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The Devil is in the Details:  
A Comparison of the Corporate Average Effective Tax  
Rate Calculations Used by Government Agencies

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THE DEVIL IS IN THE DETAILS:  
A COMPARISON OF THE CORPORATE AVERAGE EFFECTIVE TAX RATE  
CALCULATIONS USED BY GOVERNMENT AGENCIES

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*I investigate the sources of differences among corporate average effective tax rates (AETR) published by several government agencies including Treasury, the Congressional Research Service, the Congressional Budget Office, and the Government Accountability Office. I also extend and investigate the time series AETRs published by Alan Auerbach, whose methodology is the basis for the CRS methodology, and extend the CRS estimates as well. Some important sources of differences in measured AETRs include: whether losses are netted against profits in the income measure, what sources of data are used for the income and tax measures, whether financial firms are included in the calculations, whether foreign income is included, and how any adjustment for the inflation induce erosion in the value of debt is calculated. Business cycle fluctuations greatly accentuate the differences in measured AETRs caused by difference in methodologies; while different methodologies produce relatively similar AETRs in non-recession years, small methodological differences can cause large disparities in measured AETRs during a recession, primarily due to the large increases in losses during these times.*

Keywords average effective tax rates, government agencies  
JEL Classification codes: H20, H60

## **I. Introduction**

The purpose of this analysis is to compare and contrast six publicly available average effective tax rate (AETRs) measures with the goal of documenting the sources of differences across AETR measures, and how these differences impact the size of the AETRs. The average effective tax rate measures under consideration are measures used by government agencies including the Congressional Research Service (CRS), the Congressional Budget Office (CBO), the Government Accountability Office (GAO), and the U.S. Treasury Department (Treasury). We also extend and analyze the published AETR measure of Alan Auerbach, on which the CRS estimates are based, through 2013. We represent the results of GAO by presenting the AETR computed by Lyon (2013), which adjusts and extends the GAO AETR. By documenting the differences in the above AETR measures and demonstrating how quantitatively meaningful the differences are, we will better understand how to choose the best AETR measure for any given analysis. This paper is divided into four additional sections. In the next section, we provide a very brief overview of some of the AETR literature and outline the history of the AETRs constructed by these government agencies. Then we provide a brief description of AETR construction and we quantify and compare the agency AETRs. Next, we show how differing assumptions would alter them. Finally we will conclude.

## *II. Literature review*

As has been documented extensively in the literature, effective tax rate measures can be divided into two broad groups – average effective tax rates and marginal effective tax rates. Average effective tax rates, which are the focus of this study, are defined as actual taxes paid divided by actual pretax capital income. They can be useful for characterizing the overall tax burden imposed by the tax system, and how it is changing over time, and in this sense are useful for measuring the equity of the tax system.<sup>1</sup> Much of the accounting literature

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<sup>1</sup> Marginal effective tax rates are defined as a change in tax for a given change in income, and are computed as the expected pretax rate of return minus the expected after-tax rate of return on a new marginal investment, divided by the pretax rate of return. They are useful for measuring the

on AETR's focuses on proper measurement of average effective tax rates. For example, Callihan (1994), Spooner (1986), Omer Molloy Ziebart (1991), and Plesko (2003) all discuss alternative effective tax rate measures and highlight the limitations of using financial statement data, particularly measures of tax expense, to estimate average effective tax rates. Reviews of this literature and the AETR measures are provided by Callihan (1994) and Plesko (2003).

By contrast, studies from the tax economics literature tend to focus on patterns of AETRs over time or across countries in an attempt to understand issues such as global competitiveness or corporate tax evasion. For example, Auerbach and Poterba (1987) and Auerbach (2006) decompose the changes in corporate tax revenues into changes in corporate profitability versus changes in AETRs, and then look to the sources of changes in AETRs. They conclude that changes in capital cost recovery provisions and changes in incidence of net operating losses and use of net operating loss deductions (NOLDs) caused declines in corporate AETRs. Mackie (1991) concludes that high profitability and concomitant low importance of NOLD's drives the pattern of corporate tax receipts and corporate AETRs during the 1990s. Desai (2003) investigates the divergence between book income and tax income, and includes that the observed changes are consistent with tax sheltering behavior. He provides a helpful review of the literature on corporate profits and tax revenues.

The estimation of effective tax rates by government agencies dates back several decades. The Joint Committee on Taxation published AETR estimates (measured as current tax expense over pretax book income) at the request of Congressmen Pease and Dorgan in a study published in 1983, and GAO followed this methodology to produce AETRs in studies published 1990 and 1992. But the methodology was heavily criticized because it included foreign income in the denominator but failed to account for foreign taxes paid in the numerator. Subsequently GAO published a study using a revised methodology in 2008. The most recent government agency effective tax rate measures - which are the subject of this

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incentive effects of tax laws on a given investment; or stated differently, for measuring the efficiency of the tax system. Fullerton (1983) provides a helpful summary of different effective tax rate measures, their measurement, and their appropriate application.

study – were estimated by CRS, CBO, GAO, and Treasury, and the Lyon etr is an extension and correction of the most recent GAO estimate.

### *III. Conceptual Construction of AETR's by Auerbach, CBO, CRS, Treasury - AETR Comparison*

Defining an effective tax rate measure involves choosing the definition of income and tax liability for the measure and choosing the data source for the measure. Sometimes these choices are driven by data availability (single year versus multi-year), or by the nature of the inquiry (cross country versus domestic). But often these choices are spurious, and these spurious differences can sometimes lead to meaningful discrepancies in measured AETRs. Table One identifies some major decision points in choosing an AETR measure, and describes the choices made by Auerbach, Treasury, CBO, and CRS , and GAO/Lyon.<sup>2</sup> The impact of these different choices on the reported AETRs can be seen graphically in Figure One. While nearly a 30 year time series is available for Auerbach, CBO, and CRS, the Treasury and GAO/Lyon AETR time series spans a shorter horizon of 6 years. We extended the Auerbach AETR measure from 2003 (last published) to 2012 and the CRS (last published 2009) to 2012.<sup>3</sup>

In the earlier years of the sample period, the Auerbach, CBO , and CRS time series appear quite similar. However, over time, particularly during recession periods, the Auerbach measure differs significantly from CBO and CRS. Most obviously, in 2008, the Auerbach AETR rises to a value of almost 80%. Then in 2009, Auerbach's tax rate is incomputable (because aggregate book income is negative).<sup>4</sup> As can be seen in Table One . one difference between the Auerbach and other measures is that Auerbach uses adjusted tax based income as the denominator while the others use NIPA income or m-3 book income. The Auerbach income has the potential to fluctuate more than NIPA income or m-3 income over the business cycle for three reasons. First, there are a large number of reported

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<sup>2</sup> Appendix one discusses the choices in greater detail. Note that GAO/Lyon presents a variety of AETR measures, but we focus on two for this comparison: primarily actual tax paid divided by positive-only pretax "book" income, and primarily actual tax paid divided by pretax book income-net-of-losses, where primarily actual tax paid includes federal tax liability, state and local tax expense, the current book provision for foreign income tax, the section 78 gross up for foreign income tax, and foreign withholding tax.

<sup>3</sup> Thank you to Alan Auerbach, Anne Moore, and Mark Keightley for providing detailed methodology and original data which made these extensions straightforward.

<sup>4</sup> The etr would actually be negative; due to positive tax liability and negative aggregate income. Positive taxes with negative income result from restricted loss refundibility. The netting of losses from income can therefore sometimes lead to unanticipated results – large losses relative to income combined with greatly restricted refundibility of those losses generates negative etrs.

nondeductible tax losses in recession periods which greatly reduce income without a corresponding reduction in tax in the current period (even after accounting for carryback refunds). Second, as seen in Table One, Auerbach's income includes capital gains realizations, which fluctuate over the business cycle, while the others do not. Finally, as also can be seen in Table One, Auerbach's tax based income includes the tax deduction for bad debt, which tends to be large in recession periods, while NIPA income does not, and m-3 income includes a smaller (book) deduction for bad debt.

The increased divergence among the AETR measures during a recession is also seen around 2001. Also, CBO's AETR falls increasingly below the CRS and Auerbach measures over time. As seen in Table One, CBO does not remove S corporations from their income measure, but taxes associated with S corporations are not in the corporate tax numerator. S corporations comprise an increasing share of corporate income over time, so this could explain why the CBO AETR falls further and further below the AETR measures which exclude S corporation income from the income base.

