New Real-Time Evidence of the U.S. External Variables ☆

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Abstract

This paper introduces a comprehensive new real-time data set (RTDS) related to the U.S. external sector variables. The RTDS is constructed based on official publications of 37 quarterly and annual variables. It includes variables related to the U.S. current account, financial account and international investment position accounts. Firstly, we employ standard statistical tests to examine whether initial announcements of the variables are rational forecasts of revised data. We find evidence against the desirable properties of revisions for some of the variables. Secondly, we run a real-time exercise to examine the relationship between U.S. current account balance and domestic savings. The response of current account balance is weaker using latest vintage data than the response when real-time data is used. Differences in the relationship remain valid once revisions are taken into account.

Keywords: current account, financial account, international investment position accounts, revision, real-time data

1. Introduction

Macroeconomics and finance literature generally and typically draw empirical conclusions based on most recent historical data (i.e. data that has been available to the researcher at the time of the study). Although we are only *one-click* away from such final data, most of the variables of our interest are revised almost forever after they are initially released. More importantly, data revisions can be considerable, indicating that they may reflect measurement error in initial estimates rather than they ought to be unpredictable given the information set available.

There has been significant effort in literature to study different aspects of uncertainty stemming from data estimation process for a long time. Some authors have explored on whether preliminary announcements of major variables are predictable or not [for example, see Aruoba, 2008, Mankiw et al., 1984, Mankiw and Runkle, 1986, Mork, 1987, 1990, Faust et al., 2005]. Some others have analysed the impact of real-time data either on econometric

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modelling and forecasting exercises [for example, see Christoffersen et al., 2002, Faust et al., 2003, Diebold and Rudebusch, 1991, Rudebusch, 2001, Croushore and Stark, 2001, Akdogan and Aksoy, 2010] or on monetary policy analysis [for example, see Orphanides, 2001, 2003, Bernanke and Boivin, 2003]. Although some of the results are mixed, it is now widely recognized that the use of real-time data may be crucial for studies especially, to which the availability of information matters.

Only a minority of the related literature has assessed the worth of real-time data in open economy settings. Faust et al. [2003] and Akdogan and Aksoy [2010] have examined the real-time forecasting performance of economic models of exchange rate determination with the latter putting emphasis on possible non-linear adjustments to fundamentals driven equilibrium. Both papers have concluded that the exchange rate forecastability is sensitive to real-time issues. Besides, Curcuru et al. [2008] and Lane and Milesi-Ferretti [2009] have considered the role of data uncertainty in explaining the order of external imbalances. Both studies, in general, have argued the previously estimated differences between U.S. financial stocks and accumulated financial flows with the rest of the world are very likely to reflect the unrecorded flows rather than mismeasured capital gains.

Popular variables of interest that have been studied in real-time literature are mostly related to domestic production sectors, labour markets, money markets, and price levels. Some of the variables include nominal/real gross domestic product, monetary aggregates like M1 and M2, unemployment rate and various consumer price inflation measures. Besides these, Curcuru et al. [2008] and Lane and Milesi-Ferretti [2009] have examined the U.S. decomposition of financial flows and positions in real-time, but with only unrevised and finally revised figures at annual frequency.

There is not any comprehensive RTDS publicly available for the full set of variables related to a country's external sector. What we do mean from the external sector is the representation of flows of goods, services, and income, financial transactions as well as outstanding financial assets and liabilities vis-à-vis foreigners. At most, ArchivaL Federal Reserve Economic Data (ALFRED) of St. Louis FED contains real-time data for a range of the U.S. balance of payments (BOP) variables[1]. However, in ALFRED, the vintage coverage for these variables is quite shorter than the vintages covered for the U.S. National Income and Product Accounts (NIPAs) variables in RTDS for Macroeconomists of Philedelphia FED[2].

In this paper, we introduce a comprehensive new RTDS for the U.S. external sector variables. The RTDS is constructed based on the official news releases and publications by the U.S. Bureau of Economic Analysis (BEA). The data set includes 37 quarterly and annual variables associated with the U.S. current account (CA), financial account (FA) and international investment position accounts (IIP). For the U.S. quarterly BOP variables, our RTDS is an extended version of ALFRED in terms of the vintages it covers. For the U.S. IIP, it is a new real-time database that captures annual data for major variables of U.S. financial positions. We analyze the properties of revisions to the U.S. BOP variables in an empirical approach

[1]ALFRED is available at Federal Reserve Bank of St. Louis website, `http://alfred.stlouisfed.org`.

[2]The data set is available at Federal Reserve Bank of Philadelphia website, `https://www.philadelphiafed.org`.

similar to Mankiw et al. [1984] and Aruoba [2008]. We specifically investigate the zero mean, small variance and unpredictability properties of revisions. We are obviously not the first to examine the nature of data revisions in general. However, we do believe that this paper differs from the existing literature in terms of the variables it deals with[3]. We provide statistical properties of revisions and test for their rationality under the news and noise hypotheses. We examine not only revisions to annualized growth rates, as it is the usual practice, but also the revisions to levels on the grounds that the nature of our variables necessitates such analysis from a statistical perspective. While working with levels, we bear in mind the problems associated with studying level variables.

We find strong evidence against the desirable properties of revisions for some of the U.S. BOP variables. Firstly, our empirical results indicate that initial announcements are biased. Secondly, the revisions are quite large in magnitudes relative to the final value of the variables. Finally, we find evidence against the news hypothesis for a considerable number of variables.

We also run empirical exercises to see whether the relationship between the U.S. current account balance and domestic savings changes when available data at different vintages are considered. This is nothing but the examination of Feldstein and Horioka [1980] regression using U.S. time series available for 91 data vintages. Feldstein and Horioka [1980] (FH hereafter) estimate a regression of domestic investment on national savings using cross sectional data from 16 OECD countries. They empirically found that a change in domestic savings leads to an almost one-to-one change in domestic investment, leaving current account balance mostly unchanged. Although FH interpreted this finding against perfect international capital mobility, there is a vast amount of literature which concludes the strong association between domestic savings and investment can be valid independent of the degree of financial integration (for example, see Frenkel and Razin, 1986 for the role of fiscal shocks; Baxter and Crucini, 1993 for the role of productivity shocks; Kraay and Ventura, 2000; and Lane and Milesi-Ferretti, 2002, 2004 for the role of foreign assets; Sinn, 1992; and Coakley et al., 1996 for the role of intertemporal budget constraint).

To our knowledge, real-time open economy consideration of econometric modeling with external sector variables has not been studied before. We focus on a simple model with possible misspecification problems and do not put a lot of emphasis on the explanations to our results. However, we still find it intriguing as it allows us to examine the allocation of marginal unit of savings in open economy theory in real-time. In contrast to the revision analysis, in this exercise, we examine our variables of interest in ratios (of GDP). Hence, we do consider the revisions to ratios that is what that matters in theory. Moreover, such an exercise gives us the opportunity to use real-time current account balance available in our RTDS in conjunction with other real-time variables, namely nominal GDP and domestic savings, available in Real-Time Dataset for Macroeconomists of Philadelphia FED and ALFRED of St. Louis FED (ALFRED), respectively.

[3]Some statistical measures of revisions to external sector variables are analyzed in data quality reports of some official statistics providers [for example, see McLennan, 1996, Mistry, 2007, Yorgason and Scott, 2012, ECB, 2014].

The relationship between current account balance and domestic savings is found to be weak both at the latest vintage and in real-time, in favor of the FH findings. The relation is stronger when sample period and vintage change. However, for a fixed sample period, the estimated relation in real-time adjusts to its latest vintage counterpart after a considerable number of vintages.

The paper proceeds as follows. In the next section we describe our RTDS and the data used in the empirical analysis. In Section 3, we consider the statistical properties of data revisions. In Section 4, we examine the effects of revisions on the FH regression. Section 5 concludes. We also present detailed and supplementary information about the data set, revision analysis, and FH regression in Appendices A, B, C and D.

2. An Overview of the RTDS

We have matrix-form data for each variable covered in our RTDS. The first dimension is related to vintage dates in columns whereas the second dimension is reference periods (observation dates) in rows. Given a reference period, the RTDS records all the initial announcements and the subsequent intermediate revisions announced later on for each variable.

The data set consists of time series snapshots of several U.S. macroeconomic and financial variables in relation with the rest of the world. The RTDS is constructed based on the publications of the official statistical agency, BEA. The related publications are on the U.S. international transactions accounts (ITAs) and international investment position accounts (IIP)[4].

The data set has coverage of 37 quarterly and annual variables, with data vintages being collected since 1991. The first sub-data set includes time series for 25 major quarterly variables regarding the U.S. ITAs. The time series for these variables go back to the first quarter of 1960 in some of the vintages. Unlike the data set for the U.S. ITAs, its IIP counterpart comprises annual series of 12 selected variables[5]. For the majority of the variables, annual series start at most from 1976.

The RTDS covers 4 types of variables.

(i) *gross CA* variables - gross flows related to the U.S. current account,
(ii) *net CA* variables - net flows related to the U.S. current account,
(iii) *net FA* variables- net flows related to the U.S. financial account,

[4]We use the term *international economic accounts* for any statistics related to the quarterly international transactions accounts and annual international investment position accounts throughout this paper. The terms *international transactions accounts* and *balance of payments accounts* are used interchangeably in the paper.

[5]BEA has started to release IIP statistics on a quarterly basis only since March 2013. Quarterly time series have considerably short time-span and are available for only a number of vintages. Therefore we choose to record the annual series in annual vintages up to March 2013 and through quarterly vintages until then.

(iv) *IIP* variables- financial positions related to the U.S. international investment position accounts.

Only *net* IIP variable in the data set is the net international investment position. Details of the variables are presented in Appendix A.
There are at most 91 vintages in the ITAs RTDS. The IIP RTDS contains 26 vintages. The first vintage is June 1991 for all variables with few exceptions. For the IIP data set, the vintages are annual up to the June 2012 vintage. Afterwards they are quarterly. The latest vintage for all variables is December 2013.
Time series for all variables in the RTDS are presented *as they appear* in the official releases through time. Hence, the RTDS is constructed based on a snapshot approach, representing the state of information as available at the moment the snapshot was taken. The snapshot approach has some implications for our RTDS. Firstly, this approach requires that all variables in our RTDS being presented in levels. Quarterly variables are at quarterly levels, rather than annualized. Secondly, time series in the RTDS may differ from the series someone would have constructed through summing up relevant items in the international economic accounts. This is a consequence of the rounding effects, but these effects are still negligible. Thirdly, the RTDS documents time series for each variable in a vintage if the series were explicitly published in the official releases. This does not mean that the RTDS has missing vintages in-between for some variables, but rather means that the starting vintage may differ across variables. Finally, the time-span covered for a variable may differ across vintages. Having said that, given BEA's transparent revision policy, time-span for a vintage can easily be extended far back to the origin of series available in other vintages of the same variable. This is what we have done to perform the empirical analysis.
We have both seasonally adjusted and non-seasonally adjusted data in our RTDS for the ITAs variables. The data related to the IIP variables are non-seasonally adjusted. All time series are in current prices, in terms of millions of U.S. dollars.
The accuracy of the RTDS is checked through basic accounting rules emerging from the definitions of balance of payments and international investment position accounts. In this sense, the figures reported in the data set are accurate.
More details on the originality, construction and accuracy of the RTDS, the coverage of variables and the technical information can be found in Appendix A.

3. Revision Analysis

3.1. Methodology

We employ the methodology originally developed by Mankiw et al. [1984], which analyzes the preliminary announcements of the U.S. money stock growth rates. According to Mankiw et al. [1984], revisions to preliminary announcements can be characterized as noise or news by testing two mutually exclusive hypotheses. Under the noise view, the initial announcement of a variable is equal to the true value of the variable plus a *measurement* error. Hence, initial estimates can be thought of as errors-in-variables problem. Under the news view, the initial announcement is a rational forecast of the true value conditional on all the available

information at the time of initial announcement. Hence, under news, revision is nothing, but a *rational forecast* error.
Let y_t denote the time series of variable y. y_t^f is the true (final) value for the same variable at time t, which is assumed to be observable later some time. y_t^{t+1} is the initial announcement which is available at time t+1 for the same variable at time t.
Under both the noise and the news views, the initial value is equal to the sum of the true value and an error term.

$$y_t^{t+1} \equiv y_t^f + \epsilon_{t+1} \tag{1}$$

where ϵ captures the error term which is assumed to have zero mean.
Assuming that the statistical agency initially announces the originally measured value of the variable at time t, we consider the following statistical model to test the noise hypothesis

$$y_t^{t+1} = \alpha_1 + \beta_1 y_t^f + \omega_{t+1}^1 \tag{2}$$

where the error term ω_{t+1}^1 is orthogonal to y_t^f, but it is correlated with y_t^{t+1}. The joint hypothesis $\alpha_1 = 0$ and $\beta_1 = 1$ tests the noise hypothesis. If we fail to reject the noise hypothesis, it implies that preliminary announcement is a conditionally biased forecast of the final value. In this case, the ratio of initial to final variance is greater than one.
Now assume that the data agency optimally adjusts the original value in a linear fashion conditional on all the information available at the time of the initial announcement and announces her optimal forecast as the initial value. We primarily adopt the following model to test the news hypothesis

$$y_t^f = \alpha_2 + \beta_2 y_t^{t+1} + \omega_{t+1}^2 \tag{3}$$

where the error term ω_{t+1}^2 is orthogonal to y_t^{t+1}, but it is correlated with y_t^f. The joint hypothesis $\alpha_2 = 0$ and $\beta_2 = 1$ tests the news hypothesis. If we fail to reject the news hypothesis, it implies that preliminary announcement is a rational forecast of the final value. As optimal forecasts are less variable than the item forecasted, the variance of the final value should be larger than the variance of the initial value under the news view. We call the model presented in (3) the "simple" news model since only an intercept term is included in the model to capture the information set available at the time of the initial announcement. As the noise and news hypotheses are not collectively exhaustive, for a variable, there is always a possibility that we reject both of the hypotheses Aruoba [2008][6]. For such cases, we do also consider an augmented news model

$$y_t^f = \alpha_3 + \beta_3 y_t^{t+1} + \gamma y_{t-1}^t + \omega_{t+1}^3 \tag{4}$$

where the error term ω_{t+1}^3 is again uncorrelated with the initial value. y_{t-1}^t captures a subset of information set that was available at the time of initial announcement. y_{t-1}^t is simply the

[6]Aruoba [2008] actually demonstrates that if the final revision has a non-zero mean, we can reject both hypotheses emerging from models in 2 and 3.

first estimate announced at time t for the previous quarter[7]. The joint hypothesis $\alpha_3 = 0$, $\beta_3 = 1$ and $\gamma = 0$ tests the augmented news hypothesis. This additional parametric restriction allows for a more powerful test of the news hypothesis as we include extra information set variable in the augmented news model presented in (4).
Under the news view, we expect the revisions to have zero mean (unbiasedness), the variance of revisions to be small relative to the variance of final values and revisions to be unpredictable given the information set available at the time of the initial announcement (rationality). In the benchmark analysis, we empirically question whether the final revisions (i.e. $r_t^f \equiv y_t^f - y_t^{t+1}$) to our variables of interest satisfy these properties in line with the news hypothesis.

