of money demand over an extended period for Europe, reflecting the second tier of the ECB pillars on monetary stability. In considering the effectiveness of money supply as a leading indicator of inflation, Altimari (2001) combines Eurostat data to backcast the HICP and interest rates combined with fixed GDP based weights with AWM data for other economic variables.

Both the structure of the model under consideration and the use to which it will be put are important determinants of the appropriate dataset. For example Fagan and Morgan (2005, p.13) note that it is inappropriate for individual euro member country models to include a monetary policy rule based on national aggregates, as monetary policy is no longer set in that manner. What is not pointed out, however, is the intrinsic difficulty that arises from the change in the nature of policy-making in Euro member countries over the last 30 years. Although the ECB sets monetary policy *now* on the basis of Euro area aggregates, this was not the case prior to the advent of the euro. Thus, the counter argument is that it is questionable how Euro Area aggregates, such as those of the AWM database or constructed by Eurostat, can reflect reality when they are applied in a context which implicitly assumes an area wide monetary policy rule when this in no way reflects the reality of economic policy in earlier periods.

Not only was the monetary policy followed by the Bundesbank during the 1970s and 1980s very different from that of other current Euro Area countries, but a number of these countries were not even members of the then operative exchange rate systems. For example, Spain was not a member of either the European Monetary System (or the earlier "snake") until it became a member of the European Community in January 1986. Further, although Italy was a member of the EMS, the lira was revalued nine times between the start of EMS in March 1979 and early 1990, representing a cumulative devaluation of 64% (Gros and Thygesen, 1998, p.69). Indeed, Italy retained a policy of wage indexation until the mid-1980s (Gros and Thygesen, 1998, p.266). Therefore, the estimation of monetary policy relationships for the Euro Area using historical data that gives substantial weight to countries such as Spain and Italy, which had very different policies compared with Germany and France, is very likely to distort the results. Policy relationships can only be meaningfully estimated using data that reflect the policy decisions being taken "in real time", and the aggregation of the (historically heterogenous) Euroland countries does not provide such a coherent dataset for the past.

Nevertheless, although national policies were initially the clear determinants of monetary policy outcomes in the 1970s, the later period has seen constrained arrangements in the transition to the Euro. These constraints were most notable in the need to meet the criteria for Euro membership, but they also existed in various guises (primarily through the limited fluctuations allowed in exchange rates) during earlier phases of European monetary integration. This implies that the advent of the Euro Area should not be represented as an abrupt structural break, as in Bruggeman and Lutkepohl (2004, 2005), but rather there was a form of evolution towards this state. Indeed, a similar argument applies to the accession countries, many of which have displayed radical changes to their economic systems in their transition to membership of the European Union and continue to evidence change in moving towards Euro Area membership.

In the end the researcher needs to consider the end use of the data very carefully before selecting a data series, and the adoption of the AWM data as a 'benchmark', as suggested in a number of recent papers, is not a good precedent. This data is not appropriate for all purposes. The logic of using the AWM database would, if repeated in future, imply that after the accession countries joined the Euro Area, then historical Euro Area data should be reconstructed to include these countries. Considered in relation to the very different economic policies pursued within these countries during the 1970s and 1980s, such aggregation would offer a distorted view of the nature of economic relationships within the (enlarged) Euro Area.

Although acknowledging that the historical economic policies pursued by the members current Euro Area countries are more similar would be the case for an enlarged Euro Area, the analysis below nevertheless illustrates that a simple historical aggregation over the Euro twelve is distortionary for some purposes. Our discussion starts with financial markets, where the issues are most clearly seen.

# 3 Data Construction

This section deals with the methodologies we use to constuct Euro Area financial markets data. In terms of these markets, Europe can be broadly divided into a core and periphery countries. For financial market data in particular, the use of fixed weights is unrepresentative of earlier periods of history. Financial markets in many countries currently in the Euro Area were relatively undeveloped in the 1970s and (in some cases) the 1980s, and were not typically used as international financial instruments. One measure of the importance of individual country financial markets is their global credit ratings. Typically countries rated under investment grade (AA) would not be considerd as representative of general financial conditions.

The problem this poses in constructing weighted aggregates over this period is that European wide finanical aggregates are unduly influenced by highly divergent financial market rates in the periphery countries. For example, in the late 1980s, the Deutschmark was the dominant European currency, followed by the French franc, while the bund rate was the benchmark for investment opportunities[3]. Financial markets in Greece, Spain and even Italy were considered highly speculative, and illiquid, much like many of the analyses of emerging markets in Latin America and Asia are today[4]. The divergence of the financial markets returns in these countries from those experienced in the core seriously affects the aggregates constructed employing fixed weights. The extent of this deviation is demonstrated in what follows, and an alternative is proposed.

In dealing with this issue for each of exchange rates, short term interest rates, long term interest rates and equity returns, the following subsections canvass the extent of distortion due to dispersion in the individual country indices, a number of proposed alternatives (and sensitivity to assumptions regarding the construction of those alternatives) and finally a choice of index to represent the Euro Area. In each case the choice is weighted up against the ready availability of the AWM data, and in a number of cases the diffference between the indices is deemed to be insubstantial so that the use of readily

[3]This is effectively the argument made by Artis and Beyer (2004) in their use of German interest rates in conjunction with aggregated Euro Area series for other variables.

[4]Rigobon (2002) illustrates the degree to which returns behaviour can change when a country is upgraded to investment grade.

publicly available data dominates the decision.

## 3.1 The AWM Weights

Due to the importance of the AWM database, the weights used in that aggregation play a vital role. As already noted, these weights (except for the construction of the HICP) are based on PPP-adjusted real GDP in 2001. The weights are shown in Table 1. For comparison some alternative weights proposed on http://fx.sauder.ubc.ca/euro/euro.html#Rates for calculating back values of the euro on the basis of trade weights are also given. These weights are not the irrevocable exchange rates at which the Euro was formed on 1 January 2000. The formation of the Euro was on a 1:1 basis with the ECU, which had traded as a basket of currencies which included the British pound, Greek Drachma and Danish Kroner, which did not join the Euro at 1 January 2001, the Greek drachma joined a year subsequently, and did not include the currencies of either Finland or Austria which did join the Euro. Hence taking the so-called irrevocable rates at which domestic currencies ceased to exist and were converted to Euro for weighting back data is fraught with hazard and does not provide a consistent basis with methods of aggregating other national data.

A cursory examination of the weights in this table illustrates the potential importance of the comment above that some financial markets were undeveloped: in aggregating, Spain, Italy, Portugal and Greece account for 36 percent of the Euro Area weights.

