THE EFFECT OF THE AMERICAN TAX RELIEF ACT OF 2012: AN EMPIRICAL ANALYSIS

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Abstract

This paper examines the effect of the American Tax Relief Act of 2012 (ATRA 2012) on federal individual income tax. Based on publicly available tax return data provided by the IRS statistics, this study develops a systematic method to expand the available tax data to perform detailed analysis on tax increases due to the new tax changes.

I. INTRODUCTION

The American Tax Relief Act of 2012 (ATRA 2012) was passed by Congress and took effect on January 1, 2013. ATRA 2012 is an act to provide a comprehensive tax reform by addressing the expiration of the Bush tax cuts[1] and generating new tax revenue to avert the fiscal cliff. Thus, ATRA 2012 is often referred to as the fiscal cliff deal. This paper gives a detailed analysis of the effect of the new law on tax revenue increases.

Tax researchers have long been troubled by data limitation.

[1] Bush tax cuts normally are referred to as the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA), and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA).

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Unlike the financial reporting of public companies and capital market information, data on tax returns is protected and normally is not publically available. As Shackelford and Shevlin (2001) discussed in regard to confidential data, there is a series of tax articles (e.g., Boynton, Dobbins, and Plesko, 1992; Collins, Kemsley, and Shackelford, 1997; Collinsand Shackelford, 1997; Landsman, Shackelford, and Yetman, 2002; Mills and Newberry, 2003; Plesko, 2003) published in leading accounting journals which used data that are not publically available. The researchers who gain access to confidential data typically do so either by means of personal contacts with firm officials (e.g., Landsman and Shackelford, 1995), or through financial consultants (e.g., Myers, 2000), or by special arrangement with the IRS (e.g., Collin, Kemsley, and Shackelford, 1995).

Although empirical tax research suffers from data limitation, tax researchers still can benefit from some publicly-available data. For example, some tax researchers (e.g., Weisbrod and Cordes, 1998; Feenberg and Poterba, 2003; Kopczuk and Pop-Eleches, 2007) have been using statistics of income (SOI) data provided by the IRS that are available for public use. SOI tabulations contain data on sources of income, adjusted gross income, exemptions, deductions, taxable income, income tax, etc. While providing a rich body of tax information, the SOI data are far too limited for data mining when compared to databases in other fields. In this study, we introduce the data-modeling method that helped us to obtain sub-population data by using mathematical interpolation. To our knowledge, this is the first attempt to develop a systematic method to solve data limitation on SOI.

Using our data modeling procedure, we examine the effects of the prominent tax changes in the 2012 individual income tax. We use 2010 individual income tax return data collected from SOI to estimate the tax increases if the new law had been implemented in 2010 instead of 2012, as a way of suggesting what the coming effects of the policy are likely to be. The examinations are focused on the top marginal tax rate change, top capital gain rate change, the revival of personal exemption phase-out and limitation on

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itemized deduction, and the interaction of alternative minimum tax (AMT).

We find that the new law would have provided a tax revenue increase of $68 billion from individual income tax returns if it had been implemented in 2010 instead of 2013, based on 2010 tax return data. Among the increases, taxpayers with AGI over $10 million would have had the largest tax increase of $22 billion, as well as the largest tax rate increase of 6.3%. In 2010, taxpayers with AGI between $1.5 million and $2 million would have had the highest tax rate of 25%. If the new law is applied to that year's data, we find that taxpayers with AGI between $2 million and $5 million would have had the highest tax rate of 31% among all taxpayers. We further find that the average tax rate of taxpayers with AGI above $10 million would have been similar to that of taxpayers with AGI between $0.5 and$1 million, which was 27%. The lower tax rate on the taxpayers with the highest wealth in this example can be attributed to the large portion of capital gains in their taxable income, and they would have benefitted from the tax advantage on capital gains.

But the new tax change will also have a profound influence on the alternative minimum tax. Due to the large increase of regular income tax on wealthy taxpayers, many of them will not be subject to AMT anymore. On the other hand, a high percentage of upper-middle income taxpayers are still subject to AMT and the new tax change accelerates the process of AMT being an upper middle class tax.

The next section summarizes the major tax changes due to ATRA 2012. Section III discusses data modeling and reports data descriptive statistics. Section IV examines the effect of each major tax change and presents the results. Finally, we provide concluding remarks in Section V.

II. OVERVIEW OF FISCAL CLIFF DEAL ON TAXES

The main aspects of ATRA 2012 that will affect individual income taxes are summarized in the following sections:

Raising the Top Tax Rates

The American Taxpayer Relief Act of 2012 makes the 10%, 15%, 25%, and 28% income tax brackets from the Bush tax cuts permanent, and retains the 33% and 35% income tax bracket from Bush tax cuts for taxable income under the benchmarks of wealthy filers – $400,000 (for a single filer), $425,000 (for a head of household), and $450,000 (for a married couple filing jointly). For the filers whose taxable income exceeds the benchmarks, their top marginal tax rate will be increased to 39.6%. At the same time, they will also face an increase of the top capital gains (dividends) tax rate to 20%, up from the maximum of 15%.

Phasing Out Exemptions and Reducing Deductions

Personal exemption phase-out (PEP) and limitations on itemized deductions (Pease) were temporarily eliminated since 2010[2]. Now, the Act revives both PEP and Pease to filers whose adjusted gross income (AGI) is more than $250,000 (single), $275,000 (head of household), and $300,000 (married couples filing jointly). PEP reduces the value of each personal exemption from its full value by 2% for each $2,500 above the AGI threshold, and the Pease provision cuts itemized deductions by 3% of adjusted gross income above the AGI threshold but not by more than 80% of the itemized deduction.

Interacting with AMT

The Act made the Alternative Minimum Tax (AMT) patches[3] permanent. This means the AMT is now indexed to

[2]The Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) called for a phased-in repeal of the personal exemption phase-out and for a gradual reduction of the Pease Limitation resulting in full suspension in 2010. All of the changes in EGTRRA were scheduled to expire after 2010, but Congress extended the 2001 tax cuts for two more years until January 2013.

