

# Series I Savings Bonds Announcement Effects on Treasury Inflation-Protected Securities

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JEL classification:

G11 (investment decisions), G14 (Information and Market Efficiency;  
Event Studies)

Keywords: Savings bonds; Investment decisions;

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### Abstract:

The paper discusses the announcement effects of Series I savings bonds on U.S. Treasury Inflation Protected Securities (TIPS).

The author uses an event study methodology to study yield movements both pre-announcement and post announcement for on-the-run TIPS issues surrounding the biannual announcement dates going back to the start of the Series I Savings Bond Program in 1998. Since the Treasury offers 5, 10, 20 and 30 year TIPS, and the Series I savings bond can be held and earn interest from 1-30 years, the announcement effect is tested for all on-the-run TIPS.

## **1. Introduction**

The United States Treasury Department offers two types of inflation indexed securities, a marketable series of Treasury Inflation Protected Securities (TIPS) and a non-marketable security, the Series I savings bond. See Table 1 for a comparison of TIPS and Series I Savings Bonds.

A Series I savings bond has two interest components: a fixed interest rate that remains the same over the life of the bond, and a inflation component that changes every six months based on changes in the Consumer Price Index (CPI). The first business day of November and of May, the Treasury Department announces the relevant inflation component for all outstanding Series I savings bonds over their next six month compounding period, and the fixed rate component applicable to Series I savings bonds purchased over the next six months.

While there are material differences between a Series I savings bond and a Treasury Inflation Protected Security, the two types, U.S. Treasury issued inflation protected securities are close enough substitutes that the secondary market for TIPS should react to the announcement of the new interest rate components for the Series I Savings Bond. One difference between the two types of inflation protected securities is that the TIPS are marketable securities and savings bonds are not marketable. Savings bonds offer the opportunity to defer taxes on the interest earnings until the bond is redeemed or matures. While TIPS held in tax advantaged retirement accounts do not result in a current tax obligation, TIPS held in taxable accounts generate taxable income on both the coupon interest and on the accretion of the inflation component payable in the tax year earned. Series I savings bonds have a minimum holding period of one-year and pay an early redemption penalty of the most recent three months interest when redeemed in the first five years after issuance beyond that there is no price risk in early redemption.<sup>i</sup>

The valuation of the options is not the focus of this paper. Instead the focus is to consider the yield movement in the market value of on-the-run TIPS securities in the days before and after the Treasury Department's semi-annual announcements of the new fixed coupon rate and inflation component for the Series I savings bonds. The on-the-run securities are the most recent offering of a TIPS maturity. TIPS are currently offered in five, ten, and twenty-year maturities. A thirty-year TIPS has been issued in the past, but the last thirty-year TIPS was issued in April 2002. The twenty-year TIPS bond was shelved for a period of time, but is once again a regular offering on the Treasury calendar.

## **2. Literature Review**

The similarities and differences between Series I savings bonds and TIPS has been studied previously (Arak & Rosenstein 2006). In that work the authors conclude that the difference in real yields differential between the Series I and TIPS issues can be partially explained by the optionality of the Series I savings bond, namely the lack of price risk on early redemption<sup>ii</sup> and the option to defer income taxes until the bonds are redeemed or mature.<sup>iii</sup> Because of the value of these options, the real yield on the Series I savings bond is consistently lower than the real yield on a TIPS security. The authors also identify an embedded option in the TIPS security not available in the Series I savings bond, namely the ability to harvest tax losses in a rising interest environment but point out that this is option is worth less in TIPS than in non-indexed securities because the interest rate on the indexed security adjusts for rising inflation.

Arak and Rosenstein (2004) considered the embedded options in Series EE savings bonds, two of which are common to the Series I savings bond, namely the early redemption option and the tax deferral option. Since that work, Treasury has negated most of the value of the early

redemption option in the Series EE by offering fixed rate yields, instead of floating rates, at interest rates below the 3.53 percent needed to have the Series EE double in value within 20 years, a requirement of these bonds, until the interest payment made at year 20.<sup>iv</sup>

Roll (2004) describes the relationship between TIPS and the non-indexed marketable U.S. Treasury securities and how TIPS can be used to estimate real yield curves and then can be compared against the nominal Treasury yield curve to derive the term structure of anticipated inflation on a daily basis. The dramatic decline in TIPS real yields since 1999 is supported by empirical tests. Real yields on TIPS currently range from 80-202 basis points.

