2 Background Information

2.1 House Price Data: Sorting Out the Sources

Even when data for a given country can be identified through national sources, problems with the time series length or geographic coverage are often present. One must also be aware of conceptual and methodological differences in the construction of the house price indexes, in the data aggregation, in the treatment of seasonality, and in the release of the data. These differences across sources in part reflect the segmentation and heterogeneity that characterizes the housing market, but more generally arise from the different motivations that drive the economic agents collecting the primary data that we combine in the database.

The data available from national sources comes from several sources:

A. Private banks, insurers and financial institutions—mortgage or insurance data is often not publicly available and the sample depends on the geographical footprint of these institutions;
B. Real estate agencies—real estate quotes may differ from actual transaction prices and that could bias the construction of the price index, while their sample depends on the geographical footprint of these institutions;
C. Land register/tax offices—tax avoidance motives may bias the results, and could vary over time, over locations and depending on the characteristics of the dwellings;
D. Official institutions not directly participating in the housing or mortgage/insurance markets (Central Banks, National Statistical Offices, international organizations);
E. Others not directly involved in the housing or mortgage/insurance markets (newspapers, universities).

We select data from national public sources—primarily from central banks, statistical offices or other non-government organizations not directly involved in the housing market transactions—to minimize the impact of the potential bias from the collection of data by market participants. We also use data from private organizations (e.g., newspapers, real estate agencies) and even from international organizations (e.g., BIS) in some cases. It is worth pointing out that we rely on publicly available, primary sources in constructing this dataset in order to facilitate both the replication of the country series as well as the wider dissemination of the panel itself. In some instances, we use historical data to extend the series back to the first quarter of 1975. A few of the historical series were obtained upon request from national sources (as indicated in the country descriptions below) or through secondary sources documented in the literature. To the best of our knowledge, the historical series that we use can also be independently recovered by the interested scholars—without further restrictions.

Housing is a heterogeneous good. Quality can vary due to a dwelling's location and its characteristics (e.g., size, property type, new versus existing, date of construction, etc.). The quality of the property differs across locations and over time due to owner modifications as well—a house purchased ten years ago and sold today may be quite different as a result of renovations undertaken and maintenance (or lack thereof). The dwelling characteristics and quality proxies that can be used to control for those differences depend on what is feasible to

obtain by the source of the primary data and what is necessary for its own purposes. The approach used to control for quality and dwelling characteristics could introduce some cross-country heterogeneity in the house price indexes as well. The use of few or no explanatory variables may result in an omitted variable bias whereby prices may fluctuate partly because of changes in the composition of houses being transacted. Both problems may well be present to some extent in our dataset, as standardizing the approach and the controls across countries is beyond the scope of our work.

As housing stock data is generally unavailable, house price indexes are constructed with a sample of the stock of houses actually sold over the sample period. Transactions in the housing market occur infrequently and tend to be unequally distributed across locations. Hence, the sample size and representativeness of the data can be a concern—more so depending on the methodology applied to construct the house price indexes. Several house price index construction methods have been widely utilized attempting to control for sample size as well as for the quality and characteristics of the dwellings (see Section 2.1.3 below for further details): the repeat sales method, the stratification or mix adjustment method, the sale price-appraisal ratio (SPAR) method, and the hedonic regression method. Not all sources collect enough explanatory variables to implement all these methods, so the choice of methodology in each country is partly determined by those data limitations. Lack of enough disaggregated data also prevents us from reconstructing the country house price indexes under a common methodology to correct for the biases and inconsistencies that heterogeneity along this dimension introduces in our panel.

2.1.1 Selection of Comparable House Price Series

The real-time, quarterly database on international house prices currently contains indexes for 23 countries going back to the first quarter of 1975 on (nominal and real) house prices and (nominal and real) personal disposable income (PDI) per working age (15/16-64) population.[1] We use the Personal Consumption Expenditure (PCE) deflator for every country to express the nominal house price and PDI series in real terms.[2] The notion of personal disposable income available to the household sector that we adopt (the PDI) and its measurement in the national accounts are explained in greater detail in Section 2.2 below.

The house price data differs significantly across countries due to characteristics such as the property type, the area covered, the property vintage, or the priced unit. Moreover, as emphasized earlier, differences also arise due to the diverse methodologies applied to construct the indexes in each country, due to the data aggregation procedures used, the frequency of the data releases or even the treatment of seasonality by the source. With the aim to facilitate further research on international house prices, the database we construct is guided by the goal of minimizing the country differences arising from the heterogeneous characteristics of the available sources while doing the least possible violence to the data itself.

To attain this goal we favor the selection of aggregate indexes that share multiple *similarities* in common with our benchmark rather than attempting the more intrusive (and perhaps impractical) approach of reconstructing the indexes from disaggregated data under a common methodology. We choose a representative series from multiple, publicly available sources after sorting out the data for each country for comparability in terms of concept and methodology. Then, we homogenize the country series—as best as possible—in regards to frequency, seasonal adjustment, and to correct for the presence of breaks or outliers in the data.