3.2. Empirical Implementation

Our empirical analysis focuses on quarterly U.S. BOP variables. Among CA variables, we study the total of gross credit entries- exports of goods and services and total income receipts, the total of gross debit entries- imports of goods and services and total income payments, the current account balance, and their major components[8]. Among FA variables, we investigate the changes in foreign financial assets owned by U.S. residents, changes in U.S. financial assets owned by foreigners and their major components. We only consider the seasonally adjusted variables in the analysis.

3.2.1. Initial and Final Estimates

In all instances, the initial value of a variable at time t appears as the last observation in the vintage of next quarter in our RTDS. This observation truly matches with the initial announcement of BEA for that variable in the BOP presentation.
We define the final value of a variable at time t as the value announced three years after the initial announcement for the variable at time t. The final value definition is similar to the one of Aruoba [2008]. This definition allows us to rule out benchmark revisions that possibly take place in later vintages. Benchmark revisions to the U.S. ITAs can be made both due to the arrival of new information (i.e. results of benchmark surveys which take place normally at five-year intervals) or due to re-definitions, re-classifications or changes in estimation methodologies (which are performed in annual periodicity). The latter covers as many years as possible in order to provide consistent time series for researchers. Hence, such changes may show up as persistent shifts in revisions which is one thing that we want to avoid in the analysis for sure.
The definition for final revisions used in the benchmark analysis is not arbitrary for the following reasons. We try to determine the number of periods after which there are no

[7]The choice of the information set variable may seem arbitrary. However, we did so in order to be able to compare the empirical results when variables are defined in growth rates and in levels. We include lagged values of independent and dependent level variables to the models presented in (2) and (3) in order to categorize the revisions in levels. In both models of levels, the lagged values of initial estimates are already part of the information set.

[8]We only exclude net unilateral transfers from the analysis.

more or only minimal marginal revisions to the variables related to the U.S. ITAs except benchmark revisions. This exercise did not allow us to pin down a clear-cut time horizon for convergence as in NIPAs variables analyzed by Aruoba [2008][9]. In general, for the majority of the ITAs variables, incremental revisions converge to zero after three to five years. This result partly comes from the fact that our variables are open to revisions related to re-classifications, re-definitions or changes in methodologies every June following the reference year[10]. We prefer to use three-year time horizon to define the final revisions, as this definition is also suggested by others. Mistry [2007] argues that data is assumed to become mature three years after the initial estimate. After three years, data is mainly revised due to methodological improvements, rather than the arrival of new information. Moreover, in the OECD's revision analysis of GDP for G7 countries', Ahmad et al. [2004] also suggest that the most accurate and reliable data, excluding benchmark revisions, form at least two to three years after the period to which the data refers.

3.2.2. Revisions to Growth Rates vs. to Levels

We do consider two types of revisions to ITAs variables. Firstly, we examine the revisions to annualized growth rates, as it is the standard analysis employed in literature, i.e. empirical analysis of revisions to GDP and its components. We provide sample evidence on the validity of the zero mean, small variance and predictability properties of revisions to annualized growth rates as in Aruoba [2008], and McKenzie and Gamba [2008].

We compute the initial and final values in terms of annualized growth rates for each variable in order to identify the final revisions. The annualized growth rate of an initial announcement is computed using the formula $[(y_t^{t+1} - y_{t-1}^{t+1}) \backslash |y_{t-1}^{t+1}|] \times 400$, where the denominator is defined in absolute terms[11].

We report the mean of revisions and the mean of absolute revisions as indicators for the average direction and average size of revisions to growth rates, respectively. We compute noise-to-signal ratio -the standard deviation of revisions scaled with the standard deviation of the final variable - for the variability of revisions. The correlation between revisions and initial announcements and the first order autocorrelation coefficient of revisions are also reported to get an informal idea about the degree of predictability in revisions. For a formal inspection, we test the noise and news hypotheses for growth rates by estimating the statistical models presented in (2) and (3). We basically try to classify revisions to growth rates as news or noise if we reject one of the hypotheses, but fail to reject the other. For cases where we cannot clearly categorize them, we also estimate an augmented news model as in (4).

[9] Aruoba [2008] clearly identifies a three-year time horizon after the initial announcement for revisions to NIPAs variables such as GDP.

[10] In contrast, comprehensive revisions (results of benchmark surveys, definitional and methodological changes) to NIPAs variables are for every five years [BEA, 2014a].

[11] For instance, in a specific vintage, the computed growth rates for current account balance can be positive in three cases: (i) when there is an increase in current account surplus, (ii) when there is an improvement in current account deficit, (iii) when the current account balance is in surplus at time t, but it was in deficit at time t-1.

Studying revisions to growth rates is mostly the case in literature mainly because the analysis of levels may suffer from the trend in level variables ([Mankiw and Runkle, 1986]. In contrast to time series of growth rates, revisions in levels often mirror the non-stationarity property of a level variable.

Not surprisingly, we fail to reject the null hypothesis of unit root for all CA variables and final revisions to most CA variables in levels[12]. We observe strong trend in gross CA variables. Moreover, net CA variables have some persistence although they are not as much persistent as gross variables in our sample. This is not so surprising since the U.S. trade balance on goods, trade balance on goods and services, and current account balance are in deficit throughout our sample period. On the other hand, the U.S. trade balance on services is in surplus for the entire sample.

Having said that, we still believe that an analysis of revisions to levels have especially valuable information for net variables. Net variables are volatile and can take both negative and positive values through time. Hence, growth rate series for such variables are mostly off the scale depending on the level of volatility and do not contain that much of informative value.

We account for the non-stationarity problem in the most simplistic way. In order to examine some of the sample statistics of revisions in levels, firstly, we calculate the final revisions *scaled* with the size of the final variable. Relevant scaling depends on nature of the each variable. The scaling item is the absolute value of the final value of the variable for CA variables and the average quarterly value of the corresponding final IIP variable for FA variables[13]. We find evidence to reject the unit root in scaled revisions for all CA and FA variables. Scaled revisions also allows us to compare the results across time and across certain variables. We utilize from *scaled* revisions to compute sample mean, absolute mean and standard deviation of final revisions.

For the degree of predictability in revisions to levels, we use *unscaled* revisions in the news and noise regressions. However, to account for non-sationarity, we add past values of dependent and independent variables to all the news and noise regressions for CA variables[14]. For FA variables, we estimate the models presented as in (2), (3) and (4).

Finally, the sign convention used in the empirical analysis differs from the sign convention of the RTDS for some of the variables[15]. This ensures that the signs of variables in the revision analysis reflect those discussed in theory. Details on the issue are available in Appendix C.

3.3. Empirical Results

In the first part, we document benchmark sample statistics of final revisions to annualized growth rates. In the second part, we present more outcomes on the predictability of revisions emerging from the estimations of statistical models in (2), (3) and (4).

[12]Details for all the unit roots test results are presented in Appendix C.

[13]Scaling items are explained in detail in Appendix B.

[14]The lag length considered is 4.

[15]Revisions to growth rates and to levels are calculated once variables are transformed to have the appropriate signs.

The sample for most of the variables covers the reference periods from the first quarter of 1992 through the third quarter of 2010. For total income receipts/payments and income balance, the number of observations is 47[16].
We also report the results of the following empirical checks. Most of these results are detailed in Appendix C.

(i) Revision analysis in levels,
(ii) Benchmark results for subsamples,
(iii) Entire revision history for each variable up to the final revision.

Throughout the paper, boldface figures in the tables are significant for the relevant null at least at the 5 percent significance level. Moreover, test statistics are computed using Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors [Newey and West, 1987] when appropriate.

3.3.1. Sample Statistics of Final Revisions

Throughout the section, we examine the statistical properties of final revisions for our variables in 3 sub-sections. The first sub-section reports the revision analysis regarding gross CA variables. Results for net CA variables and net FA variables are in the following sub-sections, respectively. This is mostly due to the different nature of these variables. While gross variables comprise trend, all FA variables are stationary. Net FA variables encompass higher volatility than gross CA variables. Net CA variables are somewhere in the middle of gross CA and net FA variables in terms of the trend and volatility they contain. As a result, we examine our results for means separately for these three categories.
The results for revisions to growth rates are reported in Table 1. The first column of Table 1 reports the number of observations used in the analysis for each variable. The subsequent columns correspond to mean revisions, mean absolute revisions, noise-to-signal ratios, correlations with preliminary announcements and first-order autocorrelation coefficients for final revisions, respectively.
The means of final revisions to gross CA variables lie in the range of -0.3 percent and 2.2 percent. On average, the majority of gross variables are initially underestimated. Services imports, and U.S. residents' and foreigners' income streams from international investment have mean absolute revisions larger than the average mean absolute revision of all gross variables, 6.3 percent.
Mean revisions are even larger for net variables compared to gross CA variables. On average, most of the net CA variables are also underestimated in the initial announcement. Among net CA variables, income balance stands out with its largest mean absolute revision. When income balance is excluded from the analysis, current account balance and balance on goods and services have also mean absolute revisions greater than the group average, 19.3 percent.
The means of final revisions are off the scale for FA variables and the general picture for these variables is blurred when revisions are defined in growth rates. However, we can safely argue that, large mean absolute revisions to foreign government assets other than official

[16]Please see Appendix A for the details related to shorter coverage for these variables in the RTDS.

Table 1: Sample Statistics of Final Revisions. Revisions to Growth Rates.

	N	MR	MAR	NSR	Corr.	AC
Gross Current Account Variables						
Exports of Goods and Services and Income Receipts	75	0.36	3.23	0.28	−0.20	**−0.29**
Exports of Goods and Services	75	0.19	2.78	0.28	**−0.29**	**−0.28**
Exports of Goods	75	−0.27	3.29	0.28	**−0.40**	**−0.39**
Exports of Services	75	**1.37**	5.44	0.64	−0.05	**−0.25**
Total Income Receipts	47	2.15	9.66	0.52	**−0.33**	**−0.34**
Receipts on U.S. Owned Assets	75	0.19	9.71	0.57	**−0.35**	**−0.33**
Imports of Goods and Services and Income Payments	75	0.10	3.11	0.28	**−0.37**	**−0.42**
Imports of Goods and Services	75	0.16	2.15	0.21	**−0.38**	**−0.27**
Imports of Goods	75	−0.08	1.97	0.15	**−0.33**	−0.16
Imports of Services	75	1.14	7.93	1.61	**−0.84**	**−0.28**
Total Income Payments	47	0.78	14.27	0.56	−0.08	**−0.47**
Payments on Foreign Owned Assets	75	−0.16	11.89	0.54	−0.12	**−0.47**
Net Current Account Variables						
Balance on Current Account	75	1.31	24.06	0.63	**−0.76**	**−0.46**
Balance on Goods and Services	75	2.96	17.80	0.50	**−0.84**	**−0.37**
Balance on Goods	75	−0.13	8.69	0.35	**−0.45**	**−0.50**
Balance on Services	75	−0.12	26.64	1.23	**−0.68**	−0.11
Balance on Income	47	213.27	514.04	1.13	**−0.49**	0.00
Net Financial Account Variables						
U.S. Owned Assets Abroad	75	−1,945.31	4,136.76	4.08	**−0.97**	−0.01
Official Reserve Assets	75	−0.55	0.57	0.00	0.02	−0.01
Other Government Assets	75	−709.33	1,681.51	0.66	**0.45**	**−0.32**
Private Assets	75	1,058.54	1,468.05	0.92	**0.33**	−0.04
Foreign Owned Assets in the U.S.	75	−7.94	197.01	0.98	**−0.82**	−0.01
Official Assets	75	341.46	441.45	0.52	**0.86**	−0.01
Other Assets	75	506.21	637.45	0.87	−0.20	−0.04

Notes: N=number of observations, MR= mean of revisions, MAR= mean of absolute revisions, NSR= noise-to-signal ratio, Corr.= Correlation between revisions and initial announcements, AC=first-order autocorrelation coefficient of revisions. Growth rates are in terms of annualized percentages. Boldface figures are significant at least at the 5 percent level. HAC standard errors are computed for significance.

reserves and foreign private assets owned by U.S. residents drives sizable mean revisions to U.S. residents' net transactions on all foreign assets. Having said it all, exports of services has non-zero mean revision among all the variables defined in terms of growth rates[17].
Noise-to-signal ratios range from 0 to 4.1, averaging 0.7. Even after being scaled with the standard deviation of the final variable, on average, the standard deviation of revisions is

[17]The mean revision of total income receipts and foreign owned assets other than official assets is significant at 10 percent level.

lowest for gross variables and larger for net variables. Noise-to-signal ratio is very close to or even bigger than one for services imports, trade balance on services, income balance, U.S. owned private assets abroad and U.S. assets owned by foreigners. The standard deviation of revisions to foreign assets owned by U.S. residents is 4 times larger than the standard deviation of the variable itself. On the other hand, the revisions to U.S. owned official reserve assets only occur in the announcements following the initial estimates and they are small. This ensures that noise-to-signal ratio is zero for this variable.

For 18 variables, revisions are significantly correlated with the initial announcements. Three of variables have positive correlations. For example, the correlation of U.S. official assets owned by foreigners is 0.9. Finally, first-order autocorrelation coefficient of revisions is statistically different from zero for 15 variables. However, the persistence of revisions is quite weak when revisions are defined in growth rates.

To save some space, we report the results for revisions in levels in Table C.6 in Appendix C. However, it is worthwhile to discuss what changes in our previous results when we define the revisions in levels.

When revisions are defined in terms of levels, almost all the variables are underestimated initially. Mean scaled revisions are significantly different from zero for twelve variables, including the current account balance[18]. In contrast to results for revisions in growth rates, on average, mean revisions are larger in magnitudes for gross variables than for net variables[19]. Standard deviation of scaled revisions is the highest for gross variables and lowest for net CA variables. Standard deviation of foreign reserve assets owned by U.S. officials is still negligible.

3.3.2. News vs. Noise

The results for revisions to annualized growth rates are reported in Table 2. In Table 2, we provide the number of observations, F-test statistics and corresponding p-values for the noise, news and augmented news hypotheses, respectively.

When estimates are defined in growth rates, we fail to reject the noise hypothesis for thirteen variables. Furthermore, final revisions to nine of these variables are better characterized as noise, indicating that initial announcements are not optimal forecasts of final values[20]. Some of the variables with noisy revisions are U.S. income on foreign assets, services imports, goods imports, net transactions on all U.S. assets by all foreigners, trade balance on goods and current account balance. We reject both the news and noise hypotheses for other six variables. For all of these variables, the slope coefficient is significantly different from one in both news and noise regressions. For net transactions on all foreign assets by all U.S. residents, the intercept term is significantly different from zero in the simple news

[18]Imports of goods and services, imports of goods, trade balance on services have also significant mean of revisions at 10 percent level.