MacKinlay (1997) provides a review of the evolution of event study methodology in economics and finance, especially as it relates to stock returns surrounding an event. Christiansen (2000) considers the covariance structure of government bond returns surrounding macroeconomic announcements, particularly employment situation report and producer price inflation (PPI). The findings that conditional variances, conditional covariances, and correlations are greater on announcement days than on non-announcement days are not tested in this paper, but the idea that yields across government bonds have higher correlations on announcement dates makes sense in terms of the price reaction of outstanding TIPS to a Treasury Department announcement on Series I savings bonds.

## **Hypothesis**

The null hypothesis is that the mean real yield for the on-the-run TIPS issuances, adjusted for the newly announced real return on the Series I savings bonds, is the same in the five trading days pre-announcement as it is for the five trading days post announcement. ( $H_0=0$ ) Since closing

yields are used for the TIPS, and the announcement is made at 10:00am, the event date is treated as the first trading day of the post-announcement period. The announcement of a new fixed coupon rate, along with the inflation component, happens every six months on the first business day of May and November. Subtracting out the real yield on the Series I savings bond doesn't actually impact the analysis, since the same constant is being subtracted from both samples. The logic in comparing the two means is that the Treasury would want to consider the embedded value of the options inherent in the Series I savings bond in pricing the fixed rate component and if they did the pricing well, there should be little to no reaction in the TIPS issue after the fixed rate had been announced.

### **Methodology**

A paired t- test is used to test the hypothesis that the mean yield for the on-the-run TIPS issues is the same, pre and post announcement, after adjusting the yields for the new (announced) real rate of return. The adjustment, with hindsight, is not necessary to the evaluation of the two means but doesn't impact the results. This is done for the on-the-run TIPS maturities at every announcement date except the September 1998 initial pricing of Series I savings bonds. Table 2 lists the announcement dates.

When there is a difference in means, a paired t-test will be run using the corresponding event window and the Treasury Constant Maturity yield curve (CMT) to see if there is a difference in means for the nominal treasury yield curve. Since the announcement dates are the first business day of the month, there are times when the employment situation report, for example, are released on the same business day, or in the event window surrounding the Series I bond information.



## **Results**

The paired t-tests of the TIPS issues in the event windows surrounding the announcement date of the Series I savings bond are shown in Table 3. In 51 out of 69 pairings, or 73.9 percent of the time, the difference in means pre and post event supported the null hypothesis that the means were equal, tested at an alpha level of .05.

For those observations supporting the alternate hypothesis, the nominal Treasury constant maturity (CMT) yield curve was tested over the event windows and are presented in Table 4. Ten out of thirty-seven pairings supported the null hypothesis that the means were equal to zero at an alpha level of .05. Twenty-seven out of 37 pairings, or 73 percent of the CMT pairings, supported the alternate hypothesis, that the mean was not equal to zero.

## **Conclusion**

The idea that the semiannual announcement of the fixed rate for the Series I savings bond moves TIPS prices is not supported by this research. What is more likely is that the Treasury Department uses prevailing TIPS yields along with pricing the embedded options in the Series I savings bond to set the new fixed interest rate on the Series I savings bond with a goal of not causing yields to move in the TIPS market. Given the overlap in the event window between the Treasury Department's announcement dates for the Series I bonds and macroeconomic data like the employment situation report, the Treasury's pricing of the fixed rate component appears to be successful in not moving TIPS yields.





## References

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**Table 1: Comparison of TIPS and Series I Savings Bonds**