## 3.2 The Exchange Rate

The issue here is an appropriate representation of the exchange rate for the Euro zone exchange rate with the non-Euro zone through time. Effectively this means determination of an exchange rate with the US (as the dominant

Table 1:
Aggregation weights for Euro Area countries

| country | AWM weight | PACIFIC weight[1] | country | AWM weight | PACIFIC weight[1] |
|---|---|---|---|---|---|
| Germany | 0.283 | 0.3438 | Finland | 0.017 | 0.0472 |
| France | 0.201 | 0.1747 | Ireland | 0.015 | 0.0766 |
| Italy | 0.195 | 0.1294 | Luxembourg | 0.003 | |
| Spain | 0.111 | 0.0540 | Netherlands | 0.060 | 0.1053 |
| Austria | 0.030 | 0.0322 | Portugal | 0.024 | 0.0130 |
| Belgium | 0.036 | 0.0766 | Greece | 0.025 | |

1.The PACIFIC weights are from http://fx.sauder.ubc.ca/euro/ based on trade data, and do not include the Greek drachma which joined on 1 January 2001.

world currency), from which other exchange rates can then be extracted via the no-arbitrage condition.

The Euro has operated from 1 January 1999, with Euro notes and coins in circulation from 1 January 2002. The exchange rates from the individual currencies to the Euro were determined at the so-called irrevocable rates at 31 December 1998. Clearly, once the Euro was introduced the member countries had a single exchange rate with non-Euro countries. However, prior to the introduction of the Euro there were differences. The German mark was the dominant European currency traded prior to the advent of the Euro, being the second most traded currency after the US dollar in the triennial surveys of foreign exchange market activity carried out by the Bank for International Settlements (see BIS 1999). The French franc came in as around the 5th most traded currency, while the remaining EMS currencies made up some 17 percent of the total traditional foreign exchange trade volume in 1998. In the most recent survey for April 2004, the euro was involved in some 37 percent of the corresponding market (BIS 2005).

The issue is what is the appropriate representation of the Euro area 'currency' to international currencies prior to the advent of the Euro. One possibility is to construct a weighted average using fixed weights, in the same way as the AWM applies to the national economic data. The result of using the AWM weights of Table 1 to aggregate the historical bilateral exchange rates against the US dollar is the synthetic back series shown in Figure 1. The backdata on bilateral exchange rates were first adjusted by the irrevocable weights.[5] For comparison, the German mark and French franc exchange rates against the US dollar are included in the figure.

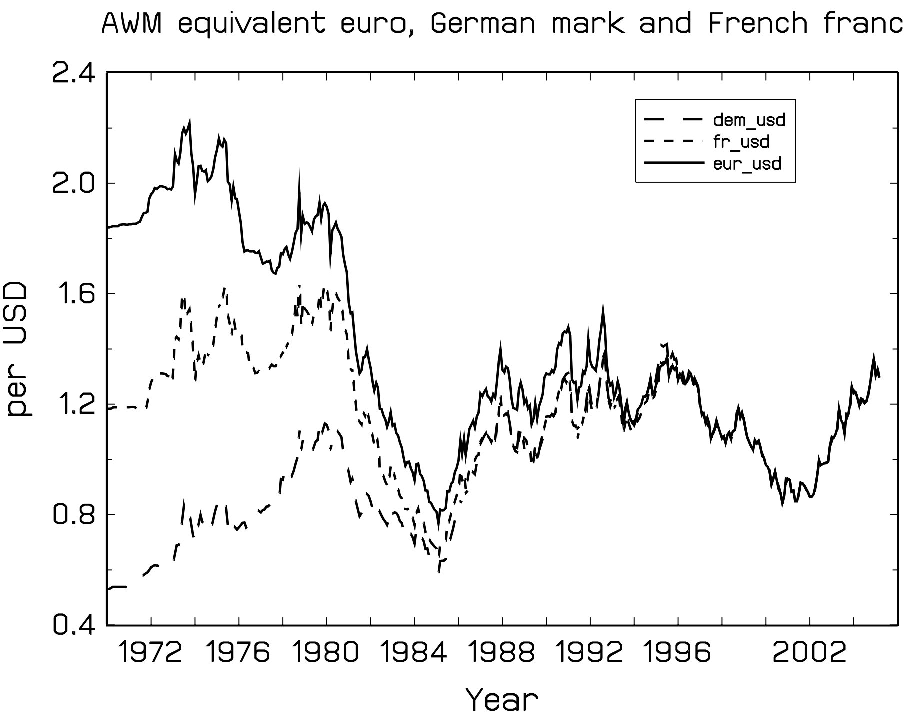
Notice the huge divergence in the 1970s between the synthetic Euro Area rate (denoted eur_usd) and that of the French franc or, even more markedly, the Deutschmark. Although this divergence reduces over time, it is nevertheless substantial during the 1980s, especially so in the first half of that decade.

Prior to the adoption of the Euro the "core" countries of (mainland western) Europe were represented by Germany, the Benelux countries (Belgium, Netherlands and Luxembourg) and France[6]. These countries account for a total of 62.8% of the total AWM aggregation weight, with 42.1% accounted for by Germany and the Benelux countries and 21.6% by France. Much of the divergence evident in Figure 1 is due to the role of the non-core European countries in the calculations. For this reason we construct a proxy "core" of European currencies (using the same relative weights as in the AWM) to represent a benchmark during this period. This is plotted in Figure 2 along with the Italian, Spanish, Greek and Portugese exchange rates for the same period.

The issues for the divergence of the remaining currencies in the Euro from

[5] A problem with the irrevocable exchange rates for calculating back data is that they are based on conversions to the ECU which did not include all the countries in the final Euro but did include both Denmark and the UK which did not ultimately join the Euro.

[6] However, France could also be considered to be non-core at various times during the 1970s particularly, due to frequent revaluations and it was only in the snake from for a total of around 4 years (see footnote 11 in Scheller (2004)). However, we retain it in the core due to its importance in the Euro Area.