Selecting closely *comparable* house price indexes and extending the country series back to 1975 makes the panel more suitable for international comparisons across countries and across time. We select country series that are closely aligned with the features of the FHFA quarterly nationwide house price index for existing single-family houses (formerly called OFHEO house price index) in the U.S. A brief description of all house price series is given in this paper discussing the similarities and differences in the data country-by-country. We make note of the features in which discrepancies still persist, and adjust the data along other dimensions to make the reported measures more comparable. We do not attempt to change the primary source data whenever it cannot be reconciled in some aspects with the FHFA reference series by a

[1] The OECD defines working-age population as equivalent to the economically-active population; a concept proposed by the International Labor Organization (ILO). As such, working-age population comprises of "all persons of either sex above a specified age" who supply labor for production purposes (whether employed, unemployed, or seeking work for the first time). The specified age above which population can be counted as economically active is often determined by law, and may differ across countries. For most countries the working age is 15-64. The notable exceptions are the U.S. (which is 16 and over) and Belgium (which is 15 and over). We do not correct for these differences in the definition of working-age population because these differences, in fact, can affect the supply of labor for production purposes and therefore are economically-relevant.

[2] PCE deflator data are obtained from the most recent OECD Economic Outlook database available at the time of an update. The first release is based on OECD Economic Outlook database 89. The PCE deflator for South Africa is obtained from national sources.

straightforward transformation. The transformations that we do apply to the data are discussed in the next section of the paper. Some heterogeneity is inevitable under our approach—especially in concept and methodology.[3]

2.1.2 Other Resources Available on House Prices

Three major international conferences have been hosted over the past 10 years in order to discuss housing indicators and the different methodologies to construct them:

- October 27-28, 2003 – BIS-IMF Conference on Real Estate Indicators and Financial Stability – http://www.bis.org/publ/bppdf/bispap21.htm
- November 6-7, 2006 – OECD-IMF Workshop on Real Estate Price Indexes
- November 11-12, 2009 – Eurostat-IFC-IAOS Conference on Residential Property Price Indices – http://epp.eurostat.ec.europa.eu/portal/page/portal/conferences/introduction/2009/rppi_conference

The ideas, methods and sources argued about during those meetings can be a valuable reference for understanding the measurement of house prices across countries. Other useful references on methodology are Eurostat (2012) and the highly-regarded handbook on residential property price indexes from Eurostat; International Labour Organization; International Monetary Fund; Organisation for Economic Co-operation and Development; United Nations Economic Commission for Europe; World Bank (2013). The latter represents the most current overview of conceptual and practical issues related to the compilation and construction of house price indexes. The handbook is coordinated by the Statistical Office of the European Union (Eurostat), and published jointly under the responsibility of six international organizations: the International Labour Organization (ILO), the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), the Statistical Office of the European Union (Eurostat), the United Nations Economic Commission for Europe (UNECE), and the Inter-Secretariat Working Group on Price Statistics (IWGPS) from the World Bank.

In regards to sources of international data, there already exist a number of compilations of international house price series available. One of the most comprehensive repositories of international house price data, publicly available, is maintained by the Bank for International Settlements (BIS) at http://www.bis.org/statistics/pp.htm. It includes three datasets. The detailed dataset has nominal residential property prices for 58 advanced and emerging countries at present, as released by the source (without attempting to homogenize them). For most countries the dataset contains several series (especially if a breakdown is available, or data is available from multiple compilers). Since June 2014 a dataset with the selected (nominal and real) residential property price series, and one containing long (nominal) series (with a starting date of 1970) have been additionally published beyond the detailed one. These new datasets contain a single selected series for each country that is the closest to nationwide coverage. It typically covers all types of dwellings in markets for both new and existing dwellings in the country as a whole. The long series have been constructed for a smaller set of countries by back-calculating

[3] The most notable deviation being Japan where, as customary, we use land prices as a proxy for the unavailable house price statistics.

the selected ones with historical data with limited coverage for earlier periods. Since September 2016, the BIS has published a dataset on commercial property prices. Finally, a short note on recent developments is also published on a quarterly basis: http://www.bis.org/statistics/pp_residential.pdf. Panel data can also be obtained from international organizations—like the OECD at http://www.oecd.org/statistics/, or Eurostat which provides standardized quarterly series since 2005 for all European Union member states at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_hpi_q&lang=en.[4] The IMF combines the OECD dataset with other sources for non-OECD member countries to construct a Global House Price Index with a total of 51 advanced and emerging economies with varying concept and coverage, as illustrated here: http://www.imf.org/external/pubs/ft/fandd/2013/12/picture.htm.[5]

Data can also be obtained directly from official and public national sources. Private compilations of house price data for a variety of countries also exist, e.g., the Global Property Guide (GPG) website at http://www.globalpropertyguide.com/real-estate-house-prices/ is a very valuable reference and one of the most comprehensive on the existing sources by country.[6] GPG collects detailed house price data for 60 countries, including all series available for each. Other sources include Knight Frank surveys 55 countries since 2006 to produce a global house price index. More information about Knight Frank's research on real estate can be found at http://my.knightfrank.com/research-reports/global-house-price-index.aspx. Another private source of international house price data, although access to their series may require a subscription, is the website of Trading Economics at http://www.tradingeconomics.com/country-list/housing-index. The Economist makes its data available at http://www.economist.com/houseprices. The Economist tracks house prices since 2002 and its readers can compare 21 markets on a number of house price indicators. The time-series data of The Economist, GPG and Knight Frank do not always extend as far back in time or is easily accessible for research purposes.

