# Inflation-Based Adjustments in Federal Civil Monetary Penalties

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ADMINISTRATIVE CONFERENCE
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## I. Introduction

Civil monetary penalties play a vital role in federal law. The Federal Civil Penalties Inflation Adjustment Act of 1990[2] acknowledges that "the power of Federal agencies to impose civil monetary penalties … plays an important role in deterring violations and furthering the policy goals embodied in … laws and regulations."[3] Over time, however, inflation erodes "the impact of many civil monetary penalties" and "weaken[s] the[ir] deterrent effect."[4] The Act represented Congress's first effort to "maintain comprehensive, detailed accounting of the efforts of Federal agencies to assess and collect civil monetary penalties."[5] In prescribing "regular adjustment for inflation of civil monetary penalties," Congress hoped to "maintain the deterrent effect of civil monetary penalties and promote compliance with the law" and to "improve the collection by the Federal Government of civil monetary penalties."[6]

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[1] Professor of Law, University of Louisville. I thank Mathew Bizanz, Jennifer Hendricks, and L. Joseph Tackett for very capable research assistance. David Pritzker and Stephanie Tatham provided very helpful commentary and suggestions throughout the preparation of this report. Special thanks to Heather Elaine Worland Chen.

[2] Pub. L. 101-410, Oct. 5, 1990, 104 Stat. 890, *codified as amended at* 28 U.S.C. § 2461 note.

[3] *Id.* § 2(a).

[4] *Id.*

[5] *Id.*

[6] *Id.* § 2(b).

In practice, the Federal Civil Penalties Inflation Adjustment Act ("the Act" or "the Inflation Adjustment Act") has fallen far short of these goals.[7] Three statutory defects are especially salient. First, inflation adjustments under the Act suffer from an "inflation gap." The Act imposes a 10 percent cap on initial penalty adjustments. That cap creates an "inflation gap" reflecting the sometimes considerable difference between penalties as adjusted under the Act and the levels that such penalties would reach if they were set more precisely according to an actual measure of changes in the cost of living. This gap grows over time and can never be closed.

Second, the Act directs federal agencies to use Consumer Price Index data in ways that are guaranteed to be out of sync with inflation. Agencies must use CPI data that is at least 7 months old, and sometimes as much as 18 months old. In effect, agencies lose a year of inflation every time they make an inflation-based adjustment. This problem is known as "CPI lag." As with the "inflation gap" prescribed by the Act, errors forced by these adjustments create distortions relative to actual inflation. Under the existing statutory scheme, these errors can never be corrected.

Third, the Act's rules on rounding effectively prevent some agencies from making a second round of penalty adjustments until inflation increases at least 45 percent. At inflation rates approximating 2.5 percent, refinements to initial penalty adjustments may not be permitted for 15 years or more.

This report will examine the Federal Civil Penalties Inflation Adjustment Act in detail. Careful parsing of statutory language reveals how the Act dictates each of these three sources of economic distortion in the inflation-based adjustment of federal civil monetary penalties. By recounting the legislative history of the Act, I hope to show how Congress came to adopt these provisions. I will then devote close attention to each of the three most salient problems afflicting the Inflation Adjustment Act: the "inflation gap" attributable to the Act's 10 percent cap on initial cost-of-living adjustments, the "CPI lag" that forces federal agencies to ignore between six and 18 months of Consumer Price Index data in adjusting civil monetary penalties, and the Act's unwieldy rounding provisions. This report will provide formal mathematical descriptions of the

[7] *See generally* United States General Accounting Office, *Civil Penalties: Agencies Unable to Fully Adjust Penalties for Inflation Under Current Law*, GAO-03-409 (March 2003) [hereinafter 2003 GAO Report].

problems at hand, as well as concrete illustrations drawn from actual federal civil penalties.

Proper adjustment of civil monetary penalties is central to the mission of the federal government. Civil penalties proceed from the assumption that economic loss deters private actors from engaging in socially destructive conduct. That deterrent effect may be eroded, even perversely distorted, if agencies do not receive appropriate statutory and administrative guidance for making accurate downstream adjustments in the levels of those penalties as prices change within the United States economy as a whole. The defects in the Federal Civil Penalties Inflation Adjustment Act are profound and destructive. Because they arise from the plain language of the Act, those defects transcend the corrective power of federal regulatory agencies. Although some agencies have attempted to adjust civil monetary penalties in common-sense ways that better reflect the real economic impact of inflation, those efforts do not comply with the plain language of the Inflation Adjustment Act. This report will therefore recommend specific amendments to the Act.

## II. Adjusting civil penalties under the Inflation Adjustment Act

Section 4 of the Federal Civil Penalties Inflation Adjustment Act directs "[t]he head of each agency … by regulation" to perform an "inflation adjustment" for "each civil monetary penalty provided by law within the jurisdiction of the Federal agency."[8] The Act then instructs each agency to publish the resulting regulation in the *Federal Register*.[9] Under a 1996 amendment to the Act, the first inflation adjustment was to have been performed on October 23, 1996 — 180 days after the amendment's enactment date of April 26, 1996.[10] Subsequent adjustments must be performed "at least once every 4 years thereafter."[11]

According to section 5 of the Inflation Adjustment Act, "[t]he inflation adjustment under section 4 shall be determined by increasing the maximum civil monetary penalty or the range of minimum and maximum civil monetary

[8] Inflation Adjustment Act, *supra* note 2, § 4(1).
[9] *Id.* § 4(2).
[10] *See* Pub. L. No. 104-134, § 31001(s)(1)(A), 110 Stat. 1321, 1373.
[11] *Id.*

penalties, as applicable, for each civil monetary penalty by the cost-of-living adjustment."[12] In turn, "the term 'cost-of-living adjustment'" is defined "as the percentage (if any) for each civil monetary penalty by which — (1) the Consumer Price index for the month of June of the calendar year preceding the adjustment, exceeds (2) the Consumer Price Index for the month of June of the calendar year in which the amount of such civil monetary penalty was last set or adjusted pursuant to law."[13]

Section 5 of the Act also prescribes an elaborate process for the rounding of "[a]ny increase determined under" the statute's inflation adjustment mechanism:

> Any increase determined under this subsection shall be rounded to the nearest —
>
> (1) multiple of $10 in the case of penalties less than or equal to $100;
> (2) multiple of $100 in the case of penalties greater than $100 but less than or equal to $1,000;
> (3) multiple of $1,000 in the case of penalties greater than $1,000 but less than or equal to $10,000;
> (4) multiple of $5,000 in the case of penalties greater than $10,000 but less than or equal to $100,000;
> (5) multiple of $10,000 in the case of penalties greater than $100,000 but less than or equal to $200,000;
> (6) multiple of $25,000 in the case of penalties greater than $200,000.[14]

In a 1996 amendment to the Act, Congress imposed a 10 percent cap on the initial inflation adjustment of any civil monetary penalty required under section 4 of the Act: "The first adjustment of a civil monetary penalty … may not exceed 10 percent of such penalty."[15] Section 6 of the Act ensures that inflation-adjusted increases are strictly prospective in application: "Any increase under this Act in a civil monetary penalty shall apply only to violations which occur after the

[12] Inflation Adjustment Act, *supra* note 2, § 5(a).
[13] *Id.* § 5(b).
[14] *Id.* § 5(a).
[15] Pub. L. No. 104-134, § 31001(s)(1), 110 Stat. 1321, 1373.

