

*Real Effective Exchange Rate based on CPI as Price Index for India**

Effective exchange rates are summary indicators of movements in the exchange rates of home currency against a basket of currencies of trade partner countries and are considered to be an indicator of international competitiveness. Till now, in case of India, the Reserve Bank was providing the REER index (6 and 36 currencies) using the wholesale price index (WPI) for India and consumer price indices (CPI) for partner countries. However, with the availability of all India CPI index for India, the Reserve Bank has now decided to compute and provide data on REER using new CPI for India. In this context, this article briefly discusses the methodology along with the rationale for computing the CPI based REER and also provides yearly and monthly time series data for both CPI and WPI based REER indices (both 6 and 36 currency basket based on trade as well export weights) since 2004-05.

REER based on CPI as Price Index for India

At present, the trade/export weighted REER is computed using inflation differential based on the WPI for India and CPI for partner countries. Earlier there was no single consumer price index that could better capture nation-wide actual changes in retail prices at aggregate level. With the launch of new CPI index, measuring changes in prices of goods and services consumed by rural and urban households, it is possible to compute CPI based REER index for India. The CPI based index of REER is most frequently used indicator of competitiveness across countries. Thus, REER index constructed using a CPI for both India and trade partner countries would ensure a higher degree of comparability of former's international competitiveness *vis-à-vis* trading partner countries. Further, since October 2013, the RBI has started providing indicative projections of

inflation in terms of the broader CPI-Combined. Thus, with greater focus on CPI inflation as primary objective of domestic monetary policy, it is pertinent to have an alternative index of REER based on CPI. The methodology used for computation of CPI-based REER is provided in Annex 1.

To make the CPI based REER consistent and comparable with extant REER (based on WPI for India), the base year is chosen to be 2004-05. Although the new series of Consumer Price Index-Combined (CPI-C) (Base: 2010=100) is available on a monthly basis from January-2011, a back-casted series, using CPI-IW since January 2001, is provided in the *Report of the Expert Committee to Revise and Strengthen the Monetary Policy Framework* (Chairman: Dr. Urjit Patel) released by the Reserve Bank in January 2014.¹ The same series has been used to compute the CPI based REER index since 2004-05 both on monthly and yearly basis. For comparison, the annual series on CPI based REER (using both trade and export weights) is provided along with WPI based REER in Table 1 and 2.

Table 1: CPI and WPI Based Index of REER (Trade Weighted)

	36-Currency REER		6-Currency REER	
	(2004-05=100)		(2004-05=100)	
	CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER
2004-05	100.0	100.0	100.0	100.0
2005-06	102.4	103.1	104.4	105.2
2006-07	100.8	101.2	103.8	104.3
2007-08	109.2	108.5	113.4	112.8
2008-09	99.7	98.1	103.9	102.3
2009-10	103.9	95.7	110.7	102.0
2010-11	112.7	103.9	124.5	114.9
2011-12	110.3	101.4	121.2	111.5
2012-13	105.6	94.6	117.1	104.9
2013-14 P	103.3	89.5	112.4	97.5

P: Provisional

* Prepared in the Division of International Trade and Finance, Department of Economic and Policy Research, Reserve Bank of India.

¹ Available at http://rbidocs.rbi.org.in/rdocs/PublicationReport/Pdfs/ECOMRF210114_F.pdf