As seen in Table One, another "choice variable" governing the AETR definition is inclusion of only firms with positive only versus inclusion of both firms with positive and negative income. Other things equal, AETRs which use positive only income in the denominator, such as the Treasury measure and a few of the GAO/Lyon measures, will be smaller than those which include net income and losses, particularly during recession periods. An AETR which uses positive only income highlights the impact of tax incentives such as accelerated depreciation and tax credits on the tax rate paid by profitable firms. If we believe that in a long run steady state, a given corporation must eventually make positive income or go out of business, then AETRs which use positive income might be better approximations to a steady state AETR. Although steady state AETRs are by nature a theoretical construct, they are useful for policy making because they allow us to abstract from the impact of macro-economic influences and focus more on the impact of policy in determining the AETR.

By contrast, an AETR which nets losses from income highlights the impact of partial loss refundability. Partial loss refundability under current law implies that current year losses typically are not able to be immediately used to obtain a full refund.<sup>5</sup> Hence partial loss refundability results in higher AETRs than would occur if losses were fully refundable. Therefore, this AETR quantifies the tax burden or penalty imposed by partial loss refundability, and demonstrates how this burden changes over time. It also highlights how business cycle driven losses differ across industries and companies. This contrast can be seen by comparing the GAO/Lyon m-3 based income measures which (as reported in Table One) net losses from positive income to the analogous GAO/Lyon and Treasury positive only measures. The positive net negative AETRs are also lower than the measures which use adjusted tax based income and those which use NIPA income (excluding s corps). We will investigate the cause of this discrepancy below.

### *Sensitivity Comparisons*

In order to demonstrate how particular choices impact measured AETRs, we conduct a sensitivity analysis in which we re-compute some of the AETR's, isolating the impact of a single Table One "choice variable". The particular assumptions of interest are: the choice of NIPA versus adjusted tax based income; the choice of positive only income versus positive income net of losses; the choice of domestic only income versus domestic plus repatriated foreign income; the choice of whether to include or exclude back taxes and carryback refunds in the numerator; the choice of whether to include or exclude financial corporations; and finally, the choice of whether to include the inflation induced erosion in the value of debt or not.

### NIPA data vs Other Data

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<sup>5</sup> An immediate refund can only be obtained to the extent the corporation has sufficient positive income to offset the loss in one of the two previous years. Otherwise, a refund cannot be obtained until a future year in which the corporation has positive income.

The impact of choosing NIPA data versus adjusted tax based income is captured in Figure Two. The Auerbach numerator is used in two of the AETRs presented, but in one of the AETRs, the CRS NIPA income measure is used, while in the other the Auerbach tax adjusted income measure is used. Finally, the CRS AETR is included for comparison. The NIPA based Auerbach measure is very similar to the CRS measure. The use of tax adjusted versus NIPA data appears to explain nearly all of the discrepancy between the CRS and Auerbach AETRs.

### Positive Only vs Positive Net of Negative

Using positive income versus positive income net of negative income in the denominator of the AETR can have a significant impact on the AETR. To gauge the impact, we re-compute the Auerbach and CRS AETR measures using positive income by adding tax losses into Auerbach's profit measure.<sup>6</sup> In order for the numerator to be consistent with the positive only income, we add back the tax value of the net operating loss deductions. This version of Auerbach's AETR is displayed in Figure Three. Generally, the AETRs based on positive income look very similar to those based on positive income net of losses, though the AETR based on positive income net of losses is always higher than the positive only AETR because of the restricted refundability of losses discussed above. However, in periods of recessions such as 2001 and even more so 2009, the two rates diverge substantially (by 15 percentage points or more). The AETR measure which uses positive income in the denominator abstracts from the combined effect of unusually high tax losses and restricted loss refundability on the AETR. By contrast, the measure which uses income net of loss in the denominator highlights this impact of the AETR.<sup>7</sup>

### Domestic Only vs Domestic and Foreign

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<sup>6</sup>Note that some portion of `iva` and `ccadj` accrues to firms with negative tax profits and therefore should be removed for perfect representation of positive only income. However, we do not know what portion of `iva` and `ccadj` accrues to negative income firms, and an ad hoc adjustment would likely not be appropriate b/c it probably varies by industry. Therefore we do not adjust for this fact. So "adjusting" to create positive only income means adding back tax losses. This is not the same as isolating only those taxpayers with positive book income (which could be done with schedule m-3 data), but hopefully it is a reasonable proxy.

<sup>7</sup>Note that in some years GAO's `aetr`'s based on m-3 book income net of book losses are – like Auerbachs – incomputable because of negative book income. However, m-3 income is negative in 2008 while Auerbachs are negative in 2009. It is not clear why these data are different.

As reported in Table One, CRS, CBO , and Auerbach income measures include domestic only income and taxes, while Treasury and GAO measures include domestic income and repatriated foreign source income and the associated taxes. We re-compute the Auerbach ETR, adding foreign taxes associated with repatriated foreign source income to Auerbach’s numerator (similar to Treasury), and adding repatriated foreign source income to Auerbach’s denominator.

The changes smooth and reduce the AETR, especially during recession periods, because the ratio of foreign source losses to foreign source income is considerably smaller than is the ratio of domestic losses to domestic income. However, an AETR based on domestic plus repatriated foreign source income is in practice more similar to a domestic AETR than to a true worldwide AETR; the United States taxes repatriated foreign source income and provides a credit for foreign taxes paid, but in almost all cases, the statutory U.S. tax rate exceeds the foreign tax rate and therefore the US tax system determines the total AETR on this income. None of these AETR measures represents a true worldwide AETR ; that is, all foreign and domestic taxes imposed on the worldwide income of all U.S. owned corporations. True worldwide AETR’s are difficult to construct with m-3 or NIPA data due to the lack of availability tax expense associated with the foreign income. Appendix Two presents a simplified worldwide AETR for the domestic versus foreign source income of US corporations, and also touches on some of these data issues.

#### Tax Variables Included in the Numerator

The fourth choice involves investigating alternative specifications of taxes in the numerator. As reported in Table One, Auerbach, uses 1120 reported total tax less credits for taxes paid. CRS uses nonfinancial nonfarm state local and federal tax receipts data from the Flow of Funds. These data are originally from IRS data, but because the Flow of Funds data report federal state and local taxes together, CRS must scale

them to include only federal taxes.<sup>8</sup> Further, Auerbach and CRS add backtaxes and carryback refunds into the numerator, while CBO, GAO/Lyon, and Treasury do not. Adding backtaxes and carryback refunds provides a complete picture of the total taxes received by the US government in a given year, but it also increases the inter-temporal component of the AETR measure, since backtaxes and carryback refunds are associated with tax liabilities' from other years.<sup>9</sup> CBO abstracts from such issues and uses a measure of total tax less credit in a given year. Treasury uses Form 1120 reported total tax less credit plus Form 1118 reported foreign taxes paid (on repatriated income); but also abstracts from back taxes and carryback refunds, and, as mentioned previously, adds back in the tax value of NOLDs. As is seen in Figure Five, excluding versus including backtaxes and carryback refunds doesn't make much of a difference to the AETR measures, except, around the 2001 the recession. Backtax and carryback refund data move in opposite directions; that is, backtaxes increase liability and carryback refunds decrease it. In non recession years the two tend to net over time, but in recession years carryback refunds are high relative to back taxes and hence the combined impact of including these variables in taxes paid is negative.

### Financial Only Measure

Financial firms generate little receipts type income, which raises a question as to whether standard effective tax rate calculations are appropriate for these firms. So researchers sometimes abstract from this issue by focusing exclusively on nonfinancial firms, which represent the majority of firms, income, and assets. But according to NIPA data, financial firms comprise an increasingly large fraction of total income – the financial industry comprises more than a third of total income throughout most of the 2000's. We demonstrate the impact of including versus excluding the financial sector on the AETR by re-computing the domestic NIPA based AETR with and without the financial sector. Figure Six presents these

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<sup>8</sup> This difference tends to make CRS taxes slightly smaller than Auerbach taxes.

<sup>9</sup> That having been said, nearly every etr has some intertemporal component, since even year t liability has some intertemporal component – for example, some of year t's deductions will involve investments made in prior years, any net operating loss deduction or credit carryforward originates from other years liabilities.

AETRs.<sup>10</sup> Notice that including financial firms generally does not alter the time series pattern of the AETR, but it generally reduces the estimated AETR, between 1 and 5 percentage points. The industry level data suggests that this is due at least in part to the fact that financial companies have relatively fewer losses than nonfinancial companies. This probably explains in part why the GAO/Lyon income net of loss measure falls below the CRS AETR measure.