date the increase takes effect."[16] Finally, the Act exempts four statutes: the Internal Revenue Code of 1986, the Tariff Act of 1930, the Occupational Safety and Health Act of 1970, and the Social Security Act.[17]

## III. The legislative history and purposes of the Inflation Adjustment Act

### *A. Senate Bill 2599 (1986)*

Senator Frank Lautenberg of New Jersey introduced the Federal Civil Penalties Adjustment Act in 1986 as Senate Bill 2559.[18] This bill prescribed a two-step process for performing inflation adjustments of federal civil monetary penalties according to increases in the cost of living. The first step consisted of an initial *historical* cost-of-living adjustment based on "the percentage (if any) by which (1) the average of the Consumer Price Index as of the close of the 12-month period ending on September 30, 1986, exceeds (2) the average of the Consumer Price Index as of the close of the 12-month period ending on September 30 of the calendar year in which such penalty amount was last determined under law."[19] "Any increase determined under" the original Lautenberg bill's historical cost-of-living adjustment would have been "rounded to the nearest multiple of $10."[20] The initial cost-of-living adjustment would be capped at "1000 percent of the original penalty amount."[21]

S. 2599 also prescribed *annual, prospective* adjustments after 1987.[22] After an initial round of historical adjustments in federal civil monetary penalties, a prospective series of annual adjustments, carried out by "the head of each Federal agency" and "publish[ed] in the Federal Register," would apply "in lieu of the schedule prescribed under" the bill's historical cost-of-living adjustment provision.[23] Not later than December 15 of each year, this annual adjustment

[16] Inflation Adjustment Act, *supra* note 2, § 6.
[17] *See id.* § 4(1).
[18] S. 2559, 99th Cong. (1986).
[19] *Id.* §4(c).
[20] *Id.* § 4(b).
[21] *Id.* ("[I]n no event shall such increase exceed 1000 percent of the original penalty amount.").
[22] *See id.* § 5(c).
[23] *Id.* § 5(a).

process would require each agency to "increase each base penalty amount" within its jurisdiction "by the cost of living adjustment" for "the succeeding calendar year."[24] The bill further contemplated that each agency would "add[] to [its] schedule any civil monetary penalty within [its] jurisdiction … that was enacted into law in the previous calendar year and increas[e] the base penalty amount by the cost of living adjustment for the current calendar year."[25]

S. 2599's definition of its "cost-of-living adjustment" plays a critical role in the legislative history of the Federal Civil Penalties Inflation Adjustment Act. That definition warrants full elaboration here:

> [T]he cost-of-living adjustment for any calendar year is —
>
> (1) in the case of base penalties provided by law before December 15, 1986, the percentage (if any) by which —
>
> (A) the Consumer Price Index for the preceding calendar year, exceeds
>
> (B) the Consumer Price Index for the calendar year 1986; and
>
> (2) in the case of base penalties provided by law on or after December 15, 1986, the percentage (if any) by which —
>
> (A) the Consumer Price Index for the preceding calendar year, exceeds
>
> (B) the Consumer Price Index for the calendar year in which the base penalty was provided by law.[26]

S. 2559 further defined "the Consumer Price Index for any calendar year" as "the average of the Consumer Price Index as of the close of the 12-month period ending on September 30 of such calendar year."[27] Although S. 2599 provided

[24] *Id.* § 5(b); *see also id.* § 5(a) (directing "schedules of civil monetary penalties" to apply "in the succeeding calendar year").
[25] *Id.* § 5(b).
[26] *Id.* § 5(c).
[27] *Id.* § 5(d).

that any increases determined under its mechanism for annual, prospective cost-of-living adjustments would "be rounded to the nearest multiple of $10," those adjustments were not subject to any cap.[28]

S. 2599's references to "the preceding calendar year" in its discussion of cost-of-living adjustments are ambiguous. One plausible reading of the bill's cost-of-living adjustment confirms that portion of the contemporary statute from which the "CPI lag" arises. The corresponding section of the Inflation Adjustment Act requires reference to "the Consumer Price Index for the month of June of the calendar year preceding the adjustment." But it is also plausible to read this portion of Senate Bill 2599 as referring to CPI data for the nearly complete year preceding the bill's December 15 deadline for annual agency action.

Three pieces of evidence support the latter reading. First, section 5 of S. 2599, titled "Annual Adjustments for Taxable Years Beginning After 1987," contemplated that annual adjustments beyond the bill's historical cost-of-living adjustment would take place "[n]ot later than December 15 *of 1987* and each subsequent calendar year."[29] "[I]n the case of base penalties provided by law before December 15, 1986," the bill prescribed an annual cost-of-living adjustment based on "the percentage (if any) by which … the Consumer Price Index for the preceding calendar year, exceeds … the Consumer Price Index for the calendar year 1986."[30] For this initial adjustment (which had been scheduled to take place no later than December 15, 1987) to make sense, the bill's reference to "the preceding calendar year" *must* refer to CPI data for 1987 rather than 1986. Second, the bill defined "the Consumer Price Index for any calendar year" as "the average of the Consumer Price Index as of the close of the 12-month period ending on September 30 of such calendar year."[31] It is far more natural to expect that an agency head, directed by law to calculate an annual cost-of-living adjustment on December 15 "for the preceding year," would use CPI data reaching back from September 30 of that year to October 1 of the previous year. Finally, given the prevalence of concerns that civil monetary penalties were losing ground to inflation, a legislative purpose that found its way into the text of the

[28] *Id.* § 5(b).
[29] *Id.* § 5(a) (emphasis added).
[30] *Id.* § 5(c).
[31] *Id.* § 5(d).

Inflation Adjustment Act,[32] it seems inconceivable that Senate Bill 2599 would have mandated an inflation adjustment mechanism that requires federal agency heads to ignore an entire year of inflation data.

### *B. Senate Bill 1014 (1987)*

Senator Lautenberg's proposal to adjust federal civil monetary penalties for inflation underwent considerable debate and revision in the subsequent Congress. The Subcommittee on Oversight of Government Management of the Senate Committee on Governmental Affairs conducted hearings on January 31, 1988, to consider what by then had become Senate Bill 1014, the proposed Federal Civil Penalties Inflation Adjustment Act of 1987.[33]

S. 1014 retained the distinctive features of its predecessor, S. 2559. The new bill preserved the two-step cost-of-living adjustment prescribed by S. 2559. The first step prescribed a *historical* cost-of-living adjustment based on "the percentage (if any) by which (1) the average of the Consumer Price Index as of the close of the 12-month period ending on September 30, ~~1986~~ *1987*, exceeds … (2) the average of the Consumer Price Index as of the close of the 12-month period ending on September 30 of the calendar year in which such penalty amount was last determined under law."[34] Beyond updating the year from ~~1986~~ to *1987*, S. 1014 made no changes to the baseline set by S. 2559. As in the original bill, S. 1014 directed that "[a]ny increase determined under" the new bill's historical cost-of-living adjustment "shall be rounded to the nearest multiple of $10."[35] S. 1014 made another material change to the first step of the two-step cost-of-living adjustment. Whereas Senator Lautenberg's original bill had provided that the increase based on the historical cost-of-living adjustment "in no event shall …

[32] *See* Inflation Adjustment Act, *supra* note 2, § 2(a)(2), (3) ("The Congress finds that … the impact of many civil monetary penalties has been and is diminished due to the effect of inflation" and that "by reducing the impact of civil monetary penalties, inflation has weakened the deterrent effect of such penalties.").
[33] S. 1014, 100th Cong. (1987).
[34] *Id.* § 4(c) (annotations added).
[35] *Id.* § 4(b).

exceed 1000 percent of the original penalty amount,"[36] S. 1014 omitted any mention of a cap on its initial inflation adjustment.