[4] A quarterly version of the OECD data has been used in a number of cross-country studies as well (see, e.g., OECD (2005) , Girouard et al. (2006), and André (2010))). The OECD cross-country dataset came about with the same intent of making heterogeneous national sources more comparable. Differences appear partly because our coverage is not limited to OECD countries and because we restrict ourselves to use only publicly available sources that can be independently replicated.

[5] For further background on the IMF data sources, see also Igan and Loungani (2012).

[6] See a summary of definitions and sources used by GPG at: http://www.globalpropertyguide.com/investment-analysis/House-Price-Data-and-Sources.

2.1.3 More in Depth: Different Approaches to Construct a House Price Index

Summary of Standard Methodologies to Construct a House Price Index

- Repeat sales method:

The repeat sales method compares the prices of dwellings that are sold more than once within sample. It is generally implemented pooling all the repeat sales data over all periods under observation in a regression. Methodological problems include: (a) small sample size as at least two transactions on the same property are needed in sample, but housing transactions are infrequent; (b) bias due to quality changes over time (e.g. as a result of depreciation, maintenance, renovations). The repeat sales method is used by the FHFA to construct the U.S. series that we use for reference.

- Stratification and mix-adjustment method:

The method relies on the stratification of transactions data by groups with similar characteristics in the sample, rather than tracking individual dwellings. The average transaction prices of every grouping in each period are then used as the price for dwellings with those same characteristics (even though the properties in the group are changing over time). The overall price index is then constructed by aggregating across all groups. This allows for larger samples, but stratification is still subject to a quality bias problem similar to the repeat sales method. A post-stratification of samples is then usually applied to control for the changes over time in the quality of the dwellings sold. The method including quality controls is known as mix adjustment.

- Sale price-appraisal ratio (SPAR) method:

The SPAR method combines transaction price data with appraisal information on the dwelling to calculate a transaction price-to-appraisal ratio. This ratio is used to control for the quality across properties and over time. This method may be applied on all available data, not just on the subset of dwellings reporting repeat sales. However, implementing this method requires access to a database on official property valuations providing appraisals of properties (such as through matched real estate taxation data, matched mortgage valuation data, etc.).

- Hedonic regression method:

The hedonic regression methods (which can be combined with all other methods) are econometric models to account for the heterogeneous characteristics of the dwellings and for quality changes over time. The standard method models dwelling prices as a function of the characteristics of the property and a set of time dummy variables. As data on all sample periods are pooled together, this method controls for quality bias and can be applied to samples that include non-repeat sale transaction prices. The hedonic imputation method constructs a house price index based on dwelling characteristics using the predicted value to impute a price on periods in which there are no transactions. In the housing market where sales are infrequent this allows the sample of dwellings to remain stable over time.

2.2 Personal Disposable Income Data: Measuring Households' Income in the National Accounts

In addition to house price index data, we also collect series on personal disposable income (PDI)—which represent the income resources "at hand" for the household sector for current purchases—for each country, expressed per working-age population. PDI series are also reported in real terms with the personal consumption expenditure (PCE) deflator. PDI is generally the preferred measure to assess the affordability of housing, and therefore, an economically relevant variable for the study of housing demand and the determinants of house prices.

For all countries, PDI data is collected from national sources. In the U.S., the information on PDI can be found in the National Income and Product Accounts (NIPA) produced by the Bureau of Economic Analysis (BEA).[7] Other countries report their national accounts and income distribution through their official statistical offices. All of the countries in the international house price database currently follow the United Nation's System of National Accounts (UNSNA), which establishes international guidelines for national accounting. This provides some consistency on the sources, although the implementation may still differ from country to country.

Heterogeneity arises most notably because some countries do not incorporate all the guidelines of UNSNA in their national accounts. Differences emerge from country-specific departures from UNSNA guidelines which we generally cannot correct for. Hence, while we rely on commonly reported (publicly available) data in order to obtain or derive the PDI per capita measures, consistency across countries exists to the extent that the reporting countries adopt similar UNSNA guidelines to construct their national accounts. We discuss those differences further in Section 2.2.1 below.

We also illustrate the different methods of extracting PDI data from various national account aggregates and describe the relevant accounting identities that relate to those aggregates, allowing for a more comprehensive interpretation of the data.

2.2.1 Differences in the Adoption of the United Nations' System of National Accounts (UNSNA)

The United States NIPAs have not adopted all of the guidelines for national accounting set forth by the UNSNA, and this occurs with other countries included in the international house price database as well. However, the differences between the NIPAs and UNSNA in the definition of gross domestic product (GDP) appear small—as discussed in Mead, Moses, and Moulton (2004)[8]—and the same is expected for other countries. Although the impact should not be overestimated, the differences are more significant when we compare the aggregate components of GDP or gross national product (GNP). In particular, we highlight here the differences that occur in the classification of certain groups (unincorporated firms and nonprofit institutions

[7] For more details about the NIPAs, see Seskin and Parker (1998).

