THE MARKET VALUE OF U.S. GOVERNMENT DEBT; MONTHLY, 1942-1980

W. Michael COX and Eric HIRSCHHORN*

Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA

The market value of outstanding United States Treasury debt is calculated on a monthly basis using price and par value data from the *Treasury Bulletin*. Separate series for Treasury Bills, Bonds, Certificates of Indebtedness, Notes and total Treasury debt are presented along with estimates of privately held Treasury debt and gross federal debt. The calculated market value series is compared to par value and an existing annual market value series.

1. Introduction

In recent work in monetary and macroeconomic theory, issues involving public debt have come to play an increasingly important role. Yet one important aggregate statistic that has not been available on a monthly basis is the market value of government debt. Although aggregate statistics on the par value of government debt are calculated and reported monthly by the Department of the Treasury, it is questionable whether this series serves as a reasonable proxy for the market value measures. Par value has become particularly suspect recently given the relatively broad range of interest rate movements experienced in the seventies.

Only recently [Seater (1981a)] have annual measures of market value aggregates become available. The purpose of this paper is to report and describe the calculation of several new monthly series on the market value of government debt. These series are calculated and reported on an end-of-month basis over the time period 1942-1980.

The paper also considers questions of related interest. An examination is made of the real value of government debt over the time period 1942-1980. In addition, the stochastic structure of the market value and par value series are compared and evaluated.

2. Marketable securities

The market values of Treasury Bills, Treasury Bonds, Treasury Certificates

of Indebtedness, and Treasury Notes are reported in tables 1–4. Data are monthly calculations for the period from 1942–1980. Although calculation of the different series presented a variety of problems, several common aspects of their construction should be pointed out.

First, all data are taken from the *Treasury Bulletin*.[1] Each issue of each type of security was assigned a particular (unique) number according to its maturity date and series type. This enabled each issue to be followed on a month-to-month basis. One benefit of this method is that it permits detection of instances when the bid price, discount, or quantity of an issue is not reported in the Treasury statistics.[2] A second benefit of this method is that it enables reporting errors (typing or other errors) in the *Bulletin* to be detected.[3]

From November 1942 through December 1980 amounts outstanding are for the last trading day of each month. Prior to that time, Treasury statistics were reported at the middle of each month, hence amounts outstanding from January to October 1942 are on a middle-of-month basis. The market value of each series was calculated by multiplying the par value of the amount outstanding of each issue by its corresponding bid price. In some cases prices or quantities outstanding were reported at the end of a month for issues which would not be made available until the first few days of the next month. This practice has become much more common in recent years. In all such cases the issues were excluded from the end-of-month calculations.

Bonds. The *Treasury Bulletin* reports on a monthly basis the market price and par value of outstanding quantities for each Treasury Bond issued. Market prices are converted to fractions of one dollar, multiplied by outstanding par values, and summed to give the market value of bonds outstanding each month.

Notes. The same method of calculation as that for bonds is used.

Certificates of indebtedness. Certificates of indebtedness were issued by the Treasury through 1967. Bid data on certificates is reported in 'erms of

---

[1]Data on marketable securities are taken from tables MQ-1, MQ-2, and MQ-3, 'Market Quotations on Treasury Securities'. All types of marketable Treasury debt — bank eligible, bank restricted, taxable, tax exempt — are included. Panama Canal bonds are excluded.

[2]In most of these instances, the bid price or discount may be determined from bid data of the following month together with the reported change from the previous month. When this is not possible, bid prices or discounts for the immediately preceding month are used. In no case is an issue ignored that was outstanding yet not reported in the Treasury data.

[3]Ten reporting errors were located in the amount outstanding statistics and confirmed in conversations with the Treasury. These errors range in magnitude from $30 million to $3 billion. In all such cases the corrected figure was used rather than the figure reported in the Treasury statistics. Detailed information regarding these errors is available from the authors upon request.

Table 1

Market value of treasury bills (millions of dollars).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
42	2099	2099	1799	1949	2051	2505	3259	3964	4316	4817	5718	6624
43	7419	8229	9230	10041	10848	11859	12454	12840	13048	13060	13070	13067
44	13095	13106	13141	13144	13759	14727	15517	15708	15740	16054	16398	16421
45	16397	16391	16913	17033	17038	17031	17015	17029	17011	17019	17018	17029
46	17033	17023	17039	17045	17031	17029	17015	17014	16998	16977	16991	17027
47	17068	17041	17029	16603	15992	15765	15743	15720	15709	15714	15316	15115
48	14819	14419	13928	13729	13743	13743	13250	12824	12609	12588	12401	12203
49	12115	12118	11630	11525	11530	11520	11516	12109	12300	12303	12305	12302
50	12315	12320	12316	12604	13005	13512	13622	13612	13614	13608	13582	13601
51	13606	13608	13603	13604	13587	13585	14385	14978	15585	16816	18052	18053
52	18061	18065	16829	17428	18226	17181	17166	17161	17170	19654	21633	21642
53	21644	21644	19159	19256	19858	19660	20151	20160	19473	19478	19472	19476
54	19486	19485	20984	21991	22000	19501	19493	19484	19484	19482	19482	19480
55	19481	19475	19469	19466	19479	19476	19863	20261	20750	20758	20756	22236
56	22251	22260	20750	20742	20735	20744	20752	20737	20727	22332	24062	25081
57	25160	25142	25151	25180	26657	23313	26243	27944	26469	26483	26521	26748
58	27205	26088	22993	22383	22391	22383	22376	22335	22630	25831	28975	29591
59	30174	31639	32056	34018	34701	31629	36602	38254	36674	38688	38709	39164
60	40667	40645	36875	36813	37153	33216	36144	36168	36288	39148	39071	39206
61	39489	39692	36394	37960	38182	36601	40527	40624	41614	42301	43001	43022
62	43608	43942	42732	43112	43444	41731	42500	43314	41947	45776	47471	47909
63	48542	49560	48165	49027	49271	46865	46806	46798	47795	48242	50037	51072
64	52038	53028	52052	50552	51748	50267	49561	50525	51803	54680	55524	55833
65	57764	58164	55901	56295	57309	53093	53065	53067	53013	56943	59421	59355
66	60777	61202	58704	58706	58723	54163	54162	57032	57365	61226	62875	63649
67	64656	65072	65832	62906	61151	57785	61959	61432	62414	67796	68324	67431
68	72647	71856	70363	67558	68510	63414	67770	69702	68706	71758	71785	70945
69	73791	73715	73546	67048	70947	66642	70128	69851	70977	77276	79562	75858
70	78826	79752	80474	78077	78713	74765	80591	80311	76129	83882	83379	84609
71	86054	85600	83628	83119	81616	78367	85293	87902	87456	86321	88779	96440
72	96577	97183	98402	94776	91867	93305	94386	94969	93420	94526	97353	100712
73	99057	99137	101521	101401	101035	96430	97681	99520	97723	95278	104471	105095
74	105591	105688	107669	104912	105629	102804	104149	106835	108201	109481	112127	117420
75	119067	121204	122072	120200	129550	124598	130832	135307	139988	144596	148498	155080
76	157644	159551	155762	159347	159090	152726	158794	158937	158977	159154	159582	161821
77	161691	161558	161993	159683	155493	152656	151620	146598	153169	153363	148435	158026
78	158168	158740	168437	156450	150243	156189	156663	156854	156937	156917	157061	157144
79	152148	150847	160953	156277	158408	155604	155677	155846	156512	150061	159580	166843
80	169509	170279	179892	176357	190815	180323	186477	193342	193388	195107	200563	195835