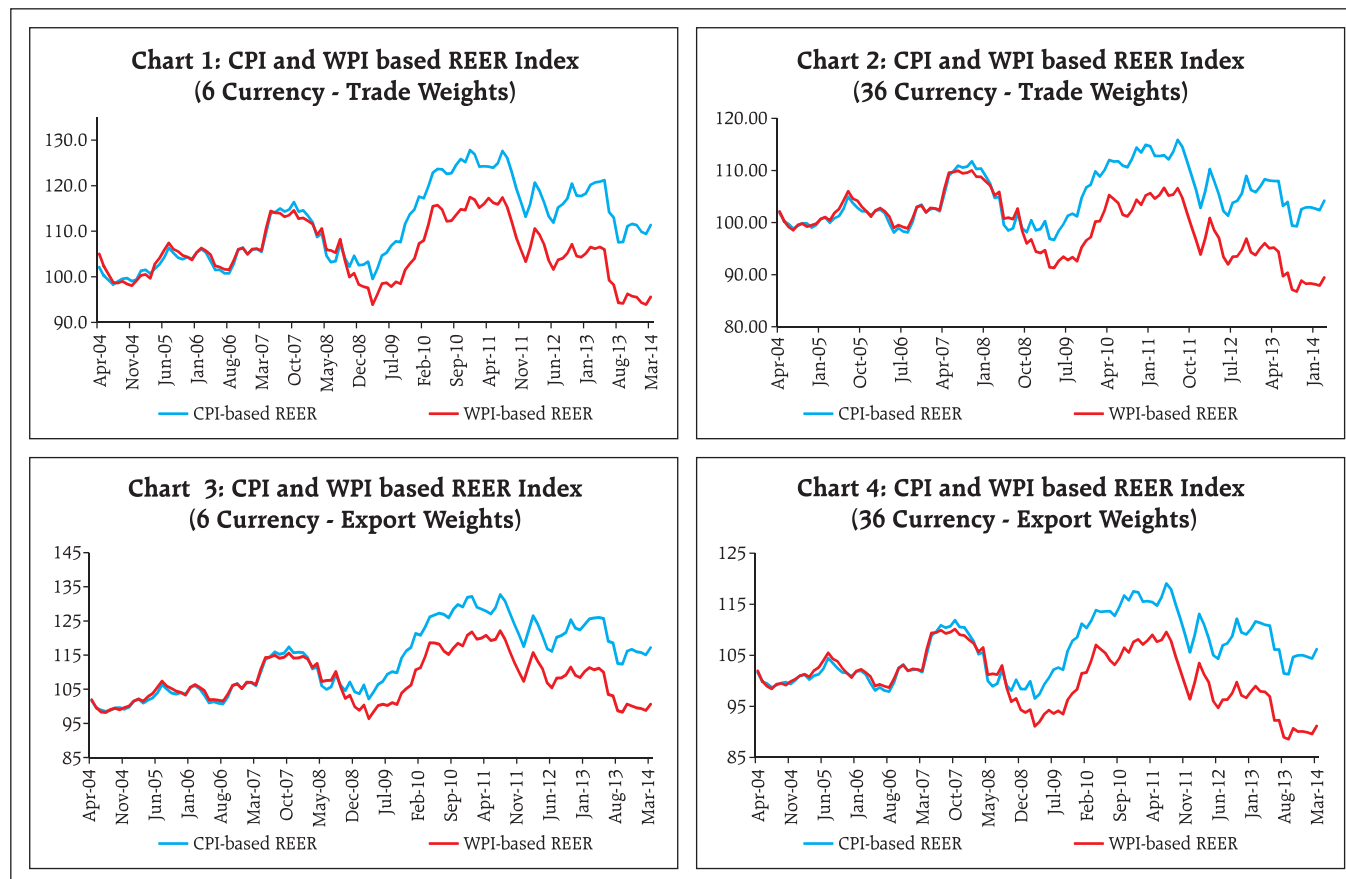
Table 2: CPI and WPI Based Index of REER (Export Weighted)

	36-currency REER		6-currency REER	
	(2004-05=100)		(2004-05=100)	
	CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER
2004-05	100.0	100.0	100.0	100.0
2005-06	102.0	102.7	104.3	105.0
2006-07	100.5	100.9	104.0	104.5
2007-08	109.2	108.6	114.6	113.9
2008-09	99.7	98.2	106.0	104.3
2009-10	105.0	96.7	113.4	104.4
2010-11	115.0	106.1	128.5	118.5
2011-12	113.2	104.1	125.8	115.7
2012-13	108.7	97.4	121.8	109.2
2013-14 P	105.6	91.5	117.6	102.0

P: Provisional

After moving broadly in tandem till 2008-09, the WPI-based 6/36 currency REER and CPI-based 6/36 currency REER have shown divergent trend since 2009-10 (Tables 1 & 2 and Charts 1 to 4). This reflects widening differential between WPI and CPI inflation

in recent years. Monthly series on both CPI and WPI based REER Index (both trade and export weighted) is provided in Annex 2 and 3. The new CPI back-casted series adjusted for 2004-05 as base year is also provided in Annex 4.