[8] Once a year, the BEA prepares annual estimates on a UNSNA basis in response to a questionnaire from the Organisation for Economic Co-operation and Development (OECD). These estimates can be found at http://bea.gov/national/sna.htm, and are published by international organizations such as the OECD. While it improves the comparability of U.S. national accounts statistics with those of other countries, the exercise does not extend to quarterly data. These estimates, therefore, do not reconcile the methodological differences that exist in the quarterly data even among OECD member states.

serving households (NPISHs)) and in the presentation of the national accounts, as they affect the derivations of PDI.

A. In regards to differences in classification: unincorporated firms or enterprises are, in principle, included in the UNSNA in the household sector, but appear in the business sector in the NIPAs.[9] Nonprofit institutions serving households (NPISHs)[10] are classified in the UNSNA either in the non-financial or the financial corporation sectors, but included in the household sector in the NIPAs. Other countries follow the same practice and bundle households with NPISHs together—for example, France. For measuring national income, however, the institutions classification used in the NIPAs changes to conform more closely with the UNSNA guidelines, which somewhat mitigates cross-country differences in the PDIs.

   The NIPAs define the personal sector to include households and the income that is earned by, or transferred to, households and all NPISHs, as well as the income of unincorporated enterprises (including owner-occupied housing). The personal sector is thus closer conceptually to the combination of the UNSNA household sector, which includes unincorporated enterprises, and the NPISH sector, which is included in the UNSNA corporation sector. As a result, the main discrepancy that remains is due to the classification of NPISHs. For most countries in the international house price database, the personal sector includes NPISHs, while other countries adhering to the UNSNA guidelines would exclude them from the household sector.[11] We adopt the NIPA classification of the personal sector as the reference, but do not attempt to adjust for discrepancies in the classification of NPISHs further as they generally represent a tiny share of the economy.

B. In regards to differences in presentation: The UNSNA household disposable income (HDI) and the NIPA disposable personal income (DPI) are calculated using different methods. Both income measures include all sources of personal income, less contributions for social insurance and personal taxes. The NIPA measure includes interest and other transfers paid by persons, which are excluded from the UNSNA measure. The NIPA measure also includes pension fund contributions but does not include pension fund benefits, while the UNSNA measure excludes pension fund contributions and

[9] A corporation is a firm or enterprise with a legal identity separate from that of its owners and limited liability. Unincorporated firms or enterprises have no distinction between the firm and its owners, which are personally liable in case of bankruptcy. One of the major legal requirements to become a corporation is the publication of a complete set of accounts—there are also differences in taxation. The published accounts of corporations help to construct the national accounts of the corporate sector. Unincorporated enterprises tend to be small or medium-sized, and play an important role in agriculture and occupations requiring advanced technical knowledge which can be pursued in self-employment (such as the so-called liberal professions in law, medicine, architecture, engineering, etc.). Their output contribution remains limited by the fact that as they expand, small firms tend to either disappear or transform themselves into corporations.

[10] NPISHs are owners of unincorporated enterprises or firms, nonprofit institutions that primarily serve individuals, religious organizations, private trust funds, and private noninsured welfare funds. For additional information, see Mead, McCully, and Reinsdorf (2003).

[11] Statistical offices that include NPISHs in the personal sector are those of the U.S., Australia, Belgium, Switzerland, Germany, the U.K., Israel, Korea, Norway, New Zealand, and Eurostat—which serves as our PDI source for Denmark, Spain, Finland, Ireland, Italy, Luxembourg, the Netherlands, and Sweden.

includes pension fund benefits instead. Again, while we adopt the definition of disposable personal income from the NIPAs as our reference for the PDI, we do not attempt to correct for the discrepancies between HDI and DPI across countries any further.

Another difference arises because the national income (NI), which corresponds to the sum of all incomes, does not equal the net national product (NNP = GNP – depreciation of capital) given that the components are measured independently. In the NIPAs, the difference between GDP and GDI is called the statistical discrepancy. Not all other countries incorporate such an item in the income side. This is because one or more expenditure or income categories included are absorbing the difference as a residual or because the discrepancy is allocated to the income components of the national accounts. The distribution of the statistical error could affect the derivations of the PDI measures, but correcting for it goes beyond the scope of this project.

2.2.2 From Gross Domestic Product to National Income

GDP is the broadest measure of a country's economic activity. It represents the total final goods and services produced by the factors of production within a country for a given period, at market prices. GDP can be calculated using three separate approaches: the product (or value-added) approach, the income approach, and the expenditure approach. These three approaches must result in equivalent measures of economic activity (PRODUCT = EXPENDITURE = INCOME), up to a statistical discrepancy. These relationships implied by the circular flow model are the basis for national accounting which tracks the flow of final goods and services from firms to final consumers, the opposing flow of expenditure payments from final consumers to firms, and the flow of factor payments (income) from firms to their providers of productive goods and services. National accounting also explicitly describes the participation of government as well as the linkages of an economy with the rest of the world.