AWM equivalent euro, German mark and French franc
dem_usd
fr_usd
eur_usd
2.4
2.0
1.6
1.2
0.8
0.4
per USD
1972
1976
1980
1984
1988
1992
1996
2002
Year


Figure 1:

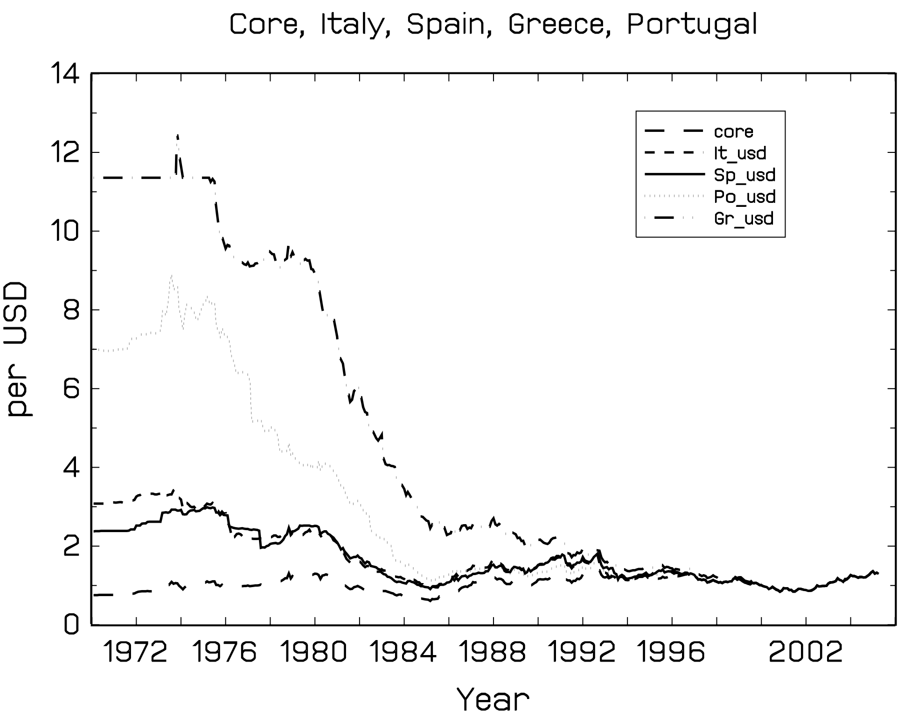

Core, Italy, Spain, Greece, Portugal
core
It_usd
Sp_usd
Po_usd
Gr_usd
per USD
0
2
4
6
8
10
12
14
1972
1976
1980
1984
1988
1992
1996
2002
Year

Figure 2:

the core are captured by considering two groups, namely a group comprising Iterate1.epsain, and a second group containing Greece and Portugal. In the first group of Italy and Spain, these currencies were not of international importance in financial markets, with their markets relatively underdeveloped in the pre 1990s and plagued by low credit rating and low liquidity. However, they have a substantial weight in the Euro Area (a total of 0.306), so that their deviations from the core influence the final outcome substantially. The other countries, namely Portugal and Greece, have relatively low weights, of 0.024 and 0.025 respectively, but their currencies had very large deviations from the final euro value early in the sample period - that is they had the largest distance to converge to their final euro exchange rate.

For these reasons we believe it is unrepresentative to construct an historical Euro Area exchange rate series on the basis of the fixed weights of Table 1 applied to the individual country exchange rates. Indeed, it appears from Figure 2 that, in terms of exchange rates, Greece and Portugal made substantial progress towards their their eventual Euro exchange rates during the first half of the 1980s[7].

There are a number of possible alternatives to aggregation of exchange rates based on applying the AWM weights throughout the period. The route we follow is to construct a erate2.epsnthetic Euro rate that includes all the currencies incorporated into the current Euro, but with the weighting system altered to reflect the extent of divergence from the core exchange rates in the early part of the sample.

#### 3.2.1 Option 1

Prior to January 1999, the non-core currencies of the Euro Area are introduced with a sliding weight based on the weight of Table 1 and the distance of the exchange rate (against the US dollar) from that of the "core" currencies.

[7]It may be relevant to note that Greece joined the European Community in 1981 and Portugal in 1986.

In practical terms this is achieved by calculating the weight of the non-core currency in the historical euro as a ratio of the distance the currency is currently from the core as a proportion of the maximum distance it is from the core in the sample period. The remaining weight is distributed to the core currencies. To make this concrete consider the example of Italy. The weight that the Italian lira receives is 0.195. To introduce the lira into the historical series the weight of the lira at any time prior to the introduction of the Euro is given by

$$w_{It,t} = 0.195 * \left( \frac{x_{It,t} - core_t}{\max\limits_{all\ t}(x_{It,t} - core_t)} \right)$$

where $x_{It,t}$ represents the value of the Italian lira in US dollars at time $t$ (expressed as a Euro/dollar exchange rate) and $core_t$ represents the value of the core currencies in US dollars at time $t$.

The weight $w_{It,t}$ assigns to the Italian lira is, by construction, at most 0.195. Because in the final recalculation of the historical Euro substitute the weights pre-1999 sum to less than 1 the weights are simply redistributed to ensure a sum of 1. This redistribution sometimes has the consequence of inflating the weight of a particular non-core currency above its final value in 1999. However, we ensure that does not occur by restricting the weight of each non-core currency to be a maximum their final value (0.195 in the case of Italy), with the corresponding excess redistributed among the core.

A major disadvantage with this method is that the scaling factor for reweighting the currencies in the historical euro is not sample invariant, being dependent on the maximum distance between the core exchange rate against the US dollar and the periphery currencies, and the results may be quite sensitive to alternative starting points.

### 3.2.2 Option 2:

To remove the scale dependency in the previous method we propose a constant starting point for the reweighting based on the relative distance of the non-core currencies from the core. This date is selected as March 1979, the data at which the European Monetary System began (and the ECU was created[8]). A further reason for the selection of this date is that France continually participated in the EMS, but was not a continual participant in the earlier "snake". The use of this date is also in line with previous literature on European integration (REFS).

Adopting the March 1979 as the starting point, the weight for currency $j$ at time $t, w_{j,t}$, is calculated as follows:

$$w_{j,t} = \begin{cases} w_{j,F} * \left( \frac{x_{j,t} - core_t}{(x_{j,1979:1} - core_{1979:1})} \right) & \text{if } |x_{j,t} - core_t| < |x_{j,1979:1} - core_{1979:1}| \\ 0 \quad \text{else} \end{cases}$$

where $w_{j,F}$ is the final weight for currency $j$ in the Euro (as given in Table 1), $x_{j,t}$ is the bilateral exchange rate for currency $j$ against the numeraire (USD), $core_t$ is the exchange rate for the core currencies against the USD at time $t$ and $x_{j,1979:1} - core_{1979:1}$ is the distance between the two exchange rates as at March 1979. The weight $w_{j,t}$ then represents a fraction of the final weight of country $j$, where that fraction is given by the extent of exchange rate convergence towards the core already achieved. Where that distance is exceeded no weight is given to currency $j$ in calculating the synthetic Euro exchange rate.

The Euro exchange rate calculated using this method is depicted in Figure 3 with that calculated using the (constant weight) AWM methodology and in Figure 4 with the Deutschmark and French franc bilateral rates to the US dollar. The method has reduced the exchange rate in the early 1970s,

[8] The ECU was also considered as an alternative, but has vastly different properties and countries involved which are not currently part of the Eurozone, in particular Denmark and the UK. Additionally backdata is not available and would also need to be constructed.