Annex 1 The Methodology

Nominal effective exchange rate is calculated as geometric weighted averages of bilateral exchange rates of domestic currency in terms of foreign currency. The real exchange rate can be defined as the weighted average of bilateral nominal exchange rates that have been adjusted for relative price levels. Specifically, the NEER can be calculated as follows:

$$NEER = \prod_{i=1}^n (e/e_i)^{w_i}$$

The REER is the weighted average of NEER adjusted by the ratio of domestic price to foreign prices. Specifically,

$$REER = \prod_{i=1}^n [(e/e_i) (P/P_i)]^{w_i}$$

Where e represents the exchange rate of Indian rupee against a numeraire, *i.e.*, the IMF's Special Drawing Rights (SDRs) in indexed form and e_i is exchange rate of foreign currency 'i' against the numeraire (SDR per currency i) in indexed form. Similarly, P and P_i represent price index of home country and price index for trade partner country i, respectively while n implies number of countries/currencies (other than home country) covered under NEER and REER index. As set out in the methodology, the REER has four parameters/variables pertaining to country/currency coverage (n), relative prices (P/P_i), weights (w_i) and exchange rates (e/e_i).

As in the case of existing REER indices, the Special Drawing Right (SDR) is used as the numeraire currency in the construction of CPI based REER indices since the exchange value of the SDR is determined by a weighted average of a basket of major currencies (*i.e.*, the U.S. dollar, Euro, Japanese yen, and pound sterling), which would offset fluctuations in individual currencies. The exchange rate of a currency is expressed as the number of units of numeraire (SDRs) per ith currency. A rise in 'e' or 'e/e_i', thus represents an appreciation of rupee relative to the currency i and *vice versa*, where e represents exchange rate of Indian rupee against the numeraire, SDR in indexed form and e_i represents exchange rate of foreign currency 'i' against the numeraire (SDRs) in indexed form.

As in the case of 6 and 36 currency WPI based REER index, the 6 and 36 currency CPI based REER index also uses a 3-year moving average trade weights with a view to suitably reflect the dynamically changing pattern of India's foreign trade with its major trading partner countries. In order to calculate the weights, the geometric average of India's bilateral trade (exports plus imports) with countries/regions represented by the 6 currencies/ 36 currencies during the preceding three years has been taken. This has then been normalised to arrive at the requisite weights (w_i). The normalised weights (both trade and export weights) for the 6 and 36-currencies, respectively for the year 2013-14 are provided in Table a and b, respectively.

Table a: 6-currency Normalised Weights for 2013-14

(Per cent)

Country	Trade Weights	Export Weights
China	26.56	14.06
Hong Kong	8.35	10.61
Euro	31.09	34.21
Japan	6.65	5.29
UK	5.79	7.35
USA	21.56	28.48

Table b: 36-currency Normalised Weights for 2013-14

(Per cent)

Country	Trade Weights	Export Weights	Country	Trade Weights	Export Weights
Argentina	0.25	0.20	Philippines	0.24	0.43
Australia	2.36	0.91	Qatar	1.89	0.25
Bangladesh	0.73	1.68	Russia	0.97	0.80
Brazil	1.51	2.18	Saudi Arabia	5.51	2.68
Canada	0.69	0.75	Singapore	3.37	5.49
Taiwan	1.18	1.19	South Africa	2.08	1.92
Egypt	0.75	1.01	Sri Lanka	0.74	1.65
Indonesia	3.02	2.47	Sweden	0.40	0.30
Iran	2.38	1.14	Switzerland	4.80	0.40
Israel	0.95	1.48	Thailand	1.28	1.23
Kenya	0.45	1.12	Turkey	0.69	1.42
Korea	2.65	1.74	UAE	11.44	14.84
Kuwait	2.52	0.56	China	10.84	6.56
Malaysia	2.07	1.72	Hong Kong	3.41	4.95
Mexico	0.58	0.53	Euro	12.69	15.97
Vietnam	0.81	1.43	Japan	2.72	2.47
Nigeria	2.49	1.05	UK	2.36	3.43
Pakistan	0.36	0.75	USA	8.80	13.30