As a second step, S. 1014 prescribed *annual, prospective* adjustments for taxable years after *1988*.[37] Beginning no later than December 15, 1988, S. 1014 directed agency heads to make annual cost-of-living adjustments. "[I]n the case of base penalties provided by law before December 15, ~~1986~~ *1987*," agencies would base these adjustments on "the percentage (if any) by which … (A) the Consumer Price Index for the preceding calendar year, exceeds (B) the Consumer Price Index for the calendar year ~~1986~~ *1987*."[38] "[I]n the case of base penalties provided by law on or after December 15, ~~1986~~ *1987*," agencies would make annual cost-of-living adjustments according to "the percentage (if any) by which … (A) the Consumer Price Index for the preceding calendar year, exceeds (B) the Consumer Price Index for the calendar year in which the base penalty was provided by law."[39] Consistent with the corresponding provision of S. 2559, S. 1014 defined "the Consumer Price Index for any calendar year" as "the average of the Consumer Price Index as of the close of the 12-month period ending on September 30 of such calendar year."[40] Finally, S. 1014 preserved other aspects of annual adjustments under S. 2559: Although any increases determined under the annual, prospective adjustments prescribed by S. 1014 would not be subject to any cap, they would "be rounded to the nearest multiple of $10."[41]

*1. Hearings on Senate Bill 1014 (1998)*

In January 1998, the Senate Subcommittee on Oversight of Government Management of the Committee on Governmental Affairs on held a hearing on Senate Bill 1014.[42] This hearing enabled a wide range of representatives — from the White House's Office of Management and Budget (OMB), the Department of

[36] S. 2559, *supra* note 18, § 4(b).
[37] *See* S. 1014, *supra* note 33, § 5(c).
[38] *Id.* § 5(c)(1) (annotations added).
[39] *Id.* § 5(c)(1) (annotations added).
[40] *Id.* § 5(d).
[41] *Id.*
[42] *See generally Federal Civil Penalties Adjustment Act of 1987: Hearing on S.1014 Before the Subcommittee on Oversight of Government Management of the Senate Comm. on Government Affairs*, 100th Cong. (1988).

Health and Human Services (HHS), the Department of Justice (DOJ), Public Citizen's Congress Watch, and the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) — to influence congressional consideration of inflation-based adjustment of civil monetary penalties.

This hearing constituted a crucial turning point in the legislative process. In virtually every meaningful respect, this hearing transformed Senator Lautenberg's original bills, S. 2559 and S. 1014, into the law that eventually became the Federal Civil Penalties Inflation Adjustment Act of 1990. Many witnesses testified that they deemed annual adjustments to be too frequent and too burdensome. The subcommittee also fielded considerable amounts of criticism suggesting that automatic adjustments reported solely in the *Federal Register* would subject private parties to increased civil monetary penalties without appropriate notice and due process. Finally, the subcommittee evidently heard enough testimony to persuade Congress to adopt a more elaborate rounding mechanism than the simple $10 provision originally proposed by Senator Lautenberg.

During the Senate subcommittee hearing, members of Congress and representatives of federal agencies put special emphasis on the frequency of inflation-based adjustments to civil monetary penalties. Joseph R. Wright Jr., deputy director of the Office of Management and Budget, testified against annual adjustments and instead proposed that adjustments should occur every three to five years.[43] He argued that the administrative burden might outweigh the value of annual adjustments.[44] He also argued that annual adjustments might not properly deter private misconduct:

> Very often, the statutory amount is a ceiling, *i.e.*, a figure representing the maximum sum the government could impose. But administrators, for one reason or another, do not always seek or threaten to impose the maximum amount. *Thus increases by small, regular increments may serve no purpose at all*. In fact, if the CMP is viewed as a recovery device as well as a deterrent, we believe the cost of carrying out an annual adjustment

[43] *Id.* at 7 (statement of Joseph Wright Jr.).

[44] *Id.* ("[Annual adjustments] may be a little bit too often in this area … . And in many cases, the administrative burden of making these adjustments may not be worth it.").

> would outweigh the incremental revenues collected as a result of the adjustment.[45]

William Love, acting director of the Interstate Commerce Commission, also favored a five-year adjustment cycle:

> Notwithstanding the fact that monetary penalties are less frequently imposed today, developing cases based on small penalties often requires agency staff to document large numbers of counts to support a penalty which would realistically serve as a deterrent, and which would justify the expenditures of government resources to collect the penalty. To provide more realistic deterrents, the lower range of penalties could be statutorily increased at the outset. Subsequently, a year-to-year inflation adjustment would not appear necessary; a 5-year renew cycle might be an appropriate alternative.[46]

By contrast, the sponsors of the bill expressed reluctance to conduct periodic adjustments on a five-year cycle. Senator Lautenberg said, "I do not like to see us at first blush extend the review period to five years. Because if we look at one of the worst periods of inflation that we had in our history, a period ranging from 1979–1981, I mean we would be looking at a substantial change in the value of the penalty; and maybe three years."[47] His cosponsor, Senator Carl Levin, added, "I have kind of a preference that it should be biannual [*sic*], every 2 years, or every 3 years, because in 5 years, you could have inflation running strong."[48] Michael Waldman, legislative director of Public Citizen's Congress Watch, also preferred more frequent adjustments:

> [W]e would like to see it done as often as possible. We prefer 1 year. If it has to be higher in the wisdom of the committee, that may be the case. But I might want to point out that 5 years, when we get up to that level, is

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[45] *Id.* at 43 (emphasis added).

[46] *Id.* at 94 (letter from William Love to Sen. Carl Levin (Feb. 23, 1988)).

[47] *Id.* at 16 (statement of Sen. Frank Lautenberg).

[48] *Id.* at 31 (statement of Sen. Carl Levin). Inasmuch as he expressed a preference for Senator Levin undoubtedly meant "biennial" rather than "biannual." A biennial adjustment would take place every second year. A biannual adjustment takes place every six months, or twice in a single year. *See* Bill Bryson, Bryson's Dictionary for Writers and Editors 39 (3d ed. 2008).

> really quite a long time. For instance, right now, inflation is running between 4 and 5 percent. If inflation stayed the same rate, the difference between a statute passed today and 5 years from now would be a diminution in value of 20 to 25 percent. And that seems like a significant reduction in deterrent value. So I would hope that it would remain at 1 year, but certainly not go as high as 5 years.[49]

S. 1014's debate over the length of the inflation adjustment cycle should be seen in historical context. In 1988, the galloping inflation of the 1970s remained salient. The participants in the Senate hearing also had reason to fear the considerable burden of identifying all civil monetary penalties and updating them as often as once a year. Presumably, advances in computing power and automation, as well as the greater ease with which government agencies and members of the public may obtain inflation data, would allay those fears today. And even though inflation since 1988 has never returned to the levels that it reached during the 1970s, it is worth noting that an annual 2.5 percent increase in inflation, compounded over five years, would require a 13 percent adjustment at the end of that period. ($1.025 \wedge 5 \approx 1.131$.) A 13 percent increase is less than the 20 to 25 percent increase that Michael Waldman identified in his congressional testimony. Thirteen percent nevertheless exceeds the 10 percent threshold that Congress considered meaningful enough to adopt as the limit on the first adjustment of a civil monetary penalty.