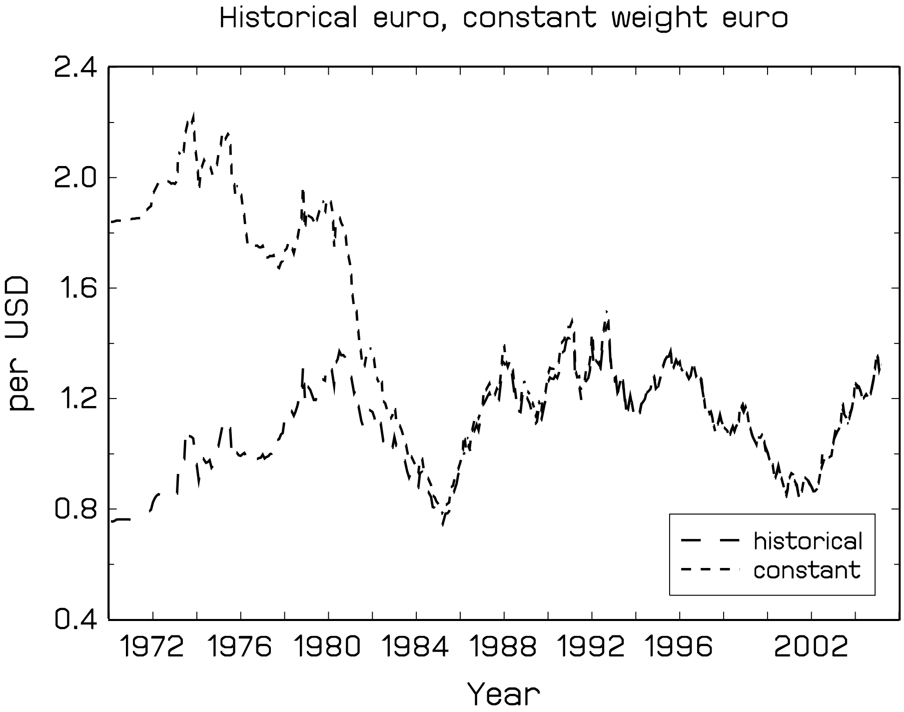



Figure 3:

moving it closer to the core countries and downweighting the extreme values of the peripheral countries' exchange rates depicted in Figure 2.

#### 3.2.3 Option 3:

The AWM model uses the ECB's Effective Exchange Rate (EER) as its indicator of exchange rates. This is a trade weighted index with regards to several groups of trading partners. At least four EER indices are currently calculated against increasingly larger groups of countries, ranging from 12 in the so-called 'narrow' group to 42 in the largest grouping.[9] Clearly this is not a bilateral exchange rate as proposed in the previous options and is not

[9]The 12 countries in the narrow group are Australia, Canada, Denmark, Hong Kong, Japan, Norway, Singapore, South Korea, Sweden, Switzerland, United Kingdom and United States.

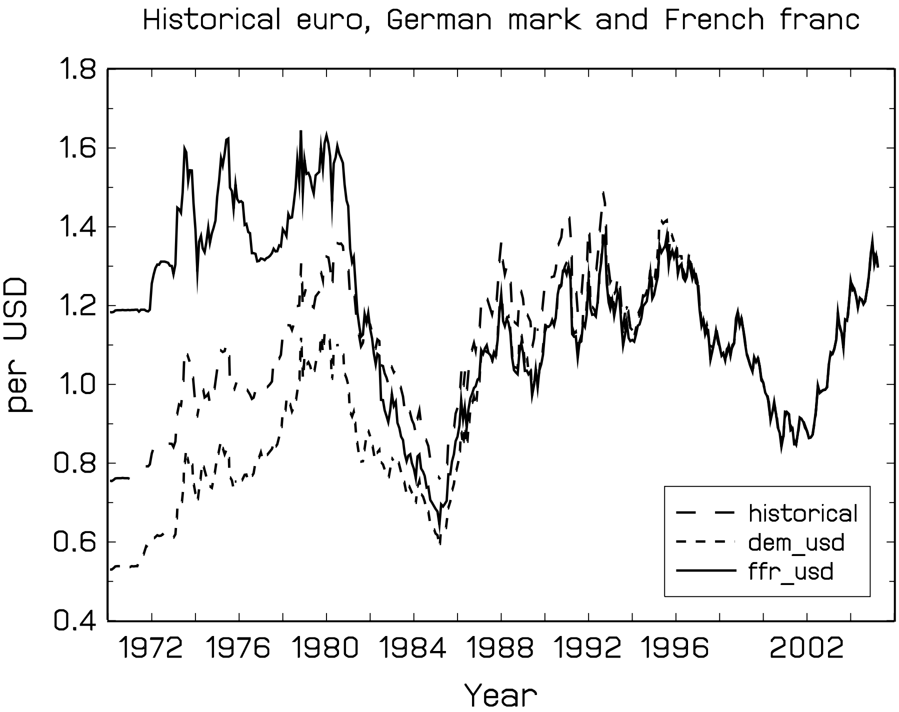

Historical euro, German mark and French franc
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
per USD
1972
1976
1980
1984
1988
1992
1996
2002
Year
historical
dem_usd
ffr_usd

Figure 4:

directly comparable.

## 3.3 Interest Rates

Eurowide interest rates can be formed in a number of ways. In the current European situation the short term interest rate is, like the euro exchange rate, common to all the constituent countries. The long term interest rate, which is market determined, can differ amongst the countries, reflecting amongst other things, the degree of committment market participants believe particular countries have to meeting the Euroland targets for fiscal and monetary probity, different institutional structures, different country and soveerate3.eps factors and  not least different inflationary outlooks despite common monetary policy brought about in some instances by supply side factors. In applications to date there have been uses of each of the AWM data, the German rate as indicative, averages of component countries and a combination of the German rate and common rate during the euro era; for examplerate4.eps (2006),  Artis and Beyer (2004), Gerlach and Schnabel (2000) and Erhmann and Fratzcher (2005) respectively.

