

Data Appendix for “Asset Prices, Consumption, and the Business Cycle”

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This paper works with quarterly data on equity markets and macroeconomic variables for 11 countries: Australia, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States. It also works with annual data for 3 countries: Sweden, the United Kingdom, and the United States.

All stock market and macroeconomic series are denominated in **local currency** units. Sample periods show a great deal of variation across both countries and variables. Only quarterly data on equity markets have a homogeneous sample period across countries (1969.4 - 1997.1), with the exception of the US, where the data ends in 1996.4. To compute the statistics presented in Tables 1 to 13, the following criterion concerning sample periods has been used: for each country the longest common sample for the whole set of stock market and macroeconomic variables is selected.

This has produced the following sample periods for each country (in parentheses the country code used in the tables):

1. Quarterly data: Australia (AUL), 1970.1 - 1996.3; Canada (CAN), 1970.1 - 1996.3; France (FR), 1973.2 - 1996.3; Germany (GER), 1978.4 - 1996.3; Italy (ITA), 1971.2 - 1995.3; Japan (JAP), 1970.2 - 1996.3; the Netherlands (NTH), 1977.2 - 1996.2; Sweden (SWD), 1970.1 - 1995.1; Switzerland (SWT), 1982.2 - 1996.3; the United Kingdom (UK), 1970.1 - 1996.3; the United States (USA), 1947.2 - 1996.4.
2. Annual data: Sweden (SWD), 1920-1994; the United Kingdom (UK), 1919-1994; the United States (USA), 1891-1995.

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1 Quarterly Data.

1.1 Stock Market Data.

The sample period and data source of quarterly stock market data are the same for all countries, except for the US. The source for US data is the Center for Research in Security Prices (CRSP) at the University of Chicago, while for all other countries is Morgan Stanley Capital International (MSCI). The sample period chosen goes from the earliest to latest dates available at the time this paper is being written. Thus for the US the sample period goes from 1925.4 to 1996.4, and for all other countries from 1969.4 to 1997.1.

Quarterly stock market data (for all countries other than US) are based on the monthly MSCI National Price and Gross Return Indices in **local currency**. The National Price Index is an end-of-month Laspeyres price index. The National Gross Return Index is the index associated with stocks' total monthly return, where the term "gross" refers to returns calculated with dividend reinvestment before withholding taxes have been paid. The dividend yield that enters the computation of the stock total return at time t is a moving average of the dividends in the previous 11 months and the current month divided by the stock price at the end of the current month. That is, the national gross return index I_t is calculated as:

$$I_t = I_{t-1} \frac{P_t}{P_{t-1}} [1 + DY_t]$$

where $DY_t = \frac{\frac{1}{12} \sum_{i=0}^{11} D_{t-i}}{P_t}$, and P_t is the national price index. These indices are representative, but not comprehensive in that they do not include the whole universe of stocks traded in each country's stock market.

For each country, an end-of-quarter price index has been computed by selecting the end-of-quarter values of the corresponding monthly national price index. Quarterly dividends on the portfolio represented by the index are computed by adding up monthly dividends on this portfolio during the quarter. The monthly dividend on the index portfolio at time t is obtained from the monthly dividend yield, under the assumption that the dividend has been approximately constant during the last 12 months. The dividend yield can be easily extracted from the price and gross return indices using the formula above. Finally, a quarterly stock total return series is obtained from the end-of-quarter price index and the quarterly dividend series.

Tax credit on dividends, applicable to the UK, France and Germany, is available only to local investors. MSCI calculates returns from the perspec-

tive of US investors, so it excludes from its indices the tax credits which are available only to local investors. Since I am interested in the gross return to local investors, I add back in the tax credits. The tax credits for 1992 were used: 25% for UK, 33.33% for France, and 36% for Germany.