#### Corporate versus NonCorporate Income

When examining the tax rate on corporate income, removing S corporation income from NIPA or SOI “corporate” income measures is appropriate, since the taxes associated with that income are not part of the corporate tax base. However, NIPA does not separately estimate economic income for S corporations; hence it must be estimated from published SOI sources if it is to be removed from the data. Ideally, a separate tax rate for non-corporate entities including S corporations and partnerships would be estimated. In combination with the c corporation AETR, this non-corporate AETR would provide a more complete understanding of business entity taxation. Estimating of non-corporate business AETR’s is uncommon, because it can be difficult to determine the total taxes paid at the individual level which are associated with the pass through entity income. But additional work in this area would be beneficial, particularly because of the strong increase in business activity in pass through entities rather than in corporate form.

#### The Inflation Induced erosion in the value of debt

Auerbach (1987) and Mackie (1991) argue that in order to properly measure economic income, one must include as income the transfer from bond holders to equity holders that results from the fact that inflation erodes the real value of debt. Auerbach measures this gain as the percentage change in the GNP deflator times the market value of gross nonfinancial credit market debt.<sup>11</sup> CRS measures the gain as the net of book value of total financial liabilities times the change in the CPI. Figure Seven shows the CRS and

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<sup>10</sup> BEA does not separate rest of world profits by industry hence it is difficult to compare total worldwide profits including and excluding the financial sector.

<sup>11</sup> Auerbach constructs the market value of nonfinancial debt starting from book value of credit market instruments in the Flow of Funds data. See Auerbach (1987) for additional details.

Auerbach measures with and without the adjustment included. The two measures of the adjustment are quite different, and hence impact the CRS versus Auerbach estimates very differently. The CRS adjustment has only a small impact on the AETR, and the impact declines over time. The Auerbach adjustment has a substantial impact on the AETR. This impact increases over time, and is at its greatest in the 2008 recession. CRS's use of total net liabilities is somewhat inconsistent with their overall approach, given that a large portion of total assets and liabilities are foreign assets and liabilities, but CRS does not include foreign income in their income measure. It is the use of these *total* net liabilities that causes the CRS adjustment to be extremely small. If CRS instead used *credit market* net liabilities, the adjustment would be somewhat larger, though not as large as Auerbach's. Again, Auerbach uses market value of gross credit market liabilities – both the use of market value rather than book value and the use of gross liabilities rather than net liabilities tend to make the Auerbach adjustment larger than the CRS adjustment, especially in recent years. Ironically, because of the other differences between the two estimates, a more similar inflation adjustment would end up making the two AETR's less similar, either by reducing the CRS AETR further or increasing the Auerbach AETR more. Treasury, CBO, and GAO/Lyon do not include this adjustment.

#### Treasury M-3 Based AETRs versus GAO/Lyon M-3 based AETRS

Finally, we provide a more detailed comparison of the Treasury and the GAO/Lyon AETRs, which both use m-3 income in the denominator, but which use different tax measures and different levels of data aggregation for the AETR computations. As described above, we use Treasury's methodology to derive annual AETRs for the 2006-2011 time period, so that they can be compared to the GAO/Lyon AETRs which use the same m-3 income data. We also extend the methodology to compute "Treasury AETRs" which include loss firms as well as positive income firms in the denominator of the AETR, so that they can be compared to the GAO/Lyon "positive net negative" AETRs. These results are displayed in Figure Eight. Notice that both the positive only Treasury AETRs and the "positive net of negative" Treasury AETRs are very close to their GAO/Lyon counterparts, which suggests that neither the differences in

measures of tax numerators nor the differences resulting from Treasury’s micro-level “data cleaning” meaningfully alter the aggregate AETRs.

## *V. Conclusions*

Though it overly ambitious to devise a single “best” AETR measure, we offer some broad conclusions based on the patterns we observed in this analysis. First, recessions accentuate differences across AETR measures. Including versus excluding loss firms, backtaxes, the adjustment for the inflation induced erosion in the value of debt, and alternative income measures, causes much bigger disparities in computed AETRs during recession years than during nonrecession years.

Second, AETRs computed using positive income in the denominator probably provide the most information about the general burden imposed by the tax system; while AETRs which use positive net of negative income highlight the burden imposed by the partial refundability of losses. When using positive income in the denominator, it is better to add back the tax value of losses into the numerator, so that the measure truly focuses on the impact of the tax system on positive income, abstracting from losses.

Third, although time series AETR’s highlight the impact of the business cycle, AETRs computed using the average of several years of data smooth ad hoc fluctuations and hence also might be better for comparing tax burdens across industries. Fourth, because m-3 data is explicitly designed to reconcile financial and taxable income at the entity level and is inherently linked to entity level taxes paid data, it is arguably better suited for AETR calculations than is the aggregate NIPA measure or the adjusted taxable income measure (which, as mentioned above, include tax income concepts like the bad debt deduction and capital gains realizations).

That having been said, the fact that m-3 is a large-firm sample does leave the possibility that the AETRs are not representative of the universe of firms, especially when considering losses, since, as noted previously the large firms in m-3 constitutes 70%-80% of income but only 60% of losses.<sup>12</sup>

Fifth, perhaps an AETR measure should be devised specifically for financial firms. However, since financial firms constitute a large fraction of income, it seems reasonable to compute AETRs for the finance industry using the standard measure, rather than excluding them from the computation. Sixth, as was demonstrated above, inclusion versus exclusion of backtaxes and carryback refunds does not impact AETRs significantly (in part because the two cancel). But using current year backtaxes and carryback refunds as a proxy for the backtaxes and refunds that will be associated with current year liability seems reasonable. Seventh, it also seems reasonable to include a measure for the gain to equity holders resulting from the inflation induced erosion in the value of debt, though it can meaningfully increase the AETR even in nonrecession years.

Finally, it would be ideal to measure the worldwide AETR including both foreign and domestic taxes and income, and then further subdivide this worldwide AETR into its domestic and foreign components, in order to better understand the relative burdens imposed on U.S companies by the U.S. versus foreign tax systems. It would be helpful to examine this issue further at a more disaggregated level using m-3 data and Compustat data.

In summary, the Auerbach, CBO, CRS, and some of the GAO/Lyon measures highlight the significance of the partial refundibility of losses and the impact of the business cycle on AETRs; and Auerbach and CRS also include additional detail (backtaxes and carryback refunds) which only appear to make a

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<sup>12</sup> We could test the generality of the m-3 based aetrs by calculating aetrs by size class using tax adjusted data (or “worldwide” data for firms with only domestic income) and inferring the “m-3 based” aetrs for smaller size classes from the relationship between the m-3 based aetr and the tax adjusted aetr for the m-3 comparable size class. We could also compare the m-3 based aetrs using positive income net of negative income to the Auerbach, CBO, and CRS aetrs’ (which include the universe of firms and use positive net of negative income in the denominator) to see if they are representative/comparable.

difference in recessions. The Treasury measure and other of the GAO/Lyon measures abstract from this issue to highlight the more general burden imposed by the tax system on firms when they are profitable.

Table One: Choices in Income and Tax Measures Across Different AETR's

	Auerbach	Treasury	CRS	CBO	GAO/LYON
Data for Income Measure	IRS Form 1120, adjust for CCADJ & IVA	M-3 worldwide income of tax consolidated group	NIPA	NIPA	M-3 worldwide income of tax consolidated group
Include or Exclude Realized or Accrued Gains	include	exclude	exclude	exclude	exclude
Include Bad Debt Deduction in Income Measure?	yes	yes, but smaller than the tax deduction	no	no	yes, but smaller than the tax deduction
Include an adjustment for the misreporting of income?	no	no	yes	yes	no
Inflation Adjust Inventories?	yes	yes	yes	yes	yes
Positive Income only or Positive Net of Negative Income?	positive and negative	positive only	positive and negative	positive and negative	done both ways
Treatment of NOLDS	add nold back to income measure	add tax value of nold to numerator	nothing	nothing	nothing
Domestic Only Income or Domestic + Foreign Income?	domestic only	domestic + repatriated foreign	domestic only	domestic only	domestic+repatriated foreign source income
Federal Only Taxes or Federal, State and Local Taxes?	IRS tax data - federal only	IRS tax data – federal only	IRS tax data – federal only	IRS tax data – federal only	both ways, but book tax expense data
Include Back Taxes and Carryback Refunds?	include	exclude	include	include	exclude
Sample Size	universe	companies with >\$10 million assets	universe	universe	companies with > \$10 million in assets
Nonfinancial Only Companies or Financial and Nonfinancial Companies?	nonfinancial	financial and nonfinancial	nonfinancial	financial and nonfinancial	financial and nonfinancial
Include S corporations?	removed	removed	removed	included	removed
Include Adjust for the Inflation Induced Erosion in Value of Debt?	yes	no	yes	no	no

**Disclosures**

The author has no financial arrangements that might give rise to conflicts of interest with respect to the research reported in this paper.