Table 2

Market value of treasury bonds (millions of dollars).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
42	36487	36295	38031	38149	40191	40271	42273	43448	43435	43410	45257	51132
43	51278	51254	51184	51331	60334	59996	59873	59786	67737	70137	70058	70045
44	70039	76125	75012	74697	74727	81442	81492	83567	83469	83405	83247	93914
45	95248	95712	95682	96042	95977	96353	111823	111895	110818	111075	111335	125245
46	127590	128594	128150	126505	126663	125080	124380	123977	123408	123814	123221	123902
47	123988	124093	124242	123981	124011	123595	123542	123837	123633	121856	121163	119457
48	119430	119601	117317	117404	115295	114311	114060	113990	113460	113387	113567	113228
49	113470	113593	113704	113669	113709	113364	113663	114045	112702	112693	112755	108615
50	108073	107908	105669	105361	105277	104946	105003	105075	98473	98238	98186	95493
51	95583	95391	94293	80237	79895	78255	78572	79128	77840	77755	77443	76002
52	76232	76123	76354	76970	76924	75558	79514	79069	78532	79013	78909	78612
53	78520	78731	78420	77682	78282	78532	78780	78730	72022	72294	74292	76927
54	77449	83700	84037	84530	81442	81776	81867	85361	85206	84990	84667	82031
55	81313	80412	80136	79842	80025	79430	79300	79365	79939	80373	79765	79616
56	80201	80118	78947	78550	79558	79452	78311	77222	76556	76196	75753	75092
57	76851	76380	76548	75718	75155	74129	74220	74524	74254	74060	76950	79816
58	79927	85121	86935	87263	87485	89633	88220	82051	79755	79720	80382	76848
59	77284	77932	77349	77069	76911	76515	76582	75544	75651	76496	75900	74982
60	75908	76288	78236	78000	78247	75763	77525	78245	78294	78047	74636	76253
61	75549	76173	76864	77501	77236	74540	76457	73883	75119	68914	70803	70777
62	71756	72293	73176	74867	72289	71236	71090	73939	76724	77065	77406	75810
63	75963	78308	76959	77140	77022	78807	78742	77109	82963	82546	82623	82344
64	84648	82796	82480	82691	84551	84856	93462	93300	93341	93417	93137	93281
65	99186	96786	96865	96864	98865	99028	98858	100258	99644	99460	99094	97709
66	97365	95123	96668	96137	94733	94046	93657	91033	92437	93138	91314	93523
67	94493	93435	94765	93487	92212	89818	90398	89818	89890	88187	85869	86104
68	87292	85662	84855	84918	82462	83403	84515	81769	81508	81081	78415	76119
69	75919	71708	71553	72478	59649	68482	68391	68226	60332	59864	59080	57429
70	57748	53119	53037	51671	51084	52009	52741	48470	49163	49173	51100	50808
71	52035	48132	48778	47700	45850	46685	46653	45949	46301	46793	45556	45598
72	45251	45320	44830	45011	45419	44225	42568	41492	40785	41022	41357	39472
73	39644	39126	38909	39042	39431	39273	38111	35926	36936	36303	35995	32541
74	32263	30123	29233	28736	26857	26731	26422	26852	27166	27653	27797	28189
75	28488	29561	29192	29855	32111	32423	32250	33176	33627	33493	34272	34867
76	35264	35890	36196	35901	35309	36700	36117	37590	37842	37867	39658	40199
77	38088	40543	39066	39023	41133	38587	41745	43392	43091	42436	44055	43256
78	44158	46034	45741	45408	47282	46754	48764	51577	51056	51195	53810	52854
79	55014	56983	57286	58267	61605	63130	63083	64750	63587	60168	64131	63860
80	61492	56913	56619	65247	70673	72220	70510	69405	67018	66396	66882	68197