	<b>TIPS</b>	<b>I-Bonds</b>
<b>Type of investment</b>	Marketable--can be bought and sold in the secondary securities market	Non-marketable - cannot be bought or sold in secondary securities market. Registered in names of individuals and some entities, including trusts, states, corporations, partnerships, etc. See <a href="#">Learn More about Entity Accounts</a> for full information in the entity registration types.
<b>How to buy</b>	At auction through TreasuryDirect, Legacy Treasury Direct, or through banks, brokers, and dealers. <b>Starting in January 2007, 20-year TIPS are no longer available in Legacy Treasury Direct, but are available in TreasuryDirect.</b>	Electronic: Anytime online from TreasuryDirect. Paper: most banks, credit unions, or savings institutions.
<b>Purchase limits</b>	Auction: Non-competitive bidding: up to \$5 million; Competitive bidding: up to 35% of offering amount	Electronic: \$5,000 per Social Security number per calendar year. Paper: \$5,000 per Social Security number per calendar year.
<b>Par Amount/Face Amount</b>	Minimum purchase is \$100. Increments of 100.	Electronic: purchased in amounts \$25 or more, to the penny; Paper: Offered in 8 denominations \$50, \$75, \$100, \$200, \$500, \$1,000, and \$5,000).
<b>Inflation Indexing</b>	Inflation adjustments measured by CPI-U published monthly	Semiannual inflation rate (based on CPI-U changes) announced in May and November.
<b>Discounts/Face Amount</b>	Price and interest determined at auction.	Electronic I Bonds - purchased in amounts of 25 or more, to the penny. Paper bonds issued at face amount (A \$100 I-Bond costs \$100.)
<b>Earnings Rates</b>	Principal increases/decreases with inflation/deflation. Coupons calculated based on adjusted principal. Fixed coupon rate.	Earnings rate is a combination of the fixed rate of return, set at the time of purchase, and a variable semiannual inflation rate.
<b>Coupons/interest</b>	Semiannual interest payments at the coupon rate set at auction. Inflation-adjusted principal is used to calculate the coupon amount	Interest accrues over the life of the bond and is paid upon redemption
<b>Tax Issues</b>	Semiannual interest payments and inflation adjustments that increase the principal are subject to federal tax in the year that they occur, but are exempt from state and local income taxes.	Tax reporting of interest can be deferred until redemption, final maturity, or other taxable disposition, whichever occurs first. Interest is subject to federal income tax, but exempt from state and local income taxes. Interest can also be claimed annually.
<b>Life Span</b>	TIPS are issued in terms of 5, 10, and 20 years.	Earn interest for up to 30 years.
<b>Disposal before maturity</b>	Can be sold prior to maturity in the secondary market.	Redeemable after 12 months with three months interest penalty. No penalty after 5 years.

[http://www.treasurydirect.gov/indiv/products/prod\\_tipsvsibonds.htm](http://www.treasurydirect.gov/indiv/products/prod_tipsvsibonds.htm)

**Table 2: Semiannual Series I Announcement Dates: Present to Inception**

<b>Day and Date of Announcement</b>	<b>FIXED RATES<sup>1</sup></b>	<b>INFLATION RATES<sup>2</sup></b>	<b>Composite Rate</b>
Friday, May 1	0.10%	-2.78%	0.00% <sup>3</sup>
Monday, Nov. 3	0.70%	2.46%	5.64%
Thursday, May 1	0.00%	2.42%	4.84%
Thursday, Nov 1	1.20%	1.53%	4.28%
Tuesday, May 1	1.30%	1.21%	3.74%
Wednesday, Nov 1	1.40%	1.55%	4.52%
Monday, May 1	1.40%	0.50%	2.41%
Tuesday, Nov 1	1.00%	2.85%	6.73%
Monday, May 2	1.20%	1.79%	4.80%
Monday, Nov 1	1.00%	1.33%	3.67%
Monday, May 3	1.00%	1.19%	3.39%
Monday, Nov 3	1.10%	0.54%	2.19%
Thursday, May 1	1.10%	1.77%	4.66%
Friday, Nov 1	1.60%	1.23%	4.08%
Wednesday, May 1	2.00%	0.28%	2.57%
Thursday, Nov 1	2.00%	1.19%	4.40%
Tuesday, May 1	3.00%	1.44%	5.92%
Wednesday, Nov 1	3.40%	1.52%	6.49%
Monday, May 1	3.60%	1.91%	7.49%
Monday, Nov 1	3.40%	1.76%	6.98%
Monday, May 3	3.30%	0.86%	5.05%
Monday, Nov 2	3.30%	0.86%	5.05%
Tues, Sep 1	3.40%	0.62%	4.66%

<sup>1</sup>Annual rates compounded semiannually<sup>2</sup>Semiannual rates<sup>3</sup>Because of the negative inflation rate the composite rate is zero for the May 1, 2009 announcement.