Participants in the Senate hearing on S. 1014 also expressed concerns that an automatic adjustment mechanism would not provide private parties adequate notice of increases in civil monetary penalties. Thomas M. Boyd, acting assistant attorney general, emphasized this point:

> Our principal concern with the proposed bill is one of notice. As a result of this bill, eventually the language identifying the prohibited conduct will be found in the statute, while the size of the penalty will be found elsewhere in the *Federal Register*. There is obvious opportunity for confusion and mistakes, particularly on the part of those to whom the law

[49] *Id.* (statement of Michael Waldman).

> is addressed, who seek to evaluate the consequences of certain conduct or practices that may impinge upon the law.[50]

Stuart E. Schiffer, deputy assistant attorney general for the Civil Division of the Department of Justice, likewise suggested that civil penalties might lack deterrent power if penalties published "in the Federal Register each year" were at odds with "the original dollar amount" stipulated in "statutes that contain the terms themselves."[51] According to B. Wayne Vance, general counsel for the Department of Transportation, the annual publication of inflation adjustments in the *Federal Register* could make it "difficult for those subject to our statutes to understand what the current penalty is at a particular time, and whether the applicable penalty was that in place at the time of the violation, or that in place at the time enforcement is initiated."[52]

One witness did express a contrary view. Kenneth R. Thomas, legislative attorney for the Congressional Research Service, argued that the bill did not present a notice problem:

> [C]oncerns were expressed about whether proper notice would be provided to the public of the new penalties, so as not to violate the due process rights of persons upon whom the fines are imposed. Under the Federal Register Act, publication serves as constructive notice to the public of the content of the notice. As the bill provides that the heads of the agencies will list specific schedules of penalties, and that enforcement of such penalties will not occur until after publication, any individuals who are later fined will have had constructive notice of the penalties against them.[53]

Finally, the Senate hearing on S. 1014 addressed the rounding of inflation-based adjustments. S. 1014 and its predecessor bill, S. 2559, had both provided that cost-of-living adjustments would be rounded to the nearest multiple of $10. During the Senate hearing on S. 1014, Senator Lautenberg himself expressed doubt over the rounding mechanism that he had proposed: "[T]he original bill

[50] *Id.* at 136 (1989) (letter from Thomas M. Boyd to Sen. Carl Levin (Apr. 14, 1988)).
[51] *Id.* at 14 (statement of Stuart E. Schiffer).
[52] *Id.* at 103 (letter from B. Wayne Vance, to Sen. Carl Levin (Feb. 23, 1988)).
[53] *Id.* at 230–231 (letter from Kenneth R. Thomas to Sen. Carl Levin (Feb. 26, 1988)).

provides that all adjusted penalties are to be rounded off to the nearest 10 dollars. I would suggest that larger penalties should be rounded off to larger numbers. Maybe even the 10 dollars is too small, but that is something that we ought to work on."[54] Lando W. Zech, Jr., chairman of the Nuclear Regulatory Commission suggested that "penalty amounts should be rounded off to the nearest increment of the original penalty to minimize calculation error."[55] In its report to the Senate subcommittee, the President's Council on Integrity and Efficiency (PCIE) concluded that the impact of inflation adjustments, together with Senator Lautenberg's proposed rounding mechanism, would be "very little" or even "minimal" for "just over 40 percent of" affected penalties.[56]

*2. Amendments to Senate Bill 1014*

The Senate hearing on S. 1014 triggered substantial amendments to the proposed Civil Penalties Inflation Adjustment Act. "In response to … concerns" expressed at that hearing, the Subcommittee on Oversight of Government Management "substantially revised the bill."[57] The subcommittee deleted Senator Lautenberg's automatic adjustment provision: "Instead of requiring an automatic inflation adjustment published only in the Federal Register, the revised bill provides for the President to report to Congress every five years as to which penalties need to be adjusted, and by how much, to keep up with inflation … ."[58] In the absence of "automatic, across-the-board adjustment," the revised bill contemplated that "separate legislative action" would be "required to make each adjustment."[59] The revision likewise addressed "[c]oncerns about the excessive frequency of adjustments … by requiring that adjustments be calculated and reported to Congress every five years, rather than every year."[60]

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[54] *Id.* at 4 (statement of Sen. Frank Lautenberg).
[55] *Id.* at 116 (letter from Lando W. Zech, Jr., to Sen. Carl Levin (Mar. 4, 1988)).
[56] *Id.* at 41 (report prepared by the President's Council on Integrity and Efficiency (July 1, 1988)).
[57] *Civil Penalties Adjustment Act of 1989: Report of the Committee on Governmental Affairs to Accompany S.535, to Increase Civil Monetary Penalties Based on the Effect of Inflation*, 101st Cong. 5 (1989).
[58] *Id.*
[59] *Id.*
[60] *Id.*

Although the subcommittee ultimately approved the revision by unanimous vote, and although the Justice Department expressed "no objection to the bill as amended," the full committee on governmental affairs "did not have time to act on the bill before the end of the session."[61]

### *C. Senate Bill 535 (1989)*

Senators Lautenberg and Levin introduced Senate Bill 535 in the 101st Congress on March 8, 1989.[62] S. 535 was "identical to S. 1014, as amended" by the Senate Subcommittee on Oversight of Government Management.[63] In House hearings on S. 535, Senator Lautenberg acknowledged that he and his colleagues had "modified the legislation in response to concerns raised by the administration and others."[64] The House concurred in the Senate's approval of S. 535 and recommended the bill's passage.

Most of the features observed in the contemporary Civil Penalties Inflation Adjustment Act can be traced to S. 535. This bill resolved the ambiguity in previous versions' reference to "the preceding calendar year" by unambiguously defining "the term 'cost-of-living adjustment'" as "the percentage (if any) for each civil monetary penalty by which — (1) the Consumer Price Index *for the month of June of the calendar year preceding the adjustment*, exceeds (2) the Consumer Price Index for the month of June of the calendar year in which the amount of such civil monetary penalty was last set or adjusted pursuant to law."[65] This definition codified the "CPI lag" anomaly of the Inflation Adjustment Act.

In addition, S. 535 replaced earlier bills' simple $10 rounding provision with an elaborate, six-tiered mechanism:

> Any increase determined under this subsection shall be rounded to the nearest —

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[61] *Id.*
[62] S. 535, 101st Cong. (1989).
[63] *Senate Report on S. 1014*, *supra* note 42, at 5.
[64] *Federal Civil Penalties Adjustment Act of 1989: Hearing on S. 535 Before the Subcomm. on Legislation and National Security of the H. Comm. on Gov't Operations*, 101st Cong. 15 (1989) (statement of Sen. Frank Lautenberg).
[65] S. 535, *supra* note 62, § 5(b).