[19]Average mean absolute revision is 3 percent for gross variables and 1.5 percent for net CA and net FA variables. However, results for net FA variables are not directly comparable with the results of other variables due to the differences in scaling item. Please see Appendix B for details on scaling.

[20]For these variables, we reject the simple news hypothesis, but fail to reject the noise hypothesis.

Table 2: Predictability of Final Revisions. Estimates in Growth Rates.

		Noise Hypothesis		**News Hypothesis**			
		$H_0 : \alpha_1 = 0, \beta_1 = 1$		$H_0 : \alpha_2 = 0, \beta_2 = 1$		$H_0 : \alpha_2 = 0, \beta_2 = 1, \gamma = 0$	
	N	F statistics	p value	F statistics	p value	F statistics	p value
Gross Current Account Variables							
Exports of Goods and Services and Income Receipts	75	1.80	0.17	**4.28**	0.02	**2.78**	0.05
Exports of Goods and Services	75	0.42	0.66	**9.45**	0.00	**6.79**	0.00
Exports of Goods	75	**3.74**	0.03	**9.00**	0.00	**7.70**	0.00
Exports of Services	75	**11.35**	0.00	2.66	0.08	2.43	0.07
Total Income Receipts	47	1.35	0.27	2.23	0.12	1.84	0.16
Receipts on Foreign Assets	75	1.48	0.23	**4.57**	0.01	**3.58**	0.02
Imports of Goods and Services and Income Payments	75	0.26	0.77	**11.44**	0.00	**10.20**	0.00
Imports of Goods and Services	75	**3.60**	0.03	2.89	0.06	1.96	0.13
Imports of Goods	75	1.93	0.15	**3.41**	0.04	2.38	0.08
Imports of Services	75	1.11	0.33	**24.78**	0.00	**19.74**	0.00
Total Income Payments	47	2.42	0.10	0.25	0.78	1.00	0.40
Payments on Foreign Owned Assets	75	1.95	0.15	0.20	0.82	1.53	0.21
Net Current Account Variables							
Balance on Current Account	75	0.72	0.49	**17.03**	0.00	**20.40**	0.00
Balance on Goods and Services	75	**3.56**	0.03	**36.34**	0.00	**97.21**	0.00
Balance on Goods	75	0.94	0.39	**5.96**	0.00	**8.94**	0.00
Balance on Services	75	**9.87**	0.00	**7.56**	0.00	**4.74**	0.00
Balance on Income	43	**63.48**	0.00	**49.00**	0.00	**31.79**	0.00
Net Financial Account Variables							
U.S. Owned Assets Abroad	75	**46.23**	0.00	**4,579.28**	0.00	**6,150.17**	0.00
Official Reserve Assets	75	0.50	0.61	0.50	0.61	0.33	0.80
Other Government Assets	75	**469.51**	0.00	1.55	0.22	1.36	0.26
Private Assets	75	**114.59**	0.00	1.18	0.31	0.85	0.47
Foreign Owned Assets in the U.S.	75	1.22	0.30	**29.61**	0.00	**30.95**	0.00
Official Assets	75	**203.84**	0.00	**7.78**	0.00	**7.15**	0.00
Other Assets	75	**251.38**	0.00	2.03	0.14	2.25	0.09

Notes: N denotes the number of observations. For the noise and simple news hypotheses, α and β refer to the constant term and the slope term for the relevant explanatory variable estimated as in models (2) and (3), respectively. For the augmented news hypothesis, additionally, γ is the coefficient of the value initially announced at time t for the same variable at time t-1 estimated as in model (4). Boldface F statistics are significant at least at the 5 percent level. HAC standard errors are computed for significance.

regression[21]. Finally, revisions to five variables are better characterized as news. These variables include exports of services, total imports of goods and services, net transactions on foreign assets other than official assets by U.S. officials, foreign assets by U.S. private residents; and U.S. assets owned by private foreigners and international organizations.
The augmented news regression results changes the simple news results for only imports of goods. For this variable, the simple news regression indicates rejection of news hypothesis, whilst we fail to reject the augmented news hypothesis and we classify revisions to imports

[21]For income balance and total trade balance on goods and services, the intercept term is also significantly different from zero at 10 percent level in one of the regressions.

of goods neither as news nor as noise.
In order to save some space, we report the regression results for levels in Table C.7 in Appendix C. However, in the most conservative way, when we compare the noise and the simple news results of growth rates and levels, we certainly have the power to argue the followings. Imports of services are characterized as noise. Furthermore, we fail to reject the noise hypothesis for another five variables[22]. We can only identify revisions to net transactions on U.S. assets by private foreigners and international organizations as news. We reject both of the hypotheses for five variables[23]. For current account balance, we certainly reject the news hypothesis independent of the definition of revisions.

4. Feldstein-Horioka Regression in Real-Time

4.1. Methodology

Given that the difference between domestic savings and domestic investment is equal to the current account balance, we simply consider the following model.

$$(CA\backslash Y)_t = \alpha + \beta(S\backslash Y)_t + \epsilon_t \tag{5}$$

where $(CA\backslash Y)$ is current account balance and $(S\backslash Y)$ is gross national savings, both of which are expressed as ratios of GDP. ϵ is a white noise innovation. A strong association between savings and investment (hence a weak link between current account balance and savings) would imply a positive but low slope coefficient in model (5).
The main aim of our exercise is to examine the validity of the model in (5) using real-time data. In other words, we explore whether the estimated slope coefficient changes when we do account for revisions to data. Hence, we aim to estimate the following statistical model

$$(CA\backslash Y)_{t,v} = \alpha + \beta(S\backslash Y)_{t,v} + \epsilon_{t,v} \tag{6}$$

where $(CA\backslash Y)_{t,v}$ and $(S\backslash Y)_{t,v}$ are the estimates of period t value of current account balance and domestic savings, respectively, which are officially released at time v, where $t \leq v$. The model in (5) can be considered as a special case of model (6). The model in (5) simply ignores the possible revisions to the variables of interest. Hence, v can be considered as fixed in (5), i.e. v corresponds to the latest vintage.

4.2. Empirical Implementation

We run two benchmark exercises. Firstly, we perform a real-time exercise. We estimate the relationship with the most available data to an econometrician in a specific point in time (vintage). More clearly, we assume that the econometrician's aim is to estimate the link

[22]These variables are total exports of goods and services, imports of goods, total income payments to foreign financial investment in the U.S., trade balance on goods, and U.S. owned official reserve assets abroad.

[23]These variables are exports of goods, trade balance on services, income balance, changes in total foreign assets owned by U.S. residents and net transactions on U.S. assets by foreign officials.

between U.S. current account balance and domestic savings as of the end of each quarter starting from the second quarter of 1991 vintage till end-2013 vintage[24]. Additionally, the econometrician uses all of the available information on U.S. current account balance and domestic savings as of the end of each quarter to estimate the relationship. Hence, the relationship is estimated with an increasing sample size whenever new vintage data is available. For example, the sample period used for estimation corresponding to the first vintage is 1961q1-1991q1. Sample enlarges to 1961q1-2013q3 period in the latest vintage.

We reproduce the empirical results ignoring the real-time aspects and use only the latest vintage data. We assume that the econometrician estimates the link based on all the information available as of the end of 2013. This means that the econometrician uses the full sample period (1961q1-2013q3) at the latest vintage. In order to compare the estimation results of models in (5) and (6), we also estimate the association of interest at the latest vintage with different sample periods. The sample periods used in latest vintage estimations are directly comparable with the sample periods used in real-time estimations. For instance, the estimation is initially performed using the 1961q1-1991q1 data at the latest vintage. The model is re-estimated as the sample increases by one observation by one until the sample reaches to full size.

Real-time estimations consider revisions to all of the variables of interest: U.S. current account balance, domestic savings and nominal GDP. However, as the official publication dates of each variable differ, we make the simplifying assumption described above in order to synchronize vintages for each quarterly variable. As a result, each variable has an upper triangle real-time data matrix of same dimensions. The synchronization assumption allows us to take into account of all the revisions to quarterly U.S. current account balance and of some of the revisions to U.S. domestic savings and GDP at current prices. For domestic savings and GDP, a new observation in a specific vintage may not correspond to the initial estimate for that variable. More information on the synchronization of the vintages can be found in Appendix A.

We also estimate the link between variables of interest for a fixed sample period through all vintages. The sample used in the estimations, in this case, is the period from 1961q1 through 1991q1. The choice of the sample period may seem arbitrary and results most probably do not constitute any factual evidence. However, as we want to re-estimate the relationship using as many as vintages of data possible, the period used in fixed sample real-time estimations is directly related to the available sample in the first vintage (June 1991 vintage). The model is re-estimated using the fixed sample for all vintages.

In order to get the best model specification to explain the relationship of interest, we have estimated different models of current account balance and savings in all the exercises. Given the sample evidence of non-stationarity of savings and current account balance[25], we consider models (of variables in GDP ratios), for which lagged values of both variables, and/or de-

[24]This assumption allows us to synchronize the vintages for current account balance, domestic savings and GDP series all of which come from different data sources. Moreover, the vintages considered in all exercises are directly limited to the quarterly vintages available for the U.S. current account balance in our dataset.

[25]Unit root test results are reported in Appendix D.

trended savings are assumed to be explanatory of current account balance dynamics. We also consider a model where all variables are defined in terms of first differences.
We only present the results of estimated models with the lowest Schwarz information criteria. When appropriate, we use the HAC standard errors [Newey and West, 1987] to compute the probabilities for significance of independent variables used to explain the current account dynamics[26].
We report the results of following empirical checks in Appendix D.

(i) Unit root test results in real-time and at latest vintage,
(ii) The link between current account balance and *private* savings in real-time.

4.3. Empirical Results

We report the regression results for three models with the lowest Schwarz criteria, on average. The estimated models are as follows.

$$(CA\backslash Y)_{t,v} = \alpha^1 + \beta_1^1 (S\backslash Y)_{t,v} + \beta_2^1 (CA\backslash Y)_{t-1,v} + \beta_3 (S\backslash Y)_{t-1,v} + \epsilon_{t,v}^1 \tag{7}$$

$$(CA\backslash Y)_{t,v} = \alpha^2 + \beta_1^2 (S\backslash Y)_{t,v}^c + \beta_2^2 (CA\backslash Y)_{t-1,v} + \epsilon_{t,v}^2 \tag{8}$$

$$\Delta(CA\backslash Y)_{t,v} = \alpha^3 + \beta_1^3 \Delta(S\backslash Y)_{t,v} + \epsilon_{t,v}^3 \tag{9}$$

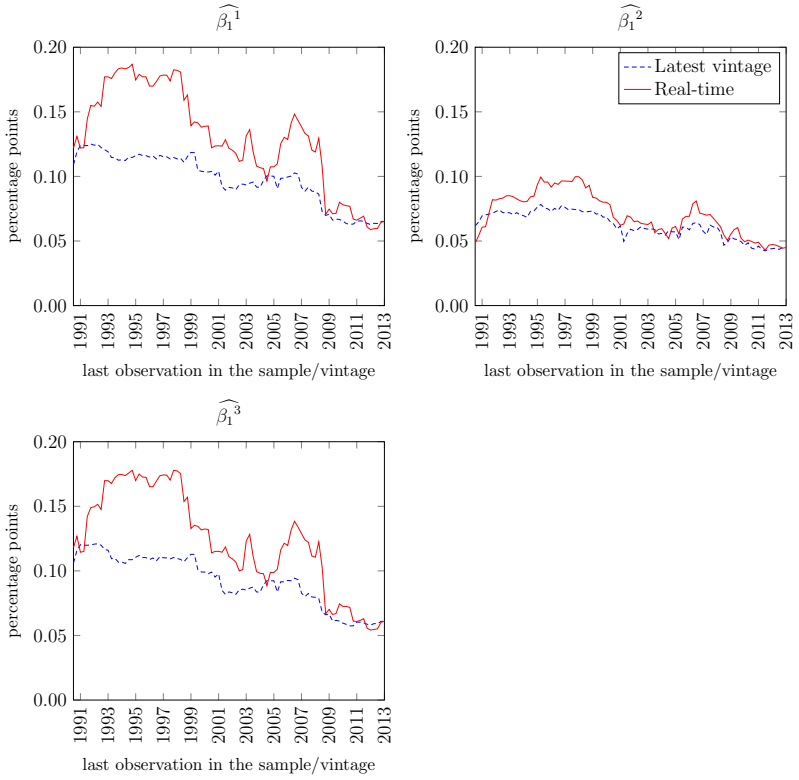
The first two models are defined in ratios. In the second model, domestic savings, $(S\backslash Y)_{t,v}^c$, is de-trended[27]. The last model is estimated in first differences [28].
Figure 1 displays the estimated β_1 coefficients from three models in (7), (8) and (9). The upper left panel is the results for estimated model in (7), upper right is for model in (8) and lower left panel is for model in (9). The straight line corresponds to real-time results whereas the broken line shows the results for the latest vintage. As we move along a straight line, both sample size and vintage changes. As we move forward on a broken line sample size increases at the latest vintage. Hence, the end point of both lines corresponds to the estimated β_1 coefficient for the full sample at the latest vintage. The vertical difference between the two lines in a specific time corresponds to the impact of revisions to all variables on the regression results. The significance of the estimated β_1 coefficients from three models over time are depicted in Figure D.2 in Appendix D.
Using the full sample period at the latest vintage, β_1 coefficient is estimated in the range of .04 and .07 depending on the model, and they are not significantly different from zero at the 5 percent significance level. The coefficient is estimated in the range of .06 and .10 depending on the model, on average, when sample size changes at the latest vintage.

[26]We perform the Ljung-Box Q test to detect autocorrelation in residuals for the first eight lags. When we reject the null of no autocorrelation at 5 percent significance level, we use the HAC standard errors to compute probabilities.

[27]We use the Hodrick-Prescott filter to de-trend the savings series. De-trending procedure is re-performed whenever the sample size and/or data vintage change.

[28]The model in (9) is actually a restricted version of model in (7).

Figure 1: Estimated Current Account Response to Domestic Savings, $\widehat{\beta_1}^i$. Rolling Sample.



The magnitude of the estimated β_1 coefficients in all models decrease as we increase the sample size available at the latest vintage. Estimated β_1 coefficients in all models are significantly different from zero in at least two thirds of 91 latest vintage data samples considered[29]. Significant current account responses corresponds to earlier sample periods. On the other hand, the relationship between current account and domestic savings is weak.