**Table 3: Paired t-test of preannouncement and post-announcement means.**

<u>Day and Date of Announcement</u>		<u>5-vr</u>	<u>10-vr</u>	<u>20-vr</u>	<u>30-vr</u>
Friday, May 01, 2009	t Stat	-	-	-	-
	P(T<=t) two-tail	0.2974496	4.0659492	4.0197675	1.5857478
		0.7809316	<b>0.0152737</b>	<b>0.0158675</b>	0.1879796
Monday, November 03, 2008	t Stat	2.7764451	2.7764451	2.7764451	2.7764451
	P(T<=t) two-tail	0.0581548	0.0572142	0.2365248	0.2001158
		0.0581548	0.0572142	0.2365248	0.2001158
Thursday, May 01, 2008	t Stat	1.4041922	1.4773078	1.2514085	1.3230092
	P(T<=t) two-tail	0.2329433	0.2136534	0.2789768	0.2563945
		0.2329433	0.2136534	0.2789768	0.2563945
Thursday, November 01, 2007	t Stat	4.2178423	4.4224193	3.9962876	3.7880421
	P(T<=t) two-tail	<b>0.0135009</b>	<b>0.0114893</b>	<b>0.016184</b>	<b>0.0193014</b>
		<b>0.0135009</b>	<b>0.0114893</b>	<b>0.016184</b>	<b>0.0193014</b>
Tuesday, May 01, 2007	t Stat	1.5591589	1.0643042	0.1435916	-5.666E-15
	P(T<=t) two-tail	0.1939669	0.3471731	0.8927664	1
		0.1939669	0.3471731	0.8927664	1
Wednesday, November 01, 2006	t Stat	1.5718105	1.7655867	2.0073241	2.1811193
	P(T<=t) two-tail	0.1910939	0.1522212	0.1151499	0.0946261
		0.1910939	0.1522212	0.1151499	0.0946261
Monday, May 01, 2006	t Stat	0.7762155	0.5897678	1.2902488	1.4863211
	P(T<=t) two-tail	0.4809619	0.5870496	0.2664991	0.2113895
		0.4809619	0.5870496	0.2664991	0.2113895
Tuesday, November 01, 2005	t Stat	7.2029406	0.9525793	0.1744083	0.1778217
	P(T<=t) two-tail	<b>0.0019691</b>	0.3947455	0.8700162	0.8675051
		<b>0.0019691</b>	0.3947455	0.8700162	0.8675051
Monday, May 02, 2005	t Stat	4.2382327	0.6556101	0.9307578	0.7257747
	P(T<=t) two-tail	<b>0.0132823</b>	0.5478683	0.4046663	0.5081653
		<b>0.0132823</b>	0.5478683	0.4046663	0.5081653
Monday, November 01, 2004	t Stat		0.6666667	0.1706647	0.2779446
	P(T<=t) two-tail		0.5414697	0.8727728	0.7948299
			0.5414697	0.8727728	0.7948299
Monday, May 03, 2004	t Stat		2.6233033		2.2543039
	P(T<=t) two-tail		0.058596		0.0872285
			0.058596		0.0872285
Monday, November 03, 2003	t Stat		2.8253331		0.236525
	P(T<=t) two-tail		<b>0.0475698</b>		0.8246439
			<b>0.0475698</b>		0.8246439
Thursday, May 01, 2003	t Stat		3.7441198		2.4317909
	P(T<=t) two-tail		<b>0.0200492</b>		0.0718419
			<b>0.0200492</b>		0.0718419
Friday, November 01, 2002	t Stat		7.4135713		1.5860894
	P(T<=t) two-tail		<b>0.0017665</b>		0.187904
			<b>0.0017665</b>		0.187904
Wednesday, May 01, 2002	t Stat		1.2060454		-
	P(T<=t) two-tail		0.2942564		1.0866107
			0.2942564		0.3383069
Thursday, November 01, 2001	t Stat		2.656844		5.312334