Figures 5 and 6 show the short term and long term interest rates from the AWM, the German interest rate and the historical rate constructed using the weights corresponding to those calculated for the exchange rate in the previous section. A few modifications are worth noting. The AWM provides data on a quarterly basis, to obtain a monthly data series we backed out the quarterly weights based on the available interest rate data, as not all countries are covered for the entire period, and applied these weights to the intervening months of the quarter. In the case of our own constructed historical series in some cases interest rate data and exchange rate data had different availability in the sample. In this case the weights were redistributed across the available interest rates in proportion. In both the short and long interest rates the divergence between the AWM and the historical rate calculated using our

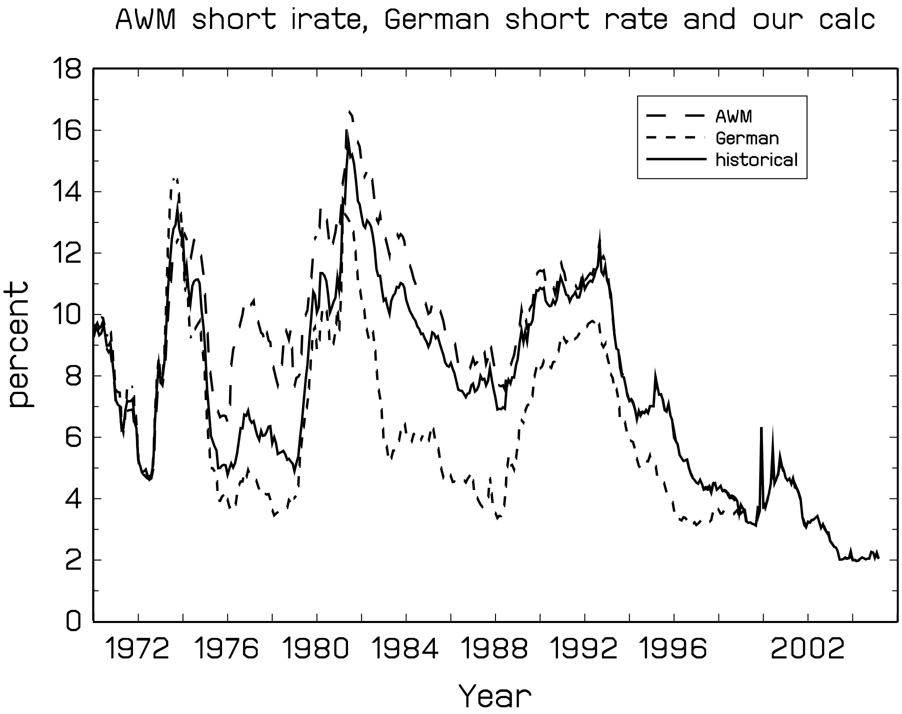



Figure 5:

own weights is most pronounced in the period between 1976 and 1980. Here, there is a much greater drop in interest rates (corresponding to the German drop) than in the AWM. Post this date the interest rates are close between the two aggregate series, and for the long rate, prior to 1976 the two long rates are very close. It is worth noting that some further support for the 'core' country approach to constructing long bond rates particularly is found in Dunne, Moore and Portes (2006) who find that some combination of French and German bonds provides the reference rate (or benchmark) for the Euro area even in the recent euro denominated era.[10]

The constructed AWM bond rate seems to represent the series reasonably well.

[10]They use Euro-MTS data from April 200 to March 2005 comparing the euro-denominated but different sovereignty long bonds.

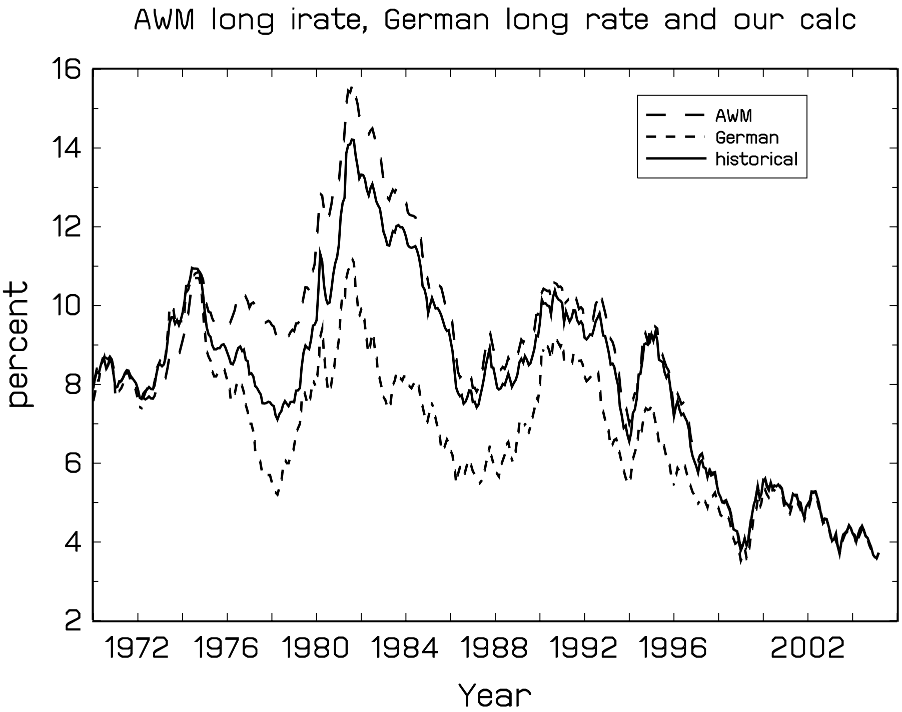

AWM long irate, German long rate and our calc
AWM
German
historical
percent
Year
16
14
12
10
8
6
4
2
1972
1976
1980
1984
1988
1992
1996
2002

Figure 6:

### 3.4 Equity markets

Constructing a share market index across Euroland is an even more difficult prospect than for interest rates. Not only are the currencies of denomination different, but the series are in levels rather than returns. To deal with this we transform all the individual country series into returns and aggregate them in the same way as the interest rates. The exchange rate problem remains, as it does in most of these data series. However, at least there is consistency between the treatment of the financial market series which should result in no induced violations of conditions such as UIP.

The various stages of development of the different countries, and different investment rules mean that particularly in the early years of the sample the core and periphery countries will be present in the Euroland equity markets. The resulting Euroland equity price index is given with the German and French Bourses for comparison in Figure 7, with all based at 100 in January 1970. The strong correlation of the historical index with the French equity index is clearly evident in the figure.