Table 3

Market value of treasury certificates (millions of dollars)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
42	0	0	0	1507	1511	1512	3096	4707	6218	6216	6745	10515
43	10582	11202	11210	11216	16630	16646	16657	17587	21242	23306	23228	22952
44	22970	25804	25819	25425	25387	28966	28991	30173	29691	29687	29697	30528
45	30556	30536	34710	34617	34586	29796	34596	34604	35239	35185	35204	38334
46	41725	41593	40549	38577	37013	34969	37912	36633	34665	32660	30644	30150
47	29947	28914	27923	26412	26428	25425	25247	25156	25023	24941	24597	21333
48	20752	19010	20421	20161	20174	22710	22384	22399	22416	26127	26156	26700
49	29804	29612	28973	28901	28929	29639	29436	29465	30683	30344	30370	29872
50	29506	27507	24569	23620	23642	18579	12922	12932	11733	5422	5373	5373
51	0	0	0	0	0	9519	9537	14759	15442	28212	28251	29330
52	29394	29436	29366	28731	28764	28793	28442	28328	28121	17089	17107	16933
53	16817	16064	16077	16072	16072	15905	21773	21681	26471	26531	26514	26520
54	26545	25413	19491	19526	18677	18496	18497	18324	18217	18204	18202	28480
55	28457	21430	17684	20890	17034	13825	16025	9030	9031	12007	12005	15725
56	15748	15747	20765	20723	20749	16309	16300	19499	19493	19509	19507	19013
57	19037	20217	19433	19423	21764	20434	20440	34039	34959	34678	34743	34720
58	34849	31836	31792	31446	31459	33142	33108	38334	38278	38356	38367	36277
59	36178	37899	34345	34326	33782	33793	33377	20292	20278	20333	19634	19642
60	19672	15266	15348	15321	17747	17819	17812	25610	25573	25593	18508	18516
61	18484	11521	4476	11519	13348	13345	13352	5511	5512	5516	5512	5509
62	5512	12397	12403	12403	13590	13566	13556	20443	17903	17913	22762	22754
63	22757	23795	21795	21797	22188	22190	22164	16973	15480	15480	10929	10933
64	10942	4195	4198	4207	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0
66	1650	1649	1651	1651	1650	1651	1651	6978	6982	6991	5912	5930
67	5938	5932	5941	5942	5626	5615	5613					

Table 4

Market value of treasury notes (millions of dollars).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
42	5633	5635	5611	5603	5592	6723	6706	6699	7961	10103	10102	9869
43	9891	9890	9824	9820	9832	9214	11935	11931	11645	11647	11651	11234
44	11227	13355	16305	16337	16340	17485	17495	18167	18039	18031	18026	23129
45	23169	23169	18724	18724	18704	23621	23610	23624	23630	23645	23646	23120
46	19698	19713	18397	18378	18381	18342	13427	13418	13404	13407	13445	10137
47	10135	10156	8183	8175	8171	8217	8221	8223	7859	7867	7871	11412
48	11423	11432	11443	11452	11464	11475	11485	11496	11318	7145	7154	7172
49	3592	3596	3600	3605	3608	3614	3620	3623	3626	3630	3632	8301
50	8319	10193	14792	15578	15577	20384	25763	25748	31645	36875	36905	39253
51	43831	43859	43681	43755	43712	35742	36352	30927	30804	23434	18171	18085
52	18177	18200	18292	18813	18790	18755	18715	18708	18718	29987	29962	29983
53	30025	30014	30044	29990	29970	30088	30164	30252	33458	33729	33258	31453
54	31639	27123	27047	27115	32194	32291	32287	32246	32212	36342	36341	28121
55	28034	35131	34861	34829	40575	40546	40454	47236	47435	47548	47460	42898
56	43137	43127	35708	35661	35791	35705	35633	34695	34733	34809	34768	34852
57	35022	33599	34071	34106	30618	30635	30720	16830	18963	19088	20507	20846
58	20969	20852	21073	25227	25318	20806	20745	20394	20428	21657	21707	25770
59	28493	24973	25009	26679	26709	26645	26681	39894	39888	42495	42534	43271
60	43550	47610	48387	50273	47370	51746	52370	42785	42831	42744	51679	52218
61	51964	59331	58584	58334	56877	56771	56820	65444	65673	68323	71925	71870
62	71839	64898	65171	65098	66079	65871	65822	58592	58689	58170	54183	54180
63	54201	50486	53782	53366	52380	52373	52196	58554	54103	53586	58537	58476
64	56276	64198	64166	64915	67097	67175	58568	58446	58443	57956	58653	58818
65	53066	55263	54853	54895	52367	52437	52428	50270	49894	49957	49968	49794
66	49866	50511	50499	50560	50350	50360	50295	45204	45449	45196	47919	48314
67	48456	48468	48826	48435	49390	48817	48942	57159	57144	56472	60656	60580
68	58289	66197	66026	65676	70252	70543	71013	75418	75374	75059	76005	74855
69	75036	76572	76784	76814	76901	76124	76265	75618	74084	82574	82107	81133
70	81125	83085	89266	87914	88086	90669	91220	89240	98637	99111	103251	103276
71	104108	108358	109232	106175	103915	103978	103805	109977	111286	114404	116570	117346
72	116719	115948	114336	116897	115943	114934	115207	116533	116436	116414	120551	120014
73	121341	119178	118543	119031	116435	115877	113174	115585	119582	119635	123626	123361
74	123537	124834	122609	122854	124289	124023	123769	122589	124744	125392	128375	129277
75	132180	133959	141902	143273	146605	149319	151760	153293	155925	166550	165809	168336
76	172951	178027	184809	187662	186162	192576	198695	205906	209667	211688	220342	224093
77	222885	229216	233324	234173	233600	237103	233615	240473	242992	245050	251236	250891
78	255199	256194	259435	258630	256994	259135	261121	263485	262037	263273	262806	254638
79	264219	261752	262106	265982	268904	267353	272042	269223	264597	262548	266640	270529
80	268273	259527	264151	282948	289461	300184	297449	285854	294379	290937	287639	303439

interest rates. Monthly price statistics were calculated for each issue using the present value formula

$$P = \frac{(1+R)}{(1+(D/365)r)},$$

where P is the present value (calculated market price), R is the coupon rate, r is the reported market bid rate, and D is the number of days left to maturity (all maturities are one year or less). Each calculated market price was multiplied by the corresponding outstanding par value and summed to obtain the market value of certificates.