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## Appendix One:

### Discussion and Comparison of Auerbach, Treasury, CBO, CRS, and GAO/LYON AETRs

The Auerbach, CRS, and CBO methodologies are all relatively similar – each measure is a time series aggregate measure of the AETR, which includes the universe of firms and which uses pretax domestic-only income net of losses as the income measure. The biggest difference among these measures is that Auerbach creates an “adjusted” tax based income measure – by starting with tax data for pretax income and adding the capital consumption adjustment and the inventory valuation adjustment to proxy economic income. CRS and CBO use NIPA’s measure of pretax economic income. The capital consumption adjustment and the inventory valuation adjustment accounted for important differences between NIPA “economic” income and tax income. But other differences between tax income and NIPA income are also important and hence adjusted tax based income can differ meaningfully from NIPA economic income and from financial statement income. For example, NIPA income does not include a deduction for bad debt expense (while adjusted tax based income does); NIPA income does not include capital gains income (while adjusted tax based income does), and NIPA includes an adjustment for misreported income (ie tax evasion), while adjusted tax based income does not. Appendix OneA contains additional details concerning how these income measures differ from one another and from financial accounting methods that companies use in their financial statements.

The pretax domestic only income measure used by Auerbach, CRS, and CBO, includes profits of US and foreign companies earned on US soil - and therefore excludes both repatriated and deferred foreign earnings of US companies. By contrast, the GAO/Lyon and Treasury income measures start with the financial accounting book income measure for the tax consolidated group reported by companies on schedule m-3 of the 1120.<sup>13</sup> Financial income of the tax group includes domestic income as well as any repatriated foreign source income.<sup>14</sup> But it excludes the deferred foreign income of US firms, which is large, and which are likely taxed differently than the repatriated foreign source income.<sup>15</sup> In fact, the domestic plus repatriated foreign source income AETR is probably more comparable to the domestic AETR than a worldwide AETR because repatriated foreign source income is in practice subject to the

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<sup>13</sup> The tax consolidated group refers to the entities who file together as a US taxpayer; the income of this group includes domestically earned income and repatriated foreign source dividends, interest, royalties, and other income. Schedule m-3 also reports financial accounting book income of the GAAP consolidated group. The GAAP consolidated group refers to all the entities owned by the U.S. taxpayer; the income of this group includes domestic income and the earnings and repatriated as well as deferred profits of controlled foreign corporations owned by U.S. parents, but it excludes intercompany payments such as interest and royalties, which are a debit to the foreign entity and a credit to the U.S. parent (and hence net to zero).

<sup>14</sup> The pretax income of the tax consolidated group can be computed using m-3 data, but the tax expense associated with deferred income is not reported on the m-3 and therefore pretax income of the worldwide (GAAP consolidated) group cannot be computed from m-3 data. It is our goal ultimately to supplement m-3 data with other data sources so that an aetr based on the worldwide income of the GAAP group can be created.

<sup>15</sup> Companies tend to repatriate their higher tax income in order to use the foreign tax credits to shield other foreign income from tax. Companies do not tend to repatriate their low or zero tax income; instead they take advantage of the benefits of deferral for this income.

same statutory tax rate as domestic income. Hence it can be viewed as a slightly more comprehensive “domestic” AETR measure which captures the total domestic and foreign tax rate on all income subject to US taxation in the current period.<sup>16</sup>

The m-3 income measure is an after tax income measure; hence GAO/ Lyon, and Treasury add m-3 reported current and deferred federal, state, and local book tax expense, as well as foreign current and deferred tax expense and foreign withholding tax expense, to the income measure to obtain pretax income. However, as noted in Lyon (2013), m-3 does not report the tax expense associated with voluntary repatriated dividends. Treasury proxies this value by including the taxes paid associated with voluntary dividends. GAO originally omitted this portion of tax expense entirely (from both the numerator and the denominator) and their AETR is misstated for this reason. Lyon corrected this misstatement by adding the section 78 gross up (which includes taxes associated with both voluntary and “deemed” repatriations). But taxes associated with “deemed” repatriations should not be included, since the income on which those taxes are paid is not part of the AETR income base. However, previously taxed income (PTI), which is income from prior year “deemed repatriations”, is part of the AETR income base. One could view the inclusion of taxes paid on deemed repatriations as a proxy for taxes paid on PTI. But PTI averages roughly 40% of deemed repatriations across the sample period, hence it is not a good proxy. For this reason Treasury excludes the taxes associated with deemed dividends from the numerator, which implicitly assumes zero taxes paid on PTI. The bottom line is that the GAO/Lyon AETR is slightly overstated (perhaps by 2 percentage points) while Treasury is slightly understated (perhaps by one percentage point).<sup>17</sup>

Another difference between CRS, Auerbach and CBO on the one hand, and GAO/ Lyon and Treasury on the other is that the schedule M-3 data used by GAO/Lyon and Treasury is only filed by taxpayers with greater than 10 million dollars in assets, and hence the AETRs using these data are only for large firms, while the Auerbach, CRS, and CBO datasets in principle includes the universe of c corporation companies. This sample selection issue could skew the values of the net income AETRs; for example, the large firms represented in schedule m-3 hold 70% to 80% of total positive U.S. taxable income but only 60% of negative U.S. income. This implies that all else equal, the positive net of negative AETR’s for the m-3 sample will be lower than the positive net of negative AETRs for the universe of firms. Note that this

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<sup>16</sup> If on average companies pay systematically higher foreign taxes than the US statutory rate of 35%, the domestic+repatriated aetr would be higher than the domestic etr. But this is typically not the case.

<sup>17</sup> Subpart F of the Internal Revenue Code mandates that current taxes be paid on certain passive and highly mobile deferred foreign income, even if that income is not currently repatriated. “Deemed” repatriations represent this passive and mobile deferred foreign income on which taxes must be paid currently. Since deemed repatriations are not actual repatriations, this income is not included in the income base of the Treasury or GAO/Lyon tax base, but taxpayers can repatriate this income at a later tax without tax consequences. These subsequent repatriations constitute PTI.

does not imply that larger firms pay lower average effective tax rates on positive income; but instead reflects the fact that larger firms have proportionally more positive income. As will be discussed below, the restricted refundability of losses often implies that positive net of negative AETRs exceed positive only AETRs.

Treasury measures the AETR using only positive income, while (as described above) GAO/Lyon present measures using only positive income as well as using positive income net of losses (like CRS, CBO, and Auerbach). However, Lyon argues that netting losses from income is more appropriate for an AETR measure, and so he focuses more on this measure.

But netting can lead to “unusual” results such as AETRs in excess of one or undefined (negative) AETRs, particularly during economic downturns, when the impact of partial loss refundability on the AETR swamps all other aspects of the AETR. It is therefore useful to examine both types of AETRs to get a complete sense of the impact of the tax system of the tax rate paid by firms.

With respect to taxes, CBO, CRS, and Auerbach use some variant of domestic federal taxes paid, and Treasury uses the federal taxes paid on domestic plus repatriated foreign source income, but removes the portion of domestic tax associated with residual taxes on subpart F income . As mentioned previously, GAO/Lyon use primarily actual taxes paid, and this measure is somewhat more comprehensive than the others because it includes state and local income tax expense and foreign taxes and tax expense.<sup>18</sup> Taxes paid are typically considered superior to book tax expense for the numerator of the AETR because book tax expense incorporates many accounting rules which imply that tax expense does not necessarily mimic what companies pay each year. In addition, as mentioned above, Lyon (2013) notes that foreign tax expense reported on schedule m-3 of the corporate tax return does not include all foreign taxes paid, and so the section 78 gross up must be added to tax expense to create a better proxy of total foreign taxes paid. But the section 78 gross up overstates the foreign taxes paid that are associated with repatriated foreign source income. This is because the section 78 also includes foreign taxes paid that are associated with subpart F income, which is not actually repatriated and therefore is not actually included in the denominator of the AETR. Also, there are residual US taxes associated with subpart F income which also ought to be removed from the numerator of the AETR. These taxes comprise on average about 1% of total US taxes paid. Removing the section 78 taxes associated with subpart F income and the residual tax

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<sup>18</sup> State and local income tax expense in 2007 is approximately 10% the size of U.S. federal income tax expense. Primarily actual tax uses taxes paid where available; rather than tax expense. It is typically smaller than total tax expense.

associated with subpart F income would reduce Lyon's effective rates approximately 2 to 3 percentage points.