[3] Since AMT has a nearly flat tax rate and the AMT exemptions were not automatically indexed for inflation for years, Congress had passed one-year patches to minimize the impact of the tax.

inflation. Unlike the income tax, which has a progressive tax rate system, the AMT rate is more like a flat tax rate because its statutory marginal rate only includes two-tier rates – 26% and 28%. For years since the Bush administration, Congress passed a series of one-year patches on AMT exemptions in order to minimize the AMT's impact on middle class taxpayers. Now, the Act has made the AMT patches permanent to reduce its impact on middle class taxpayers.

III. DATA MODELING

The original data come from the IRS website under the Tax Stats homepage. The statistics provided by the IRS are in the list of Excel tables that report data on sources of taxable income (TI), adjusted gross income (AGI), deductions, exemptions, taxable income, income tax, alternative income tax, etc. The sample of returns provided by the IRS is classified into subpopulations, called strata. However, the tax return data provided is still insufficient for our examination. For example, IRS statistics only provide return information on AGI between $200,000 and $500,000 by the category of different filing status; if we want to analyze the data inside this AGI range, such as the AGI thresholds of $250,000 (for single)/$300,000 (for married filing jointly). Based on the given information, we cannot accurately estimate the number of filers who are affected by PEP and Pease. To solve the data limitation, we use an interpolation, a mathematical procedure used in numerical analysis, to construct sub-levels inside the given AGI stratum of $200,000-$500,000.

For example, there are 3,471,723 returns with AGI between $200,000 and $500,000, and there are 1,534,373 returns with AGI between $200,000 and $250,000 reported from the IRS statistics. Based on the given information, we may reasonably infer that the number of returns within higher AGI region follows the exponential function, thus the linear interpolation of the exponential return numbers is

$$ln(y) = a + bln(x) + \epsilon \quad (1)$$

Here variable x is the middle position of the sub-ranges (in thousands) and y is the number of returns in the sub-levels. Variable ϵ is the manual adjustment, which does not affect the continuity of the function. In the formula, x is chosen as the following values (in thousands): 225, 275, 325, 375, 425, and 475 for the corresponding sub-levels. To correct for potentially unbounded AGI outliers, two constraints are formulated as following:

$$\begin{cases} ln(15343) = a + bln(225) \\ \prod_i [a + bln(x_i)] = ln(3471723) \end{cases} \quad (2)$$

The first formula of (2) states that there are 1,534,373 returns with AGI between \$200,000 and \$250,000. Like the denotation of summation symbol $\sum$, the product operator $\prod$ denotes the product of a sequence. The second formula of (2) presents the specification that the total return number between \$200,000 and \$500,000 is 3,471,723. After solving these equations, we have a=31.45, and b=-3.18. With the adjustment based on the total AGI, we have the final partition presented in Table 1 that shows the sub-AGI levels inside the range of AGI from \$200,000 to 500,000, in \$50,000 increments. The interpolation serves to create sub-levels with smooth and reasonable distributions that satisfy all the constraints. For returns with AGI above \$500,000, the IRS statistics only provide information with one stratum which is AGI from \$500,000 to \$1,000,000. Using the same method, we also extrapolate more sub-levels inside this stratum to allow us to perform detailed analysis.

After we partition the return numbers, other information may also be calculated based on the return numbers. For example, two constraints are enforced on the interpolation of the AGI amount in each sub-range: (1) the sum of AGI between \$200,000 and \$500,000 is known, and the total of all interpolated sublevel AGIs should be equal to the sum; (2) in each sublevel (see Column1 of Table 1), there should be a reasonable AGI average. Following the two rules, we partitioned the following data: the

total number of returns, the AGI amount, the number of the returns with taxable income, the taxable income amount, the number of personal exemptions, the personal exemption amount, the number of standard deductions, the standard deduction amount, the number of itemized deductions, the itemized deduction amount, the qualified dividend amount, the capital gain amount, the number of returns with AMT, and the AMT amount. Each parameter is also partitioned in four filing categories: married filing jointly and qualifying widow/widower (MJ), single (SG), head of the household (HH), and married filing separately (MS).

Table 1: Substrata of the AGI

AGI Size	Number of Returns Before Adjustment	Number of Returns After Adjustment
$200,000 - $250,000	1,534,373	1,534,373
$250,000 - $300,000	811,098	793,898
$300,000 - $350,000	477,085	468,675
$350,000 - $400,000	302,806	304,918
$400,000 - $450,000	203,462	213,370
$450,000 - $500,000	142,899	156,489
$500,000 - $550,000	104,449	118,068

Table 1 reports sublevels of the AGI from $200,000 to $550,000, in $50,000 increments. Using interpolation, a mathematical procedure, we interpolate sublevels of the AGI and partition the tax return numbers accordingly. Column 2 displays the number of returns before adjustment, referred to as variable ϵ in equation (1), and Column 3 displays the number of returns after adjustment.

It is worth noting that our interpolation is based on the ratio of a partitioned stratum, not on the absolute value. For example, when partitioning the amount of taxable income, we first did the partition on AGI amount and then on the ratio of the taxable income to AGI amount, since the ratio varies more slowly than the taxable income amount does. Utilizing the partition results, we have much richer data information to analyze the effects of new tax legislation on categories such as source of income, deductions, level of income, and filing status.

Figure 1 shows our data modeling results using the interpolation. It provides much more detailed information compared to IRS statistical tables. For example, Figure 1(a) shows how many returns filed had taxable income, used itemized deductions, or had AMT by different AGI intervals. From the figure, we find that there is an extremely high percentage of taxpayers with AGI between $300,000 and $500,000 subjected to the AMT tax.