Annex 2: CPI and WPI based Index of REER (Monthly Series) (Contd.)									
	36-currency REER (Trade Weights)		6-currency REER (Trade Weights)			36-currency REER (Trade Weights)		6-currency REER (Trade Weights)	
	(2004-05=100)		(2004-05=100)			(2004-05=100)		(2004-05=100)	
	CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER		CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER
Apr-04	101.85	102.14	102.11	105.03	Jan-07	102.61	102.81	105.91	106.12
May-04	100.26	100.28	100.23	102.29	Feb-07	102.69	102.71	106.15	106.16
Jun-04	99.69	99.14	99.25	100.52	Mar-07	102.16	102.45	105.48	105.78
Jul-04	98.81	98.52	98.28	98.77	Apr-07	105.54	106.42	109.70	110.62
Aug-04	99.38	99.57	99.01	98.61	May-07	109.05	109.57	113.92	114.46
Sep-04	99.86	99.80	99.57	99.02	Jun-07	109.85	109.70	114.21	114.05
Oct-04	99.84	99.23	99.72	98.42	Jul-07	110.93	109.95	114.97	113.95
Nov-04	99.03	99.51	99.06	98.07	Aug-07	110.57	109.45	114.31	113.15
Dec-04	99.53	99.77	99.37	99.12	Sep-07	110.74	109.57	114.77	113.55
Jan-05	100.71	100.70	101.31	100.30	Oct-07	111.75	110.00	116.38	114.56
Feb-05	100.98	101.07	101.55	100.53	Nov-07	110.30	108.80	114.32	112.77
Mar-05	99.95	100.44	100.70	99.69	Dec-07	110.37	108.78	114.57	112.92
Apr-05	100.85	101.87	101.79	102.82	Jan-08	109.00	107.94	113.39	112.29
May-05	101.27	102.61	102.73	104.09	Feb-08	107.48	107.11	112.00	111.61
Jun-05	102.67	104.27	104.21	105.84	Mar-08	104.77	105.22	108.74	109.21
Jul-05	104.97	106.01	106.38	107.43	Apr-08	104.94	105.89	109.59	110.58
Aug-05	103.77	104.59	105.24	106.07	May-08	99.57	100.75	104.68	105.92
Sep-05	102.84	104.19	104.20	105.57	Jun-08	98.49	100.94	103.21	105.77
Oct-05	102.19	103.02	103.87	104.71	Jul-08	98.90	100.67	103.44	105.29
Nov-05	102.15	102.14	104.37	104.36	Aug-08	101.86	102.69	107.36	108.24
Dec-05	101.37	101.12	103.96	103.70	Sep-08	98.92	98.49	104.13	103.67
Jan-06	102.26	102.35	105.29	105.38	Oct-08	98.16	96.00	102.23	99.98
Feb-06	102.49	102.78	106.03	106.33	Nov-08	100.44	96.78	104.62	100.80
Mar-06	101.79	102.17	105.33	105.73	Dec-08	98.53	94.44	102.55	98.30
Apr-06	99.79	101.14	103.48	104.87	Jan-09	98.76	94.15	102.65	97.86
May-06	98.10	98.98	101.51	102.42	Feb-09	100.27	94.70	103.33	97.58
Jun-06	98.94	99.53	101.53	102.14	Mar-09	96.90	91.42	99.53	93.90
Jul-06	98.29	99.14	100.77	101.64	Apr-09	96.67	91.29	101.79	96.12
Aug-06	98.11	98.90	100.78	101.59	May-09	98.41	92.64	104.65	98.51
Sep-06	99.98	100.73	102.81	103.58	Jun-09	99.69	93.45	105.30	98.71
Oct-06	103.01	102.98	106.04	106.01	Jul-09	101.33	92.81	106.83	97.84
Nov-06	103.42	103.29	106.43	106.30	Aug-09	101.73	93.35	107.78	98.90
Dec-06	101.96	101.97	104.96	104.97	Sep-09	101.20	92.60	107.63	98.48