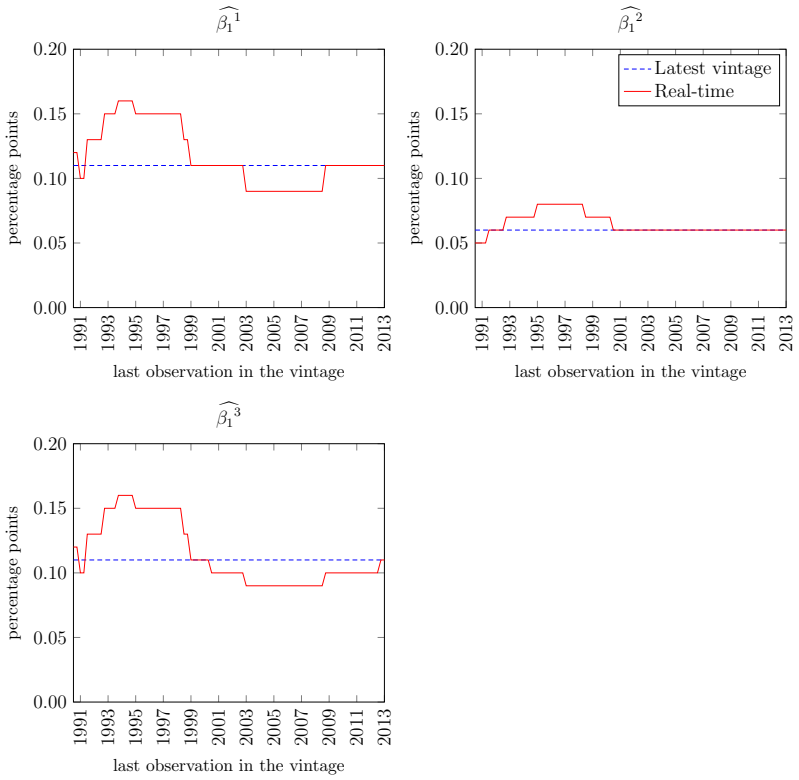
In contrast, estimated β_1 coefficients from all models are larger than their latest vintage counterparts for most of the sample periods when we consider all data vintages. The coefficient is, on average, in the range of .07 and .13 depending on the model. The estimated coefficients of all models are significantly different from zero in majority of 91 vintages at least at the 5 percent significance level[30].

Figure 2 displays the estimated β_1 coefficients from three models in (7), (8) and (9) using fixed sample period. The upper left panel is the results for estimated model in (7), upper right is for model in (8) and lower left panel is for model in (9). The straight line corresponds to real-time results whereas the broken line shows the results for the latest vintage. As we move along a straight or dotted line sample size does not change. However, along a straight

[29]The coefficient is significant in 72 samples in the estimated model as in (7), 60 samples in the estimated model as in (8) and 66 samples in the estimated model as in (9).

[30]For 73 vintages, the estimated coefficients of the models as in (7) and (9) are significant at least at the 5 percent level. The coefficient is also significant in 67 samples in the estimated model as in (8).

Figure 2: Estimated Current Account Response to Domestic Savings, $\widehat{\beta_1}^i$. Fixed Sample.



line, vintage changes. The end point of both lines corresponds to the estimated β_1 coefficient for the sample period 1961q1-1991q1 at the latest vintage. The significance of the estimated β_1 coefficients using fixed sample period are depicted in Figure D.5 in Appendix D.
When the sample size is fixed to the period 1961q1-1991q1, β_1 coefficient of estimated models in (7) and (9) are underestimated in most of the earlier vintages, then overestimated at later vintages before its estimated latest vintage value approaches to its real-time estimate. Hence, it takes a considerable number of vintages for the β_1 estimate to converge to its real-time counterpart. Additionally, the coefficients of estimated models in (7) and (9) are statistically significant in the majority of the vintages, including the latest vintage[31]. The divergence of the estimated β_1 coefficients at latest vintage and in real-time is minimal and not significant in the majority of the cases when model (8) is estimated.
Although we do present results of private savings in Appendix D to some space, the relationship between current account balance and private savings is also estimated to be weak.

5. Conclusion

This paper introduces a comprehensive new real-time data set related to the U.S. flows of goods, services and income, financial flows and financial positions in relation with the rest

[31]The estimated coefficient from models (7) and (9) is non-zero for 66 and 56 vintages, respectively.

of the world. The data set comprises 37 quarterly and annual variables related to the U.S. current account, financial account and international investment position accounts.
The variables included in our RTDS have time series long enough and they have sufficient number of vintages for research purposes. In addition, it is compatible with the Philadelphia FED's Real-Time Data Set for Macroeconomists and ALFRED of the St. Louis FED.
We empirically examine the revisions to the U.S. variables of current and financial accounts using standard statistical tests. However, we do believe that this paper differs from the existing literature in terms of the variables it deals with. We examine not only revisions to annualized growth rates as it is usually the practice, but also the revisions to levels because of the nature of our variables necessitates such analysis from a statistical perspective. While working with levels, we bear in mind the problems with working with level variables.
We find strong evidence against the desirable properties of revisions for some of the U.S. balance of payments variables. Firstly, our empirical results indicate that initial announcements are biased. Secondly, the revisions are quite large in magnitudes relative to the final value of the variables. Finally, we find evidence against the news hypothesis for a considerable number of variables.
We also run empirical exercises to see whether the relationship between the U.S. current account balance and domestic savings changes when available data at different vintages are considered. This is nothing but the examination of Feldstein and Horioka [1980] regression using U.S. time series available for 91 data vintages.
To our knowledge, real-time open economy consideration of econometric modeling with external sector variables has not been studied before. Although we focus on a simple model with possible mis-specification problems, we still find it intriguing as it allows us to examine the allocation of marginal unit of savings in open economy theory in real-time. In contrast to the revision analysis, in this exercise, we examine our variables of interest in ratios (of GDP). Hence, we do consider the revisions to ratios that is what that matters in theory.
The relationship between current account balance and domestic savings is found to be weak both at the latest vintage and in real-time. However, the current account balance response is estimated to be significantly higher when sample period and vintage change. For a fixed sample period, the estimated relation in real-time adjusts to its latest vintage counterpart after a considerable number of vintages.
We believe that real-time data set presented in this paper has a variety of uses for researchers interested particularly in open economy issues. The data set can be useful to evaluate the state of the open economy and examine the perceptions of policy makers and other economic agents about this state. For instance, we have real-time data in our RTDS for the U.S. net international investment position, which is a critical state variable in open economy macroeconomic models. More specifically, it would be interesting to study the role of real-time data for the theory of global imbalances and its empirical applications. We think that RTDS comprise new valuable information for the existing literature on the order of external imbalances, the likelihood of economic adjustment and stabilizing factors such as financial portfolio compositions and valuation effects.

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Appendix A. Details on Real-Time Database

Appendix A.1. Originality

We have constructed the RTDS presented in this paper from scratch based on BEA's news releases and articles on related issues and accordingly labeled the RTDS as new because of two reasons. Firstly, to our knowledge, there is not any harmonized e-archive publicly available for the IIP variables of our RTDS.

Besides, ALFRED ArchivaL Federal Reserve Economic Data consists of time series for the U.S. ITAs variables under consideration in this paper. The time series for these variables starts from the first quarter of 1960.

Table A.3 presents a comparison of the coverage of vintages for ITAs variables between our RTDS and ALFRED.

Table A.3: Vintage Coverage. ITAs Variables.

	Earliest Vintage	
Variables	Our RTDS	ALFRED
Balances on current account and on income	1991q2	1996q4
Balance on goods and services	1993q2	1996q4
Net unilateral current transfers, balances on goods, on services	1991q1	1999q1
Exports/imports of goods and services, total income receipts/payments	1999q2	2009q2
All others	1991q1	1998q3

The earliest available vintage in ALFRED is the final quarter of 1996 for only three of the U.S. ITAs variables. The earliest vintage for current account balance, trade balance on goods and services, and income balance is fourth quarter of 1996. The starting vintage is the first quarter of 1999 for balance on goods, balance on services, and net unilateral current transfers. For exports of goods and services, total income receipts, imports of goods and services, and total income payments, the earliest vintage is the second quarter of 2009. For all other variables, vintages start from the third quarter of 1998.

On the contrary, our RTDS for the U.S. ITAs variables have extended vintage coverage, vintages starting from June 1991 for most of the ITAs variables. Information on vintages of our RTDS are reported in Section Appendix A.4 of this Appendix.

Appendix A.2. Data Sources

The RTDS regarding the U.S. international economic accounts is constructed based on the publicly available information provided by BEA. All of the U.S. international economic accounts series are from electronic sources available at BEA's website, `http://www.bea.gov`. The RTDS can be grouped into two parts as these sub-data sets are constructed based on two distinct news releases of BEA. The first part of the data set is for the U.S. international transactions accounts (ITAs) and the latter is for the U.S. international investment position (IIP) accounts.

For the U.S. BOP data set, two sources of BEA information are used. Time series in this data set are directly related to the information presented in *Table 1 U.S. International*

Transactions of BEA's quarterly new releases, *U.S. International Transactions*. For more recent vintages, the series in the data set are constructed from BEA's data archive available online at BEA's website[32]. All the data presented in BEA's news releases can be tracked from this archive in Excel or CSV format going back to the June 2001 vintage.
BEA's Survey of Current Business (SCB) monthly periodical is the main source for earlier vintages[33]. For the months relevant to the timing of news releases (often next month following the official release), SCB includes articles presenting latest estimates, estimation methodologies and information on major revisions. Historical quarterly and annual articles related to the U.S. BOP appear in the January, April, July, and October issues of SCB[34]. Annual SCB articles related to the U.S. IIP appear in the July edition[35].
SCB publications are available online in PDF formats for more recent vintages and available in scanned versions of hardcopies for earlier vintages. SCB publications are only print versions of data releases and contain the same information as in news releases.
For the U.S. IIP accounts, the main data source is the relevant SCB publications. Time series in the data set are directly related to the information presented in *Table 1 U.S. Net International Investment Position at the End of Period* of BEA's new releases, *U.S. Net International Investment Position*.

Appendix A.3. Coverage and Definitions of Variables

Information in this section relies heavily on Bach [2010], BEA [2011], Yorgason and Scott [2012], BEA [2014b], BEA's news releases and SCB articles on the relevant issues.
ITAs are a statistical summary of transactions between U.S. residents and non-residents during a quarter. They are organized into three principle components: the current account (CA), the capital account (KA), and the financial account (FA). Our data set for the ITAs comprises major variables related to CA and FA. Data set for the U.S. ITAs are available for 25 variables. CA records U.S. transactions in produced assets (in goods and services), in primary income (in income to capital and labor in return to their contributions to production) and in secondary income (in current transfers, i.e. gifts) with the rest of the world. CA transactions are closely related to the U.S. current production, consumption, and income generated from productive activities. Hence, they are used in compiling the U.S. National Income and Product Accounts (NIPAs) also prepared by BEA, of which gross domestic product and national income are important components for economic research, for instance[36].
FA records net investment transactions between U.S. residents and nonresidents for direct investment, portfolio investment, other investment and financial derivatives. The financial account is closely related to the international investment position accounts (IIP). U.S. FA

[32]The archive is available at `http://www.bea.gov/histdata/BPyear.asp`.
[33]Survey of Current Business articles can be found at `http://www.bea.gov/scb/`.
[34]Prior to 1996, these articles appeared in March, June, September, and December issues.
[35]Starting from March 2013, quarterly and annual articles for these accounts are in the January, April, July, and October issues of SCB.
[36]The relationship of international economic accounts with other accounts is discussed in more detail in BEA [2014b].

data are used in compiling the flow of funds statistics prepared by the Federal Reserve Board. However, none of the FA variables are included in the NIPAs.
On the other hand, IIP is statistical summary of end-of-period value of accumulated stocks of U.S. assets and U.S. liabilities with the rest of the world. End-of-period value of the net international investment position (NIIP) is also included in these accounts. Accounts include positions of direct investment, portfolio investment, other investment, reserve assets and financial derivatives[37]. Changes in the volume of assets arise from transactions in FA, valuation changes in assets and other changes[38]. U.S. IIP data are used in compiling national balance sheet statistics prepared by the Federal Reserve Board.
All the transactions and positions are recorded at market values whenever possible. However, ITAs variables reflect realized capital gain and losses that are due to changes in ownership, but they do not reflect unrealized capital gains and losses that arise from changes in asset prices. In contrast, holding gains and losses are recorded in IIP variables. IIP RTDS is available for 12 variables.
The statistics for both the ITAs and IIP variables are compiled from the perspective of U.S. residents. Nevertheless, the accounting principles applied differ across these accounts. ITAs record quarterly cross-border *flows* in the forms of transactions and changes in financial assets and liabilities. Hence, ITAs record external economic activities *within* a quarter. On the other hand, cross-border *positions* are recorded in the IIP accounts to refer to the stock of financial assets and liabilities. Hence, IIP records the *stocks* of assets and liabilities at a point in time, which is *end of period* in the U.S. case[39].

Appendix A.3.1. Recording Basis and Seasonality
Each item in the international economic accounts is recorded on a different basis. CA transactions are recorded on gross basis whereas FA transactions are recorded on net basis. Some of the items related to the CA published as memoranda items are on net basis as well. Moreover, IIP positions are recorded on gross basis, except NIIP.
The data set associated with ITAs variables includes both non-seasonally adjusted and seasonally adjusted data. The data set for IIP variables comprises time series with no seasonal adjustment[40].

Appendix A.3.2. Sign Convention
The sign convention used in the RTDS is the same as the one used in the official news releases related to the international economic accounts in line with the IMF's Balance of

[37]The organizations of U.S. FA and IIP are similar. Both cover the same financial instruments. FA records flows whereas IIP records positions.

[38]The composition of the changes in IIP in a particular year by asset category is presented in "Table 1 International Investment Position of the United States at Yearend" in the corresponding SCB article. Please notice that the table names and data coverage of tables may be different in the news releases and SCB articles. More recently, BEA has started to publish the composition in excel format separately from the news release.

[39]End of period is end of year up to the March 2013 vintage, and it is end of quarter since then.

[40]Non-seasonally adjusted FA data is used in reconciliation of quarterly financial flows to changes in quarterly IIP.

Payments Manual 5[41]. Exports, income receivables, transfers received, financial flows related to reductions in U.S. assets or increases in U.S. liabilities are shown as credit entries with positive signs. On the other hand, imports, income payables, U.S. transfers to abroad, financial flows associated with increases in U.S. assets or reductions in U.S. liabilities are shown as debit entries with negative signs.

As financial flows are recorded on net basis, FA variables can take either positive or negative through time in a vintage. Similarly, current transfers made and received are not explicitly available in the ITAs presentation, rather unilateral current transfers are presented on a net basis. Since current transfers made from the U.S. residents to nonresidents are higher than the current transfers received, U.S. unilateral current transfers are always presented as time series of negative values in the RTDS for a vintage. As memoranda variables related to the CA are on net basis, they can be either positive or negative through time.

For all other variables recorded on gross basis, the sign of a variable's value depends on whether the item is a debit or credit entry. All IIP variables are recorded with positive signs, as they are stock variables. The exception is NIIP which is the difference between the value of U.S. assets and the value of U.S. liabilities; it can be either positive or negative through time.

The sign convention used by BEA is quite useful to perform the aggregations across accounts without making any sign transformations, but a bit confusing for data users[42]. For instance, according to this convention, net exports will be equal to exports *plus* imports as imports are already recorded with a negative sign.

Appendix A.3.3. Variables

All the variables covered in our RTDS are listed in Table A.4. The names of variables are presented in the first column of the table. Reference line number for each variable is in parenthesis. The second column is for a brief definition of variables.