Bills. Bid prices for Bills, which are sold on a discount basis, are not reported but can be calculated with the formula used on the securities market,

$$P = 100(1 - (D/360)r),$$

where P is the bid price, D is the number of days to maturity, and r is the bid rate of interest (the 360 day year is a convention used for discount bills on the securities markets). Calculated prices for each issue were multiplied by the corresponding outstanding volume, and summed to obtain total market value of bills for each month.

Total market value of marketable treasury debt. For each month, the total market value of marketable Treasury debt was obtained by adding together the market values obtained for Bills, Bonds, Certificates, and Notes. These calculations are reported in table 5 and fig. 1. In addition, the value of marketable Treasury debt and gross federal debt in constant dollars (for a definition of gross debt see below) are plotted in fig. 2.

The accuracy of the total market value calculations, as well as the accuracy of the underlying series on Bills, Bonds, Certificates, and Notes should be extremely high since in principle the technique employed here is a simple accounting construct. Some evidence of the accuracy of the calculations may be obtained by examining the correlation between the annual December calculations for each of the market value series reported here and the corresponding annual market values series calculated in the independent work by Seater. These correlation statistics are: $\rho_{BILLS} = 0.9998$, $\rho_{BONDS} = 0.9998$, $\rho_{CI} = 0.9932$, $\rho_{NOTES} = 0.9995$, $\rho_{TOTAL} = 0.9989$. The important point of the correlation statistics is that the market value series calculated in this manner are very similar to the annual series constructed by Seater. The differences that exist are due to slightly different assumptions, but these

Table 5

Market value of total marketable treasury debt (millions of dollars).

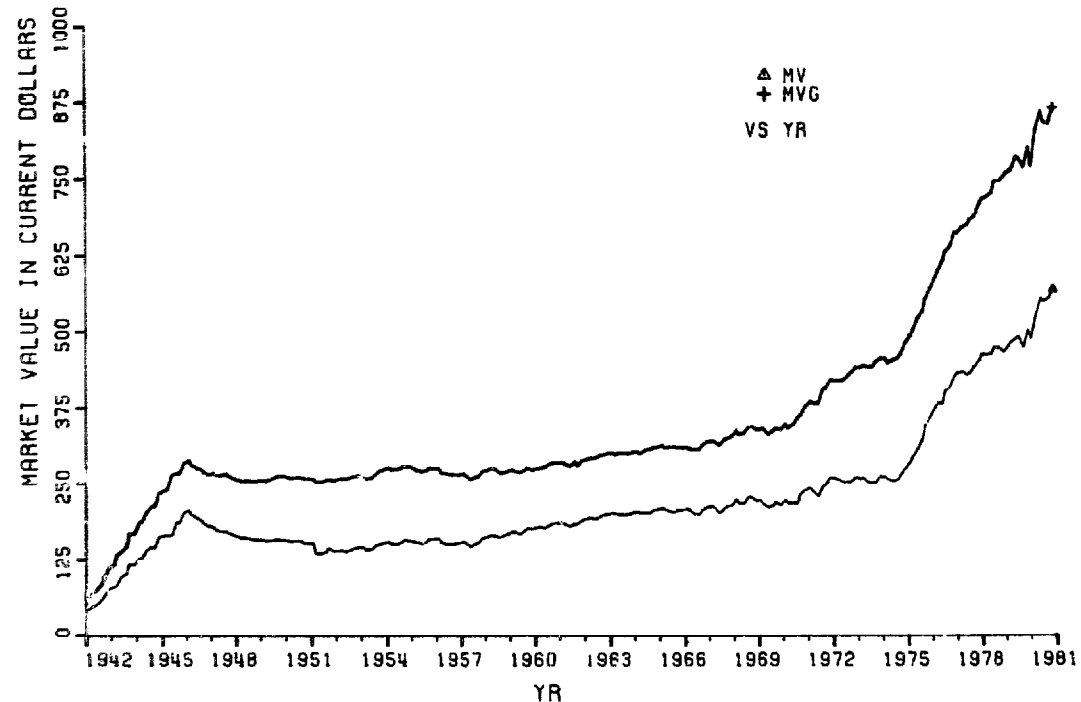|	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
42	44219	44029	45442	47210	49345	51011	55334	58818	61930	64546	67822	78189
43	79170	80576	81448	82409	97644	97715	100918	102145	113672	118149	118007	117297
44	117330	128391	130277	129603	130213	142621	143493	147615	146939	147176	147368	163992
45	165372	165809	166028	166416	166305	166800	187044	187153	186698	186924	187203	203728
46	206047	206923	204135	200505	199088	195420	192734	191042	188475	186858	184300	181215
47	181139	180203	177377	175170	174603	173002	172753	172935	172224	170378	168947	167317
48	166424	164462	163109	162747	160675	162239	161181	160709	159804	159246	159277	159302
49	158980	158918	157907	157700	157775	158137	158235	159243	159312	158970	159062	159090
50	158213	157927	157346	157163	157500	157421	157310	157367	155465	154142	154046	153720
51	153019	152858	151577	137596	137194	137101	138047	139791	139670	146217	141916	141470
52	143864	141825	140840	141942	142703	140288	143838	143266	142540	145743	147611	147170
53	147006	146452	143700	143000	144182	144185	150869	150823	151424	152031	153537	154376
54	155119	155721	151559	153162	154312	152065	152144	155414	155118	159019	158692	158162
55	157285	156448	152151	155027	157114	153276	155643	155892	157155	160686	159985	160474
56	161338	161252	156171	155676	156834	152210	150995	152152	151509	152847	154090	154039
57	156070	155937	155204	154427	154194	148510	151624	153336	154646	154308	158720	162159
58	162949	163896	162793	166319	166652	165963	164449	163114	161092	165564	169432	168485
59	172129	172442	168759	172092	172103	168581	173662	173984	172486	178012	176777	177059
60	179797	179608	178846	180407	180616	178543	183850	182807	182986	185531	183895	186192
61	185486	186716	176318	185314	185642	181257	187156	185461	187917	185054	191242	191177
62	192715	193530	193482	195479	195401	192404	192968	196287	195263	198924	201822	200653
63	201462	202147	200700	201330	200862	200235	199908	199434	200340	199853	202126	202824
64	203903	204217	202896	202365	203396	202298	201591	202271	203587	206053	207315	207931
65	210016	210213	207620	208053	208542	204558	204351	203595	202554	206360	208484	206858
66	209657	208485	207462	207104	205462	200258	199765	200247	202232	206551	208020	211416
67	213543	212926	215365	210770	208379	202036	206912	208408	209448	212454	214849	214114
68	218228	223716	221244	218153	221224	217360	223297	226888	225587	227898	226206	221920
69	224746	221995	221883	216340	217497	211249	214784	213696	205394	219714	220750	214421
70	217700	221956	222777	217662	227883	217443	224552	218022	224129	232165	237731	238692
71	242196	242090	241639	236975	231381	229031	235750	243828	245042	247518	250904	259384
72	258546	258352	257568	256684	253629	252463	251962	252994	250640	251962	259261	260197
73	260043	257441	258972	259474	256951	251579	248966	251031	254241	251216	261092	260996
74	261390	260645	259511	256502	256775	253558	254340	256276	260111	262526	268298	274388
75	279735	284724	293167	293328	308266	306340	314841	321776	329539	344639	348579	358283
76	365859	374367	376766	382909	380561	382002	393696	402433	406486	408709	419582	426112
77	422664	431317	434383	432879	430216	428346	426980	430463	439252	440849	443725	452173
78	457524	460967	473614	460487	454518	462078	466548	471916	470030	471385	473684	464636
79	471381	469583	480344	480526	488917	486088	490802	489820	484697	472776	490351	501233
80	499273	486719	500662	524552	550949	552726	554435	548602	554785	552439	555084	567471