Annex 2: CPI and WPI based Index of REER (Monthly Series) (Concl.d.)									
	36-currency REER (Trade Weights)		6-currency REER (Trade Weights)			36-currency REER (Trade Weights)		6-currency REER (Trade Weights)	
	(2004-05=100)		(2004-05=100)			(2004-05=100)		(2004-05=100)	
	CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER		CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER
Oct-09	104.75	95.27	111.63	101.53	Jan-12	105.98	96.97	115.91	106.39
Nov-09	106.76	96.58	113.71	102.86	Feb-12	110.28	100.88	120.66	110.58
Dec-09	107.28	97.21	114.76	103.99	Mar-12	107.95	98.47	118.88	109.26
Jan-10	109.82	100.21	117.62	107.33	Apr-12	105.41	97.04	116.33	107.09
Feb-10	108.85	100.26	117.24	107.98	May-12	102.19	93.43	113.27	103.56
Mar-10	110.07	102.34	119.85	111.43	Jun-12	101.30	91.98	111.90	101.60
Apr-10	112.00	105.28	122.86	115.49	Jul-12	103.79	93.46	115.20	103.73
May-10	111.72	104.54	123.66	115.72	Aug-12	104.18	93.51	115.94	104.06
Jun-10	111.75	103.75	123.57	114.72	Sep-12	105.59	94.77	117.17	105.17
Jul-10	110.92	101.50	122.56	112.16	Oct-12	108.97	96.93	120.47	107.16
Aug-10	110.62	101.20	122.75	112.30	Nov-12	106.25	94.30	117.82	104.57
Sep-10	112.20	102.33	124.54	113.57	Dec-12	105.83	93.77	117.71	104.30
Oct-10	114.40	104.38	125.82	114.80	Jan-13	106.89	95.03	118.29	105.16
Nov-10	113.45	103.42	125.15	114.64	Feb-13	108.33	96.04	120.18	106.54
Dec-10	114.91	105.22	127.78	117.48	Mar-13	108.08	95.07	120.72	106.19
Jan-11	114.65	105.65	126.89	116.92	Apr-13	107.99	95.21	120.87	106.57
Feb-11	112.81	104.62	124.18	115.16	May-13	107.98	94.42	121.20	106.01
Mar-11	112.78	105.27	124.26	115.98	Jun-13	103.20	89.69	114.22	99.27
Apr-11	112.94	106.65	124.19	117.27	Jul-13	103.97	90.39	112.99	98.23
May-11	112.13	105.20	123.92	116.26	Aug-13	99.40	87.11	107.56	94.31
Jun-11	113.56	105.36	124.91	115.89	Sep-13	99.27	86.76	107.64	94.16
Jul-11	115.87	106.61	127.60	117.40	Oct-13	102.56	88.87	111.11	96.28
Aug-11	114.57	104.75	126.14	115.34	Nov-13	102.90	88.27	111.61	95.74
Sep-11	111.81	101.90	122.96	112.07	Dec-13	102.93	88.32	111.34	95.54
Oct-11	109.11	99.25	119.29	108.51	Jan-14	102.69	88.16	109.88	94.33
Nov-11	106.26	96.65	116.40	105.87	Feb-14	102.40	87.91	109.41	93.93
Dec-11	102.81	93.87	113.19	103.33	Mar-14	104.20	89.46	111.37	95.61

Note: Monthly data for 2013-14 are provisional.