The production approach measures output from the value-added of all goods and services produced in the economy. The goods and services that are produced are also consumed. The expenditure approach measures output from the value of total expenditures. Personal consumption expenditures (PCE) largely includes goods and services purchased for final use (excluding illegal transactions) in the market economy, but a portion of goods and services are incorporated through imputed values—the most important of which is rental value of owner-occupied housing. Goods and services consumed by the public sector are represented by government purchases. Gross private domestic investment measures capital purchases made by businesses. Net exports reflect the domestic consumption of goods and services produced abroad and the foreign consumption of domestically produced goods and services.[12]

The income approach measures the payments generated by participation in the production process—it adds up the remuneration to the different factors of production (such as labor and

[12] The NIPAs show GDP as the sum of personal consumption expenditures, gross private domestic investment, net exports of goods and services, and government consumption expenditures and gross investment. The UNSNA shows GDP, instead, as the sum of final consumption expenditures (by households, NPISHs, and government), gross capital formation (including gross fixed capital formation, change in inventories, and acquisitions less disposals of non-financial, non-produced assets) from private and government sources, and net exports of goods and services.

capital). However, not all income generated within an economy's borders is received by its own citizens. Gross national product (GNP) controls for this. It is equal to GDP minus factor payments received by foreign citizens from domestic production plus factor payments earned by domestic citizens from foreign production. We illustrate the different components under the income and expenditure approach in Figure 1 below.

Net national product (NNP) obtained from the product approach equals GNP minus depreciation of fixed assets (also referred to in the NIPAs as consumption of fixed capital).[13] National income (NI) is the aggregate of all factor payments from the income side. NI can be calculated directly from its income components and, to explore it further, we adopt the NIPA definitions as a reference. It includes factor remuneration: employee compensation, proprietors' income, rental income of persons, corporate profits, and net interest. It also takes account of the effect of government policies on income through business current transfer payments, taxes on production and imports less government subsidies, and current surplus of government enterprises. The difference between NNP and NI amounts to statistical error and omissions.

2.2.2.1 Income vs. Expenditure Accounting Identities

From income side: GDP = C + G + S – NFP,
From expenditure side: GDP = C + G + I + NX,
where GDP = gross domestic product,
C = private consumption,
G = government expenditures and investment,
S = national (gross) saving,
I = private (gross) investment,
NFP = net factor payments from abroad,
NX = net exports.

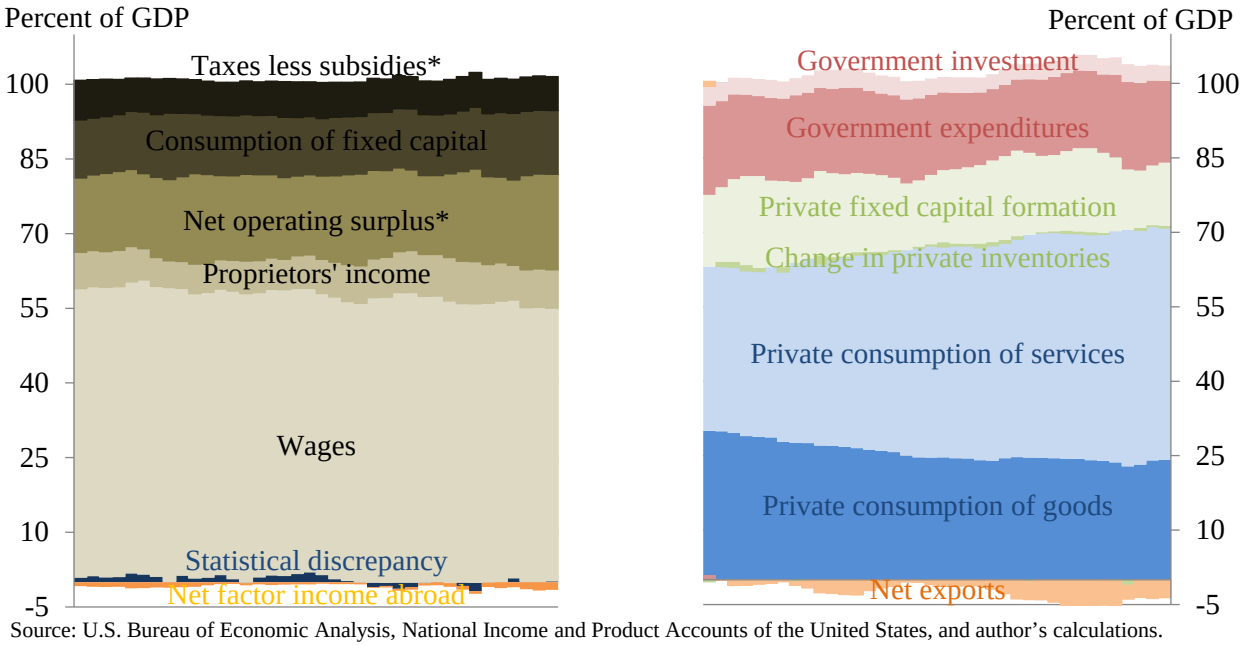
2.2.2.2 National Income Accounting Identity

Gross National Product: GNP = GDP + NFP.
National Income: NI = GNP – capital depreciation (consumption of fixed capital) – statistical discrepancy.

[13] Capital consumption adjustment for corporations and for nonfarm sole proprietorships and partnerships is the difference between capital consumption based on income tax returns and capital consumption measured at straight-line depreciation, consistent service lives, and replacement cost. The tax return data are valued at historical costs and reflect changes over time in service lives and depreciation patterns as permitted by tax regulations. Inventory valuation adjustment represents the difference between the book value of inventories used up in production and the cost of replacing them.