Fig. 1. Market value in billions of current dollars. MV is the market value of total marketable treasury debt. MVG is the market value of gross federal debt.
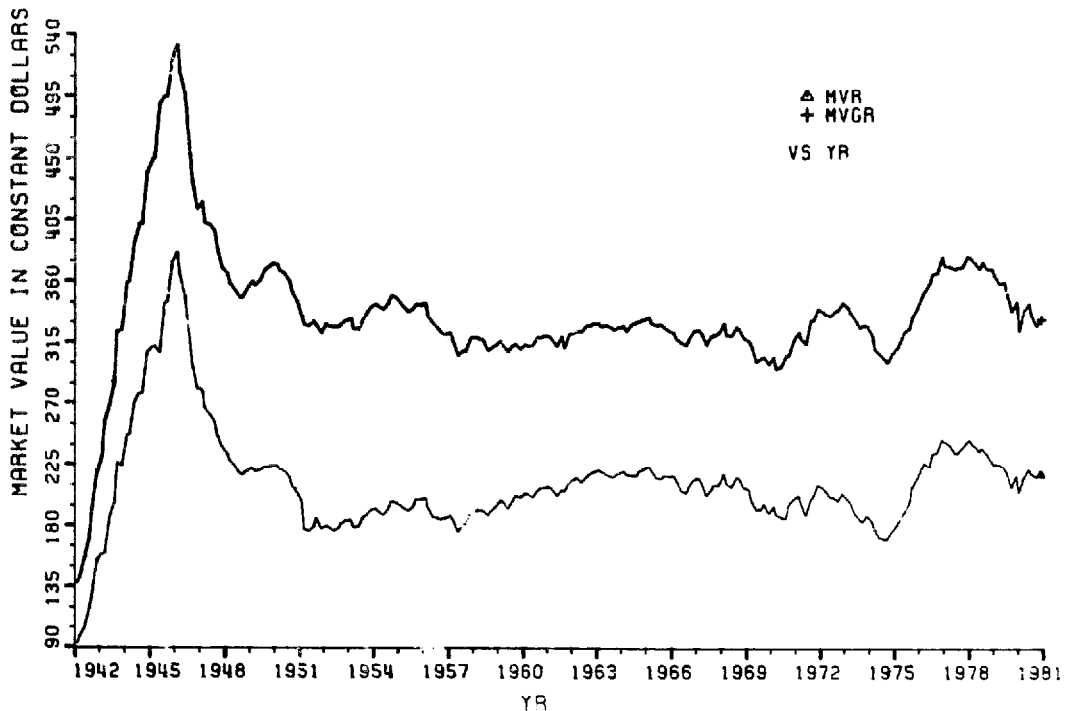
Fig. 2. Market value in billions of constant (1967) dollars. *MVR* is the market value of total marketable treasury debt in constant dollars *MVGR* is the market value of gross federal debt in constant dollars.

differences are not very large.[4] Since Seater's annual market value series are calculated over the period 1919–1975 and the monthly series reported here are calculated over the period 1942–1980 the correlation statistics provide assurance that studies of the extended period 1919–1980 may be conducted without loss of accuracy due to unmatched data.

Private holdings of marketable debt.   For some purposes it is desirable to measure only the market value of government debt that is privately held.

[4] Although these correlations are high, in some cases there are notable differences between the series. The first source of difference concerns the convention followed regarding the end-of-month calculations. As mentioned earlier, in some cases prices or quantities outstanding were reported in the monthly *Bulletin* for issues which would not be made available until the first few days of the next month. Since in Seater's work the statistics are calculated on a yearly basis it seems reasonable to include these issues in the annual market value calculations. Given the frequency of the monthly statistics, however, the appropriate convention to adopt is clearly to exclude all such issues from the end-of-month calculations. A second source of difference concerns the treatment of issues not reported. Occasionally, a piece of data is not reported for an issue, such as the price or volume outstanding (the missing data were usually prices). In a few of these cases in Seater's work the issue is omitted. Although this practice seems reasonable given the relatively large variation in the year-to-year data, for the monthly calculations it is essential that such an issue be included. Our series include such issues by reconstructing the missing data for the relevant date or, when exact reconstruction was impossible, by using the data for the most recent observation prior to the missing value. A final source of divergence concerns the reporting errors detected in the *Treasury Bulletin*.