Annex 3: CPI and WPI based Index of REER (Monthly Series) (Contd.)									
	36-currency REER (Export Weights)		6-currency REER (Export Weights)			36-currency REER (Export Weights)		6-currency REER (Export Weights)	
	(2004-05=100)		(2004-05=100)			(2004-05=100)		(2004-05=100)	
	CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER		CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER
Apr-04	101.66	101.95	101.65	101.95	Jan-07	102.16	102.36	106.87	107.08
May-04	99.85	99.88	99.56	99.58	Feb-07	102.21	102.23	106.98	106.99
Jun-04	99.45	98.91	98.87	98.33	Mar-07	101.70	101.98	106.05	106.34
Jul-04	98.72	98.43	98.46	98.17	Apr-07	105.35	106.23	109.93	110.85
Aug-04	99.14	99.33	98.85	99.04	May-07	108.86	109.38	113.71	114.26
Sep-04	99.55	99.49	99.50	99.44	Jun-07	109.62	109.46	114.51	114.35
Oct-04	99.74	99.14	99.59	98.99	Jul-07	110.88	109.89	115.93	114.90
Nov-04	99.37	99.85	99.15	99.63	Aug-07	110.41	109.29	115.23	114.07
Dec-04	100.10	100.35	99.78	100.03	Sep-07	110.70	109.53	115.59	114.36
Jan-05	100.99	100.98	101.51	101.49	Oct-07	111.88	110.13	117.39	115.56
Feb-05	101.19	101.27	102.08	102.17	Nov-07	110.54	109.04	115.66	114.10
Mar-05	100.25	100.73	100.96	101.45	Dec-07	110.46	108.87	115.83	114.17
Apr-05	100.99	102.01	101.79	102.82	Jan-08	109.10	108.04	115.75	114.63
May-05	101.29	102.63	102.40	103.75	Feb-08	107.70	107.33	114.28	113.89
Jun-05	102.37	103.97	103.90	105.52	Mar-08	105.21	105.66	110.94	111.41
Jul-05	104.44	105.47	106.33	107.38	Apr-08	105.56	106.52	111.57	112.57
Aug-05	103.47	104.29	105.06	105.88	May-08	100.00	101.18	105.99	107.25
Sep-05	102.47	103.82	103.87	105.23	Jun-08	98.92	101.37	104.95	107.55
Oct-05	101.66	102.50	103.60	104.44	Jul-08	99.44	101.22	105.70	107.59
Nov-05	101.52	101.51	104.03	104.02	Aug-08	102.16	102.99	109.29	110.18
Dec-05	100.86	100.62	103.51	103.26	Sep-08	99.08	98.64	106.17	105.70
Jan-06	101.81	101.90	105.51	105.60	Oct-08	98.09	95.93	104.60	102.29
Feb-06	101.97	102.25	106.06	106.36	Nov-08	100.20	96.54	107.11	103.20
Mar-06	101.25	101.63	105.13	105.52	Dec-08	98.39	94.31	104.21	99.89
Apr-06	99.50	100.84	103.22	104.61	Jan-09	98.36	93.77	103.66	98.82
May-06	98.10	98.99	100.99	101.89	Feb-09	99.91	94.36	106.23	100.32
Jun-06	98.71	99.30	101.33	101.94	Mar-09	96.54	91.08	102.15	96.37
Jul-06	98.08	98.93	100.90	101.77	Apr-09	97.38	91.96	104.12	98.32
Aug-06	97.90	98.69	100.70	101.50	May-09	99.30	93.48	106.41	100.17
Sep-06	99.59	100.33	102.74	103.51	Jun-09	100.55	94.26	107.33	100.61
Oct-06	102.51	102.47	106.12	106.08	Jul-09	102.17	93.58	109.43	100.22
Nov-06	103.19	103.07	106.66	106.53	Aug-09	102.59	94.15	110.12	101.06
Dec-06	101.95	101.96	105.18	105.19	Sep-09	102.16	93.48	109.83	100.50