The US quarterly stock market data are based on the monthly CRSP NYSE/AMEX Value-weighted Indices. These indices are derived from returns on a value-weighted portfolio that includes all stocks traded on the New York and American Stock Exchanges. The stock price index for the US is the end-of-quarter value of the monthly CRSP Index associated with returns excluding dividends. Monthly aggregate dividends are extracted from the NYSE/AMEX CRSP Indices to form quarterly dividend and total stock market return series.

1.2 Macroeconomic Data.

The main source for data on aggregate consumption, the consumption deflator, population, prices and short-term interest rates is the CD-ROM March 1997 version of the International Monetary Fund's International Financial Statistics (IFS). Some countries' data series, however, had to be taken from other sources. The real GDP series for Italy, for example, is from the 8/97 version of the IFS CD-ROM. Swedish consumption and population data, and all US macroeconomic data, are from national sources. In addition some series have been updated from the Datastream online data service.

The series in the IFS database are in general based on national sources and in local currency units. Thus the number of series available for each country as well as their sample periods vary widely across countries. In particular, quarterly national accounts data are available only for a relatively short time period in Germany and the Netherlands.

For each country a quarterly series on seasonally adjusted real consumption per capita was constructed from IFS quarterly data on Aggregate Private Consumption (IFS line 96) and GDP at Current and Constant 1990 Prices (IFS line 99), and annual IFS data on population (IFS line 99z). Data on aggregate private consumption were used because data on aggregate consumption of nondurables and services are not currently available in IFS. A consumption deflator is not available either, so I use a GDP deflator. This deflator was computed by dividing GDP at current prices by GDP at constant prices. Since IFS contains only annual population series, I construct a quarterly population series for each country by assuming that population grows at constant rate within the year and that the original an-

nual population data are as of December 31 of each year. For those countries for which data on National Accounts were more recent than data on Population, I predicted the last values of the quarterly population series using the mean growth rate, in quarterly terms, to make sure that all available data on real consumption could be used. The most recent population series were obtained for all countries (including the US) from the July 1997 paper version of the IFS.

The data for Germany, Sweden, and the US deserve some special description.

Data for West Germany were available only through 1994.3. To extend the series, data for united Germany were used. Short and long interest rate series for united Germany were appended to the West German series. Price indices, consumption and real GDP were extended using the growth rates of the united German data. The population series was extended using the growth rate of West German population.

The source of the consumption data for Sweden is the Swedish National Central Bureau of Statistics; it is seasonally adjusted consumption at 1985 prices, so there is no need to use the deflator. From 1994.3 onwards, the seasonally adjusted real consumption series is obtained from Datastream. This series is spliced with the original series using the new series' growth rate.

US quarterly data on population and seasonally adjusted aggregate consumption of nondurables and services in both current and constant prices are readily available from CITIBASE.

Quarterly consumer price series were derived from monthly Consumer Price Index series (IFS line 64) by selecting their last-month-of-quarter values. The source for the US monthly CPI is the CRSP Stocks, Bonds, Bills and Inflation (SBBI) file.

Quarterly short-term interest rates were constructed by selecting from monthly series the data corresponding to the last month of the quarter. For each country, the best proxy for 3-month interest rates in IFS (line 60) was chosen. The following interest rates were used to construct real 3-month interest rates (in parentheses first year. quarter available in IFS):

- Australia -> TB Rate: Weighted average yield on 13-week treasury notes allotted at last tender of month. (69.3)
- Belgium -> TB Rate: No explicit definition in IFS books.(60.1)