The name and reference line number for each ITAs variable correspond to those in *Table 1 U.S. International Transactions* and they come from *Table 1 U.S. Net International Investment Position at the End of Period* for IIP variable in BEA's electronic news releases as of December 2013[43].

[41]The sign convention used in the revision analysis differs from the one used to construct the RTDS. Please see Appendix B for a discussion of sign convention used in the revision analysis.

[42]BEA has recently changed the sign convention used in the international economic accounts presentations to avoid the confusion for data users. For more details, please see BEA [2014b].

[43]Reference line numbers and variable names are subject to changes going back to earlier vintages.

Table A.4: Variables Included in the RTDS.

Variable	Definition
Gross Current Account Variables	
Exports of goods and services and income receipts (1)	Total of lines 2 and 12.
Exports of goods and services (2)	Total of lines 3 and 4.
Exports of goods (3)	U.S. receipts from sales or transfers of goods to abroad.
Exports of services (4)	U.S. receipts from sales or transfers of services to abroad.
Total income receipts (12)	U.S. total returns on property (i.e. dividends, interest, reinvested earnings) and labor (i.e. wages) abroad.
Income receipts on U.S.-owned assets abroad (13)	Part of line 12. U.S. earnings and interest on direct investment abroad; dividends and interest on holdings of foreign securities and corporate bonds; interest on loans and deposits with foreigners; and U.S. government interest on her claims with foreigners.
Imports of goods and services and income payments (18)	Total of lines 19 and 29.
Imports of goods and services (19)	Total of lines 20 and 21.
Imports of goods (20)	U.S. payments to purchases or transfers of foreign goods to the U.S.
Imports of services (21)	U.S. payments to purchases or transfers of foreign services to the U.S.
Total income payments (29)	Foreign total returns on property (i.e. dividends, interest, reinvested earnings) and labor (i.e. wages) in the U.S.
Income payments on foreign-owned assets abroad (30)	Part of line 29. Foreign earnings and interest on direct investment in the U.S.; dividends and interest on holdings of U.S. securities and corporate bonds; interest on loans and deposits with U.S. residents; and foreign government interest on her claims with the U.S.
Net Current Account Variables	
Unilateral current transfers (35 or 76)	Net flows of goods, services and financial assets between U.S. residents and foreigners without any return (i.e. government grants and pensions; private remittances).
Balance on goods (72)	Total of lines 3 and 20.
Balance on services (73)	Total of lines 4 and 21.
Balance on goods and services (74)	Total of lines 2 and 19.
Balance on income (75)	Total of lines 12 and 29.
Balance on current account (77)	Total of lines 1, 18 and 35 or lines 74,75 and 76.
Net Financial Account Variables	
U.S.-owned assets abroad, excluding financial derivatives (40)	Total of lines 41, 46 and 50.
U.S. official reserve assets (41)	Net flows on holdings of monetary gold, SDRs, reserve position in the IMF, and foreign currencies by U.S. officials.
U.S. government assets, other than official reserve assets (46)	Net flows on U.S. government credits and other long-term assets to foreigners; repayments on these assets by foreigners; government short-term lending to foreigners.

Table A.4: Variables Included in the RTDS (cont'd)

Variable	Definition
U.S. private assets (50)	Net flows on U.S. direct investment abroad (i.e. equity capital flows, reinvested earnings); private net purchases of foreign stocks, government and corporate bonds; changes in U.S. private nonbank and bank reported claims on unaffiliated foreigners (i.e. resale agreements, short term financial instruments, deposits).
Foreign-owned assets in the U.S., excluding financial derivatives (55)	Total of lines 56 and 62.
Foreign official assets in the U.S. (56)	Net flows on holdings of U.S. Treasury securities, other government securities, stocks and corporate bonds by foreign monetary authorities and other foreign officials; other government liabilities to foreign monetary authorities and other foreign officials.
Other foreign assets in the U.S. (62)	Net flows on foreign direct investment in the U.S. (i.e. equity capital flows, reinvested earnings); net purchases of U.S. government securities, stocks, corporate and agency bonds by private foreigners and international financial organizations; changes in unaffiliated foreigners' claims reported by U.S. banks and non-banks (i.e. resale agreements, short term financial instruments, deposits); net transactions on U.S. currency between U.S. and foreign banks.
Gross International Investment Position Accounts Variables	
U.S.-owned assets abroad, excluding financial derivatives (6)	Position counterpart of line 40 in the ITAs. Total of lines 7, 12 and 17 in the IIP accounts.
U.S. official reserve assets (7)	Position counterpart of line 41 in the ITAs.
U.S. government assets, other than official reserve assets (12)	Position counterpart of line 46 in the ITAs.
U.S. private assets (17)	Position counterpart of line 50 in the ITAs.
Direct investment abroad at current cost (18)	Part of line 17 in the IIP accounts.
Foreign-owned assets in the U.S., excluding financial derivatives (26)	Position counterpart of line 55 in the ITAs. Total of lines 27 and 34 in the IIP accounts.
Foreign official assets in the U.S. (27)	Position counterpart of line 56 in the ITAs.
Other foreign assets in the U.S. (34)	Position counterpart of line 63 in the ITAs.
Direct investment in the United States at current cost (35)	Part of line 34 in the IIP accounts.
Direct investment abroad at market value (43)	Alternative current-period price measure of direct investment abroad (with owners' equity revalued using indexes of stock market prices)
Direct Investment in the United States at market value (44)	Alternative current-period price measure of direct investment in the U.S. (with owners' equity revalued using indexes of stock market prices)
Net International Investment Position Accounts Variables	
Net international investment position, excluding financial derivatives (3)	Difference between lines 6 and 26 in the IIP accounts.

Appendix A.3.4. Financial Derivatives

Starting from June 2007, more comprehensive statistics on financial derivatives was incorporated to BEA's news releases in order to capture an important area of financial activity in the coverage of the U.S. international economic accounts[44]. New data on derivatives transactions cover all activity of foreigners and U.S. residents for forward type derivatives (forwards, futures and swaps) and options in OTC markets and exchange markets. Transactions in derivatives consist of U.S. cash receipts and payments arising from the sale, purchase or periodic settlement of derivatives contracts[45].

The international economic accounts include extended coverage for derivatives transactions beginning from the first quarter of 2006 and derivatives positions beginning from the end of 2005. However, new data on financial derivatives has limited use in our RTDS. Partial estimates on derivatives transactions that have been announced previous to June 2007 are removed by BEA beginning with the first quarter of 2006 to avoid an overlap with the new source data, but are retained for the period 1977-2005 period. This leads to a break in series on financial transactions for period before first quarter of 2006 and the period thereafter. Positions on derivatives are recorded as part of U.S.-owned assets abroad and as part of foreign-owned assets in the U.S. However, derivatives transactions cannot be separated into transactions for U.S.-owned assets abroad and foreign-owned assets in the United States. Hence, it is impossible to link transactions on derivatives with derivatives positions using only publicly available BEA information. For these reasons, the RTDS presented in this paper excludes derivatives' transactions and positions.

Appendix A.4. Vintages

News releases for the ITAs lag one quarter behind the reference period. Up until March 2013, IIP releases have had new observation for the previous year and annual revisions .

Vintages are named after the release months of BEA. The names of the quarterly vintages in a year are March, June, September, and December. Annual IIP vintages are June[46].

Vintages for annual IIP variables and for most of the quarterly ITAs variables start from June 1991. The latest vintage for all annual and quarterly variables covered in the RTDS is June 2012, and December 2013, respectively.

Appendix A.4.1. International Transactions Accounts

There are at most 91 vintages in the data set related to the ITAs. However, the vintage coverage is shorter for some of the variables. Differences in the vintage coverage are consequence of the snapshot approach pursued in the construction of our RTDS. The RTDS

[44]Up until June 2007, estimates of derivatives transactions have been limited to estimates of profits and losses of foreigner's trading of future contracts on US exchanges. These future contracts excluded transactions of US residents' trading of future contracts on foreign exchanges and all activity in over the counter (OTC) markets, either in the U.S. or abroad.

[45]For more information please see Bach [2007].

[46]Starting from March 2013, IIP variables are released quarterly in the same months of ITAs news releases. For more information on the timing of BEA releases, please see Bach [2010], Yorgason and Scott [2012].

presented in this paper only documents what was readily available for researchers in the official releases on the dates of publications.
The number of vintages is 59 for exports/imports of goods and services, and total income receipts/payments. For the balance on goods and services, there are 83 vintages in the RTDS.

Appendix A.4.2. International Investment Position Accounts
There are 26 vintages in the IIP data set. The first vintage in the data set is June 1991. The vintages are annual up to the June 2012 vintage and they are quarterly afterwards.
Although earlier vintages can be extracted from corresponding SCB articles, we do not do so because of the incomparability issues with earlier vintages. Prior to June 1991 vintage, BEA has presented the IIP estimates based on a mix of valuations. Some components were valued in current-period prices, and others were valued in prices of earlier periods (historical cost valuation). In June 1990, estimates of NIIP and total positions abroad and in the U.S. have not been released. In June 1991, BEA introduced new investment measures using current-period prices and market values for IIP components for which such valuation is appropriate[47].

Appendix A.4.3. More on Differences in Vintages
BEA introduced trade balance on goods and services and the exports (imports) of goods and services in the ITAs presentation in June 1993 and June 1999 vintages, respectively, in an effort to relate several lines and to ease use of the published tables[48].
Total income receipts and payments were newly published in June 1999 release as a result of reclassification of employee compensation. Time series of total income receipts and payments goes back to the first quarter of 1986. Before 1986, series for the total income receipts and payments are the same as the time series for income receipts and payments on U.S. (foreign-owned) assets abroad (in the U.S.) and excludes relevant series for compensation of employees[49]. Compensation of employees has been reclassified to the income account from the services account. Compensation payments of employees are not distinguishable from the services accounts in official presentations before June 1999.
The shorter vintage coverage for total income receipts (payments) has no implications for net CA variables. For instance, current account balance has 91 vintages in our RTDS. Since the compensation of employees was reclassified from one current account item to the other current account item, it does not produce any compatibility issue for the current account

[47]Please see Scholl [1990, 1991], Landefeld and Lawson [1991] for the discussion of the valuation of the U.S. IIP accounts.

[48]Although these variables are not included in our RTDS for earlier vintages, one can easily compute them using other readily available gross variables in the ITAs with full vintage coverage without any loss of generality. This what we have done in the revision analysis for these variables in order to have longer sample period

[49]Since time series of total income payments/receipts are not directly compatible with earlier vintages, they are left as they have been constructed in the RTDS and in the revision analysis as well. Hence, they have sample sizes shorter than other series in our empirical analysis.

balance series across vintages. The only place where the reclassification may matter is the income balance.
Income balance has 91 vintages. Before the June 1999 vintage, the balance on income is calculated by BEA, as the difference between the receipts of income on U.S.-owned assets abroad and income payments on foreign-owned assets in the U.S. Afterwards, income balance is equal to the difference between total income receipts and total payments of income. Total income receipts/payments is the sum of income receipts/payments on U.S./foreign-owned assets abroad/in the U.S. and compensation receipts/payments of temporary employees. For the United States, compensation payments have been somewhat higher than compensation receipts since the first quarter of 1998. This implies that, starting from the June 1999 vintage; the surplus on income balance published for a specific reference period is lower than what it would have been if there were no changes in the definitions. However, this type of international employment is small, and the related compensation accounts for only a very small fraction of total U.S. income receipts and income payments [Bach, 2010]. Hence the impact of reclassification on income balance seems negligible.
The changes to the BEA's ITAs presentation mentioned above only count for a small subset of many changes that has been made by BEA through time. As the periodicity of revisions due to changes in definitions, methodologies and classifications is annual, the track of all such revisions is well beyond the scope of this paper.

Appendix A.5. Time Horizon

In some of the vintages, time series for all the ITAs variables starts with the first quarter of 1960 and ends at the third quarter 2013. For most of the IIP variables, time series covers the period between 1976 and 2012. Exceptions are direct investment measured at market values by foreigners and by the U.S. residents in the U.S. and abroad, respectively. For these variables, time series begins with the observation of 1982 and ends with the observation of 2012.

Appendix A.6. Accuracy

Firstly, the vintages of data for the ITAs variables in our RTDS truly match the vintages of data for these variables in ALFRED. However, the starting vintage is the final quarter of 1996 at most in ALFRED. To ensure data accuracy for all vintages, we apply the following procedure.
As the snapshot approach is applied in the data set construction, accuracy of the RTDS is checked through basic accounting rules emerging from the definitions of international economic accounts.
The data set for the U.S. ITAs should satisfy the following the identities through all reference periods and vintages (reference line numbers are in parenthesis starting with the capital L).

- Exports of goods, services and income receipts (L1) = Exports of goods and services (L2) + Income receipts (L12)
- Exports of goods and services (L2) = Exports of goods (L3) + Exports of services (L4)

- Imports of goods, services and income payments (L18) = Imports of goods and services (L19) + Income payments (L29)
- Imports of goods and services (L19) = Imports of goods (L20) + Imports of services (L21)
- Balance on goods (L72) = Exports of goods (L3) + Imports of goods (L20)
- Balance on services (L73) = Exports of services (L4) + Imports of services (L21)
- Balance on goods and services (L74) = Exports of goods and services (L2) + Imports of goods and services (L19) = Balance on goods (L72) + Balance on services (L73)
- Balance on income (L75) = Income receipts (L12) + Income payments (L29)
- Balance on goods and services (L74) + Balance on income (L75) = Exports of goods, services and income receipts (L1) + Imports of goods, services and income payments (L18)
- Balance on current account (L77) = Exports of goods, services and income receipts (L1) + Imports of goods, services and income payments (L18) + Unilateral current transfers (L35)
- US owned assets abroad (L40) = US official reserve assets abroad (L41) + US government assets, other than official reserve assets abroad (L46) + US private assets abroad (L50)
- Foreign owned assets in the US (L55) = Foreign official assets in the US (L56) + Other foreign assets in the US (L63)

A similar methodology is applied in order to check the accuracy of the data set for the U.S. IIP accounts. The identities used for such checks are presented below.

- Net international investment position, excluding financial derivatives (L3) = U.S. owned assets abroad, excluding financial derivatives (L6) – Foreign-owned assets in the U.S., excluding financial derivatives (L26)
- U.S. owned assets abroad, excluding financial derivatives (L6) = U.S. official reserve assets abroad (L7) + U.S. government assets, other than official reserve assets abroad (L12) + U.S. private assets abroad (L17)
- Foreign-owned assets in the U.S., excluding financial derivatives (L26) = Foreign official reserve assets in the U.S. (L27) + Other foreign assets in the U.S. (L34)

Relevant variables in our RTDS satisfy these conditions. This implies that the RTDS has no editing errors.

Appendix A.7. Compatibility and Synchronization

Although our RTDS covers fewer vintages than the Real-Time Data set for Macroeconomists have, both data sets are compatible in terms of their constructions. Both data sets have information in quarterly vintages. However, it is worth to mention that the timing of the snapshots is not the same in two data sets because of different release schedules for different variables related to the U.S. economy.