Figure 1. Composition of U.S. Annual GDP (Current $, 1975-2012)

GDP: Income Account **GDP: Expenditure Account**



Source: U.S. Bureau of Economic Analysis, National Income and Product Accounts of the United States, and author's calculations.
* Taxes less subsidies refers to taxes on production and imports less subsidies. Net operating surplus (NOS) corresponds to the income generated by either a corporation or government enterprise net of labor compensation and taxes on production and imports. NOS includes rental income, net interest payments from businesses, corporate profits, business current transfers, and current surplus of government enterprises. The term proprietor's income or mixed income is used to denote income generated by individual owners or self-employed individuals since wage income and NOS of unincorporated enterprises owned by households are often undistinguishable.

2.2.3 From National Income to Personal Disposable Income

The NIPA concept of disposable personal income is used as reference for the international house price database. In the NIPA, personal income corresponds to the components of national income that are actually received by the household sector in the form of factor payments and current transfers. Households receive income by directly participating in the production of goods and services. This is measured by wages and salaries, proprietors' income, and rental income of persons. Personal income does not include employer contributions and employee and self-employed contributions for government social insurance programs (social security and pensions, unemployment), so this is deducted from the employee compensation component of the national accounts. Households also participate in the production of goods and services through direct ownership or indirect financing of the stock of capital. The capital and financial income generated is distributed back to households in the form of personal dividend income and personal interest income.

The amount of income received is derived from the income earned in production after adjusting to reflect current transfers. Adjustments are made for transfers from businesses and the government, since including transfers among individuals would lead to double-counting in personal income. Moreover, certain nonmonetary types of income are included as part of personal income—in particular, the estimated net rental value to owner-occupants of their

homes, but also certain services such as those provided complementary and without payment by financial intermediaries. Undistributed corporate profits are not received by the household sector and, therefore, not included in personal income. If undistributed profits are added to personal income, it is considered private income instead—that's the only difference between personal income and private income.

Personal disposable income (PDI) is the part of the personal income retained by the household sector (including the NPISHs according to the NIPA guidelines) after subtracting all direct taxes (income taxes, estate and gift taxes, and property taxes plus other miscellaneous receipts) levied by the government. PDI measures the amount of income that is actually available for current spending or saving. Under the income approach, it is calculated by subtracting personal current taxes from personal income. The income approach method reflects the sources of PDI. In turn, the expenditure approach measures the uses of PDI. Under the expenditure approach, the PDI can be computed as the sum of household final consumption expenditure (including interest and transfer payments) and household savings.[14]

While the definition of PDI that we use for reference is that of the NIPAs, it should be noted that discrepancies arise in the definition across countries due to differences in the national accounting methodology that each country follows as discussed in Section 2.2.1 above. Real income is the nominal PDI divided by a general price index—the personal consumption expenditure (PCE) deflator—at a given base period. Per capita income is the ratio of PDI over the total working age (15/16-64) population of the country.

2.2.3.1 National Income by Institutional Sector[15]

The fundamental national income accounting identities are stated in Section 2.2.2.1 and Section 2.2.2.2 above. In here, we provide a basic description of how the different income components are allocated and become disposable income of the household (personal) sector, the corporate sector, and the government sector illustrating the economic relationships that exist among them in the national accounts. A complementary illustration that describes these accounting and economic relationships in the context of the circular flow model can be found in Figure 2 below.

[14] Adjustments for changing equity in pension fund reserves can also be included to insure the balance of net contributions does not enter into household savings. PDI is also the total amount of final consumption of goods and services that the household sector is able to afford in a given period (abstracting from capital transfers) without having to change their financial and non-financial asset position or their liabilities (changes that would be reflected in the Flow of Funds).

[15] In defining these accounting identities, for illustration purposes only (to keep the presentation simple) we abstract from business current transfer payments (net) and current surplus of government enterprises as these income sources tend to be small in the national accounts. Unlike what is recommended by the guidelines of UNSNA, the NIPAs correct the measure of disposable personal income including personal interest payments (INT^h) but we abstract from that item here as well to keep the identities simple. For similar reasons, we do not distinguish explicitly between government consumption and investment expenditures as it is done in the NIPAs.

National Income: $NI = GNP - depreciation - statistical\ discrepancy = PDI + DI^{corp} + DI^{gov}$

Personal Disposable Income: $PDI = (NI - \Pi^{und} - DIV^{gov}) - (T^{corp} + T^{Y} + T) + (TR - SSC) + INT^{gov}$

Corporate Disposable Income: $DI^{corp} = NI - \text{all factor payments outside the firm} = \Pi^{und}$

Government Disposable Income: $DI^{gov} = (T^{corp} + T^{Y} + T) + DIV^{gov} - (TR - SSC) - INT^{gov}$

where NI = national income,
PDI = personal disposable income,
DI^{corp} = disposable income retained by the corporate sector,
DI^{gov} = disposable income of the government,
Π^{und} = undistributed profits (essentially retained earnings),
DIV^{gov} = government dividend receipts,
T^{corp} = profit tax liability,
T^{Y} = taxes on production and imports less subsidies,
$R = T^{corp} + T^{Y}$ = other government revenue,
T = personal taxes,
TR = transfer payments—specifically, gov't social benefit payments to persons,
SSC = contributions for social insurance,
INT^{gov} = net government interest payments.