- Canada → TB Rate: Tender Rates of the last Thursday of the month on 3-month bills.(60.1)
- Denmark → MM Rate: Arithmetic average of offered interbank rates. Prior to 1/93, weighted average of three-month average interbank rate.(72.1)
- France → Interbank Money Rate: monthly average of rates for day-to-day loans against private bills A missing value occurs in the IFS CD-ROM for 1986.1. This value is then obtained from the IFS database on Datastream.
- Germany → Interbank Dep. Rate: Average of the daily quotations reported by banks for three-month interbank deposit rates.(60.1)
- Italy → MM Rate: Three-month interbank rate.(71.1)
- Japan → MM Rate: From Nov. 1990, lending rate for collateral and overnight loans in the Tokyo Call Money Market. Previously, lending rate for collateral and unconditional loans.(60.1)
- Netherlands → MM Rate: Average market rate paid on bankers' call loans.(60.1)
- Spain → MM Rate: Daily average rate on interbank operations effected through the B. of S.'s cable service. (74.1). From 93.3 on, however, IFS has stopped reporting the money market rate, which we used as the interest rate. Consequently, the IFS series is spliced with the 3-month interbank rate obtained from Datastream, which covers the period from 93.3 to 96.4.
- Sweden → TB Rate: Rate on three-month treasury discount notes.(60.1)
- Switzerland → MM Rate: Overnight Swiss franc deposit rates in international markets.(75.3)
- UK → TB Rate: Rate at which 91-day bills are allotted. Weighted average of Friday data.(64.1)

This end-of-quarter nominal interest rate series is the yield on a short-term debt instrument bought at the end of the quarter and held for three months. Therefore, to compute the real interest rate for quarter t , I subtract

the inflation rate in quarter t from the nominal end-of-quarter interest rate in quarter $t - 1$.

Long bond yields for all countries were obtained from the IFS, Datastream and other sources as follows:

- Australia -> Yield on Commonwealth government securities 10 year bonds (end of period), Source: Datastream/RBA (69.3)
- Canada -> Yield on government bonds with life over 10 years (end of period), Source: Bank of Canada (68.1)
- France -> Yield on government bonds on secondary market (over 7 years) (period avg), Source: Statistics OECD, Paris (73.1)
- Germany -> Yield on secondary market, public bonds (7 to 15 years) (end of period), Source: Statistics OECD, Paris (76.1)
- Italy -> 9-10 year treasury bond yield, Source: IFS (60.1)
- Japan -> Yield on government benchmark bond (8 to 10 years) (end of period), Source: Tokyo Stock Exchange (70.1)
- Netherlands -> Yield on the most recent 10-year government bond, Source: IFS (64.4)
- Sweden -> Government bond yield (10 years and over) (mid month data), Source: IFS (60.1)
- Switzerland -> Yield on confederation bonds (5 years and over) (monthly average), Source: Statistics OECD, Paris (82.1)
- UK -> Gross redemption yield on 20 year gilts (period average), Source: Bank of England (63.1)
- USA -> Ten-year treasury yields are from McCulloch (up to 1985.3) and thereafter yield on 10 year treasury bonds (monthly average), Source: Federal Reserve (47.1).

Bond returns were calculated from yields using the par-bond approximation given in Campbell, Lo, and MacKinlay (1997), Chapter 10, equation (10.1.19). This approximation relies on an estimate of bond duration. In each quarter the coupon rate was assumed to equal the current yield, and the corresponding value for duration was calculated from equation (10.1.18) in Campbell, Lo, and MacKinlay.

2 Annual Data.

2.1 Sweden (1918-1994)

Equity data for Sweden were derived from Frennberg and Hansson (1992), kindly provided and updated by Professor Bjorn Hansson at Lund University. Macroeconomic data come from three sources: (1) Hassler, Lundvik, Persson, and Soderlind (1994), kindly provided by Prof. Paul Soderlind at Stockholm University (SBC); (2) the March 1995 IFS tape; (3) Paul Soderlind, Institute for International Economic Studies, Stockholm University kindly provided data on total Swedish population at December 31 each year, starting in 1860, compiled from Statistical Yearbooks, Statistics Sweden.

The short interest rate is as follows: 1918-1962 : (SBC) Lowest offered interest rate for loans at the commercial bank Skandinaviska Enskilda Banken and its ancestors. No information available about the computation method. 1963-1994 : (IFS) Annual average of rate on 3-month Treasury discount notes. Annual bond data were derived from Frennberg and Hansson (1992).