There are other differences between the Treasury and GAO/Lyon measure on the one hand and Auerbach, CBO, CRS, on the other hand. The Treasury AETR adds back the tax value of net operating loss deduction to the numerator (NOLD), while none of the other measures do so.<sup>19</sup> The justification for this adjustment is that using positive only income abstracts from the impact of losses in the denominator; therefore the impact of losses should also be removed from the numerator. Finally, Treasury computes the AETR across the years of m-3 data, which mitigates time series fluctuations and removes the emphasis on business cycle variation that results from the time series AETR. Subsequently, we also compute AETRs which are analogous to the Treasury AETR, but which are computed annually rather than averaged, and which are computed using positive net of negative income in addition to positive only income, so that they can be compared to the other estimates. Lyon argues that business cycle fluctuations can be smoothed and a more accurate AETR computed by averaging over several years; hence his preferred AETR measure averages over 2004-2009, though he also presents year by year estimates since that is what GAO originally did.

Some final comparisons across the measures are relevant. Auerbach and CRS include an adjustment to income for the gain to equity holders resulting from the inflation induced erosion in the value of debt which is not included in the other measures. However, the two adjustments are quite different. Auerbach adjusts the book value of gross credit market debt (from the Flow of Funds) to its market value, multiplies it by the change in the GDP deflator, and adds that adjustment to his measure of income. CRS takes the book value of total financial assets minus total financial liabilities (from the Flow of Funds), adjusts it for the change in the consumer price index, and adds this adjustment to his measure of net income.<sup>20</sup> As we will see subsequently, the difference in these measures leads to substantially different AETR estimates for some years. Further they both are based only on nonfinancial income, while CBO, GAO/Lyon, and Treasury include financial and nonfinancial.<sup>21</sup> CRS and Auerbach also add back taxes into the tax

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<sup>19</sup>NOLDS are treated differently for book and tax purposes. In particular, the tax benefit associated with a net operating loss is recorded for book purposes in the year in which the loss occurs. Then the NOLD is carried forward as a deferred tax asset into the future

<sup>20</sup>As mentioned above, both measures adjust inventories for inflation. But Auerbach makes the inflation adjustment for debt to the gross amount, while CRS makes it to the net amount, and Auerbach excludes foreign debt, while CRS seems to include foreign assets and foreign debt. Since the capital gain attributable to equity holders results from the erosion in the value of corporate debt, arguably corporate bonds might be a more appropriate base for the adjustment than credit market instruments. And arguably inflation impacts both assets and liabilities, so therefore the adjustment should be on the net amount. But credit market assets are much smaller than credit market debt so the difference is not likely to matter if credit market instruments is the base. But if foreign and other (noncredit market) assets are included, gross versus net makes a big difference. Given that the foreign income isn't included in the income measure, foreign assets ought not to be included in the adjustment.

<sup>21</sup>There are small differences in the CRS and Auerbach estimates, including differences in the method of estimating the inflation induced erosion in the value of debt, differences in how S corporation income is removed, differences in the data sources used for federal tax receipts.

measure, while the others do not.<sup>22</sup> Finally, all the measures except CBO do not include S corporation income in the denominator (the associated taxes are not part of the corporate tax base). Additional details of these computations are available in the appendices of Auerbach (1987), CRS (2011) , CBO (2012), GAO(2013), Lyon (2013), and the President’s Framework for Business Tax Reform (2014).<sup>23</sup>

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<sup>22</sup> Including backtaxes and carryback refunds in the measure of total taxes included in the  $aetr$  arguably increases the accuracy of the measure, because it reflects increases and decreases in final taxes paid which actually occur and hence gets closer to the final “real” tax bill. However, the  $aetr$  is an attempt to identify the taxes associated with year  $t$  income. But carryback refunds and backtaxes paid in year  $t$  are obviously associated with prior years liability. Hence by including them in the tax measure, we are implicitly assuming that year  $t$  payments of backtaxes and refunds are a good proxy for the backtaxes and refunds that will be paid in association with year  $t$  liability. This may or may not be the case.

<sup>23</sup> Some of these appendices are published, but others are available upon request from the author.

## **Appendix Two: Worldwide ETR**

In this appendix we attempt to examine the relationship between the domestic AETR, the foreign AETR, and the total AETR by constructing a very simplified aggregate AETR measures for domestic only income, total (deferred and repatriated) foreign income, and total worldwide income, using NIPA income measures and IRS tax measures. This allows us to isolate the aggregate average impact of including total foreign income and taxes in the AETR,<sup>24</sup> With available data, it is quite difficult to construct a true worldwide AETR – that is, a measure which includes all foreign and U.S. taxes in the numerator and all pretax worldwide income owned by the universe of U.S. corporations in the denominator. This is because SOI 1120 data only includes repatriated foreign income, and SOI m-3 data does not include the tax expense associated with the foreign income of controlled foreign corporations (and hence pretax worldwide income cannot readily be computed). And in any case m-3 data only exists for corporations with greater than 10 million dollars in assets. Further, NIPA foreign earnings are reported on an after income tax basis (though they are reported gross of withholding taxes) so again true pretax income cannot be computed. Compustat data can be used, but, like m-3 data, it only exists for larger firms. But this simplified measure provides a rough overview of the comparison.

To estimate the foreign AETR, we start with NIPA (after tax) foreign income from the international balance of payments data and convert this to a pretax basis by grossing up the income (excluding interest, royalties, and service income) by the average foreign AETR implied by the 5471 data. We then divide the sum of 5471 and 1118 reported foreign taxes and the U.S. residual taxes paid on foreign source income by this estimate of pretax foreign income.. To estimate the domestic only AETR, we divide 1120 reported taxes less the US residual tax on foreign source income by the NIPA total domestic only pretax

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24 It is difficult to construct a true total worldwide etr estimate using m-3 data, because SOI 1120 data only includes repatriated foreign income, SOI m-3 data does not include the tax expense associated with the foreign income of controlled foreign corporations (and hence pretax worldwide income cannot readily be computed), and NIPA earnings are also reported on an after income tax basis (though they are reported gross of withholding taxes).

book income (from NIPA table 6.16d). The total AETR combines the numerators and denominators of the two measures.<sup>25</sup>

Without micro-level regression analysis, we cannot comment definitively upon the sources, significance, or implications of discrepancies between the domestic and foreign AETRs. But we can view general aggregate trends and gauge rough aggregate magnitude differences. Figure AOne, panels A and B report the results of using this methodology. Panel A shows the total (worldwide) AETR, the domestic only AETR, and the upper bound of the foreign AETR. The domestic and the total AETR mimic the patterns we saw previously; that is, they are higher during recession periods than during other times. The domestic AETR is very close to the total AETR, which makes sense; even in more recent years, domestic income still comprises the bulk of total income. The foreign AETR shows a very slight decline on average over time. The foreign AETR is also quite close to the domestic and total AETR, and exceeds the domestic AETR slightly, particularly in the early part of the period.

Panel B shows the basic foreign “AETR” implied by the 5471 data – that is, foreign income taxes paid divided by foreign pretax earnings and profits. Both the NIPA and SOI based income measures define income as income net of losses. Notice that Panel B contains two estimates. The adjusted AETR calibrates the figure to remove an estimate of double counted dividends received from other cfc’s in the measure of earnings and profits used in the AETR computation. It also adjusts for time series consistency - prior to 2004, 5471 sampling only included the top 7500 cfcs, while 2004 and after, it includes all cfc’s.<sup>26</sup>

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<sup>25</sup> Note that this domestic aetr estimate is not identical to the CRS estimates, even though both are based on domestic only NIPA profits. Differences in the two measures include the fact that CRS includes nonfinancial firms only (while this measure includes all firms), CRS includes back taxes and adjusts for the gain to equity holders resulting from the inflation induced erosion in the value of debt (this measure does not make such an adjustment), and CRS begins with a measure of total corporate tax liability and scales this measure in order to obtain a federal only corporate tax liability (this measure starts with federal only liability). Finally note that neither CBO, CRS, or Auerbach remove the residual tax from their tax liability numerator, even though the foreign source income associated with these taxes is not included in the denominator. This artificially increases their aetr estimates by a few percentage points.

<sup>26</sup> See Appendix Two for additional details.

The AETR implied by the NIPA income measure is noticeably higher than that implied by the 5471 data. This is not a surprise, since the NIPA based AETR includes withholding taxes and the residual tax on foreign source income. But the similarity of the overall domestic and foreign effective tax rates is very counterintuitive, given the widely documented opportunities for tax minimization overseas. The combination of deferral of US taxation on foreign source income and variety of transfer pricing and “hybrid” entity structures allow companies to shift profits to low or no tax jurisdictions, or to create “stateless” income classified in such a way that it is not taxable by any jurisdiction. All of this would suggest that the AETR on foreign source income ought to be substantially lower than that on domestic income. So why isn’t it? It is likely that aggregate data masks too much underlying industry and firm level heterogeneity. It is also possible that enough companies cannot shift enough income to reduce the aggregate AETR substantially. It would be interesting to investigate this issue further, but, at this stage we can only say that at the aggregate level, on average, foreign and domestic effective tax rates are roughly equal.