The meausre usied by the ECB in current monetary policy setting is the HICP, which is constructed as a weighted sum of the national HICPs, and available from 1990. Prior to this there are problems aggregating across countries due not only to weighting choices, but also to different construction of price indices by country and different treatment of seasonal adjustment - some countries did not seasonally adjust and others did. Diewert (2002) provides a comprehensive critique of the construction of the HICP, resulting in an index he describes as neither based on consumer or producer theory but some amalgamtation of the two. A further concern, but an aside, in the HICP is the apparent change in seasonality from 1999 which possibly pertains to treatment of sales data in the construction of the underlying indices. In backcasting this data to provide a quarterly series for the 1970s

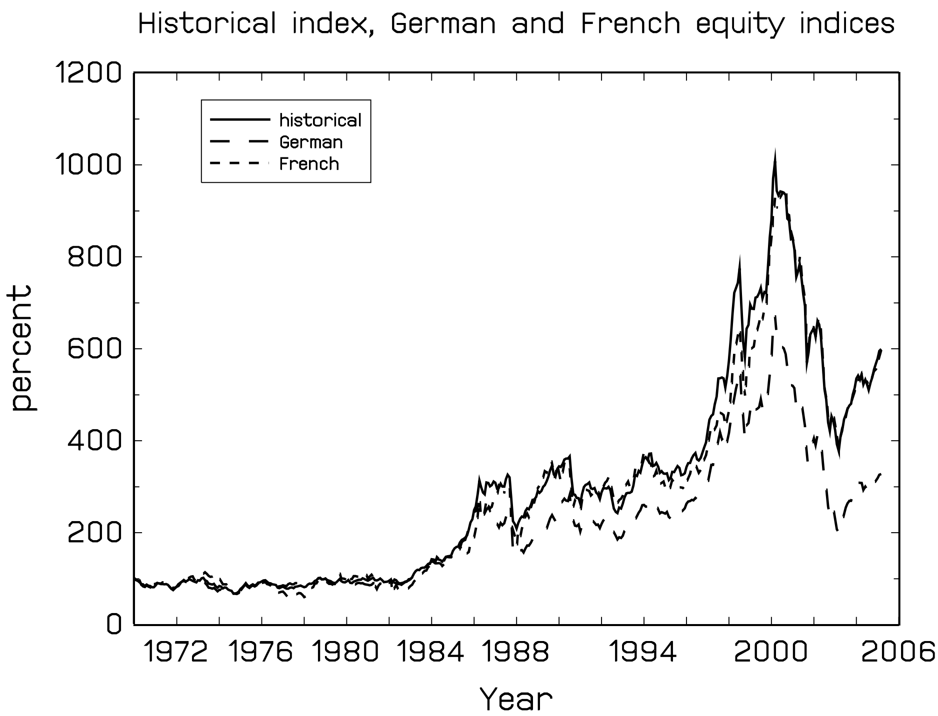

Historical index, German and French equity indices
historical
German
French
percent
Year
0
200
400
600
800
1000
1200
1972
1976
1980
1984
1988
1994
2000
2006

Figure 7:

and 1980s the AWM uses HICP weights from 1995.[11] An alternate series is provided by Eurostat as the Euro area monthly CPI inflation from which a corresponding price index can be extracted. When compared with the AWM quarterly data the Eurostat series suggests a higher level of inflation in the 1970s and 1980s. From 1990 onwards the series converge. The HICP data constructed is temporally, but not spatially consistent, see Hill (2004) who constructs a both temporally and spatially consistent data set for 1995 to 2000. Because price levels are often important in international financial relationships, such as constsrate.epseal interest rates and purchasing power parity tests we also construct a set of prices consistent with the financial markets data.

# 4 Data Choices and Consequences for Analysis

The upshot of the options for choosing an appropriate dataset to use are summarized in Table 2. The three general approaches available to researchers are either (i) using the AWM database in its entirety, although any applications requiring bivariate exchange rates or equity market indices will need an alternative source, (ii) using German data for the pre-Euro period for financial markets and inflation, and splicing these series to the Euro data as per Bruggeman and Lutkehpohl (2004,2005), or (iii) a mixed appraoch using AWM data for real variables such as GDP, employment, industrial production and some combination of other sources for the remaining data, particularly that for financial markets.

In the remainder of this paper a few simple examples are taken to show the potential impact that working with alternative forms of these data sets could have for analysis. The first, is an extremely simple Taylor rule following the analysis of Gerlach and Schnabel (2000) who simply attempted to apply

[11] Personal communication with Jose Emilio Gumiel from the ECB.

Table 2:
Potential combinations of available data

| | AWM | Eurostat | Germany/Euro | constructed series |
|---|---|---|---|---|
| GDP | x | | x | |
| CPI | x | x | x | |
| 3 month rates | x | | x | x |
| long rate | x | | x | x |
| exchange rate | | | x | x |
| equity price | | | x | x |

a Taylor rule to aggregate data in the EMU area prior to full monetary union, although Gerlach-Kristen (2003) maintains that the inclusion of long interest rates and accounting for non-stationarity are important in Euro Area results. The simplest version of a Taylor rule can be expressed as:

$$i_t = c + \gamma(y_t - \widetilde{y}) + \lambda(\pi_t - \widetilde{\pi}) + \varepsilon_t \tag{1}$$

where $i_t$ represents the nominal short interest rate associated with policy making, $y_t - \widetilde{y}$ represents the output gap, and $\pi_t - \widetilde{\pi}$ represents the deviation of actual inflation from the desired target. In Taylor and many subsequent studies including Gerlach and Schnabel (2000) $\widetilde{\pi} = 2$ percent per annum. The relative weightings on output and inflation deviations given by parameters $\gamma$ and $\lambda$ are those of most interest to policy makers - suggested values of these parameters arising from Taylor's work are 0.5 and 1.5 respectively, see Taylor (1999, p.325) for discussion, and this has become a form of benchmark for comparing other specifications and periods. The final term $\varepsilon_t$ is a disturbance term.

To give some idea of the effects of using different data sets on the outcomes of models we estimate the simple Taylor's rule using a number of combinations of the above data. In each case the target inflation rate is set at 2 percent per annum. As the changes in policy regime which dog this period do not differ by dataset this should not be the major concern in assessing the differences in the results. However, to partly address such concerns we estimate two sample periods, the first covering the entire data period from 1970 to 2005 and then two subsamples from 1970:1 to 1989:4 and from 1990:1 onwards. Table 3 reports the estimates of $\gamma$ and $\lambda$ obtained for equation (1) using alternative combinations of data sources and Newey-West corrected p-values for the estimated coefficients. The one difference between the specifications of the two estimated equations is that in the case of our constructed inflation series a dummy variable was included for the four quarters affected by German reunification, the AWM data already contains such an adjustment.[12] All the coefficients are statistically significant at 5 percent significance levels and these and other diagnostics are not reported here. The output gap in each case is constructed via a simple Hodrick Prescott filter with lambda=1600 on the quarterly AWM data for GDP, and is hence unchanged in each regression.

The differences in the relative weight placed on the output gap and deviations of inflation from target are marked in the estimations. This is unsurprisingly most apparent in the early part of the sample, when different weighting processes have more effect. Most interestingly, in the early period subsample when using German interest rates, the weight on output gap is considerably smaller than that on inflation, while estimating for the same period with the AWM or our own compiled interest rates leads to the opposite result.

In the most recent period all options agree that inflation deviations are more heavily weighted than output gaps. Not surprisingly given the data

[12]To be clear that this was not biasing our results a dummy was also tried in the other equations in case there were residual German reunification effects, but it made no material difference to the reported coefficients and was insignificant.