Monthly statistics on this series are reported in table 6. Private holdings of marketable Treasury debt were calculated in the following way:

(1) For each type of security — Bills, Bonds, Certificates, and Notes — the par value of holdings by U.S. government agencies and trust funds, and Federal Reserve Banks was subtracted from the total par value. The ratio of the par value of private holdings to the total par value outstanding was formed and then multiplied by the previously calculated market value to get the market value of private holdings of that type of security.[5]

(2) The market value of private holdings of each type of security were then summed to give total private holdings of marketable debt.[6]

Table 6

Market value of privately held treasury debt (millions of dollars).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
42	39511	39410	40651	42294	44268	45812	49619	52690	55666	57264	59726	68966
43	70205	71754	72628	73509	88079	87195	89477	89816	100887	104936	103835	101915
44	101431	112667	113975	112199	111769	122972	124156	127074	125565	124793	124254	139662
45	140911	140909	140884	140491	139930	140381	159005	158295	157035	157244	157496	172138
46	175361	176544	174079	170424	168796	164524	162166	160268	157699	156700	153815	151305
47	150584	149488	148168	146792	146352	145517	146235	146002	145340	143670	142098	139400
48	139072	137795	136500	136758	134626	135285	134243	133513	130722	130518	130356	130231
49	131075	130712	130312	130755	132288	133066	133974	13591	135501	135885	135578	134410
50	134633	134444	134029	133700	134474	133511	133800	133437	130361	129454	128949	127464
51	125952	125170	122570	114401	114270	113671	114235	115106	114413	119226	116624	115642
52	116961	117074	116077	116757	117587	115013	118595	117735	116500	119297	120783	119501
53	119951	119545	116857	116242	116981	116401	122851	122704	122842	123253	124951	124910
54	126666	127333	123038	124618	125692	123215	124032	127713	127206	131044	130206	129708
55	129841	129344	124934	127922	129929	128109	128106	128717	129831	133052	131999	131770
56	133571	133446	128233	128084	128940	123815	122964	123891	123403	124566	125213	124717
57	127875	128249	127256	126567	126165	120649	123321	124484	125875	125398	129109	131658
58	133064	134131	132463	135713	135605	133826	133300	131659	130093	134004	137052	136187
59	140473	140858	137103	140277	139923	136426	140811	141302	140029	145182	143536	144193
60	147649	147965	146383	147899	147478	144614	149039	148141	148196	150224	148561	150766
61	151003	152040	144976	150276	150545	146104	151650	149990	152118	149353	153873	154388
62	155846	156726	155594	157449	156954	154183	154445	157149	156368	159305	160434	160458
63	161590	161767	159633	160273	158981	157555	157061	156688	157157	156390	157416	158117
64	159691	159726	158026	158305	157990	156078	155495	155939	156976	159130	159279	159486
65	161520	161609	158349	158612	157895	153781	153690	152697	150771	154675	155501	154161
66	157162	156283	154657	154467	152046	146353	145676	146037	147273	151302	151674	153724
67	156155	154113	154747	149886	146737	139628	144659	147206	147951	150747	151576	151102
68	155507	159746	156764	153302	155894	149710	155220	157845	156722	158651	156659	152888
69	160170	157190	156982	152117	151819	144788	148019	146884	141401	151774	151457	146520
70	150391	153209	154276	148728	154309	146475	152313	147979	151043	157292	160531	161222
71	163936	163402	169988	157897	152140	150179	154940	159853	159927	162836	165215	170959
72	171119	172349	170924	167497	163862	162375	162686	163918	163704	165340	171987	173782
73	171803	168894	168124	166680	165438	160241	156210	157871	159895	156384	163230	164761
74	165121	164396	163858	160381	159171	156827	160239	159782	162308	165779	169340	175990
75	179411	184614	193462	189866	204977	204375	215870	222351	226108	239750	246380	252692
76	255634	267767	270359	273282	274062	272367	286382	292545	294013	296567	310574	311487
77	312854	319913	323267	318251	318109	322258	314228	319757	323974	333782	335811	337788
78	348908	351460	359838	346980	343144	342767	348057	350312	345919	348004	353133	348635
79	363701	360597	365436	365642	374751	367961	371288	370528	364439	357853	368955	380472
80	381364	374218	387353	405176	421308	421976	430333	427940	433899	432355	436989	449407

[5]Table TSO-3, 'Ownership of Federal Securities', reports the information necessary for these calculations. Since the Treasury Bulletin reports information regarding the ownership of individual issues, in principle the private holdings of Treasury securities are measurable as an accounting construct. However, the basic technique involved in generating the data of this study required the collection and entry of approximately 160,000 statistics and our feeling is that more detailed examination of the data at this point is not warranted.

[6]For some purposes it may be desirable to eliminate the federal debt held by state and local institutions. Until Dec. 1961, however, the Treasury statistics on the ownership of federal securities were not sufficiently detailed to enable calculation of this statistic.

The calculation employs an assumption that within the three rough maturity classes of short term (Bills and Certificates of Indebtedness), medium term (Notes), and long term (Bonds) the maturity composition of government and private holdings are the same.

3. Gross federal debt

Over the period of this study, non-marketable federal debt composed from 28% (January, 1946) to 46% (June, 1951) of the par value of gross federal debt with a value of 34% at the end of 1980. Since U.S. Savings Bonds, Investment Securities, Depository Securities, Foreign Securities, Government Account Securities, and other securities are not marketable, the value of Gross Federal Debt (marketable debt plus non-marketable debt) is not directly calculable using the procedures outlined above. The procedure used instead is to calculate on a monthly basis the ratio of the par value of gross federal debt to the par value of marketable Treasury debt, and multiply this ratio by the monthly market value statistics reported earlier.[7] These statistics are reported in table 7 and figs. 1 and 2.[8] In addition, the market value of gross federal debt as a share of GNP is plotted in fig. 3.