> (1) multiple of $10 in the case of penalties less than or equal to $100;
> (2) multiple of $100 in the case of penalties greater than $100 but less than or equal to $1,000;
> (3) multiple of $1,000 in the case of penalties greater than $1,000 but less than or equal to $10,000;
> (4) multiple of $5,000 in the case of penalties greater than $10,000 but less than or equal to $100,000;
> (5) multiple of $10,000 in the case of penalties greater than $100,000 but less than or equal to $200,000;
> (6) multiple of $25,000 in the case of penalties greater than $200,000.[66]

This mechanism is the source of contemporary concerns over the rounding of civil monetary penalties under the Inflation Adjustment Act.

Congress enacted S. 535 into law as the Federal Civil Penalties Adjustment Act of 1990.[67]

### *D. Legislative developments after 1990*

In 1993 Congress defeated an effort to attempt to amend the Civil Penalties Inflation Adjustment Act.[68] One provision of this bill, H.R. 3400, would have made cost-of-living adjustments automatic. In addition, H.R. 3400 would have imposed no percentage cap on initial adjustments. Had this provision become law, it would have had the effect of making the first adjustment a complete and automatic cost-of-living adjustment, subject to the one-year CPI lag imposed by the definition of "cost-of-living adjustment" in § 5(b) of the Act. Speaking in opposition to that proposal, Senator William Roth argued that it was

[66] *Id.* § 5(a).
[67] Pub. L. No. 101-410, 104 Stat. 890.
[68] H.R. 3400, § 16010.

inappropriate to delegate that task to agency heads, which would have been the practical effect of an automatic adjustment mechanism.[69]

Three years later, Congress did amend the Civil Penalties Inflation Adjustment Act through a provision of the omnibus Debt Collection Improvement Act of 1996.[70] This amendment accomplished something that Senator Lautenberg had originally proposed in 1986, but subsequent legislative consideration had previously blocked—automatic adjustment of civil monetary penalties for inflation by the heads of federal agencies.[71] That adjustment would take place every four years.[72] The 1996 amendment also capped initial inflation adjustments, without regard to the temporal gap between that adjustment and the previous statutory designation of penalty amounts, to 10 percent.[73] The 1996 amendment thus introduced the 10 percent cap that serves as the source of the contemporary Inflation Adjustment Act's "inflation gap." It also retained two other distinctive (and ultimately unwieldy) features of the original 1990 statute: the "CPI lag" introduced by the statute's reliance on CPI figures for "for the month of June *of the calendar year preceding the adjustment*," as well as the Act's elaborate, six-tiered rounding mechanism.

The Debt Collection Improvement Act was an omnibus budget bill. The legislative record consequently left no trace of any discussion in which Congress might have debated the amendments to the Inflation Adjustment Act.[74] It is nevertheless striking that the 1996 amendment prescribed automatic cost-of-living adjustments — a highly controversial mechanism that some advocates of this legislation had championed and other interested parties had vehemently opposed — and simultaneously adopted a 10 percent cap on initial adjustments. Even in the absence of legislative history, it would not be unreasonable to speculate that

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[69] S. Rep. No. 103-281, 103d Cong. (1993).

[70] Pub. L. No. 104-134, § 31001(s), 110 Stat. 1321, 1373.

[71] *Id.* § 31001(s)(1)(A).

[72] *See id.* (calling for the first adjustment to be performed October 23, 1996 —180 days after the amending statute's enactment date of April 26, 1996 — and directing subsequent adjustments to be performed "at least once every 4 years thereafter").

[73] *See id.* § 31001(s)(2).

[74] *See* 2003 GAO Report, *supra* note 7, at 22 ("The limited legislative history … regarding the 1996 amendment to the Inflation Adjustment Act does not explain why the 10 percent cap was established."). The 2003 GAO report, however, is not precisely correct in asserting that "[u]ntil the 1996 amendment, no earlier executive branch or congressional initiative had called for any cap on the amount of inflation adjustments." *Id.* Senator Lautenberg's original bills, S. 2559 and the unamended version of S. 1014, both proposed to cap first-stage, "historical" cost-of-living adjustments at 1000 percent.

the 10 percent cap may have arisen as a compromise given in exchange for acquiescence in the adoption of a controversial automatic adjustment mechanism, one to be carried out by agency heads and published in the *Federal Register*, in lieu of piecemeal congressional amendment.

A 1998 amendment to the Inflation Adjustment Act abolished the President's obligation to provide annual reports under the original statute.[75]

## III. Problems created by the mechanics of the Inflation Adjustment Act

This section of my report will address in detail the three most salient concerns about the Civil Penalties Inflation Adjustment Act. First, I will discuss the "inflation gap" arising from the statute's 10 percent cap on initial adjustments. I will then examine the "CPI lag" attributable to the statute's directive that federal agencies base their cost-of-living adjustments on CPI data no fewer than six months old and possibly as old as 18 months. Finally, I will describe how the Act's rounding mechanism confounds the rational adjustment of federal civil penalties to reflect the economic impact of inflation.

### *A. The "inflation gap"*

The 10 percent cap imposed by the 1996 amendment, when coupled with § 5(b)(2)'s reference to the most recent inflation adjustment, creates a *permanent* "inflation gap." That gap is equivalent to the difference between (1) the actual increase in inflation since the last adjustment in the penalty amount before the Inflation Adjustment Act, and (2) 10 percent.

As time passes, the Inflation Adjustment Act prevents closure of the inflation gap. The gap created by the 1996 amendment's 10 percent cap, expressed as the ratio of accumulated inflation to 10 percent, does remain constant. But the absolute amount will grow:

$$Absolute\ inflation\ gap\ over\ time \approx p \cdot [(1+\pi)^t - 1.1] \cdot (1+\pi)^g$$

[75] Pub. L. 105-362, title XIII, § 1301(a), Nov. 10, 1998, 112 Stat. 3293.

where the variable $\bar{\pi}$ represents average annual inflation, *p* represents the original penalty, *t* represents the number of years between the original penalty and the initial adjustment, and *g* represents the number of subsequent years after the initial adjustment over which inflation grows. For the sake of convenience, inflation is assumed to increase at a constant rate of 2.5 percent.

The following worked example illustrates the effect of the inflation gap. Let *p* represent the amount of the original, unadjusted penalty. Assume that 20 years (*t*) pass between the original penalty and its first adjustment. If the penalty had been fully adjusted for inflation at the time of its first adjustment, it would have been raised to $(1.025 \wedge 20) \cdot p$, or approximately $1.639 \cdot p$. But the Inflation Adjustment Act's 10 percent cap on initial increases would cap the increased penalty at $1.1 \cdot p$. The ratio between an adjusted penalty that accurately reflected inflation and a penalty adjusted according to the Act's 10 percent gap is 1.639 to 1.1, or approximately 1.490.