Figure One: Time Series of Various Average Effective Tax Rate Measures

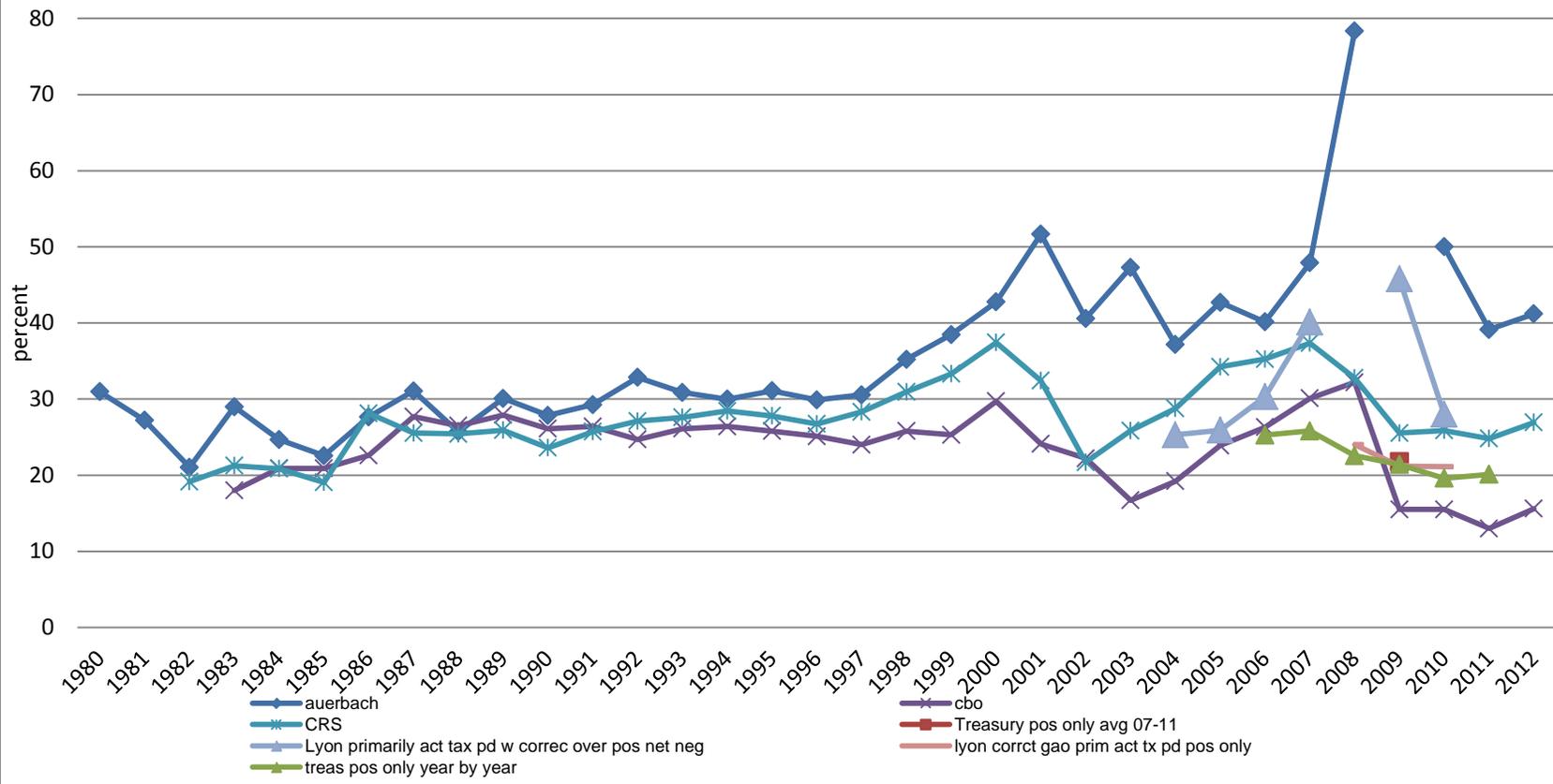


Figure Two: The Impact of Using NIPA income versus Tax Adjusted Income

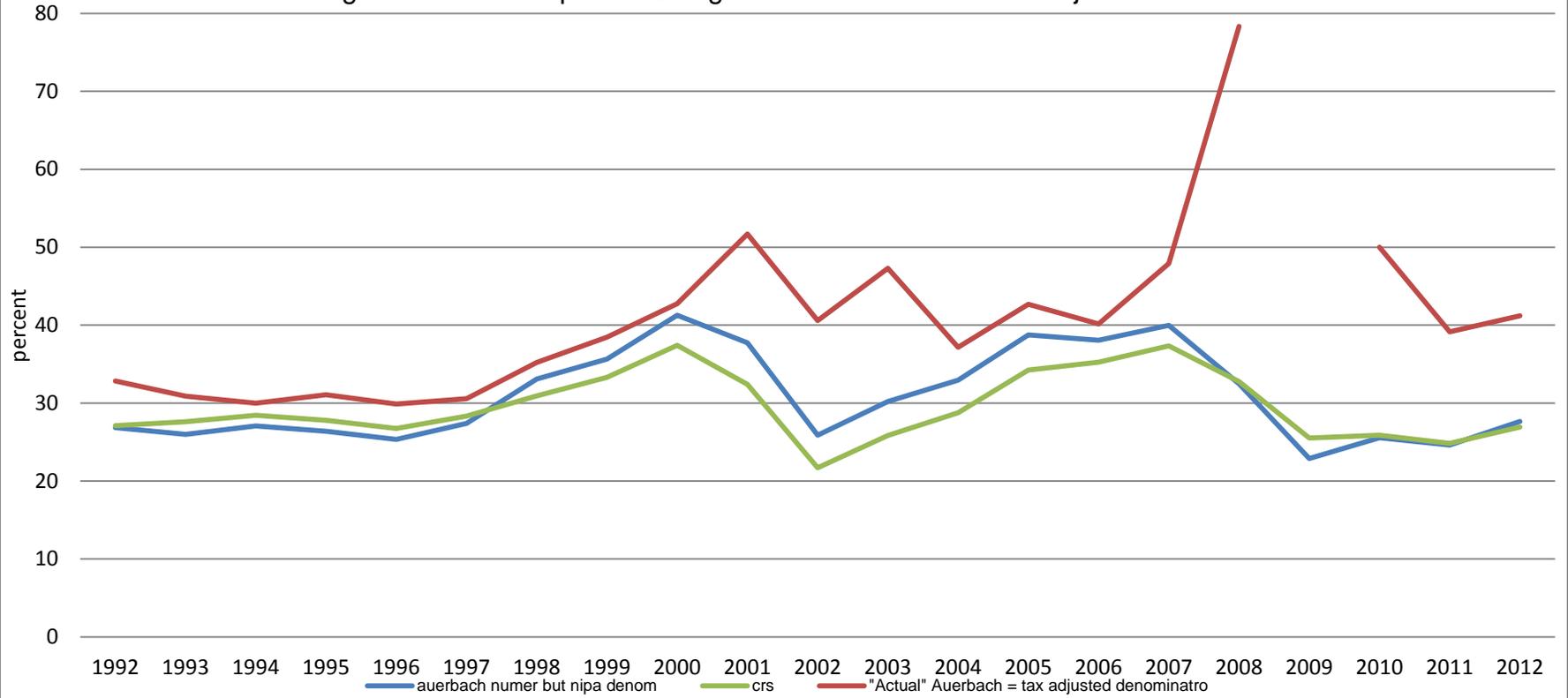


Figure Three: The Impact of Using Positive Only Income versus Positive Net of Negative Income on Average Effective Tax Rates:

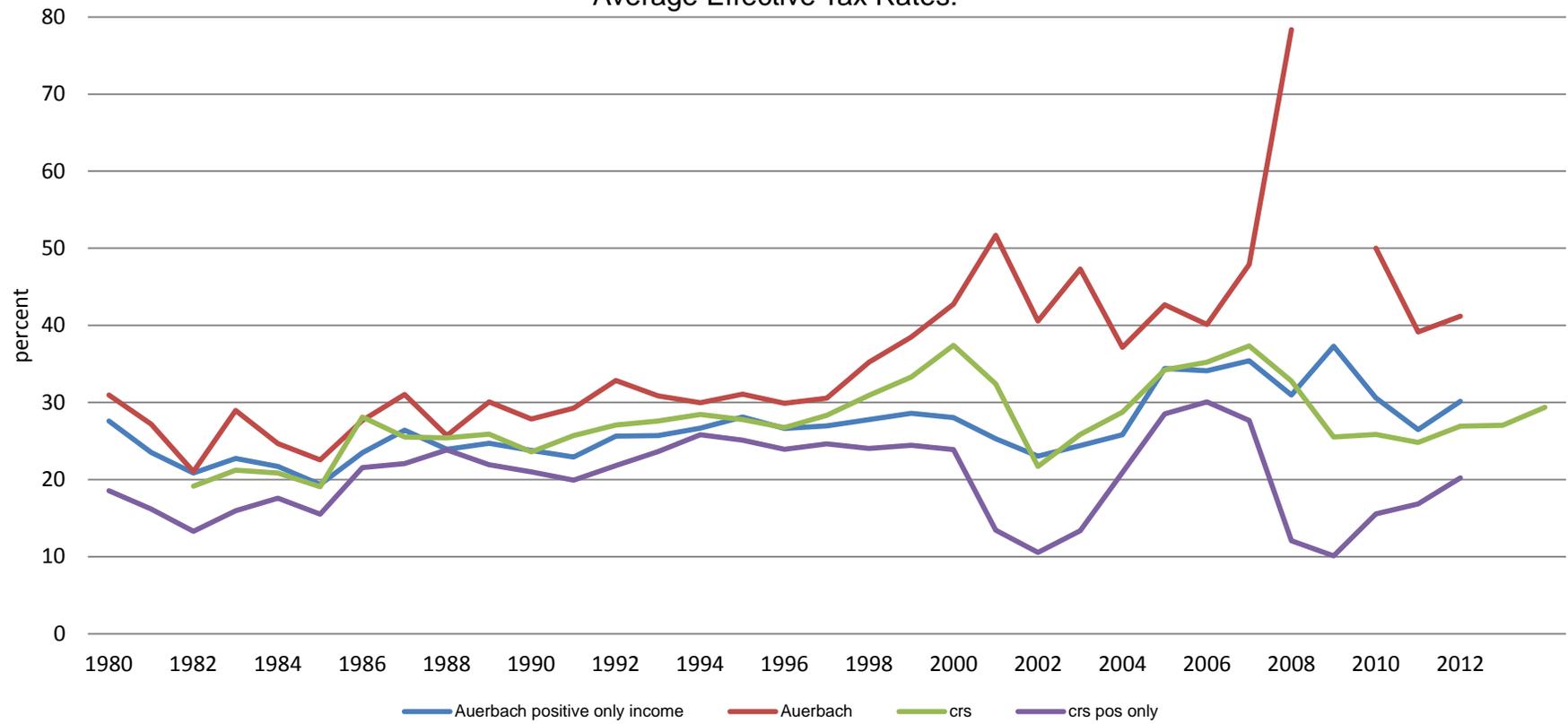


Figure Four: Domestic Only Versus Domestic + Repatriate Foreign

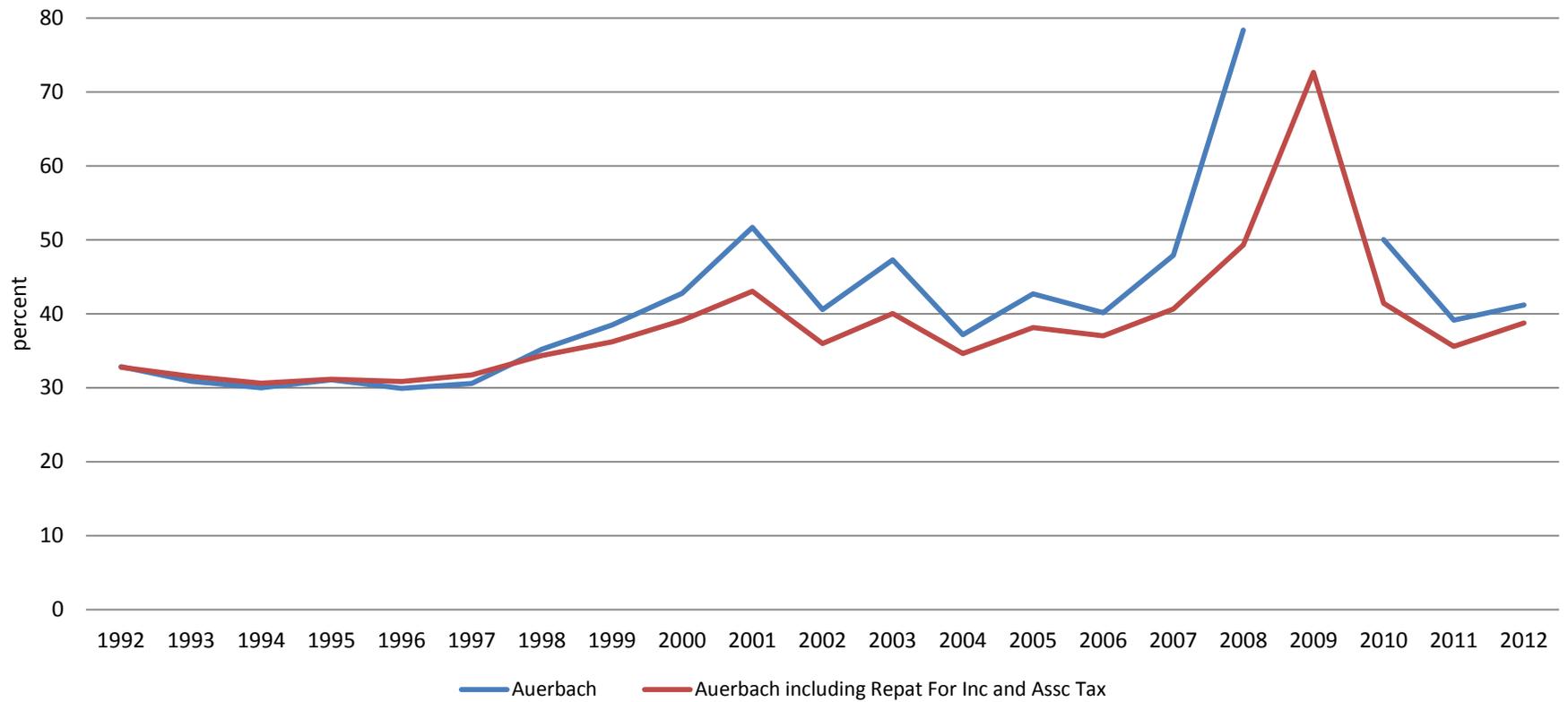


Figure Five: Auerbach with Alternative Treatments of Losses or Back Taxes and CB Refunds