Figure 1: Data Modeling Results

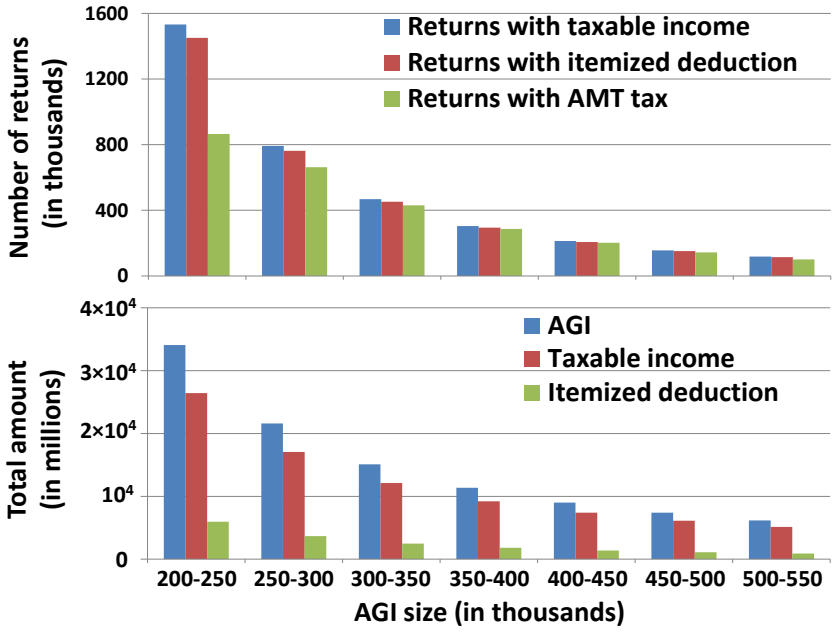


Figure 1 shows the number of returns filed in different AGI levels and the comparison of the total amount of AGI, Taxable income, and Itemized deductions in different AGI levels. The interpolation is performed on 2010 individual income tax return data reported by IRS tax stats (SOI).

IV. THE EFFECT OF 2012 TAX CHANGES AND RESULTS

A. Top Marginal Tax Rate Increase

The Act increases the top marginal tax rate to 39.6% on wealthy taxpayers – defined as those with taxable income above $400,000 (SG), $425,000 (HH), $450,000 (MFJ), and $225,000 (MFS), up from the prior top rate of 35%. This change on top marginal tax rate will result in a large tax increase on filers with taxable income that exceeds the threshold. The tax increase in each AGI region that exceeds the thresholds is calculated as

$$Num\_Returns \times (Avg\_TI - \text{Threshold}) \times 4.6\% \quad (3)$$

where *Num_Returns* denotes the number of returns; *Avg_TI* denotes the average taxable income in the calculated range of AGI; *Threshold* denotes the taxable income thresholds subjected to the new top tax rate of 39.6%, depending on filing status. Figure 2 displays the TI and the ratio of the TI to AGI in the sub AGI regions for all four filing statuses. It shows that MJ and HH returns have a lower TI to AGI ratio than SG and MS returns because on average, MJ and HH returns have larger personal exemptions and deductions than SG and MS returns.

Depending on filing status, the new top tax rate of 39.6% can affect any returns within the seven sublevels of AGI shown in Figure 2. To estimate how much additional tax revenue will be generated due to the increase in the top tax marginal rate, we need to estimate the number of returns that have taxable income above the thresholds.

To show how we estimate the tax increase due to the change of the top tax rate, here we discuss our calculation on MJ returns within the AGI of $500,000-$550,000 as an example. There are 101,688 MJ returns in the AGI of $500,000-$550,000, and these returns have an average AGI of $522,265 and an average TI of $434,695. The ratio of TI to AGI is 0.832, and thus the threshold of $450,000 corresponds to the AGI of $540,654 on average. It infers that part of the MJ returns in the given AGI range

will be subject to the top marginal tax rate. Based on the average AGI and an exponential distribution, a reasonable estimate for the number of returns with TI above the threshold would be 12,000. This will yield a total tax increase of $2.2 million on MJ returns with AGI between $500,000 and $550,000.

Figure 2: The Average Taxable Income and the Ratio of Taxable Income to AGI by AGI Sizes (Under the New Law)

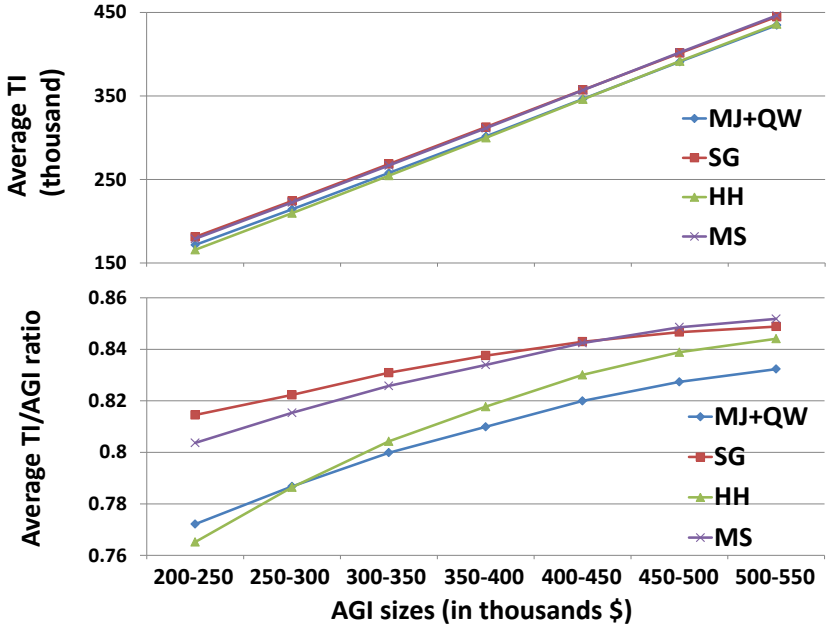


Figure 2 displays the calculated effect of the increase in top marginal rate due to ATRA 2012 on taxable income and the ratio of average taxable income to AGI for all filing statuses by the sublevels of AGI from $200,000 to $550,000, in $50,000 increments. Data source is from our data modeling (referred to in Section II).