Ten more years pass, at which point a second adjustment for inflation is made. In other words, $g = 10$. Had the original penalty, *p*, been adjusted strictly in accordance with inflation over the course of 30 years (20 + 10), it would be approximately $2.098 \cdot p$: $(1.025 \wedge 20) \cdot (1.025 \wedge 10) \cdot p = (1.025 \wedge 30) \cdot p \approx 2.098 \cdot p$. The penalty now reflects a further increase of inflation of approximately 28 percent in the 10 years that have passed since the initial 20-year adjustment: $1.025 \wedge g = 1.025 \wedge 10 \approx 1.280$. Adjusting for inflation in strict accordance with federal law, however, yields a different answer. The Act's 10 percent cap on initial adjustments means that the inflation-adjusted penalty, after the passage of the full 30 years (20 after the original penalty, plus another 10) is now $1.1 \cdot (1.025 \wedge 10) \cdot p$, or approximately $1.408 \cdot p$. After $t + g$ years, or 30 (20 + 10), the ratio between an economically adjusted penalty and one adjusted according to the Act remains approximately 1.490 (since $2.098 / 1.408 \approx 1.490$). The 1.408 multiplier attributable to the 10 years of inflation that passed between the initial adjustment and the later adjustment applies equally to an economically accurate penalty and to a penalty subject to the Inflation Adjustment Act's initial 10 percent cap. Further details and formal analysis are provided in the Mathematical Appendix to this report, at Section II.A.

In its 2003 study of the Inflation Act, the GAO provided a vivid example of the inflation gap in action.[76] In 1996 the Federal Aviation Administration (FAA) adjusted a maximum $1,000 penalty for possession of a firearm discovered at a baggage security checkpoint. That penalty had been set in 1958 and had gone unadjusted until 1996. The CPI increase from June 1958 to June 1995 (which § 5(b) of the Inflation Adjustment Act required the FAA to apply, over the more recent, more relevant, and more accurate CPI figure for June 1996) was 427.7 percent. A straightforward application of the cost-of-living adjustment described above would have yielded an adjusted penalty of $5,277. The 1996 amendment to the Inflation Adjustment Act, however, forced the FAA to cap this adjusted penalty at $1,100 — $4,177 less than a full adjustment for inflation between 1958 and 1995.

In a 1999 regulation that adjusted civil monetary penalties for inflation, the National Highway Transportation Safety Administration expressed specific concern that the Inflation Adjustment Act's 10 percent cap impaired the agency's effort "to enhance the deterrent effect of [its] penalties because of their importance to [its] enforcement programs":

> Even with [inflation] increases, these penalties appear less than adequate as a full deterrent to violations of the statutes that we enforce. For example, the maximum penalty for a related series of violations under the National Traffic and Motor Vehicle Safety Act of 1966 as amended in 1974 was $800,000. It would have increased more than threefold, to $2.45 million, in June 1996 if (fully) adjusted for inflation. However, the adjustment was capped at $880,000. Further, under this aggregate penalty ceiling, on a per vehicle basis the maximum penalty amounts to less than one dollar per vehicle where a substantial fleet was in violation of the Safety Act.[77]

These penalties redress serious violations of 49 U.S.C. § 301 and 49 U.S.C. § 325. These statutes proscribe behavior such as odometer tampering, failing to provide consumer information regarding vehicle crashworthiness, and violating safety and bumper requirements.[78]

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[76] *See* 2003 GAO Report, *supra* note 7, at 18-19.

[77] National Highway Transportation Safety Administration, *Civil Penalties*, 64 Fed. Reg. 37,876, 37,877 (July 14, 1999), *quoted in* 2003 GAO Report, *supra* note 7, at 22.

[78] 49 U.S.C. § 301; 49 U.S.C. § 325.

### *B. CPI lag*

The Inflation Adjustment Act requires agencies to set inflation adjustments not according to the most recent available Consumer Price Index data, or even CPI data for the most recent benchmark month. Rather, section 5(b) defines "the term 'cost-of-living adjustment' as the percentage (if any) for each civil monetary penalty by which — the Consumer Price Index for the month of June of the calendar year preceding the adjustment, exceeds … the Consumer Price Index for the month of June of the calendar year in which the amount of such civil monetary penalty was last set or adjusted pursuant to law."[79] The previous-June-to-distant-June methodology prescribed by § 5(b) creates an *intermittent* CPI lag, or the potential loss of an entire year of inflation adjustment each time an agency readjusts civil monetary penalties for intervening increases in the cost of living. CPI lag exacerbates the gap between actual inflation (on one hand) and legally dictated adjustments in civil monetary penalties under the Inflation Adjustment Act. This distortion compounds any inflation gap that may result from the 10 percent cap on an initial inflation adjustment under the Act. Truly perversely, if an agency tries to adjust its penalties for inflation *more* frequently, that attempt at regularity aggravates the effects of CPI lag and creates an even wider gap between legally adjusted penalties and a hypothetical penalty adjusted strictly in response to inflation.

Section 5(b)(1)'s requirement that agencies consult CPI "for the month of June of the calendar year *preceding* [an inflation] adjustment" commits agencies to ignore the most recent year of inflation every time they adjust a civil monetary penalty for inflation. Each round of adjustments under the Act therefore introduces an additional error, equivalent in magnitude to the most recent June-to-June change in CPI. Over multiple iterations, CPI lag compounds and can become quite considerable.

Part II.B of the Mathematical Appendix formally predicts the effects of CPI lag. For a prospective period of $s$ years, subsequent to an initial adjustment, during which an agency expects to adjust penalties for inflation at a frequency of once every $f$ years, the cumulative lag can be predicted with the following equation:

[79] Inflation Adjustment Act, *supra* note 2, § 5(b).

$$Cumulative\,CPI\,lag \approx (1+\pi)^{\left[\left[\frac{s}{f}\right]\right]} - 1$$

where the double brackets indicate the floor, or "greatest integer," function, which is the largest integer which is less than or equal to $s/f$.[80] For example, if an agency chooses to adjust its penalties for inflation every three years ($f$ = 3) over an 11-year period ($s$ = 11), then cumulative CPI lag can be predicted to be 1.025 ^ [[11/3]], or 1.025 ^ 3 – 1 ≈ 7.7 percent. The reason for this lag is that an agency observing a three-year cycle between adjustments can be expected to make three adjustments during an 11-year span. The compounded effect of three years' inflation, if inflation is assumed to rise by a constant 2.5 percent every year, is approximately 7.7 percent.

The GAO's 2003 report on the Inflation Adjustment Act provides a vivid illustration of CPI lag over time.[81] In a 1999 adjustment, the National Highway Transportation Safety Administration (NHTSA) expressed concern that the Inflation Adjustment Act prevented NHTSA from tripling penalties for violations of the National Traffic and Motor Vehicle Safety Act of 1966, as intervening inflation would prescribe, and instead capped NHTSA's fine at 10 percent over $800,000, or $880,000.[82] One should recall NHTSA's expression of frustration at its inability, under the Inflation Adjustment Act, to capture the full effect of inflation with a fine of $2.45 million rather than $880,000. The same episode also illustrates the deleterious effects of CPI lag. Thanks to CPI lag, multiple rounds of inflation adjustments, even if not handicapped by the initial 10 percent cap, would fall even further behind actual inflation. Perversely enough, the distortion attributable to CPI lag would have been even greater if NHTSA had made two rather than one adjustments in a four-year span:

1. Inflation from 1996 through 2000, with no lag: 10.0%
2. Inflation from 1996 through 1999: 6.1%. The amount of one year in CPI lag would have been approximately (1.1/1.061) − 1, or approximately 3.7%

[80] *See* http://en.wikipedia.org/wiki/Floor_and_ceiling_functions.
[81] *See* 2003 GAO Report, *supra* note 7, at 23-26 (especially figures 3, 4, and 5).
[82] *See* National Highway Transportation Safety Administration, *Civil Penalties*, 64 Fed. Reg. 37,876 (July 14, 1999).