2.2.3.2 Savings-Investment Identity

The income side of the national accounts is by construction reconciled with the expenditure side. Hence, the disposable income received by the different sectors has to be either invested or saved. The following economic relationships describe the linkages between disposable income and expenditures as well as between national savings and the current account (foreign savings).

National (gross) Saving: $S = S^{pvt} + S^{corp} + S^{gov} = GNP - C - G$

National (net) Saving: $S^{net} = S - \text{capital depreciation} = (NI + \text{statistical discrepancy}) - C - G$

Personal Saving:[16] $S_{pvt} = PDI - C$

Corporate Saving: $S^{corp} = DI^{corp} + \text{capital depreciation} = \Pi^{und} + \text{capital depreciation}$

Government Saving: $S_{govt} = DI^{gov} - G$

where GNP = gross national product,
C = private consumption,
G = government expenditures and investment,
S = national (gross) saving.

Balance of Payments: $CA = NX + NFP$

where CA = current account,
NFP = net factor payments from abroad,
NX = net exports.

Savings-Investment Identity: $S = I + CA$

where S = national (gross) saving,
I = private (gross) investment.

[16] Personal saving is defined in the NIPAs as S_{pvt} = PDI – Personal Outlays, where Personal Outlays = C – Personal Interest Payments – Personal Current Transfer Payments. Personal interest payments (INT^{h}) and personal current transfers are generally very small, so we abstract from them in these equations without too much loss of generality.

We illustrate the relation of GDP, GNP, net national product, national income, personal income, personal disposable income, and personal saving using annual U.S. data for the year 2012 in Table 1 and Table 2 below. This offers a more detailed description of the income and expenditure accounts under the NIPA guidelines than the stylized linkages described in Section 2.2.3.1 and Section 2.2.3.2.

Table 1. U.S. Income and Expenditure Account Tables from NIPA

Income Account			Expenditure Account		
Item	2012*	% of GDP	Item	2012*	% of GDP
Gross domestic product (GDP)	**16244.6**	100%	**Gross domestic product**	**16244.6**	100%
Plus: Receipts of factor income from the rest of the world	818.6		Personal consumption expenditures	11149.6	69%
Less: Payments of factor income to the rest of the world	565.7		Personal consumption of goods	3769.7	23%
Equals: Gross national product (GNP)	**16497.4**	102%	Personal consumption of services	7379.9	45%
Less: Consumption of fixed capital	2542.9		Government purchases	3167	19%
Equals: Net national product (NNP)	**13954.6**	86%	Government expenditures	2548.1	16%
Less: Statistical discrepancy	-17		Government investment	618.9	4%
Equals: National income (NI)	**13971.6**	86%	Gross private domestic investment	2475.2	15%
Compensation of employees	8611.6	53%	Private fixed capital formation	2409.1	15%
Wages and salaries	6926.8		Change in private inventories	66.1	0%
Wages and salaries, dispersed to employees	6906.0		Net exports of goods and services	-547.2	-3%
Wages and salaries, accrued but not dispersed	20.8		Equals: Exports	2195.9	
Supplements to wages and salaries	1684.9		Less: Imports	2743.1	
Contributions for social insurance	950.7				
Other labor income	734.2				
Proprietors' income	1224.9	8%			
Rental income of persons	541.2	3%			
Corporate profits	2009.5	12%			
Profits tax liability	434.8				
Profits after tax	1574.7				
Net dividends	770.3				
Undistributed profits	804.3				
Net interest	439.6	3%			
Business current transfer payments (net)	106.9	1%			
To persons (net)	41.4				
To government (net)	70.6				
To rest of the world (net)	-5.1				
Taxes on production and imports less subsidies	1065.6	7%			
Current surplus of government enterprises	-27.7	0%			

Source: U.S. Bureau of Economic Analysis, National Income and Product Accounts of the United States, and author's calculations.
*Current dollars.