Similarly we estimate returns with each filing status, (i.e., SG, HH, MJ, and MS) in all AGI sublevels. Figure 3(a) and (b) report the total amount of tax increase and the tax increase ratio due to the top marginal tax rate change for all returns in different filing statuses with AGI sizes above $200,000. The total tax

increase is $34.56 billion, within which $13.6 billion comes from the filers with AGI above $10 million who are also subject to the largest tax increase rate close to 4% as shown Figure 3. Among the total tax increase, the MJ, SG, HH, and MS returns contribute $27.75 billion, $4.39 billion, $0.78 billion, and $1.64 billion, respectively. Also the tax increase ratio of MS returns with AGI lower than $2 million is substantially higher than that of returns in a different filing status (i.e., SG, HH, and MJ). This result is largely due to the small taxable income threshold of $225,000 for MS filers to be subjected to the top tax rate, and also indicates the tax penalty on married filing separately.

Figure 3: The Total Tax Increase and Tax Increase Ratio Due to the New Top Marginal Tax Rate

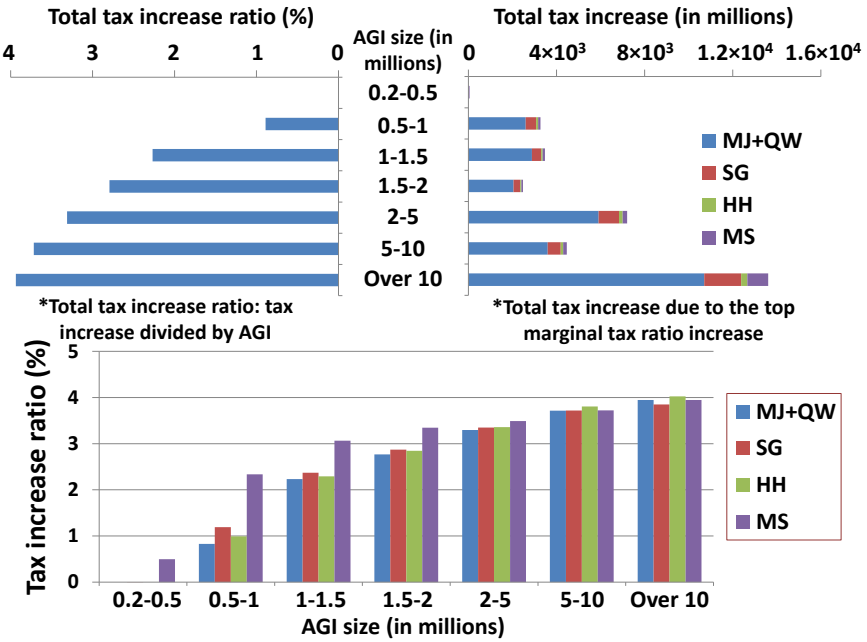


Figure 3 reports the tax increase amount and increase ratio due to the change in top marginal rate. Figure 3(a) reports the total amount of tax increase (right side bars) and tax increase ratio calculated by tax increase to AGI (left side bars) by AGI levels. Figure 3(b) compares the tax increase ratio (tax increase to AGI) among the different filing statuses.

B. Capital Gain Tax Increase

A taxpayer who pays the top marginal tax rate of 39.6% may also be subject to a new capital gain tax of 20%—a 5% increase from the previous 15%. Data from the IRS website list the sum of net short-term capital gains/losses (G_S / L_S)[4] and net long-term capital gains/losses (G_L/ L_L)[5] as well as dividends[6] and taxable net capital gains/losses (G/L)[7]. It is very important to point out that the sum of net long-term capital gain G_L given in the IRS stats table is not the taxable long-term capital gains (*LTCG*) that are subject to the capital gain tax rates of 0%, 15%, or 20%. The net long-term capital gain G_L is the sum of all taxpayers' net long-term capital gains. However, for taxpayers who also have net short-term capital losses, their taxable long-term capital gains are calculated by netting the net long-term capital gains with the net short-term capital losses. Thus, the sum of the taxable long-term capital gains from all filers is *LTCG*. To analyze the effect of increase in capital gain tax, we must calculate *LTCG* that is not provided by available data. To establish the relation between available data and *LTCG*, we divide all returns into six categories as the following:

Group	**Short-term**	**Long-term**	**Total**
A	Gain S_A	Gain L_A	Gain
B	Loss S_B	Loss L_B	Loss
C	Gain S_C	Loss L_C	Gain
D	Gain S_D	Loss L_D	Loss
E	Loss S_E	Gain L_E	Gain
F	Loss S_F	Gain L_F	Loss

Then we have the following relations:

[4] reported on line 7 of Schedule D
[5] reported on line 15 of Schedule D
[6] reported on line 9 of Form 1040
[7] reported on line 13 of Form 1040

$$S_A + S_C + S_D = G_S \quad (4a)$$
$$S_B + S_E + S_F = L_S \quad (4b)$$
$$L_A + L_E + L_F = G_L \quad (4c)$$
$$L_B + L_C + L_D = L_L \quad (4d)$$

and

$$S_A + L_A + S_C - L_C + L_E - S_E = G. \quad (4e)$$

However, we cannot establish an equation for the taxable loss ***L*** like what we do for the taxable gains ***G*** shown on (4e) because not all losses are deductible. Losses are only deductible to a maximum of $3,000. Although it seems impossible to solve these equations, they do give us some insight on the value of the net long-term taxable capital gain ***LTCG***, which is $L_A + L_E - S_E$. First, we formulate an equation from (4c) as follows

$$L_A + L_E - S_E = G_L - L_F - S_E, \quad (5)$$

Second, ***LTCG*** has to be smaller than $\boldsymbol{G_L}$. From a combination of (4a) and (4e), we also have

$$L_A + L_E - S_E = G - G_S + S_D \quad (6)$$

which means ***LTCG*** have to be larger than G-G_S.