3. Inflation from 1996-97 and 1998-99: 4.3%. The amount of two years in CPI lag would have been approximately (1.1/1.043) − 1, or approximately 5.5%

The foregoing figures are based on actual inflation numbers from 1996 through 2000. They are consistent with the amount of distortion that this report's formula for cumulative CPI lag would predict after two rounds of inflation adjustments: $1.100 / (1.025)^{[[4/2]]} = 1.100 / (1.025)^2 - 1 \approx 4.7\%$.

### *C. Rounding*

From its origins in Senator Lautenberg's original bills, S. 2599 and S. 1014, the Inflation Adjustment Act has always contemplated some form of rounding. But the Act ultimately adopted a rounding mechanism that lacks the simple elegance of a directive that all cost-of-living increases "be rounded to the nearest multiple of $10."[83] Instead, section 5(a) of the Act prescribes an elaborate six-tiered schedule for rounding. One of these directives will serve to illustrate the set. Under the Act, any cost-of-living adjustment shall be "rounded to the nearest … multiple of $100 in the case of *penalties* greater than $100 but less than or equal to $1,000."[84]

The evident intent underlying this provision is to prevent the use of awkward amounts in the adjustment of civil monetary penalties. But the rounding rules, by using the size of the *penalty* as opposed to the size of the *increase* as the trigger for rounding, create some absurd results. Some penalties (particularly smaller ones) may take as long as 17 years to trigger an increase given the rounding, since $(1 + 0.025)^{17} \approx 1.5$. The details of this calculation are laid out in Section II.C of the Mathematical Appendix. Over time, the rounding mechanism prescribed by the Act has the effect of withholding increases for certain penalties, only to unleash startlingly large increases after a long latency period. Delaying increases and then rounding them up to the nearest ten, hundred, or thousand can trigger penalty increases twice the scale of the inflation that finally merits an increase under the Inflation Adjustment Act.

A little back-of-the-envelope mathematics provides a glance at the problems created by the rounding rules. A $101 statutory penalty is, in the

[83] S. 2599, *supra* note 18, §§ 4(b), 5(b); S. 1014, *supra* note 33, §§ 4(b), 5(b).
[84] Inflation Adjustment Act, *supra* note 2, § 5(b)(2) (emphasis added).

language of the Inflation Adjustment Act, "greater than $100 but less than or equal to $1,000." Because a cost-of-living adjustment to this penalty must be "rounded to nearest … multiple of $100," there can be no such adjustment until inflation dictates an increase of at least $50. If inflation increases, as I have presumed in the interest of simplifying calculations, at a constant annual rate of 2.5 percent, then we can calculate the number of years (represented by the variable *t*) that must transpire before the agency can make an adjustment. The formula involves comparing 1.025 raised to the exponent *t*, with the sum of 1 and 50/101. The following calculation shows how the agency must wait 17 years before performing a single $100 adjustment:

$$
\begin{aligned}
&1.025^t \geq 1 + \frac{50}{101} \\
&1.025^t \approx 1.495 \\
&t\, ln(1.025) \approx ln(1.495) \\
&t \approx \frac{ln(1.495)}{ln(1.025)} \\
&t \approx 16.29 \\
&]]t[[ \approx 17
\end{aligned}
$$

where the inverted double brackets indicate the ceiling function, which is the smallest integer that is greater than or equal to *t*.[85]

In that 17th year, by which time inflation is projected to have increased 52.16 percent, the $100 increase will represent a 99 percent increase over the $101 base penalty.

The 2003 GAO report provides a real-life example of these effects.[86] The Pension and Welfare Benefits Administration (PWBA) performed cost-of-living adjustments for penalties that had originally been set by statute at $10, $100, and $1,000. Section 6 of the Inflation Adjustment Act capped initial adjustments at 10 percent each. That 10 percent cap would result in new penalties, respectively of $11, $110, and $1,100. Because the Act's rounding provisions would require the next adjustment to be rounded by a full $10, $100, or $1,000, respectively, no increase could take place until CPI had risen by 45.5 percent from the level that prevailed when the PWBA first adjusted its $10, $100, and $1,000 penalties,

[85] *See* http://en.wikipedia.org/wiki/Floor_and_ceiling_functions.
[86] *See* 2003 GAO Report, *supra* note 7, at 29-31 (especially table 3 and figure 6).

respectively to $11, $110, and $1,100. In other words, after an initial adjustment of $10, $100, and $1,000 penalties to $11, $110, and $1,100, the Act froze these new penalties in place until enough inflation had accumulate to warrant a subsequent increase of $10, $100, and $1,000, respectively, in these three penalties, respectively, to $21, $210, and $2,100. The triggering amount of inflation in each scenario would be half of $10, $100, or $1,000 — namely, $5, $50, and $500. For a further explanation of the impact of section 6's rounding provisions, see the Mathematical Appendix at Section II.C.

Anomalies traceable to the Inflation Adjustment Act's rounding provisions are so absurd that some agencies have mistakenly interpreted the statute in a common-sense way and performed rounding according to the size of the *increase*.[87] Although this sort of administrative self-help is understandable, it is contrary to the letter of the Inflation Adjustment Act.

A dramatic example of all of these effects in action can be seen in the Department of Homeland Security's (DHS) attempt to adjust a host of penalties for violations of the Immigration and Naturalization Act (INA):[88]

| INA § | Existing penalty | Year last adjusted | Cost-of-living adjustment from 2011 in % | Raw increase (2011) | Rounder | Rounded increase | Adjusted penalty | Distortion in $ and % |
|---|---|---|---|---|---|---|---|---|
| **231(g)** | $1,000 | Enacted 2002 | 21.16 | $211.60 | 10% statutory cap | $100 | $1,100 | –$111.60 –47.73% |
| **234** | $2,200 | 1999 | 31.15 | $685.30 | $1,000 | $1,000 | $3,200 | +$334.70 +45.92% |
| **240B(d)** | $1,000 min. $5,000 max. | Enacted 1996 | 39.10 | $391 min. $1,955 max. | 10% statutory cap | $100 min. $500 max. | $1,100 min. $5,500 max. | –$291 –74.42% –$1,455 –74.42% |
| **243(c)(1)(A)** | $2,000 | Enacted 1996 | 39.10 | $782.00 | 10% statutory cap | $200 | $2,200 | –$582 –74.42% |

[87] *See* GAO Reports, *Compliance with the Inflation Adjustment Act*, GAO-02-1084R (Sept. 24, 2002) (Farm Credit Administration); GAO-02-1085R (Sept. 30, 2002) (Department of Commerce).