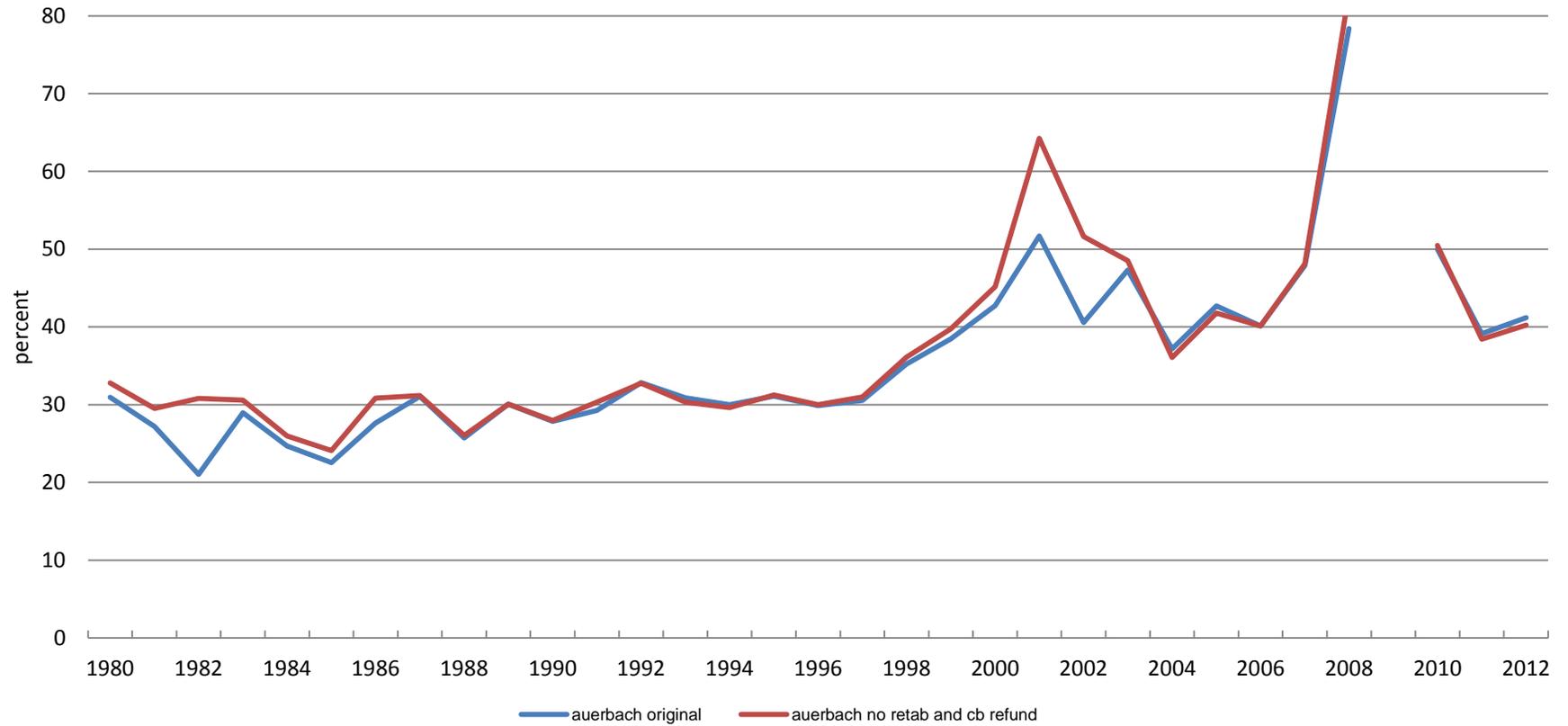


Figure Six: Financials vs No Financials

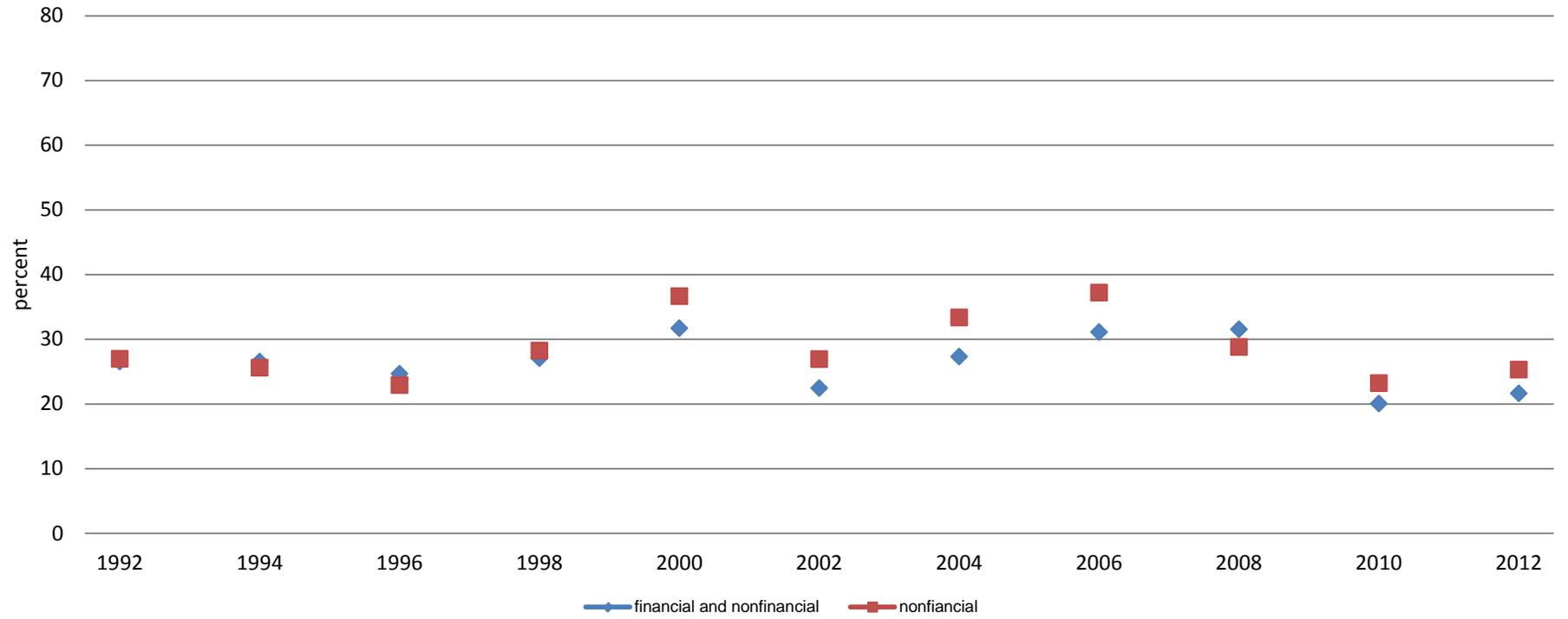


Figure Seven : Auerbach and CRS, Debt Gain and No DebtGain

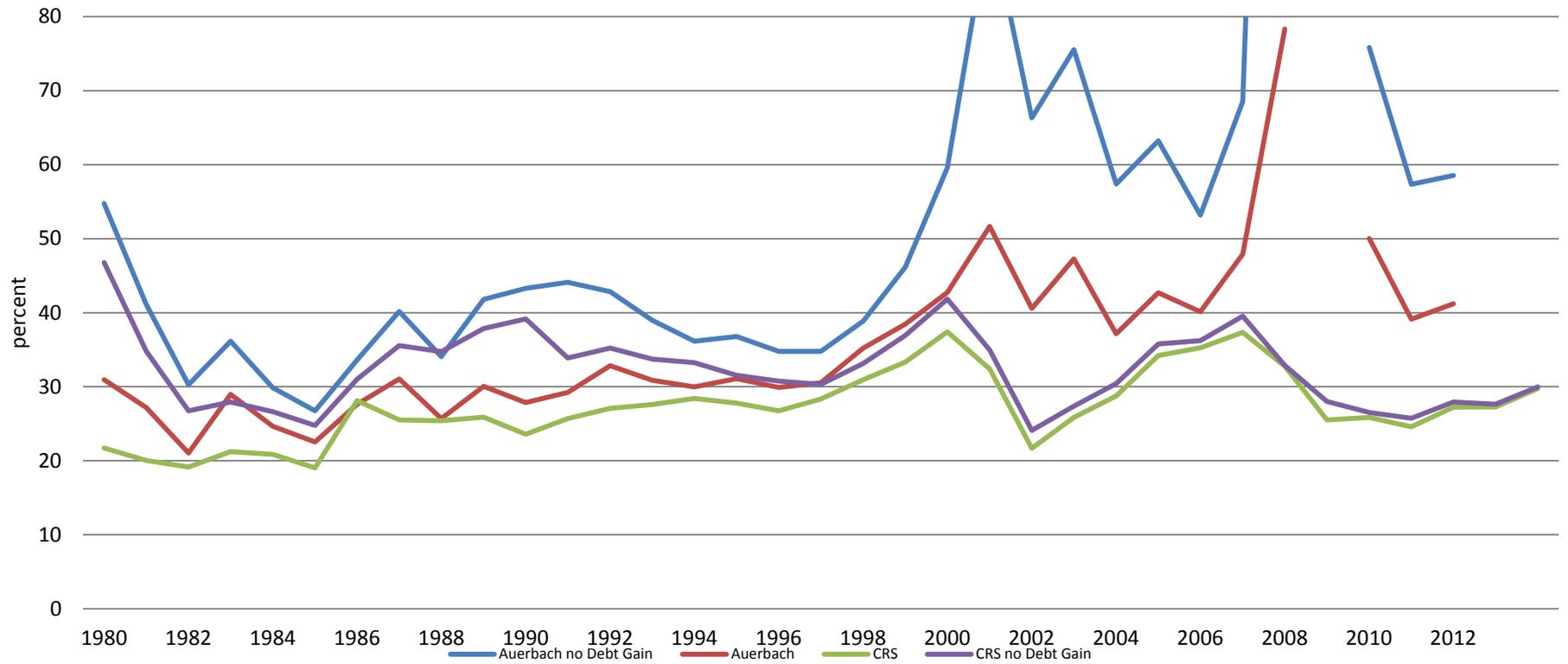


Figure Eight: Compare Treasury versus GAO/Lyon - Positive Only AETRS and Positive Net of Negative AETRS