Quarterly vintages covered in Real-Time Data set for Macroeconomists are named after the quarter in which new data is published. To be more exact, a quarterly vintage reflects the information about a variable as of the mid-day of the mid-month of a quarter in general.

In our RTDS, vintages are named after the month in which new data is published. BEA releases ITAs no later than the 15^{th} working day of corresponding publication months. BEA releases both quarterly and annual ITAs and annual IIP variables in June every year. In June, BEA publishes ITAs before annual IIP. Annual IIP publications take place in the very last working days of every June[50]. This means that, any vintage in our RTDS reflects the information for a variable as of the end of a quarter.

Current account balance (Series ID: L77) originally comprises quarterly vintages in our real-time database whereas quarterly vintages of domestic savings (Series ID: GSAVE) and nominal GDP (Series ID: NOUTPUT) are constructed from the monthly vintages available in ALFRED and Real-Time Data Set for Macroeconomists, respectively. For domestic savings, quarterly vintages are constructed from the monthly vintages of end of March, June, September and December. Only new observations related to the first quarters are associated with initial estimates of domestic savings. For all other quarters, new observations correspond to second estimates. For nominal GDP, quarterly vintages are constructed from the monthly vintages of mid-January, mid-April, mid-July and mid-October. New observations for GDP in related monthly vintages are third estimates (in BEA's jargon, final estimates), which are released at the end of the months preceding the corresponding monthly vintages.

Appendix B. Revision Analysis

Appendix B.1. Sign Convention

In contrast to the sign convention of our RTDS, imports, income payables, U.S. transfers to abroad are employed in absolute terms in the revision analysis. With this change, net exports will now be equal to exports *minus* imports as imports are presented with positive signs. In addition, we assign positive signs to increases in U.S. assets and increases in U.S. liabilities. In contrast, financial flows due to decreases in U.S. assets or in U.S. liabilities are shown with negative signs. No other change is made to the sign convention used in the RTDS.

[50]The only exception is the annual IIP publication for the end of year 1995. This publication was available in 2^{nd} of July 1996.

Appendix B.2. Other Changes

Exports of goods and services, imports of goods and services and trade balance on goods and services are not included in the RTDS for some earlier vintages[51]. However, we extended the vintages for these variables back to the June 1991 vintage without loss of generality. Although these variables were not published in earlier vintages, their components were readily available. For instance, we have sum up goods exports and services exports to compute total exports of goods and services for earlier vintages. On the contrary, although the vintages of income balance starts from June 1999 vintage, we only consider the vintages starting with June 1999 because of compatibility issues discussed earlier in Appendix A.

Appendix B.3. Revision Cycle

Near the end of each quarter, BEA publishes its first/preliminary/initial estimates of quarterly ITAs variables for the previous quarter. Hence, the last observation in each column in our RTDS for ITAs variables captures first estimate for the previous quarter. Near the end of the following quarter, BEA releases its second estimates. Additional revisions only occur every June in BEA's annual revisions. Annual revisions generally cover the most recent four years. Thus, each variable in the ITAs usually goes under four annual revisions. In addition, every few years, BEA releases benchmark revisions, which usually affect the entire time series in the vintage. Benchmark revisions are also incorporated in annual revisions and they cover benchmark survey results and/or redefinitions, re-classifications and changes in methodologies. The periodicity of benchmark surveys is five years whereas it is one year for revisions related to changes in definitions, classifications and methodologies.
The following table summarizes the revision routine for ITAs in a three-year time horizon.

Table B.5: Revision Cycle. ITAs Variables.

Time	Announced	Revised	Revised	Revised	Revised
tQ1	tQ2	tQ3	t+1Q2	t+2Q2	t+3Q2
tQ2	tQ3	tQ4	t+1Q2	t+2Q2	t+3Q2
tQ3	tQ4	t+1Q1	t+1Q2	t+2Q2	t+3Q2
tQ4	t+1Q1	t+1Q2	t+1Q2	t+2Q2	t+3Q2

The table indicates that, for instance, the variable measured at the first quarter of year t is announced in the second quarter of year t. The initial announcement is revised in the third quarter of year t. After that, revisions only occur in the second quarters of years, t+1, t+2 and t+3. These revisions correspond to annual revisions.
Please notice that the variable measured at the final quarter of year t is announced in the first quarter of year t+1. The initial announcement is revised in the second quarter of year t+1. At the time of this revision, the variable measured at the first, second, third and fourth quarters of year t are open to annual revisions.

[51]Please see Appendix A for details.

On rare occasions, BEA revises its estimates at times different than her standard revision timing. For instance, for the third quarter of 2009, BEA revised the ITAs in December 2009 to include a new treatment of special drawing rights requested by the International Monetary Fund as part of efforts to monitor the impact of the global financial crisis [BEA, 2014b]. We ignore such infrequent revisions in the revision analysis performed in this paper.

Appendix B.4. Means of Scaled Revisions

For each variable, scaled revisions to levels are calculated as follows.

$$r^s_{t,f} = (r_{t,f}/s_{t,f}) \times 100 \tag{B.1}$$

where $r_{t,f}$ is the final revision to the variable in levels at time t and $s_{t,f}$ is scaling item for the final revision $r_{t,f}$.

We use different scaling items depending on the nature of variables. For gross and net CA variables related to the current account, final revision is scaled with the size of final variable. For gross CA variables, the scaling item is the size of final gross variable itself. For net CA variables, the size of final variable is the sum of the sizes of gross components of the final net variable. For example, the scaling item for the trade balance on goods is the sum of the final estimates of exports of goods and imports of goods.

All FA variables are measured on net basis. However, gross components of FA variables are unmeasured. Hence, for FA variables, the scaling item is size of the corresponding final IIP variable. The size of corresponding IIP variable is end-of-year position divided by four. Hence, for all FA variables, the denominator is in terms of flows over a quarter and the numerator is in terms of average end-of-quarter positions in equation (B.1).

Given the volatility of FA variables, this may not be the best choice for scaling. Scaled revisions for the financial account are not directly comparable with those of the current account. Nevertheless, scaled revisions are still informative for comparison of revision sizes across different FA variables.

Sample mean scaled revision is

$$\overline{r^s_{t,f}} = (1/n) \sum_{t=1}^{n} r^s_{t,f} \tag{B.2}$$

where $r^s_{t,f}$ is the scaled final revision to the variable realized at time t and n is the number of observations.

Appendix C. More Results on Revision Analysis

Appendix C.1. Stationarity

In order to examine the stationarity of the variables, we have applied Augmented Dickey-Fuller (ADF) Test. The results discussed are based on the most appropriate test model such

that the estimated ADF model has low Schwarz information criterion, significant estimated coefficients and non-autocorrelated residuals[52].
We first study initial estimates and unscaled final revisions of level variables. We fail to reject the null hypothesis of unit root for these measures of all CA variables whereas all measures of all FA variables are stationary at least at 5 percent significant level.
We also investigate the stationarity of scaled revisions to level variables. We reject the null hypothesis of unit root for all CA and FA variables at 5 percent significance level except total credit entries- exports of goods and services and income receipts, U.S. income receipts on international financial investment and imports of goods. For total credit entries and U.S. income receipts on international financial investment, the evidence to reject unit root depends on the selected ADF model. For imports of goods, we only reject the null at 10 percent level.
We also test the null of stationarity against the alternative of unit root [Kwiatkowski et al., 1992] for total credit entries- exports of goods and services and income receipts, U.S. income receipts on international financial investment and imports of goods. Under the assumption of no trend in scaled revisions, we find sufficient evidence to fail to reject stationarity for these variables[53].

Appendix C.2. Sample Statistics of Final Revisions to Levels

The results for revisions to levels are reported in Table C.6. The first column of Table reports the number of observations used in the analysis for each variable. The subsequent columns report the mean of scaled revisions, mean absolute *scaled* revisions, standard deviation and the degree of first order auto-correlation of scaled revisions, respectively. The scaling procedure applied for revisions to levels are detailed in Appendix B.

Appendix C.3. Predictability of Final Revisions to Levels

For level estimates, we provide information on the number of observations in the first column of Table C.7. F-test statistics and corresponding p-values for the noise hypothesis are presented in the second and third columns. We provide three pieces of information regarding the news hypothesis in the subsequent columns. We document the results of news regressions starting from the weakest restriction we impose to the strongest one. We first report the results for the simple news regression, and the augmented news regression with the same restrictions applied to the regressions for annualized growth rates in order to provide a comparison with previous results for all variables. Later on, we also provide the F-statistics and p-values for the null hypothesis that the coefficient on initial estimate is equal to one and all the coefficients of lagged initial estimates and the intercept are equal to zero for gross and net CA variables. This is the strongest restriction that we have applied emerging from the

[52]We perform the Ljung-Box Q test to detect autocorrelation in residuals for the first eight lags. We consider ADF test models for which we reject the null of no autocorrelation at 5 percent significance level.

[53]HAC standard errors are computed for significance. For $lags \geqslant 1(4)$, we fail to reject the null of stationarity of total credit entries- exports of goods and services and income receipts and U.S. income receipts on international financial investment (imports of goods).

Table C.6: Sample Statistics of Final Revisions. Revisions to Levels.

	N	MR	MAR	STD	AC
Gross Current Account Variables					
Exports of Goods and Services and Income Receipts	75	**2.15**	0.02	1.43	**0.65**
Exports of Goods and Services	75	**0.52**	0.01	0.87	**0.32**
Exports of Goods	75	0.14	0.01	0.94	**0.25**
Exports of Services	75	**1.46**	0.02	2.52	**0.50**
Total Income Receipts	47	**6.34**	0.07	4.68	**0.66**
Receipts on U.S. Owned Assets	75	**7.30**	0.08	4.47	**0.66**
Imports of Goods and Services and Income Payments	75	0.02	0.01	1.36	**0.47**
Imports of Goods and Services	75	0.21	0.01	0.81	**0.44**
Imports of Goods	75	0.18	0.00	0.63	**0.44**
Imports of Services	75	0.33	0.02	3.95	**0.46**
Total Income Payments	47	−1.80	0.06	8.12	**0.48**
Payments on Foreign Owned Assets	75	−1.61	0.05	7.08	**0.47**
Net Current Account Variables					
Balance on Current Account	75	**0.84**	0.01	0.70	**0.48**
Balance on Goods and Services	75	0.11	0.00	0.47	**0.41**
Balance on Goods	75	−0.05	0.00	0.36	0.09
Balance on Services	75	0.69	0.02	2.06	**0.54**
Balance on Income	47	**4.24**	4.41	2.94	0.24
Net Financial Account Variables					
U.S. Owned Assets Abroad	75	**1.28**	0.02	2.27	0.11
Official Reserve Assets	75	0.00	0.00	0.03	−0.01
Other Government Assets	75	−0.25	0.01	2.54	−0.02
Private Assets	75	**1.36**	0.02	2.42	0.11
Foreign Owned Assets in the U.S.	75	**0.82**	0.02	1.65	0.20
Official Assets	75	**1.61**	0.02	2.24	**0.60**
Other Assets	75	**0.62**	0.02	2.00	**0.26**

Notes: N=number of observations, MR= mean of revisions, MAR= mean of absolute revisions, STD= standard deviation of revisions, AC= first-order autocorrelation coefficient of revisions. All statistics are computed using scaled revisions. Boldface figures are significant at least at the 5 percent level. HAC standard errors are computed for significance.

news regression for levels. This is true since all lagged variables related to initial estimates actually form a subset of the information set that was available at the time of the initial announcement.

When estimates are defined in levels, we fail to reject the noise hypothesis for eight variables. Final revisions to imports of services and trade balance on goods and services are better characterized as noise. We reject both of the hypotheses for other eleven variables. Among these variables, significant intercept term is one of the reasons to reject both of the hypothe-

Table C.7: Predictability of Final Revisions. Estimates in Levels

		Noise Hypothesis		**News Hypothesis**					
		H_0: $\alpha_1 = 0$, $\beta_1 = 1$		H_0: $\alpha_2 = 0$, $\beta_2 = 1$		$H_0 : \alpha_2 = 0, \beta_2 = 1$, $\gamma = 0$		$H_0 : \alpha_2 = 0, \beta_2 = 1$, lagged coeffs. of $y_t^{t+1} = 0$	
	N	F statistics	p value	F statistics	p value	F statistics	p value	F statistics	p value
Gross Current Account Variables									
Exports of Goods and Services and Income Receipts	75	**3.52**	0.04	0.11	0.90	**12.90**	0.00	**10.06**	0.00
Exports of Goods and Services	75	1.52	0.23	1.09	0.34	1.15	0.34	**2.77**	0.02
Exports of Goods	75	**3.26**	0.04	**11.01**	0.00	**8.58**	0.00	**12.77**	0.00
Exports of Services	75	**10.17**	0.00	**4.30**	0.02	**4.84**	0.00	**4.78**	0.00
Total Income Receipts	47	**5.87**	0.01	0.46	0.63	**14.41**	0.00	**21.88**	0.00
Receipts on Foreign Assets	75	**6.85**	0.00	0.81	0.45	**9.69**	0.00	**17.01**	0.00
Imports of Goods and Services and Income Payments	75	**3.39**	0.04	**8.28**	0.00	**7.26**	0.00	**12.01**	0.00
Imports of Goods and Services	75	**7.93**	0.00	**13.15**	0.00	**14.88**	0.00	**8.63**	0.00
Imports of Goods	75	1.40	0.25	2.34	0.10	**5.84**	0.00	**11.17**	0.00
Imports of Services	75	0.81	0.45	**11.91**	0.00	**51.53**	0.00	**33.15**	0.00
Total Income Payments	47	2.77	0.08	0.79	0.46	**6.04**	0.00	**4.80**	0.00
Payments on Foreign Owned Assets	75	**5.53**	0.01	1.95	0.15	**9.13**	0.00	**7.21**	0.00
Net Current Account Variables									
Balance on Current Account	75	**6.02**	0.00	**4.96**	0.01	**14.13**	0.00	**10.82**	0.00
Balance on Goods and Services	75	2.50	0.09	**8.66**	0.00	**18.65**	0.00	**14.05**	0.00
Balance on Goods	75	1.21	0.31	1.42	0.25	1.27	0.29	**8.62**	0.00
Balance on Services	75	**25.48**	0.00	**21.74**	0.00	**37.59**	0.00	**19.97**	0.00
Balance on Income	43	**7.28**	0.00	**5.54**	0.01	**5.55**	0.00	**13.08**	0.00
Net Financial Account Variables									
U.S. Owned Assets Abroad	75	**19.48**	0.00	**4.23**	0.02	**3.69**	0.02	–	–
Official Reserve Assets	75	0.51	0.60	0.51	0.60	0.34	0.80	–	–
Other Government Assets	75	0.42	0.66	0.46	0.63	0.70	0.56	–	–
Private Assets	75	**22.52**	0.00	**5.43**	0.01	**3.80**	0.01	–	–
Foreign Owned Assets in the U.S.	75	**10.03**	0.00	**3.55**	0.03	**3.69**	0.02	–	–
Official Assets	75	**20.36**	0.00	**12.39**	0.00	**10.32**	0.00	–	–
Other Assets	75	**10.04**	0.00	1.97	0.15	2.20	0.10	–	–

Notes: N denotes the number of observations. All the regressions of CA variables are estimated with lag order of four. For the noise and simple news hypotheses, α and β refer to the constant term and the slope term for the relevant explanatory variable of time t estimated as in models (2) and (3), respectively. For the augmented news hypothesis, additionally, γ is the coefficient of the value initially announced at time t for the same variable at time t-1 estimated as in model (4). For current account variables, in the final column, we also report the F-statistics and p-values for the null hypothesis that the coefficient on initial estimate is equal to one and all the coefficients of lagged initial estimates and the intercept are equal to zero. Boldface F statistics are significant at least at the 5 percent level. HAC standard errors are computed for significance.

ses for total debit entries (imports of goods and services and income payments), and goods and services imports[54]. Revisions to five of the variables are better characterized as news based on the results from simple news regression for levels. However, once we restrict the coefficient on estimates measured in time t-1 and announced at time t to be equal to zero, the results for news hypothesis changes. In this case, we reject both the noise and the augmented news hypotheses for the total gross credit entries- exports of goods and services and U.S. income receipts, for total U.S. income receipts, and for U.S. income receipts/payments on/to international financial investment. Imports of goods and total U.S. income payments to foreign financial investment are now better characterized as noise as we now reject the augmented news hypothesis. On the other hand, we can only clearly identify revisions to net transactions on U.S. assets by private foreigners and international organizations as news. Once we apply additional restrictions on all of the coefficients related to past information set that was observed at time t+1, we correspondingly reject the news hypothesis for all gross and net CA variables.