The following table displays the capital gains/losses for all returns in 2010 from the IRS website:

G_S	L_S	G_L	L_L	G
47,303,302	258,095,809	378,693,853	438,279,624	393,628,206

Thus we have

$$346{,}324{,}904 < LTCG < 378{,}693{,}853. \quad (7)$$

Further, group C and D are typically the smallest groups since returns with short-term gains normally do not occupy a large portion among all returns. That is also why the short-term capital gain $\boldsymbol{G_S}$ is one magnitude smaller than other values. Thus S_D would be much smaller than $L_F + S_E$, and we estimate ***LTCG*** as

$$LTCG \approx G - G_S + \frac{(G_L + G_S - G)}{4} = [3(G - G_S) + G_L]/4. \quad (8)$$

The results show a total taxable long-term capital gain of $354 billion for all returns in 2010. Also, the qualified dividend (QD) is subject to the long-term capital gain tax. Thus altogether we arrive at a figure of $491 billion.

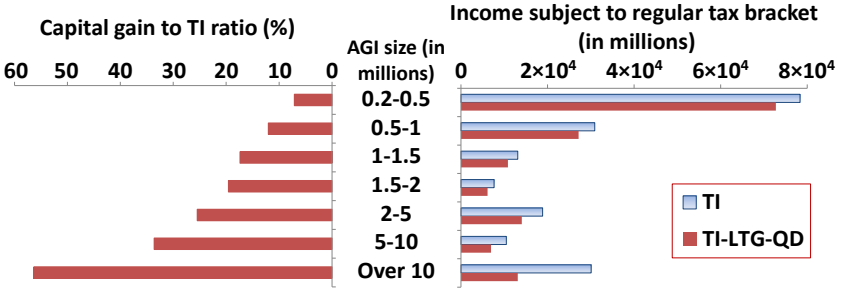
The long-term capital gains are not only subject to the capital gain tax, but also change the income tax structure because the taxable income that comes from the long-term capital gain is not subject to the regular tax brackets. Thus, to calculate the tax increase due to the top marginal tax rate change and top capital gain tax rate, we need to first exclude the long-term capital gains from the taxable income, and recalculate the tax increase due to the change of the top marginal tax rate, then add the tax increases due to the change of the capital gain tax rate.

In Section IV.A, we treated all taxable income as regular income when we calculated the tax increase. However, after introducing the long-term capital gain tax, we have to use the aforementioned two-step process to recalculate the tax increases that are due to the changes in both marginal tax rate and capital gain tax separately. This is similar to the method used in Section IV.A, but here TI is replaced with the regular taxable income RTI, which is

$$RTI = TI - LTCG - QD. \quad (9)$$

From the results shown in Figure 4, we find that taxpayers with AGI above $10 million have, on average, more than 50% long-term capital gains in their total taxable income. Thus, the increase of the capital gain tax rate has a very large impact on such taxpayers. This figure not only gives us the decomposition of taxable income but also implies the complexity of our tax system.

Figure 4: Decomposition of Taxable Income



The right side of Figure 4 reports the total taxable income (indicated by the blue bar) and the taxable income after excluding long-term capital gains LTCG and qualified dividends

QD (indicated by the red bar), according to different AGI levels. The left side of the figure reports the ratio of long-term capital gains to taxable income.

Based on our calculation, the total tax increase would be $19.75 billion if the change in tax rates were made in 2010, which is in turn 57% of the previously calculated tax increase[8] ($34.56 billion as reported in Section IV.A). Figure 5 shows the comparison of tax increases due to the change in the top marginal tax rate on all taxable income (TI) and on regular taxable income (RTI) which is calculated by subtracting long-term capital gains LTCG and qualified dividends QD from IT.

Figure 5: Comparison of Tax Increase and Tax Increase Ratio due to the Change of Marginal Tax

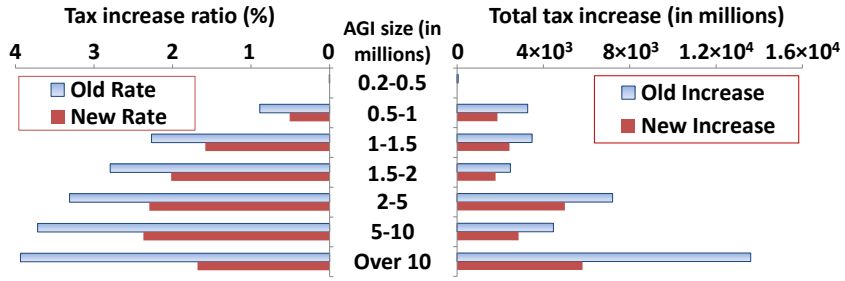


Figure 5 reports the total tax increase amount (on the right side) and the tax increase ratio (on the left side) due to top marginal tax rate change. The blue bar indicates the results calculated before excluding long-term capital gain income, and the red bar indicates the results calculated after excluding long-term capital gains and qualified dividends. The tax increase ratio is the ratio of tax increase amount to AGI.

Next we discuss the calculation of the increase in capital gain tax. For filers whose TI exceeds the top marginal tax rate threshold, we need to further check whether their RTI - income subject to the regular tax bracket - is smaller than the threshold[9]. If a filer's RTI exceeds the threshold, the capital gain tax increase is

[8] The results are reported in Section IV.A. When we calculate the tax increases due to the change in top marginal tax rate in Section IV.A, we treat all taxable income as regular income in which the long-term capital gains and qualified dividends were not calculated separately.