Table 3:
Simple Taylor rules for Europe estimated with AWM quarterly GDP data and various combinations of alternative interest rate and inflation rate series. Coefficient estimates and (p-values).

| | German rates | | AWM rates | | Our rates | |
|---|---|---|---|---|---|---|
| | $\gamma$ | $\lambda$ | $\gamma$ | $\lambda$ | $\gamma$ | $\lambda$ |
| | | | *AWM inflation series* | | | |
| 1971:1 - 2003:4 | 1.66 | 0.55 | 0.56 | 0.90 | 0.75 | 0.63 |
| | (0.00) | (0.00) | (0.01) | (0.00) | (0.00) | (0.00) |
| 1971:1 - 1989:4 | 1.26 | 0.54 | 0.56 | 0.60 | 0.79 | 0.40 |
| | (0.00) | (0.00) | (0.01) | (0.00) | (0.00) | (0.00) |
| 1990:1 - 2003:4 | 0.35 | 1.97 | 0.04 | 2.73 | 0.02 | 2.59 |
| | (0.05) | (0.00) | (0.85) | (0.00) | (0.93) | (0.00) |
| | | | *Our constructed inflation series* | | | |
| 1971:1-2003:4 | 1.06 | 0.75 | 0.46 | 1.14 | 0.62 | 0.88 |
| | (0.00) | (0.00) | (0.02) | (0.00) | (0.00) | (0.00) |
| 1971:1 - 1989:4 | 1.22 | 0.77 | 0.54 | 0.78 | 0.73 | 0.65 |
| | (0.00) | (0.00) | (0.01) | (0.00) | (0.00) | (0.00) |
| 1990:1 - 2003:4 | 0.45 | 1.80 | 0.22 | 2.53 | 0.19 | 2.43 |
| | (0.00) | (0.00) | (0.22) | (0.00) | (0.29) | (0.00) |

construction, the results with the combinations of our calculated inflation and interest rate series end up being somewhere between results obtained with the German and AWM data in most cases. In the last subsample, from 1990, the estimated coefficients and their significance, are similar across the AWM database and our constructed data. In the earlier period, our data tends to favour higher weight on the output gap than estimates calculated using the AWM data. Use of the AWM interest rate tends to support a higher weight on inflation than use of our constructed interest rate, for example in the 1971 to 2003 sample using our constructed inflation data series, the ratio of the weight on inflation to that on output gap for the AWM interest rate data is around 2.5, but less at 1.4 in the case of our constructed interest rate data.

The most difference between the results in Table 3 occurs across the rows, that is with differences in choice of interest rate data, rather than between corresponding panels with the different inflation series. Sauer and Sturm (2006) show that the choice of inflation indicator makes a difference in their model, and state that their results are indifferent to use of either the Euro Overnight Index Average or the EURIBOR 3 month rate for interest rates from 1986 onwards. Clearly, despite this being an extremely simplistic first cut, the differences in our estimates lead to different stories about how policy may evolve which are unlikely to disappear with more sophisticated modelling.

A slightly more sophisticated use of the output, inflation and interest rate data for the Euro area is undertaken in Peersman and Smets (1999). Their model is based on the simpler one of Rudebusch and Svensson (1999) where interest rates respond to contemporaneous and lagged values of the output gap and inflation, and both inflation and output are autoregressive functions and also interdependent. Rudebusch and Svensson (1999) require exogeneously generated output gap terms, while the innovation in Peersman and Smets is to use the standard AR(1) unobserved component Kalman filter to generate the unobserved output gap from the data in the model. This means that from the inflation, interest rate and output data provided to the model, not only are parameter weightings computed but also an endogeneous series on output gap. It is our intention here to repeat the Peersman and Smets analysis using the alternative data sets available and show the differences in those generated unobserved output gap data series for analysis.

# 5 Conclusions

In an introductory volume to monetary policy in the Euro Area the ECB (2001: p52) refers to the importance of "long runs of *backdata*" to underpin econometric analysis essential to understand the operation of the economy in which monetary policy is to operate. The Area Wide Model project detailed in Fagan, Henry and Mestre (2005) is an attempt to provide such series. However, this data has been generated with a particular purpose in mind, that of a simulated model of the Euro area. The database will not be suitable for all purposes. Neither does it cover all series that a researcher may wish to include, nor is its method of aggregation appropriate in all circumstances to either constructing new data series or comparing existing ones. Aggregation methods can provide a bias, for example, if they differ across different series used in testing a particular relationship. This paper focussed particularly on the issue of constructing backdata for financial markets, first showing the rather dramatic changes in the levels of the historical euro exchange rate implied by the use of alternative weighting mechanisms. We propose a sliding weight to represent the convergence of periphery countries towards the core in the exchange rate during the development of the current Euro area. Our sliding scheme has the advantage of being relatively simple to implement, however, there may be others with more desirable properties for alternative applications.

We demonstrate the differences which the various weighting schemes can make to analytical outcomes by a simple application to estimating a Taylor rule for the Euro area from 1971 to 2003, showing the sometimes substantially differing weights which the different measures of interest rate and inflation variables can imply on output gap and the deviation of inflation from target. The use of the AWM as some form of readily available benchmark data series is not necessarily optimal for the resulting research outcomes. The result of the paper is to urge due consideration of the fitness for purpose of alternative data sources in conducting Euro area research.

# References


[1] Altimari, N. (2001) "Does Money Lead Inflation in the Euro Area?", ECB Working Paper 63.

[2] Artis, M. and Beyer, A. (2004) "Issues in Money Demand: The Case of Europe", *Journal of Common Market Studies*, 42 (4), 717-36.

[3] Artis, M. Marcellino, M. and Proietti, T. (2002) "Dating the Euro Area Business Cycle", manuscript.

[4] Beyer, A. Doornick, J.A. and Hendry, D. (2001) "Constructing Historical Euro-zone data", *The Economic Journal*, 111, 102-121.

[5] Banerjee, A., Marcellino, M. and Masten, I. (2005) "Leading Indicators for Euro-area Inflation and GDP Growth", *Oxford Bulletin of Economics and Statistics*, 67, Supplement, 785-813.

[6] Bank for International Settlements (2005) "Triennial Central Bank Survey: Foreign Exchange and Derivative Markets April 2004", BIS, March 2005.

[7] Bank for International Settlements (1999) "Central Bank Survey of Foreign Exchange and Derivative Markets Activity 1998", BIS, May 1999.

[8] Beffy, P-O, Bonnet, O. Darracq-Parriès, M. and Monfort, B. (2003) "MZE: a small macro-model for the euro area", manuscript, INSEE.