Appendix C.4. Final Revisions in Subsamples

We divide our sample almost in half: before and after 2001 given that we have 75 observations in our sample at most. Consequently, our decision on subsampling is mostly related with statistical purposes, aiming to have enough observations in both sub-samples. We do not attribute an economic meaning to our subsampling decision. We only consider variables which have full sample benchmark results[55].

On these grounds, the motivation for our subsampling can be solely justified by possible changes in the benchmark results due to technological progress in data collection process. Technological progress can either improve the data collection or make the process even more complex due to increased variety of goods to be covered in data [Aruoba, 2008].

The results for unconditional properties of final revisions for two sub-samples are presented in Table C.8. Table covers the results for revisions both to growth rates and to levels. We report number of observations, means of final revisions and noise-to-signal ratios for the sub-samples of revisions to growth rates. Mean revisions and standard deviations of revisions to levels are computed using scaled revisions as before. The full sample results were already displayed in Table 1 for growth rates and in Table C.6 for levels.

If revisions are defined in terms of growth rates, mean revisions to services exports are only statistically significant in the earlier sub-sample. The mean revisions are higher in pre-2001 period for 12 out of 21 variables we considered in this analysis. The average directions of revisions change across the sub-samples for some of the variables. For example, on average, U.S. income receipts on foreign assets is overestimated in the initial announcements in pre-2001 period, while it is underestimated afterwards.

For 16 variables, noise-to-signal ratios are higher before 2001 period. In contrast, noise-to-signal ratios for services imports, trade balance on services, and for some of FA variables

[54]The intercept term is also different from zero for exports of goods in both noise and simple news regressions at 10 percent significance level.

[55]We exclude balance on income and total income receipts/payments from the sub-sample analysis.

Table C.8: Subsample Statistics of Final Revisions.

	1992Q1-2000Q4					2001Q1-2010Q3				
		Growth rates		Levels			Growth rates		Levels	
	N	MR	NSR	MR	STD	N	MR	NSR	MR	STD
Gross Current Account Variables										
Exports of Goods and Services and Income Receipts	36	0.00	0.46	**1.94**	1.32	39	0.68	0.23	**2.35**	1.51
Exports of Goods and Services	36	0.25	0.43	**0.45**	0.90	39	0.14	0.22	**0.58**	0.84
Exports of Goods	36	−0.34	0.49	−0.01	0.75	39	−0.21	0.20	0.27	1.08
Exports of Services	36	**1.84**	0.74	**1.64**	2.65	39	0.94	0.58	**1.29**	2.42
Receipts on U.S. Owned Assets	36	−1.60	0.69	**7.74**	4.04	39	1.85	0.52	**6.89**	4.85
Imports of Goods and Services and Income Payments	36	−0.09	0.31	−0.40	1.10	39	0.27	0.28	0.41	1.47
Imports of Goods and Services	36	0.22	0.24	−0.06	0.56	39	0.11	0.21	**0.46**	0.93
Imports of Goods	36	0.06	0.22	0.05	0.42	39	−0.20	0.15	0.29	0.77
Imports of Services	36	0.90	0.99	−0.60	2.57	39	1.36	1.82	1.20	4.77
Payments on Foreign Owned Assets	36	−1.45	0.57	−2.81	5.46	39	1.02	0.54	−0.50	8.22
Net Current Account Variables										
Balance on Current Account	36	1.57	0.69	**0.99**	0.68	39	1.06	0.44	**0.70**	0.70
Balance on Goods and Services	36	6.05	0.52	**0.26**	0.36	39	0.10	0.37	−0.02	0.53
Balance on Goods	36	−0.60	0.45	−0.03	0.34	39	0.30	0.22	−0.07	0.38
Balance on Services	36	3.98	0.69	**1.23**	1.50	39	−3.90	1.55	0.20	2.38
Net Financial Account Variables										
U.S. Owned Assets Abroad	36	−6,076.00	124.41	**2.09**	2.09	39	1,867.63	0.93	0.53	2.21
Official Reserve Assets	36	−1.14	0.00	−0.01	0.04	39	0.00	0.00	0.00	0.00
Other Government Assets	36	−207.94	1.28	−0.23	2.66	39	−1,172.15	0.67	−0.27	2.45
Private Assets	36	−188.14	4.58	**2.24**	2.25	39	2,209.32	0.92	0.53	2.31
Foreign Owned Assets in the U.S.	36	28.92	0.59	**1.14**	1.55	39	−41.96	1.01	0.53	1.71
Official Assets	36	603.98	0.51	**0.23**	0.79	39	99.13	0.75	**2.88**	2.39
Other Assets	36	−1.52	1.27	**1.32**	1.82	39	974.88	0.87	−0.02	1.96

Notes: N=number of observations in the corresponding sub-samples. MR= mean of revisions and NSR= noise-to-signal ratio in the corresponding sub-samples for growth rates. For levels, MR= mean of scaled revisions and STD=standard deviation of scaled revisions. Boldface figures are significant at least at the 5 percent level. HAC standard errors are computed for significance.

related to U.S. financial liabilities are higher after 2001. For example, noise-to-signal ratio for services balance is 1 for the first sub-sample period whilst the ratio more than doubles to 1.8 in post-2001 period.
When revisions are defined in levels, pre-2001 period mean scaled revisions, in magnitudes, are higher for 11 variables. Mean scaled revisions are significant in both sub-samples for 6 variables, including U.S. returns on international investment to capital and current account balance. Significant mean revisions in the full sample are due to non-zero means in the first sub-sample for other variables.
Although mean revisions are not significant in the full sample, they are significant in the first sub-sample for trade balance on goods and services and services balance. For imports of goods and services, mean of scaled revisions is significant only post-2002 period. For most of the variables, mean revisions preserve full sample sign in both sub-samples.
Standard deviations of scaled revisions are higher in post-2001 period for only four variables. Biggest increase in the standard deviation between the sub-samples corresponds to income payments to foreign financial investment in the U.S.

Appendix C.5. Incremental Revisions

In this Section, we explore more on the sources of our benchmark results and study the incremental revisions up to the 3-year time horizon after the initial announcements. We report the results for marginal revisions to growth rates in Table C.9. In the Table, we first document the means and standard deviations of incremental revisions. We consider 1-quarter, 1-year, 2-year and 3-year incremental revisions. Lastly, we report p-values for the simple news hypothesis. We consider 1-quarter ahead, 1-year ahead or 2-year ahead estimates as dependent variables in the simple news model as presented in (3).
The number of observations is 75 as in the benchmark analysis for all the incremental revisions and intermediate estimates with some exceptions. The number of observations is 57 for 1-quarter revisions. This is simply the result of official revision schedule for the U.S. ITAs. Initial and second estimates for a variable measured at first, second and third quarters are only associated with the arrival of new information. Subsequent estimates for these quarters coincide with vintages of annual revisions at which revisions are due to the arrival of new information and/or changes in definitions, methodologies or classifications. While the initial estimate of a variable at fourth quarter of a year is revised for the first time, initial announcements of that variable at previous three quarters are revised for the second time. Hence, for fourth quarters, second estimates exactly match with third estimates[56]. In order to preserve internal consistency, we prefer not to associate 1-quarter ahead estimates for a variable with an annual revision period. Therefore, we exclude the fourth quarters from 1-quarter ahead estimates. Rather, we prefer to relate these estimates with 1-year ahead estimates of fourth quarters, which are announced at annual revision periods. Similar justifications are employed to initial and 1-year ahead estimates only when it is necessary to compute the summary statistics of 1-quarter revisions and news regressions related to 1-quarter estimates.

[56]See also Appendix B, for the specific revision schedule table of BEA for ITAs.

Table C.9: Incremental Revisions.Revisions to Growth Rates.

	Mean				Standard Deviation				News Hypothesis: p-value		
	1-quarter	1-year	2-year	3-year	1-quarter	1-year	2-year	3-year	1-quarter	1-year	2-year
Gross Current Account Variables											
Exports of Goods and Services and Income Receipts	0.21	−0.24	0.30	0.17	1.68	2.96	2.33	1.86	**0.02**	**0.02**	0.07
Exports of Goods and Services	0.10	−0.23	0.28	−0.03	1.27	2.76	2.30	1.47	0.10	**0.00**	**0.00**
Exports of Goods	0.03	−0.18	−0.02	−0.08	0.36	2.91	2.28	1.68	0.60	**0.00**	**0.00**
Exports of Services	0.29	−0.29	**1.01**	0.12	4.21	5.27	4.83	2.31	0.78	0.06	0.15
Receipts on U.S. Owned Assets	0.42	−0.64	0.18	0.79	5.54	7.48	6.48	6.16	0.14	0.15	**0.03**
Imports of Goods and Services and Income Payments	**0.26**	−0.08	0.02	−0.01	1.19	2.62	3.37	1.76	**0.04**	**0.00**	**0.00**
Imports of Goods and Services	**0.17**	−0.21	0.15	0.01	0.67	2.24	2.84	1.41	0.13	**0.00**	0.17
Imports of Goods	−0.02	−0.22	−0.01	0.06	0.27	2.37	2.07	1.48	0.84	**0.00**	0.12
Imports of Services	**1.13**	−0.16	0.72	−0.28	3.72	6.11	15.68	3.14	**0.00**	0.32	**0.00**
Payments on Foreign Owned Assets	0.55	0.85	−0.58	−0.07	5.54	12.38	10.75	6.89	0.41	0.90	0.95
Net Current Account Variables											
Balance on Current Account	**74.16**	−0.61	2.76	0.35	139.91	25.89	41.61	20.96	0.06	**0.00**	**0.00**
Balance on Goods and Services	52.19	3.92	1.12	0.12	167.14	33.46	22.09	11.52	**0.00**	**0.00**	**0.00**
Balance on Goods	**92.13**	0.98	0.11	−0.47	84.06	8.45	6.94	4.98	0.55	**0.03**	**0.01**
Balance on Services	1.15	0.08	−1.00	1.15	11.31	28.66	47.68	11.31	0.11	0.86	**0.00**
Net Financial Account Variables											
U.S. Owned Assets Abroad	875.65	57,189.68	−42,508.20	−320.86	3,553.80	434,632.16	368,041.64	12,200.75	**0.00**	0.32	**0.00**
Official Reserve Assets	−89.89	−0.01	0.00	0.00	4,092.40	0.05	0.04	0.04	0.58	0.61	0.61
Other Government Assets	468.12	−233.99	−1,183.96	16.10	2,526.23	1,653.24	11,673.77	74.63	**0.00**	**0.00**	0.21
Private Assets	256.95	233.19	53.07	801.86	1,398.73	2,131.33	2,884.63	5,592.65	0.23	0.38	0.61
Foreign Owned Assets in the U.S.	13.69	299.39	−226.81	−82.99	1,236.58	2,892.86	1,797.83	686.68	**0.00**	0.32	**0.01**
Official Assets	579.38	131.36	−158.34	345.47	3,098.20	1,504.25	1,256.95	2,418.42	**0.02**	**0.01**	0.09
Other Assets	−120.87	284.29	−1,029.83	7.90	2,191.21	1,662.04	10,143.07	94.90	**0.00**	0.32	0.14

Notes: For mean and standard deviation columns, 1-quarter, 1-year, 2-year and 3-year refer to incremental revisions after 1 quarter, 1 year, 2 years and 3 years, respectively. For news hypothesis column, 1-quarter, 1-year and 2-year refer to estimates after 1 quarter, 1 year and 2 years. News hypothesis is the joint hypothesis that the constant is zero and the slope term is equal to 1 in the estimated model as in equation 3. Boldface figures are significant at least at the 5 percent level. HAC standard errors are computed for significance.

We also consider how our results change if we include fourth quarters to our sample related to 1-quarter revisions and 1-quarter ahead estimates and perform a full sample analysis. The results for this exercise can be found in Appendix C.6.

When revisions are defined in terms of growth rates, there is no general pattern emerging from means of incremental revisions. For trade balance on goods and services and foreign assets owned by U.S. private residents, the mean of all incremental revisions has the same sign as the mean of final revisions. 1-quarter revisions to growth rates are significantly different from zero for 5 of our variables, including imports of goods and services and current account balance. Although we do not report them for saving space, the results of means of absolute incremental revisions indicate that the biggest revisions in magnitude occur at 1-year revisions for most of the variables in growth rates. On the other hand, 1-quarter revisions are the largest for most of the net CA variables such as current account balance, and balance on goods and services. For all FA variables except U.S. assets owned by foreign officials, largest revisions occur in either 2-year or 3-year revisions. For gross variables, only 30 percent of the volatility in final revisions comes from 1-quarter revisions and 68 percent of it is from the 1-year revisions on average. The volatility of 1-quarter revisions is way larger than the volatility of total final revisions for current account balance, balance on goods, and goods and services balance. For net CA variables, 67 percent of the volatility in final revisions comes from 1-year ahead revisions on average. Excluding U.S. owned reserve assets abroad, 77 percent of the final revision volatility comes from the 1-quarter ahead revisions for FA variables. In contrast, the volatilities of 1-year and 2-year revisions are almost 4 times larger than the volatility of final revisions to FA variables on average.

For trade balance on goods and services, and the total of imports of goods and services and income payments, we reject the news hypothesis for all intermediate estimates. Furthermore, we reject the news hypothesis in 3 out of 4 intermediate estimates for 9 variables. This result indicates that in most of the cases, most of the intermediate revisions contribute to the rejection of news hypothesis. Hence, ignorance of initial announcements would not eliminate the problems with revisions in most of the cases.