Table 2. Personal Disposable Income by Its Components from NIPA

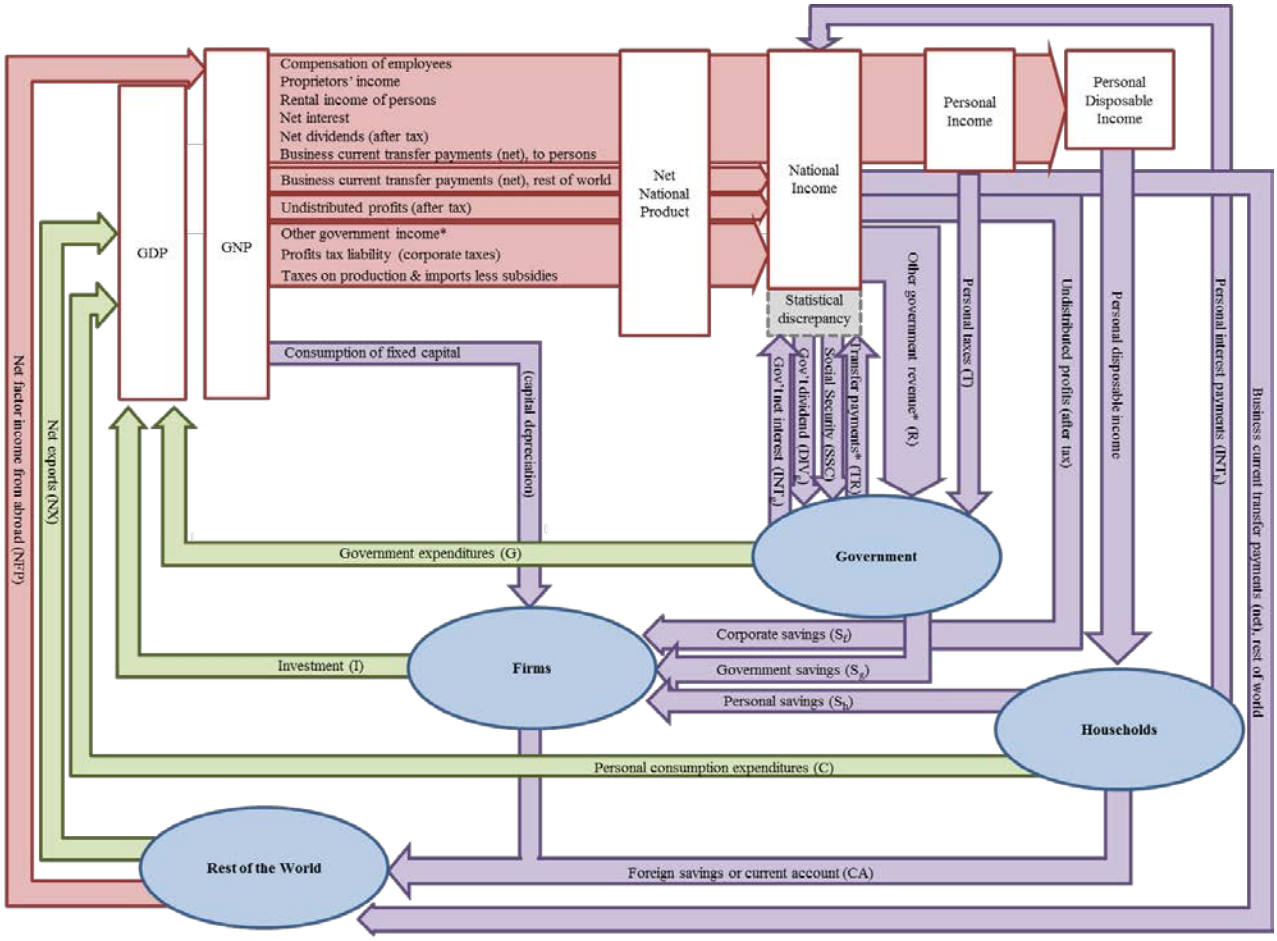
Income Account			Expenditure Account		
Item	2012*	% of GDP	Item	2012*	% of GDP
Personal income	**13431.1**	83%			
Wages and salaries, dispersed to employees	6906.0	43%			
Other labor income	734.2	5%			
Proprietors' income	1224.9	8%			
Rental income of persons	541.2	3%			
Personal dividend income	757.0	5%			
Net dividends from corporate profits	770.3				
Less: Government dividend receipts	22.8				
Personal interest income	992.6	6%			
Net interest	439.6				
Plus: Personal interest payments	172.7				
Plus: Government interest payments	431.5				
Less: Government interest receipts	115.9				
Transfer payments to persons	2375.1	15%			
Business current transfer payments, to persons (net)	41.4				
Plus: Government social benefit payments to persons	2329.2				
Less: Personal current taxes	1480.4	9%			
Equals: Personal disposable income (PDI)**	**11950.8**	74%	**Personal disposable income (PDI)**	**11950.8**	74%
			Personal outlays	11460.3	71%
			Personal consumption expenditures	11149.6	69%
			Personal interest payments	172.7	1%
			Personal current transfer payments	168	1%
			Personal savings	490.5	3%

Source: U.S. Bureau of Economic Analysis, National Income and Product Accounts of the United States, and author's calculations.
*Current dollars.
**PDI can also be computed from national income (NI). PDI = NI – wages and salaries accrued but not dispersed – contributions to social insurance – profits tax liability – government dividend receipts – undistributed profits + net government interest payments + personal interest payments – net business current transfer payments to government and rest of the world – taxes on production and imports less subsidies – current surplus of government enterprises – personal current taxes.

2.2.4 More in Depth: The Circular Flow and Personal Disposable Income

Understanding personal disposable income (PDI) in the NIPAs is further illustrated in the following stylized representation of the circular flow of the economy, which emphasizes how the different income sources enter into or are excluded from the PDI measure that we take as reference for the work on the international house price database (see Figure 2). A stylized description of the accounting identities underlying Figure 2 can be found in Section 2.2.3.1 and Section 2.2.3.2.

Figure 2. A Circular Flow Representation of the Sources of Personal Disposable Income



* *Other government income* includes business current transfer payments (net) to government and current surplus of government enterprises. *Other government revenue* includes other government income, profit tax liability and taxes on production and imports less subsidies. *Transfer payments* refer specifically to government social benefit payments to persons.
Source: Author's representation of the circular flow model based on the National Income and Product Accounts (NIPA) of the U.S. based on Gary E. Clayton (2008): "Economics: Principles and Practices," Student Center, Unit 4, Ch. 12, Figure 12.3 - Circular Flow of Economic Activity, The McGraw-Hill Companies, ©2008.