Annex 3: CPI and WPI based Index of REER (Monthly Series) (Concl'd.)									
	36-currency REER (Export Weights)		6-currency REER (Export Weights)			36-currency REER (Export Weights)		6-currency REER (Export Weights)	
	(2004-05=100)		(2004-05=100)			(2004-05=100)		(2004-05=100)	
	CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER		CPI-based REER	WPI-based REER	CPI-based REER	WPI-based REER
Oct-09	105.85	96.28	114.18	103.85	Jan-12	108.83	99.57	122.08	111.70
Nov-09	107.85	97.56	116.29	105.20	Feb-12	113.12	103.48	126.52	115.73
Dec-09	108.50	98.32	117.22	106.22	Mar-12	111.04	101.29	124.04	113.15
Jan-10	111.18	101.45	121.31	110.70	Apr-12	108.35	99.75	120.58	111.00
Feb-10	110.34	101.62	120.84	111.29	May-12	105.01	96.01	116.86	106.84
Mar-10	111.75	103.90	123.18	114.53	Jun-12	104.31	94.71	116.06	105.38
Apr-10	113.84	107.02	126.17	118.61	Jul-12	106.95	96.31	120.21	108.25
May-10	113.51	106.21	126.72	118.57	Aug-12	107.34	96.34	120.71	108.34
Jun-10	113.59	105.46	127.30	118.18	Sep-12	108.70	97.56	121.63	109.17
Jul-10	113.63	103.98	126.95	116.18	Oct-12	112.15	99.76	125.36	111.51
Aug-10	112.73	103.13	125.90	115.18	Nov-12	109.46	97.15	122.90	109.07
Sep-10	114.49	104.41	128.33	117.03	Dec-12	109.09	96.67	122.38	108.44
Oct-10	116.71	106.49	129.82	118.45	Jan-13	110.13	97.91	124.01	110.25
Nov-10	115.78	105.54	129.10	117.69	Feb-13	111.63	98.97	125.60	111.35
Dec-10	117.53	107.62	131.93	120.81	Mar-13	111.34	97.94	125.85	110.70
Jan-11	117.34	108.13	132.18	121.80	Apr-13	110.97	97.84	126.04	111.13
Feb-11	115.52	107.12	129.06	119.68	May-13	110.82	96.91	125.72	109.97
Mar-11	115.60	107.90	128.51	119.95	Jun-13	106.11	92.22	119.06	103.47
Apr-11	115.44	109.01	127.87	120.75	Jul-13	106.15	92.29	118.55	103.06
May-11	114.74	107.65	127.09	119.24	Aug-13	101.43	88.91	112.57	98.70
Jun-11	116.41	108.01	128.90	119.60	Sep-13	101.28	88.54	112.35	98.28
Jul-11	119.07	109.56	132.72	122.12	Oct-13	104.66	90.68	116.14	100.63
Aug-11	117.92	107.82	130.85	119.64	Nov-13	104.97	90.04	116.69	100.10
Sep-11	114.96	104.77	127.49	116.19	Dec-13	105.00	90.10	115.99	99.53
Oct-11	112.07	101.94	124.02	112.81	Jan-14	104.74	89.92	115.72	99.34
Nov-11	109.04	99.18	120.94	110.00	Feb-14	104.38	89.61	115.07	98.79
Dec-11	105.57	96.38	117.51	107.28	Mar-14	106.21	91.18	117.22	100.63

Note: Monthly data for 2013-14 are provisional.

Annex 4: New Consumer Price Index (Base 2004-05=100)										
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
April	97.2	101.8	106.2	113.4	122.4	132.0	147.1	161.1	177.6	194.3
May	98.0	101.2	107.5	114.1	122.5	133.3	148.3	162.4	179.3	196.0
June	98.7	101.3	109.0	115.0	124.2	134.8	150.2	165.0	181.4	199.3
July	99.5	103.0	109.7	116.6	126.3	139.5	153.6	167.6	184.1	201.9
August	100.4	103.3	110.4	117.1	127.9	140.9	153.8	169.4	186.4	204.1
September	100.6	103.4	111.2	117.2	129.1	142.0	155.2	171.4	188.1	206.6
October	101.3	104.3	112.5	118.1	131.5	143.5	156.1	172.6	189.4	208.5
November	101.0	105.4	112.5	118.3	131.5	146.4	157.0	173.1	190.2	211.6
December	100.3	105.0	112.1	118.3	129.7	146.7	158.8	172.3	190.5	209.3
January	101.0	105.1	112.1	118.5	130.3	147.7	160.6	172.9	191.6	208.4
February	101.0	105.1	112.4	119.2	130.1	146.4	159.7	173.8	192.8	
March	101.0	105.1	112.4	120.9	130.6	146.1	160.2	175.2	193.4	

Note: Based on back-casted series provided in Report of the Expert Committee to Revise and Strengthen the Monetary Policy Framework, January 2014.