2.2 United Kingdom (1919-1994)

Annual UK equity data were derived from an updated version of the data in Barclays de Zoete Wedd Research Limited (BZW henceforth, 1995) kindly provided by Mr. Phil Adams at BZW. The annual price index used is the BZW Equity Index, which is a value-weighted index. From 1918-1961, the index was computed as to include the same 30 stocks as in the FT Index. Since 1962, the index has been based on the FT Actuaries All-Share Index. Thus it is a broad index that includes all the major British stocks. It is calculated annually as follows: for the period prior to 1962, the index was computed based on end-of-year prices with weights derived from capitalization values as of beginning-of-year; from 1962 on, the index is based on the December average of the FT Actuaries All Share Index. Dividends were obtained from the BZW Income Yield series, which gives dividends as a percentage of the price index. Finally, annual stock total returns were computed from the price and dividend series.

Annual macroeconomic and population series were derived by completing IMF's IFS and British Central Statistical Office (CSO) series - which are generally available for all variables at least since 1947 - with historical data from The Economist (1987). Professor David Barr from Brunel University was of invaluable assistance in this task. Total population, consumers' total

expenditure, and GDP at constant/current prices - which I use to compute a GDP deflator - were taken from The Economist for 1918-1947 and IFS for 1948-1997. The GDP series at constant prices in The Economist was in 1985 prices, while in IFS was in 1990 prices. Therefore GDP series at constant prices in The Economist had to be re-written in terms of 1990 prices.

For the interest rate series I use Treasury Bill rates, computed as annual weighted averages of discount rates at the weekly allotments of 91 day bills from The Economist (1918-1961) and the CSO (1962-1992). This series was completed with IFS annual data on TB rates (line 60c) for 1993 to 1997. The annual consumer price index was constructed by combining the retail price index provided by Prof. Barr, which is based on CSO data and also appears in The Economist under the heading Consumer Prices-All Items, for 1918-1956, with the December value of the monthly consumer price index for the UK in IFS for 1957-1997.

Bond data for the UK were derived from the BZW Equity-Gilt study. Yields to maturity are for January 1 of each year. From 1919-1962, yields are based on prices of undated British Funds. From 1962 on yields are based on a portfolio of bonds chosen to represent as closely as possible a 20-year security on a par yield, and containing a weighted combination of four long dated bonds with a mean life of 20.5 years. Issues of less than 1 billion pounds have been excluded, and the weights vary between 40% and 5% of the index.

2.3 United States (1870-1994).

The US annual data on equity markets and macroeconomic variables are an updated version of the data in Grossman and Shiller (GS, 1981). This is the standard data set used in the equity premium literature. The stock market data refer to prices and dividends on the S&P 500 stocks and were updated using the S&P 500 stocks total return, income return and capital appreciation series in the CRSP Stocks, Bonds, Bills and Inflation Series File. The annual stock market price index is the end-of-December S&P 500 Index, while annual dividends on the index portfolio were extracted from the price index and the total return series. The annual stock total return series is the total return series on the S&P 500.

The aggregate nominal per capita consumption of nondurables and services series and the corresponding consumption deflator series in GS data set were updated using data on National Accounts from CITIBASE. The annual interest rate series is the return on 6-month commercial paper bought

in January and rolled over July. The GS series was updated using the commercial paper series in CITIBASE (FYCP series). The annual price index in this data set is the Producer Price Index, which I update using CITIBASE (PW series).

Long bond data were derived from the bond overview chapter in Shiller (1989) which for 1857-1936 is from Macaulay Table 10, column 4 (unadjusted railroad bond yield), thereafter Moody's AAA seasoned corporate bond yield average. This series was updated after 1988 using Moody's AAA corporate bond yield average for the long rate, from Moody's bond annual and website.

3 References.

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