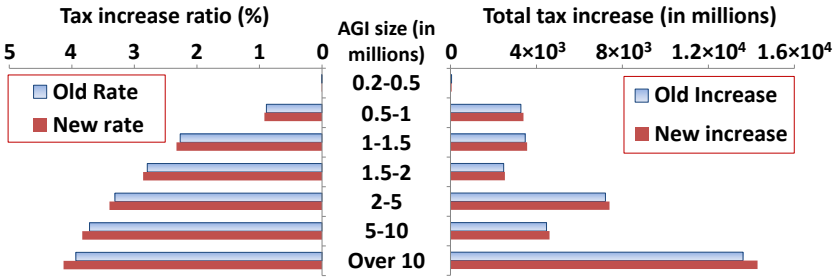
[9] The taxable income that is subject to the top capital gain tax rate of 20% is subject to the same thresholds that applied to the top marginal tax rate.

the long-term capital gain multiplied by 5%. If RTI is smaller than the threshold, only the part exceeding the threshold is subject to the tax rate increase. To illustrate the calculation procedure used to estimate tax increases due to the change in capital gain tax rate, we still use MJ returns with the AGI range of $500,000-$550,000 as an example. As mentioned in Section IV.A, there are 101,688 MJ returns in the example, with an average AGI of $522,265 and an average TI of $434,695. Approximately 12,000 returns in this AGI range exceed the threshold of the top tax rate with an average TI of $454,000. However, after decomposition of TI into regular taxable income and long-term capital gains, the average taxable income that is subject to the regular tax bracket is $394,453, which is below the threshold. An average long-term capital gain of this data pool is $40,242, and thus the 12,000 returns at the top marginal tax rate have a total in long-term capital gains of $483 million[10]. Then, we calculate the average portion of capital gains that are subject to the 20% tax rate as following:

$$\frac{454-450}{434.695-394,453} \times 100\% = 9.94\% . \quad (10)$$

Thus, we find the increase in capital gain tax is $2.4 million[11] for MJ returns with the AGI region of $500,000-$550,000.

Figure 6: Comparison of Tax Increase and Tax Increase Ratio due to the Change in Marginal Tax Rate and the Changes in Both of Marginal Tax Rate and Capital Gain Tax Rate



[10] $483 million is calculated as the average capital gain of $40,242 multiplied by 12,000 returns that exceed the threshold.

[11] 2.4 million is calculated as: $483 million x 9.94% x 5% = $2.4 million

Figure 6 reports the tax increase amount (on the right side) and the tax increase ratio (on the left side) due to top marginal tax rate change and due to the change in both top marginal tax rate and top capital gain tax rate. The blue bar indicates the tax increase amount/tax increase ratio due to the change in the top marginal tax rate; the red bar indicates the tax increase amount/tax increase ratio due to the changes in both the top marginal tax rate and the top capital tax rate. The tax increase ratio is a ratio of the tax increase amount to AGI.

Figure 6 shows the total tax increase (due to the top marginal and capital gain tax rate increases) and the ratio of tax increase to AGI. The total tax increase is $35.85 billion, $1.3 billion more than the tax increase calculated in Section IV.A. This is because the top marginal tax rate increase is 4.6% and the capital gain tax rate increase is 5%. Among the $35.85 billion tax increase, $19.75 billion of the tax increase is from the top marginal tax rate increase, and $16.1 billion is from the long-term capital gain tax rate increase.

C. Tax Increase on the Revival of PEP and Pease

The increase on the top marginal tax rate and the capital gain tax rate has a large effect on wealthy taxpayers. However, the revival of personal exemption phase-out (PEP) and limitation on itemized deduction (Pease) has a much more extensive impact on the U.S. tax system. PEP reduces the value of each personal exemption by 2% for each $2,500 above the AGI thresholds, and the Pease provision cuts itemized deductions by 3% of adjusted gross income above the AGI thresholds but not by more than 80% of the itemized deduction. The AGI thresholds of PEP and Pease are $250,000 for single filers (SG), $300,000 for married couples filing jointly (MJ) and qualified widow (QW) filers, $275,000 for

Figure 7: 2010 Tax Return Data on Personal Exemption, Itemized, and Standard Deduction by AGI Levels

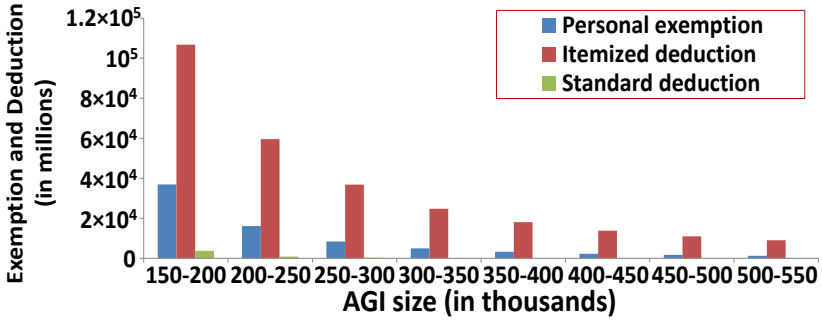


Figure 7 shows that the amount of itemized deduction, the personal exemption and standard deduction according to AGI levels.

head of household (HH), and $150,000 for married couples filing separately (MS). Figure 7 shows personal exemptions and deductions from 2010 returns with AGI from $150,000 to $550,000, in $50,000 increments.