Appendix C.6. Full Sample Results for 1-Quarter Ahead Incremental Revisions

For the reasons we have discussed in Appendix C.5, we exclude the second estimates for fourth quarters from our analysis related to 1-quarter revisions.

In this Section, we explore whether our results related to 1-quarter revisions change if we also incorporate the second estimates for fourth quarters into the analysis.

Tables C.10 document the results for revisions to growth rates. In the Table, we first document the results when we exclude the fourth quarters, then the results when we include all the quarters in the analysis. We report means and standard deviations of one-quarter revisions in both cases. We report p-values for the simple news hypothesis for two different definitions of 1-quarter estimates. Results related to 1-quarter revisions/estimates excluding fourth quarters are the same results previously presented in Tables C.9.

Table C.10: One-Quarter Ahead Revisions. Revisions to Growth Rates.

	Exc. 4th Quarters			All Quarters		
	MR	STD	p value	MR	STD	p value
Gross Current Account Variables						
Exports of Goods and Services and Income Receipts	0.21	1.68	**0.02**	0.06	2.05	0.95
Exports of Goods and Services	0.10	1.27	0.10	0.12	1.83	0.23
Exports of Goods	0.03	0.36	0.60	−0.03	1.71	**0.00**
Exports of Services	0.29	4.21	0.78	0.46	4.47	0.52
Receipts on U.S. Owned Assets	0.42	5.54	0.14	−0.29	6.58	0.91
Imports of Goods and Services and Income Payments	**0.26**	1.19	**0.04**	0.15	2.09	**0.00**
Imports of Goods and Services	**0.17**	0.67	0.13	0.16	1.29	**0.02**
Imports of Goods	−0.02	0.27	0.84	0.03	1.31	**0.00**
Imports of Services	1.13	3.72	**0.00**	0.83	5.78	0.32
Payments on Foreign Owned Assets	0.55	5.54	0.41	−0.16	9.17	0.36
Net Current Account Variables						
Balance on Current Account	**74.16**	139.91	0.06	−1.34	13.44	0.12
Balance on Goods and Services	52.19	167.14	**0.00**	−1.26	10.85	**0.00**
Balance on Goods	**92.13**	84.06	0.55	−0.51	4.39	0.30
Balance on Services	1.15	11.31	0.11	−0.32	19.76	0.93
Net Financial Account Variables						
U.S. Owned Assets Abroad	875.65	3,553.80	**0.00**	−2,580.41	22,944.98	**0.00**
Official Reserve Assets	−89.89	4,092.40	0.58	−0.54	4.79	0.61
Other Government Assets	468.12	2,526.23	**0.00**	636.37	4,573.64	**0.00**
Private Assets	256.95	1,398.73	0.23	26.39	350.55	0.21
Foreign Owned Assets in the U.S.	13.69	1,236.58	**0.00**	74.33	439.12	0.30
Official Assets	579.38	3,098.20	**0.02**	54.50	336.89	**0.00**
Other Assets	−120.87	2,191.21	**0.00**	1,312.07	10,973.51	0.57

Notes: MR=Mean of revisions, STD=standard deviation of revisions and p value=probability to reject the simple news hypothesis. Boldface figures are significant at least at 5 percent level. HAC standard errors are computed for significance.

Appendix D. More Results on FH Regression

Appendix D.1. Stationarity

We first examine the stationarity of current account balance and domestic savings (as a ratio of GDP) using the Augmented Dickey-Fuller (ADF) unit root test. In line with the scope of the exercises detailed in Section 4.2, we have performed the ADF test using both real-time data and latest vintage data. Results for the full sample at the latest vintage are reported in Table D.10. Results are based on the model with low Schwarz information criterion and well-behaved residuals (i.e. no autocorrelation).

Using the full sample data at the latest vintage, we fail to reject the null of unit root for current account balance. We are able to reject unit root in domestic savings once we allow

Table D.11: Augmented Dickey-Fuller Unit Root Test. Full sample at the latest vintage.

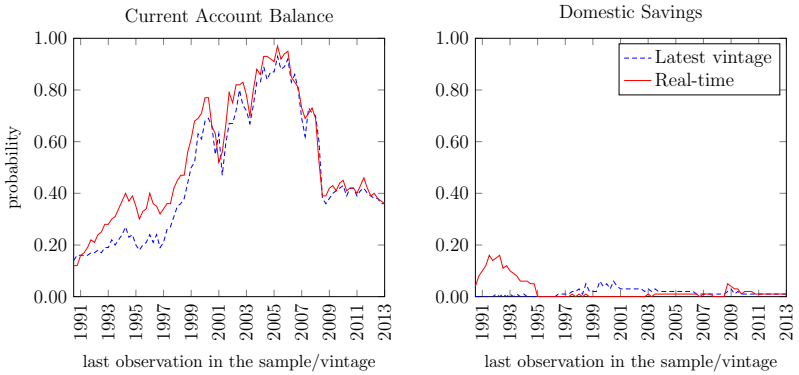
Variable	Test Statistics	p Value	Specification
CA\Y	-0.80	0.36	0
S\Y	-4.10	0.01	3, c, t
Δ(CA\Y)	-14.01	0.00	0
Δ(S\Y)	-6.92	0.00	4

Notes: The first figure listed in the specification column indicates the number of lags used to estimate ADF test equations. Accordingly, c and t indicate significant intercept and trend terms at the 1 percent level, respectively. Residuals of estimated ADF test equations are not auto-correlated.

trend in series.

Estimated probability values to reject the null hypothesis of unit root across different data vintages and sample periods are shown in Figure D.3. The left panel depicts the results for current account balance and the right panel is for domestic savings. The straight line corresponds to real-time results whereas the broken line shows the results for the latest vintage.

Figure D.3: Augmented Dickey-Fuller Test Results. Rolling Sample. Probability to Reject the Null Hypothesis of Unit Root.



The unit root results of the current account balance presented in Table D.10 are mostly robust to real-time data. However, the results for savings are mixed for earlier vintages of data are used when performing the unit root test.

The current account balance is, on average, better characterized with a random walk without drift model and it is found to be non-stationary within the sample when latest vintage data is used. In real-time, on average, first order autoregressive model with two lags of first differenced current account balance is represents the variable's dynamics well. We also fail to reject the unit root when we consider real-time data in the ADF test[57].

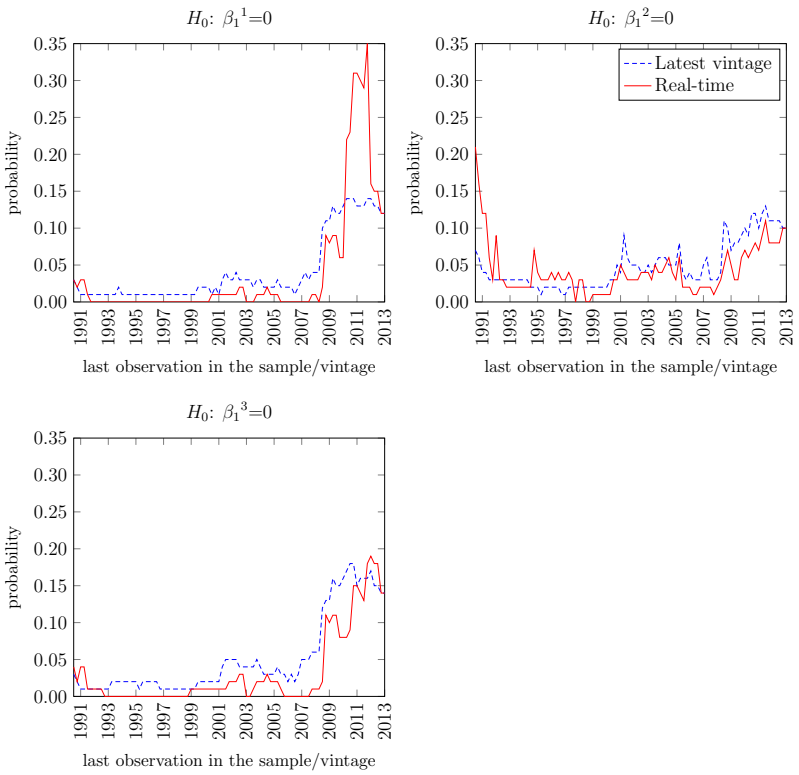
[57]The results do not depend on our choice of ADF test equation once we ensure that the residuals are not correlated. For instance, the latest vintage probabilities are quite similar when we consider an autoregressive model with two lags of first differenced current account balance.

The domestic savings is, on average, better characterized in a trend stationary model with three lagged difference terms at the latest vintage and in real-time. We find strong evidence to reject the unit root under considered model in the majority of the samples at the latest vintage. However, in real-time, we fail to reject the unit root in domestic savings when earlier vintages of data are used.
Although results are not reported, both variables are stationary in first differences both at the latest vintage and in real-time.

Appendix D.2. The Significance of the Relationship Between Current Account Balance and Domestic Savings

In this section we report the probability on the significance of the estimated β_1 coefficients from three models in (7), (8) and (9). Rolling sample results are depicted in Figure D.4 whereas fixed sample results are available in Figure D.5.
In both figures, as usual, the upper left panel is the results for model (7), the upper right panel is for model (8) and the lower panel for model (9). The straight line corresponds to real-time results whereas the broken line shows the results for the latest vintage.

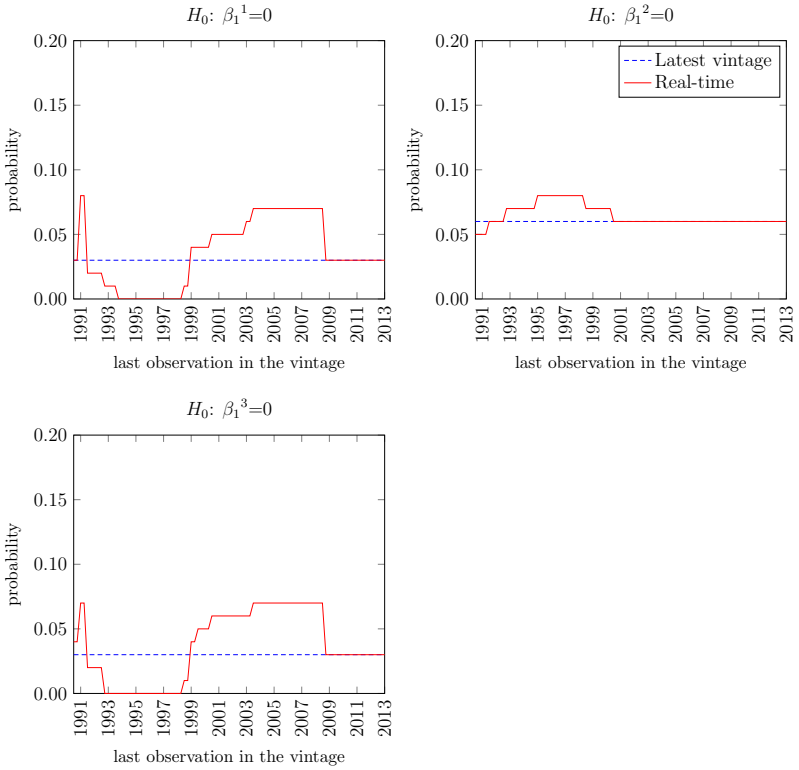
Figure D.4: Probability to Reject H_0: ${\beta_1}^i$=0. Rolling Sample.



In cases where there is significant evidence of auto-correlated residuals, we use the HAC standard errors to compute the probabilities[58].

[58]For example, the spike in the estimated real-time probabilities of model (7) is due to the fact that

Figure D.5: Probability to Reject H_0: ${\beta_1}^i$=0. Fixed Sample.



Appendix D.3. The Relationship Between Current Account Balance and Private Savings

We also perform the benchmark real-time exercise using private savings as the explanatory variable in the FH regressions. We simply estimate the models in (7), (8) and (9) using private savings. This is totally consistent with the pre-dominant role of the private sector in shaping the economy in neo-classical theory.

Similar to total gross savings series, quarterly vintages of private savings (Series ID: GPSAVE) are constructed from the monthly vintages available in ALFRED. The earliest available vintage for private savings is March 1997. Hence, in this case, the response is re-estimated through 67 vintages.

Using the full sample period at the latest vintage, the current account balance response to private savings is estimated in the range of -.03 and .09 depending on the model. The negative response is estimated from model (8) and is not significantly different from zero. The estimated response from model (8) is also statistically insignificant when sample size changes both at the latest vintage and real-time. Hence, we only report the results for estimated models in (7) and in (9).

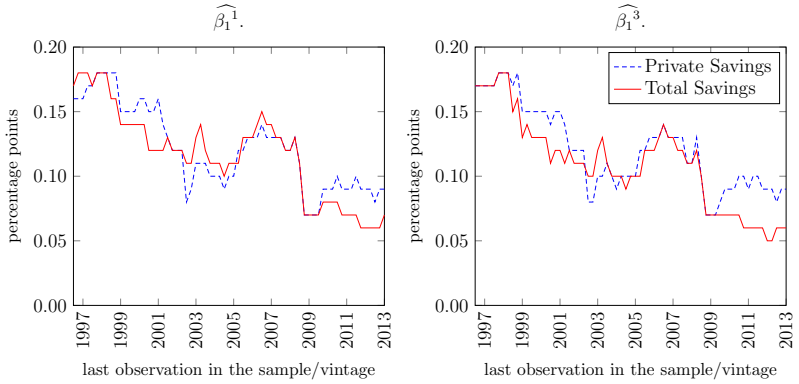
for seven sample periods in real-time we use HAC standard errors to compute the significance because of autocorrelation in residuals. Even if we have used regular standard errors we would still have been unable to reject the null hypothesis.

Figure D.6 displays the estimated current account balance response to innovations in private savings. The left panel is the results for estimated model in (7) and right panel is for estimated model as in (9). The straight line corresponds to real-time results of current account balance response to total savings[59] whereas the broken line shows the results of to private savings. As we move along either a straight or a broken line, both sample size and vintage changes. Hence, the end points of straight and broken lines correspond to the estimated responses to the total domestic savings and private savings, respectively, for the full sample at the latest vintage.

The response to private savings is estimated .09 for both models, on average, when sample size changes at the latest vintage. The response is significant for 39 vintages out of 67. On the other hand, for both models, estimated response is, larger than their vintage counterparts for most of the earlier sample periods when we consider all data vintages. Moreover, the response estimated from both models is significantly different from zero at least 5 percent significance level in almost all vintages[60].

Similar to benchmark results of total savings, the magnitude of the response to private savings estimated from both models decreases as we increase the sample size. Moreover, the relationship between current account balance and private savings is also weak.

Figure D.6: Estimated Current Account Response to Private Savings, $\widehat{\beta_1}^i$.
Rolling Sample in Real-Time.



[59]The straight line depicts our previous benchmark results of total savings for the vintages starting from June 1997.

[60]In both models, the estimated response is non-zero for 64 vintages at least at 5 percent significance level whereas the rest is significant at 10 percent level.