[9] Bruggeman, R., Donati, P. and Warne, A. (2002) "Is the Demand for Euro Area M3 Stable?", manuscript.

[10] Bruggeman, R. and Lütkepohl, H. (2004) "A Small Monetary System for the Euro Area Based on German Data", European University Institute, manuscript.

[11] Bruggeman, R. and Lütkepohl, H. (2005) "Uncovered Interest Rate Parity and the Expectations Hypothesis of the Term Structure: Empirical Results for the US and Europe", SFB 649 Discussion Paper 2005-035.

[12] Casares, M. (2006) "Monetary Policy Rules in a New Keynesian Euro Area Model", Journal of Money, Credit and Banking, forthcoming.

[13] Coenen, G. and Wieland, V. (2003) "A Small Estimated Euro Area Model with Rational Expectations and Nominal Rigidities", CFS Working Paper 2003/08.

[14] Corsetti, G. and Pesenti, P. (1999) "Stability, asymmetry, and discontinuity: the launch of the European Monetary Union", Brookings Papers on Economic Activity: 1999:2, 295-358.

[15] Dieppe, A. (2005). "The Area-Wide Model", Chapter 2 (pp.50-65) in Fagan, G. and Morgan, J. (eds) *Econometric Models of the Euro-area Central Banks*, Edward Elgar, Cheltenham UK.

[16] Diewert W. E. (2002) "Harmonized Indexes of Consumer Prices: Their Conceptual Foundations", ECB Working Paper No. 130.

[17] Dunne, P, Moore, M. and Portes, R. (2006) "Price Discovery in the European Bond Market", manuscript.

[18] Eickmeier, S. (2005) "Common Stationary and Non-Stationary Factors in the Euro Area Analyzed in a Large-Scale Factor Model", Bundesbank manuscript.

[19] Ehrmann, M. and Fratzcher, M. (2005) "Equal Size, Equal Role? Interest Rate Interdependence Between the Euro Area and the United States", *The Economic Journal*, 115, 928-948.

[20] European Central Bank (2001) *The Monetary Policy of the ECB*, ECB, Frankfurt.

[21] European Commission, Eurostat (2004) Harmonised Indices of Consumer Prices (HICPs) A Short Guide for Users March 2004, ISBN 92-894-7081-X.

[22] Fabiani, S. and Morgan, G. (2003) "Aggregation and Euro Area Phillips Curves", ECB Working Paper No.213.

[23] Fagan, G., Henry, J. and Mestre, R. (2005) "An Area Wide Model (AWM) for the Euro Area", *Economic Modelling*, 22(1), 39-59.

[24] Fagan, G. and Morgan (2005) "An Overview of the Structural Econometric Models of Euro-area Central Banks", Chapter 1 (pp.1-49) in Fagan, G. and Morgan, J. (eds) *Econometric Models of the Euro-area Central Banks*, Edward Elgar, Cheltenham UK.

[25] Garnier, J. and Wilhelmsen, B-R. (2005) "The Natural Real Interest Rate and the Output Gap in the Euro Area", ECB Working Paper No. 546.

[26] Giannone, D. and Reichlin, L. (2004) "Euro Area and US Recessions, 1970-2003", in Reichlin, L. (ed) *The Euro Area Business Cycle: Stylized Facts and Measurement Issues*, CEPR, London, pp83-93.

[27] Gerlach, S. and Schnabel, G. (2000) "The Taylor Rule and Interest Rates in the EMU Area", *Economics Letters*, 67, 165-171.

[28] Gerlach, S. and Smets, F. (1999) "Output Gaps and Monetary Policy in the EMU Area", *European Economic Review*, 43, 801-812.

[29] Gerlach, S. and Svensson, L. (2003) "Money and Inflation in the Euro Area: A Case for Monetary Indicators", *Journal of Monetary Economics*, 50, 1649-1672.

[30] Gerlach-Kristen, P. (2003) "Interest Rate Reaction Functions and the Taylor Rule in the Euro Area", ECB Working Paper No. 258.

[31] Gros, D. and Thygesen, N. (1998). *European Monetary Policy*, second edition. Pearson Education, Harlow Essex.

[32] Hahn, E. (2001) "Core Inflation in the Euro Area: Evidence from the Structural VAR Approach", CFS Working Paper 2001/09.

[33] Hill, R. (2004) "Constructing Price Indexes across Space and Time: The Case of the European Union", *American Economic Review*, 94(5), 1379-1410.

[34] Hong, E-P, and Beilby-Orrin, H. (1999) "Compilation Methodologies for Euro Zone Aggregates" from http://www1.oecd.org/std/euroaggr.html donwloaded February 2006.

[35] Jansen, E. (2004) "Modelling Inflation in the Euro Area", ANO Research Department Working Paper 2004/10

[36] Kim, S.J., Moshirian, F. and Wu, E. (2005) "Dynamic stock market integration driven by the european Monetary Union: An empirical Analysis", *Journal of Banking and Finance*, 29(5), 2475-2502.

[37] Moneta, F. (2005) "Does the Yield Spread Predict Recessions in the Euro Area?" *International Finance*, 8(2), 263-301.

[38] Pytlarczyk, E. (2005) "An estimated DSGE model for the German economy within the euro area", Bundesbank Economic Studies Discussion Paper 33/2005.

[39] Rigobon, R. (2002) "The Curse of Non-investment Grade Countries" *Journal of Development Economics*, 69 (2), 423-449.

[40] Sauer, S., and Sturm J-E. (2006) "Using Taylor Rules to Understand ECB Monetary Policy", *German Economic Review*, forthcoming.

[41] Scheller, H.K. (2004). *The European Central Bank: History, Role and Functions.* European Central Bank, Frankfurt, 2004.

[42] Smets, F. and Wouters, R. (2005) "Comparing shocks and frictions in US and euro area business cycles: a Bayesian DSGE approach", Journal of Applied Econometrics, 20 (1), xx

[43] Smets, F. and Wouters, R. (2003) "An Estimated Stochastic Dynamic General Equilibrium Model of the Euro Area", *Journal of European Economic Association*, 1 (5), 1123-1175

[44] Taylor, J.B. (1999) "A Historical Analysis of Monetary Policy Rules" in J.B.Taylor (ed) *Monetary Policy Rules*, NBER, 319-340.

[45] Taylor, J.B. (1993) "Discretion versus policy rules in practice", *Carnegie-Rochester Conference Series on Public Policy* 39, 195-214.

[46] Ullrich, K (2003) "A Comparison between the Fed and the ECB: Taylor Rules", ZEW Discussion Paper 03-19.

[47] Ungerer, H. (1997), *A Concise History of European Monetary Integration: From EPU to EMU*. Quorum Books, Westport, Connecticut.