Based on the requirement of personal exemption phase-out (PEP), we can calculate tax increase due to *PEP* for MJ returns with AGI above $300,000 as

$$\begin{cases} Empt\_Amt \times \dfrac{Avg\_AGI - 300}{2.5} \times 2\% & for\ 300 \le AGI < 425 \\ Empt\_Amt & for\ AGI \ge 425 \end{cases} \quad (11)$$

To simplify the calculation, we assume all exemptions are 100% actually used, which is very close to the real case of returns filed with AGI above $100,000. For MJ returns with AGI of $400,000-450,000, we find that 60% of them have AGI below $425,000, and an average AGI of $412,000. Thus, we have a tax increase of $2.05 billion[12] to this population. Next, we use the following formulas to calculate tax increase due to Pease provision for MJ returns with AGI above $300,000, which is the lesser of

[12] $2.05 billion is calculated as: [60% × (412-300)/2.5×2%+40%] × $2,187,239 = $2.05 billion.

$$\begin{cases} Num\_of\_itemized \times (Avg\_AGI - 300) \times 3\% \\ Num\_of\_itemized \times 0.2 \times Avg\_itemized \end{cases} \quad (12)^{13}$$

The total tax increase and tax increase ratio to AGI are shown in Figure 8. The total tax increases due to PEP and Pease are $16 billion and $32 billion, respectively. Figure 8 shows tax increase and the ratio of tax increase to AGI due to each major tax change of 2012, i.e., top marginal tax rate, top capital gain rate, PEP, and Pease. So, altogether, a tax increase of $84 billion will be expected if using the 2010 data.

Figure 8: The Decomposition of Tax Increase Amount and Ratio by Major Tax Changes in ATRA 2012

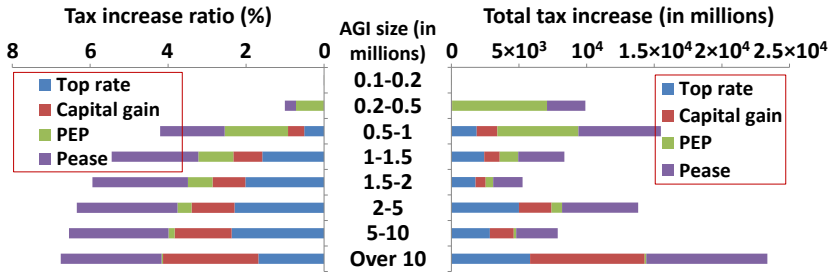


Figure 8 reports the total tax increase amount (on the right side) and the tax increase ratio (on the left side) due to the major tax changes of ATRA 2012—with top marginal tax rate change (in blue), capital gain tax rate change (in red), revival of PEP (in green), and Pease provision (in purple). The tax increase ratio is the ratio of tax increase amount to AGI.

D. Tax Increase Adjustment due to AMT

Thus far, the analysis of tax increase due to ATRA 2012 is still not complete since we haven't considered the impact of the

[13] Each taxpayer may have a very different itemized deduction that may change the relation between 2% of the itemized deduction and 3% of the AGI exceeding the threshold. However, due to the lack of information, we do not count it in our calculation.

Alternative Minimum Tax (AMT). AMT is a parallel to the regular tax system. Unlike the regular tax with progressive tax rates, AMT rates act more like that of a flat tax rate because it only includes two-tier rates—26% and 28%, and these were not previously indexed to inflation. ATRA 2012 made AMT indexed to inflation. We are informed from Figure 1 that an extremely large portion of taxpayers with AGI between $300,000 and $500,000 was subject to the AMT in 2010. In the next chart, we analyze the interaction of AMT effect on tax increases due to the new law.

The relationship between the regular tax liability and the tentative AMT calculated under the AMT system is a key to determine AMT liability. AMT results only when the tentative AMT exceeds the regular tax liability, and the amount of excess is the AMT liability. To calculate the tax increase due to the tax change in 2012, especially due to the top marginal rate change, we need to adjust the previous estimation by including the effect of AMT. Consequently, we divide all returns with a tax increase into four groups, A, B, C, and D. Here we define the 2010 regular tax as $\boldsymbol{a}$, the tax increase calculated previously as the original tax increase $\Delta\boldsymbol{a}$, and the AMT tax as $\boldsymbol{b}$.

To simplify the calculation and demonstration, the categorization of the four groups is based on two assumptions: (1) AMT tax will not change due to ATRA 2012; and (2) returns filed with standard deductions do not pay the AMT tax. Table 2 shows how AMT affects the calculation of tax increases due to the new law by categorizing tax returns into four groups. For example, Group C in Table 2 includes returns with AMT liability, but the tax increase in this group is offset by AMT because AMT results only when the regular tax exceeds tentative AMT. The last group (D) represents returns with AMT, and the amount of tax increase exceeds the amount of AMT. Therefore, the increase in regular tax eliminates AMT in group D under the new law.

After analyzing the AMT effect on the calculation of tax increases shown at Table 2, we utilize the following continuous functions to calculate the tax increase in group D

$$f(a,b) = \begin{cases} 0.05a & if\ a \le 1 \\ 0.45\left(\frac{a-1}{b-1}\right)^2 + 0.05 & if\ b \ge a > 1 \\ 1 - 0.5e^{1-a/b} & if\ a > b \end{cases} \quad (13a)$$

and

$$g(a,b) = \begin{cases} \frac{a^2}{2b} & if\ a \le b \\ \frac{3a-b}{4} & if\ 3b \ge a > b \\ a-b & if\ a > 3b \end{cases} \quad (13b)$$

where the function f describes the ratio of returns in group D to returns with AMT, and the function g estimates the average difference between the tax increase and the AMT in group D. The function is created based on the following assumptions: (1) a tax increase of $1,000 (***a***=1) will reduce 5% returns with AMT to zero AMT, i.e., 5% returns in group D; (2) a half returns with AMT tax are in group D and the average difference in group D is ***a***/2 when ***a***=**b**; and (3) when ***a*** is much larger than ***b*** (***a***> 3***b***), the average difference becomes ***a***-***b***. Thus the average tax increase in group D is estimated by: *AMT_Return_Number* × f × g.

Table 2: Grouping the AMT Effect on Tax Increases

Group (1)	A	B	C	D
Deduction (2)	Standard	Itemized	Itemized	Itemized
Original Tax Increase Δa (3)	MR + PEP	MR + PEP + Pease	MR + PEP + Pease	MR + PEP + Pease
Old AMT (4)	No	No	Yes	Yes
New AMT (5)	No, $a+\Delta a<b$	No, $a+\Delta a<b$	Yes, $a+\Delta a<b$	No, $a+\Delta a>b$
Tax increase (6)	Δa	Δa	0	$a + \Delta a$ - b

Table 2 describes how AMT affects the calculation of tax increase due to the tax changes in 2012 by categorizing the tax returns into 4 groups (Row 1). *a*=regular income tax liability; Δ*a*=the tax increase calculated previously; b=AMT. Row (2) indicates whether the group of returns takes standard or itemized deductions. Row (3) indicates the factors that cause the tax increase calculated previously.