4. The stochastic structure of market and par value

The calculation of time series on the market value of U.S. Treasury debt is primarily motivated by the usefulness of such series in empirical analyses. The data may be used for univariate analysis or in the context of a multivariate study. Previous empirical studies have relied upon par value data or on various approximations to market value by adjusting the par value data.[9] Since for many purposes market value is the correct measure of debt, these studies face potential problems from errors in variables or misspecification. In this section the univariate stochastic properties of market value and par value will be estimated and compared.

Over the long-run the two series generally move together quite closely. They both rise rapidly from 1942 through 1945 and then fall somewhat before resuming a slow but steady increase. At approximately the end of 1974 the rates of growth of both series increase. As a result of the overall

[7]The obvious problem with this method is that it is questionable whether non-marketable debt should be valued on a dollar-for-dollar basis as marketable debt. One other possible problem is that this method assumes that the maturity structure of non-marketable government debt is the same as that of marketable debt. For a more complete discussion regarding the valuation of non-marketable debt see Seater (1981a).

[8]Data used in this calculation are taken from Table FD-1, 'Summary of Federal Debt'.

[9]The exception is Seater (1981b) who uses annual market value. Tanner (1979) approximates market value by adjusting par value data using interest rates. See Seater (1981a) for a discussion of Tanner's procedure and similar procedures used by Yawitz and Meyer (197?) and Kormendi (1980).

Table 7

Market value of gross federal debt (millions of dollars).

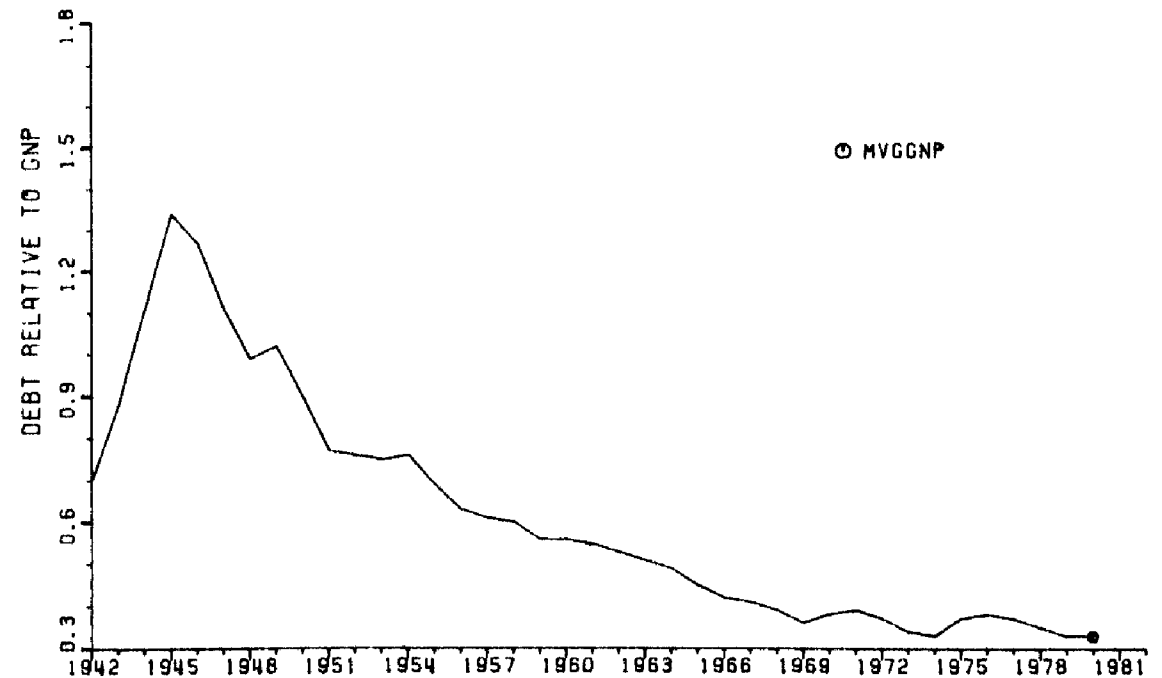|	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
42	63057	65227	65516	68287	71698	75701	80154	84639	89435	95874	98850	110891
43	114086	116968	118379	133245	139409	140436	145096	147576	161773	168422	169492	169161
44	174063	186609	188156	188444	189869	204460	212295	213555	212995	213629	218527	234225
45	237141	238925	239225	240790	244462	265408	267964	268768	267825	268009	271998	285308
46	288123	289403	286168	281783	280755	277931	275913	274504	271624	270332	268348	266121
47	266960	268794	266745	264964	265671	265151	266300	267387	265967	264431	262409	259586
48	259205	257526	256038	255397	256404	255538	256234	255767	255332	254885	255242	255990
49	256117	256434	255518	255404	255928	257938	259533	262239	263011	263030	263381	263944
50	262773	261905	260711	260203	260801	261166	261324	261831	260294	259462	259538	259109
51	258732	258249	255184	254099	253818	253977	255181	256971	256754	257639	258375	255476
52	258555	259060	257381	258778	260296	259140	262430	261836	260471	263276	265551	265098
53	264796	264225	260575	259143	259268	260627	267765	268287	270627	271900	273275	274938
54	275842	277147	273026	274867	275434	274562	274404	277641	277018	280490	280006	279531
55	277552	276022	272016	274021	275359	271107	272561	273188	273552	276686	275746	276110
56	276652	276589	276604	269173	272050	268057	265723	266610	265829	266383	267134	265687
57	268629	267865	266969	264593	264750	258082	260294	262132	262334	262402	268596	271579
58	271884	273803	272506	275756	276887	275206	272371	268510	265834	269557	273602	271537
59	273764	274258	270026	271865	272317	269826	273962	273834	271730	276737	274858	273562
60	275752	276125	276680	276992	278355	278117	283650	283376	283099	284712	283022	285944
61	284206	285680	271706	283745	285187	279760	286107	286932	287575	280289	290476	289105
62	289130	290869	291519	293014	294988	292628	292001	297251	295435	298520	301813	299973
63	299680	300723	298874	298762	300353	300977	299430	300764	300685	299666	301597	302229
64	301671	302982	301683	300199	304791	305378	304878	307386	308939	309055	311292	311137
65	311486	312976	311081	310051	312589	311011	309960	310862	308312	310275	312579	309322
66	310170	309619	309750	307864	309887	306342	304951	307288	310076	313603	315425	319473
67	321007	320562	324649	319431	322171	313312	318212	322191	322372	324005	327955	327920
68	331976	337196	333641	330965	336283	333439	339429	342657	342598	343990	342596	339364
69	340982	339264	340225	340455	339151	331053	334291	336717	331784	340662	342268	338912
70	339345	347190	350757	341555	345766	346708	354400	358271	359304	361900	373058	378237
71	381105	385763	389648	383000	387202	382522	389454	405902	404352	406931	408820	419806
72	417458	419364	419299	419158	422789	419848	426050	426796	424806	431103	436567	439967
73	438493	440592	443089	442819	441871	441102	434986	441780	447177	448683	449800	454532
74	453072	454976	453100	447539	452429	451899	451035	455317	460509	461044	469143	478755
75	483025	490692	498118	500991	517070	520627	523508	532311	536398	551952	555147	568808
76	578456	586994	594975	596487	600320	612800	618101	630391	632876	637792	651168	661011
77	651845	660989	667677	669171	670184	673926	668779	681118	692269	686997	698971	706776
78	707296	714613	721804	718340	720425	724609	727885	742925	747444	744545	751806	752109
79	759338	758002	764863	763001	776298	782591	781712	782175	790639	768099	786532	798132
80	789991	769372	780163	827265	852213	855862	848489	840085	847060	836954	837882	863822