	P(T<=t) two-tail		0.056576 2	7	0.006036 7
Tuesday, May 01, 2001	t Stat	0.429803 9	1.730554 4		3.300548
	P(T<=t) two-tail	0.689479 8	0.158579 7		0.029918 1
Wednesday, November 01, 2000	t Stat	- 0.7385489	- 3.1378582		- 1.8353259
	P(T<=t) two-tail	0.501169 4	0.034919 7		0.140357 4
Monday, May 01, 2000	t Stat	- 3.250418	- 0.5760184		8.777E- 15
	P(T<=t) two-tail	0.031363 3	0.595460 3		1
Monday, November 01, 1999	t Stat	2.449489 7	3.207134 9		2.666666 7
	P(T<=t) two-tail	0.070484	0.032677 9		0.056
Monday, May 03, 1999	t Stat	1	1		4.810702 4
	P(T<=t) two-tail	0.373901	0.373901		0.008580 9
Monday, November 02, 1998	t Stat	- 2.4904882	- 2.8987545		- 2.2283441
	P(T<=t) two-tail	0.067449 2	0.044173 1		0.089775 9

**Table 4: Paired t-test pre & post announcement for CMT Treasury Data**

<u>Day and Date of Announcement</u>	<u>CMT</u>	<u>5-yr</u>	<u>10-yr</u>	<u>30-yr</u>
Friday, May 01, 2009	t Stat P(T<=t) two-tail t Critical two-tail	- 4.8164372 <b>0.0085452</b> 2.7764451	- 5.1414767 <b>0.0067843</b> 2.7764451	-5.255 <b>0.006276</b> 2.776445
Thursday, November 01, 2007	t Stat P(T<=t) two-tail	2.4096742 0.0735808	2.4819864 0.0680661	3.628247 <b>0.022194</b>
Tuesday, November 01, 2005	t Stat P(T<=t) two-tail	- 5.7154761 <b>0.0046358</b>	- 4.0608122 <b>0.0153384</b>	
Monday, May 02, 2005	t Stat P(T<=t) two-tail	1.4467285 0.221518	0.7905694 0.4734274	
Monday, November 03, 2003	t Stat P(T<=t) two-tail	- 12.732003 <b>0.0002192</b>	-7.7326 <b>0.0015063</b>	
Thursday, May 01, 2003	t Stat P(T<=t) two-tail	2.3002185 0.0829191	1.672624 0.1697176	
Friday, November 01, 2002	t Stat P(T<=t) two-tail	-0.313625 0.76948	0.1744083 0.8700162	
Thursday, November 01, 2001	t Stat P(T<=t) two-tail	6.5765844 <b>0.002767</b>	4.4724183 <b>0.0110541</b>	5.110294 <b>0.006933</b>
Tuesday, May 01, 2001	t Stat P(T<=t) two-tail	- 0.1678363 0.8748561	- 0.6239191 0.5664984	3.09067 <b>0.036551</b>
Wednesday, November 01, 2000	t Stat P(T<=t) two-tail	- 3.7481703 <b>0.0199788</b>	- 6.4412884 <b>0.0029889</b>	-4.37816 <b>0.011892</b>
Monday, May 01, 2000	t Stat P(T<=t) two-tail	- 7.9981499 <b>0.0013251</b>	-12.49406 <b>0.0002361</b>	-5.95611 <b>0.003988</b>
Monday, November 01, 1999	t Stat P(T<=t) two-tail	8.8292065 <b>0.0009083</b>	9.6129314 <b>0.0006547</b>	8.777338 <b>0.000929</b>
Monday, May 03, 1999	t Stat P(T<=t) two-tail	- 4.9364996 <b>0.0078364</b>	- 6.4944969 <b>0.0028991</b>	-5.54353 <b>0.005179</b>
Monday, November 02, 1998	t Stat P(T<=t) two-tail	- 3.8171527 <b>0.0188242</b>	- -4.246542 <b>0.0131944</b>	-7.51566 <b>0.001678</b>

## Acknowledgements

The author would like to thank his research assistant, Jonathan Gardea for his assistance in compiling the data for this paper.

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<sup>i</sup> The minimum holding period was changed from six months to one year for savings bonds issued on or after February 1, 2003.

<sup>ii</sup> Savings bonds generally cannot be redeemed in the first year of issuance, and have an early redemption penalty of the last three months of interest earnings when redeemed in the first five years. The government occasionally makes exceptions to these early redemption limits for some bondholders, like the victims of a natural disaster.

<sup>iii</sup> Savings Bonds have an education tax exclusion that allows some bondholders to avoid taxation on interest earnings when savings bond proceeds are used for qualified education expenses.

<sup>iv</sup> At this writing the Treasury is offering a fixed rate of 0.70% for Series EE bonds, issued from May through October 2009, well below the 3.53 percent necessary to have the savings bond double in value in 20 years.