MR denotes marginal tax rate change, PEP denotes personal exemption phase-out, and Pease denotes the limitation of itemized deductions. Row (4) indicates AMT under the old law; Yes and No tell us whether there is AMT liability to the group or not. Row (5) indicates AMT under the new law. Row (6) indicates the tax increase after taking AMT into the calculation.

The total numbers of return with the original tax increase ***a*** is $2.12 million. But after the inclusion of AMT, the total number of returns with a tax increase becomes $1.26 million. Figure 9 displays the total tax increase and the ratio of tax increase to AGI after considering AMT effect. The figures show that tax returns with AGI above $1 million are not much affected by AMT because the difference between the blue bar (indicating tax increase before AMT effect) and the red bar (indicating tax increase after AMT effect) is very small. Taxpayers with AGI above $10 million will face the largest tax increase of $21.7 billion, when compared to other taxpayers in different AGI levels, about 6.3% of their total AGI. After including AMT effect, the newly calculated amount of tax increases due to the new law is $68 billion, decreased from the $84 billion that was calculated before considering AMT.

Figure 9: Total Tax Increase Amount and Ratio Before and After the Interaction of AMT

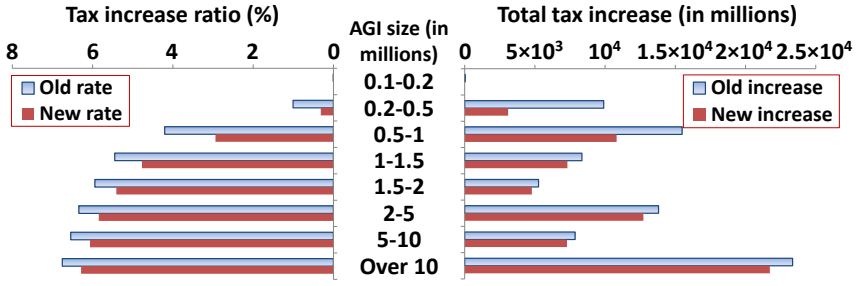


Figure 9 reports the tax increase amount (on the right side) and the tax increase ratio (on the left side) before and after the interaction of AMT by AGI levels above $100,000. The blue bar indicates the tax increase before AMT effect; the red bar indicates the tax increase after AMT effect.

V. RESULTS AND DISCUSSION

The total of individual tax revenue in 2010 was $952 billion according to IRS statistics. If we applied the new tax change in 2010, the tax revenue would have been $1,020 billion. Figure 10 summarizes the distribution of taxes and tax increases by the sizes of AGI above $100,000.

Figure 10: 2010 Tax and Tax Ratio vs. the Tax Increase Amount and Ratio due to ATRA 2012

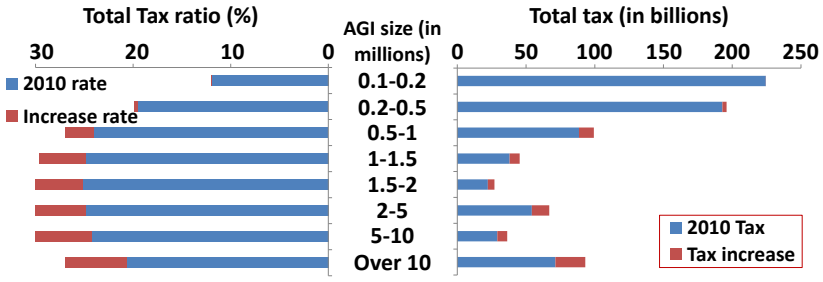


Figure 10 reports the tax amount and ratio if the ATRA 2012 had been enacted in 2010 by AGI levels above $100,000. The blue bar indicates the tax in 2010, and the red bar indicates the increase of tax and ratio due to ATRA 2012. The tax ratio is the ratio of tax to AGI. (The calculation is based on 2010 information).

Comparison of Tax Rate Distribution

We find that under the new law, taxpayers with AGI between $1 million and $5 million would have paid the highest tax rate, around 25%. Interestingly, under the old law, taxpayers with AGI above $10 million had similar tax rates to taxpayers with AGI between $200,000 and $500,000. This is largely due to the lower tax rate on long-term capital gains. We also find that under the new law, taxpayers with AGI above $10 million are among those with the largest tax increases compared to taxpayers with other AGI levels, that the rate of increase is more than 6% of their AGI, and that the average tax rate of this group becomes 27%. This is close to the tax rate of taxpayers with AGI between $0.5 and $1 million. The AGI size between $1 million and $10 million now has the largest tax rate, more than 30% of their AGIs.

Evaluation of Tax Changes

The increase on the capital gain tax rate has a large impact on taxpayers with AGI above $10 million. The change in capital gain tax brings new tax revenue of $8.5 billion from those taxpayers—about 2.45% of their AGI. It is also the main factor that helps to increase the tax rate on these extremely high-income taxpayers. PEP has almost no influence on these high-income filers, but it is the largest factor for the tax hike on taxpayers with AGI between $0.5 and $1 million. The Pease provision and the increase in top marginal tax rate, on the contrary, have a large influence on all filers with AGI above $1 million.

Interaction Effect of AMT

The new tax change has a profound influence on the AMT system. It accelerates the process of AMT being a middle class tax. The regular tax increase offsets the AMT tax liability of many high-income taxpayers. On the other hand, the majority returns that report AMT (about 3 million tax returns with AGI between $100,000 and $400,000), are still subject to AMT under the new tax law.

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