Fig. 3. Debt relative to GNP. MVGGNP is the market value of gross federal debt relative to annual gross national product.

similarities in their movements the correlation between the total market and par value series is 0.9984.

While this correlation is extremely high it does not imply that the errors from using par value data are inconsequential. Part of this correlation can be traced to the common trends in the series (the correlations between market and par value with a time trend are 0.8235 and 0.8350 respectively). The effect of common trends can be eliminated by regressing each series on simple time trends and correlating the residuals. For simple OLS regressions the correlation between market and par value residuals is 0.9956.[10] When a correction is made for first order autoregressive residuals in the time trend regressions, the correlation between market and par value residuals falls to 0.8632.

An extension of detrending is to pre-whiten the market and par value series using linear time domain (ARIMA) filters. For the monthly par value series the fitted ARIMA representation is

$$(1 - 0.21 L^{12})(1 - 0.83L)(1 - L)PV_t = 220.23 + (1 - 0.88L + 0.17L^2 + 0.11L^9)u_{1t},$$
$$\quad (0.05) \qquad (0.05) \qquad\qquad\qquad (70.28) \quad (0.07) \quad (0.05) \quad (0.04)$$

$$\sigma_{u1} = 3551,$$

where L is the lag operator ($L^n x_t = x_{t-n}$), and the standard errors of parameter estimates appear in parentheses. For the monthly market value series the same ARIMA specification is

$$(1 - 0.22 L^{12})(1 - 0.77L)(1 - L)MV_t = 285.07 + (1 - 0.73L + 0.01L^2 + 0.14L^9)u_{2t},$$
$$\quad (0.05) \qquad (0.07) \qquad\qquad\qquad (98.5) \quad (0.09) \quad (0.05) \quad (0.04)$$

$$\sigma_{u2} = 4308.$$

For both series the residuals pass all standard tests for white noise. Using these estimated filters to pre-whiten the series the correlation between the residuals (the estimated u_1 and u_2 series) is 0.8144.

In conclusion, although the levels of the par value series 'explain' (in the sense of squared correlation) over 99 percent of the variations in the levels of the market value series, pre-whitening reduces this 'explanatory power' to 66 percent. While even this smaller number is statistically significant, it demonstrates the limitations of par value as a representation of market value. This has become a more severe problem in recent years as an increase in interest rate variability has caused a decline in the correlations between the two series. In the period from January, 1975 to December, 1980 the correlation between the levels of market and par value is 0.9918 but the correlation between their first differences is only 0.6902.

[10]The results of the regressions discussed in this section are available from the authors.

5. Summary

This paper has presented a set of time series on the market value of United States Treasury debt on a monthly basis from 1942 through 1980. Individual series for Treasury Bills, Certificates of Indebtedness, Bonds, and Notes were presented along with their sum and estimates of both privately held and gross debt outstanding. The series for market value of outstanding Treasury debt has been compared to par value in order to assess the validity of par value as a proxy for market value. While the correlation between the levels of these series is high it was shown that if the series are pre-whitened the quality of the representation declines and in recent years the increase in interest rate fluctuations has led to an overall decline in the correlations.

The authors anticipate maintaining these series as more data become available. Certain other series used in compiling those reported here are also available from the authors upon request.

References

Cox, W. Michael, 1983, Is there a rule for financing public debt? The wealth content of U.S. government bonds, 1950–1981, Working paper (Virginia Polytechnic Institute and State University, Blacksburg, VA).

Hirschhorn, Eric, 1983, The expansionary effect of government debt in the United States (Virginia Polytechnic Institute and State University, Blacksburg, VA) forthcoming.

Kormendi, Roger C., 1980, Government debt, government spending and private sector behavior (University of Chicago, Chicago, IL) unpublished.

Seater, John J., 1981a, The market value of outstanding government debt, 1919–1975, Journal of Monetary Economics 8, 85–101.

Seater, John J., 1981b, Are future taxes discounted? Research paper no. 50 (Federal Reserve Bank of Philadelphia, Philadelphia, PA).

Tanner, J. Ernest, 1979, An empirical investigation of tax discounting, Journal of Money, Credit, and Banking 11, 214–218.

Treasury Bulletin, U.S. Department of Treasury, various issues, 1942–1981.

Yawitz, Jess B. and Laurence H. Meyer, 1976, An empirical investigation of the extent of tax discounting, Journal of Money, Credit, and Banking 8, 247–254.