[88] *See* Department of Homeland Security, *Civil Monetary Penalties Inflation Adjustment*, 76 Fed. Reg. 74,625, 74,627-28 (Dec. 1, 2011).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **243(c)(1)(B)** | $5,000 | Enacted 1996 | 39.10 | $1,955.00 | 10% statutory cap | $500 | $5,500 | –$1,455<br>–74.42% |
| **251(d)** | $220 for each alien not reported; $5,500 for use of alien crewman | 1999 | 31.15 | $68.53 for each alien not reported; $1,713.25 for use of alien crewman | $100 for each alien not reported; $1,000 for use of alien crewman | $100 for each alien not reported; $2,000 for use of alien crewman | $320 for each alien not reported; $7,500 for use of alien crewman | +$31.47<br>+45.92%<br>+$286.75<br>+16.74% |
| **254(a)** | $550 min.<br>$3,300 max. | 1999 | 31.15 | $171.33 min.<br>$1,027.95 max. | $100 min.<br>$1,000 max. | $200 min.<br>$1,000 max. | $750 min.<br>$4,300 max. | +$28.67<br>+17.77%<br>–$27.95<br>–2.72% |
| **255** | $1,100 | 1999 | 31.15 | $342.65 | $1,000 | $0 | $1,100 | –$342.65<br>–100.00% |

These penalties relate to a number of serious violations of the INA, including: non-compliance with departure manifest requirements for vessels and aircraft, non-compliance with landing requirements at entry points by aircraft transporting aliens, failure to depart the U.S. voluntarily, failure to comply with removal orders or to remove alien stowaways, failure to report an illegal landing or desertion of an alien crewmen or passenger, use of an alien crewmen for longshore work, employment of aliens with certain disabilities as crewman, failing to control alien crewmen, bringing alien crewmen into the U.S. with the intent to evade the INA, failing to prevent the unauthorized landing of aliens, bringing aliens into the U.S. who are subject to denial on a health-related ground or who lack required documents, as well as general penalties for failure to depart or improper entry.[89]

## IV. Possible solutions

All three of the significant defects in the Inflation Adjustment Act — the inflation gap, CPI lag, and rounding whiplash — arise from the plain language of the statute. Although some agencies have tried to work around this statute's most awkward provisions, those efforts are contrary to law. To be sure, the norms of statutory construction instruct courts and agencies alike not to interpret statutes so

[89] *Id.*

as to achieve absurd results.[90] Congress, however, ultimately chose unambiguous language to achieve dubious results. This report will therefore recommend possible legislative solutions to the major problems afflicting the Inflation Adjustment Act.

The simplest solution to the inflation gap rests in outright repeal of the 10 percent cap on initial inflation adjustments found in section 6. Until the 1996 amendment, no member of Congress or witness at a congressional hearing had proposed any cap more stringent than 1000 percent. In fairness, the 10 percent cap may be rationalized, especially in hindsight, as part of a larger legislative package. The 1996 amendment introduced an automatic adjustment mechanism that had proved quite controversial in the debates preceding passage of the original Inflation Adjustment Act in 1990. Indeed, the original 1990 statute reverted to a presidential reporting mechanism that left the actual legal work of adjusting civil monetary penalties to Congress, in the form of full-blown legislation. The 1996 amendment, seen in this light, may have conditioned congressional acquiescence in an automatic adjustment mechanism upon the imposition of a restrictive cap on initial adjustments.

Respect for the broader purposes that may be imputed to the Inflation Adjustment Act counsels consideration of an intermediate approach, of some kind of compromise. Retaining the 10 percent limit solely as a cap on any single cost-of-living adjustment allows Congress to keep some limit on inflation-based increases in civil monetary penalties. By the same token, allowing a 10 percent increase in any given year does supply a slow cure for the inflation gap that cripples the existing Inflation Adjustment Act. If we assume modest inflation, somewhere in the neighborhood of the historical average of 2.5 percent, annual 10 percent increases would enable agencies eventually to align civil monetary penalties with the inflation that has intervened since the original passage of the statute imposing those penalties.

As demonstrated in Part II.D of the Mathematical Appendix, agencies operating under a 10 percent cap on annual cost-of-living increases can close the historical inflation gap within 0.35 times the number of years that a civil penalty languished without an inflation adjustment. If Congress, in a future amendment to the Inflation Adjustment Act, elects to retain a mechanism for softening the

[90] *See*, *e.g.*, Green v. Bock Laundry Mach. Co., 490 U.S. 504, 527 (1989) (Scalia, J., concurring in the judgment); Einer Elhauge, Statutory Default Rules: How to Interpret Unclear Legislation 148 (2008).

initial implementation of inflation adjustments for civil monetary penalties that have lain dormant for long periods of time, this ratio would facilitate a reasonably informed estimate of the length of time that it will take for a phased-in set of inflation adjustments, each observing a fixed cap on annual increases, to catch up for lost intervening time and to take full effect.

Some danger does lurk if Congress chooses to limit annual inflation adjustments to 10 percent, out of an interest in softening the transition from long-neglected civil penalties. Contrary to the simplifying assumption adopted hitherto by this report, this discussion, will no longer assume that inflation increases each year by a constant 2.5 percent. Rather, it will use actual historical CPI data. Since 1914, the Consumer Price Index has increased more than 10 percent in a single year on ten occasions.[91] This represents an incidence just over 10 percent (10 occasions divided by 98 years ≈ 10.2 percent). The past two decades have witnessed remarkable stability in consumer prices. The CPI has not increased by more than 4 percent in any year since 1992. Of the ten years since 1914 that witnessed annual inflation of 10 percent or more, seven (1917 through 1920, plus 1979 through 1981) took place in streaks of three or four years. *Any* meaningful ceiling on initial or intermittent adjustments is therefore vulnerable to a mismatch between statutory design and economic realities.

CPI lag is likewise the product of poor legislative drafting. The Act's reference to "the Consumer Price Index for the month of June of the calendar year preceding the adjustment" appears to have arisen from a linguistically decisive but pragmatically disastrous resolution of ambiguous language in Senator Lautenberg's original bills.[92] There is no way to defend the plain meaning of this provision. No rational, thoughtful method for making cost-of-living adjustments in civil monetary penalties would systematically direct federal agencies to ignore six to eighteen months of CPI data. If Congress wishes to retain current law's reliance on CPI data for the month of June, it can do so by rewriting section 5(b)(2) so that it refers to "the Consumer Price Index for the most recent month of June."

Rounding has confounded the Inflation Adjustment Act ever since Senator Lautenberg invited his congressional colleagues to modify his original proposal of rounding all increases to the nearest multiple of $10. Perhaps the time has come to restore the original bill's $10 rounding provision. Alternatively, as some

[91] CPI data since 1913 is reported at ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt.
[92] Inflation Adjustment Act, *supra* note 2, § 5(b)(2).

agencies and the GAO have suggested, Congress may wish to consider repealing the rounding provision in its entirety.[93]

A less drastic alternative lies in amending the Inflation Adjustment Act so that rounding is based solely on the size of the increase rather than the size of the underlying penalty. Section 5(a) of the Act reads in part: "Any increase determined under this subsection shall be rounded to the nearest — (1) multiple of $10 in the case of penalties less than or equal to $100; (2) multiple of $100 in the case of penalties greater than $100 but less than or equal to $1,000; … ."[94] Substituting the word "increases" for the word "penalties" yields this alternative: "Any increase determined under this subsection shall be rounded to the nearest — (1) multiple of $10 in the case of ~~penalties~~ *increases* less than or equal to $100; (2) multiple of $100 in the case of ~~penalties~~ *increases* greater than $100 but less than or equal to $1,000; … ." Rounding adjustments according to the level of the increases rather than the level of the penalties will ameliorate two of the deleterious effects of the Inflation Adjustment Act. The Act's rounding provisions, as they stand, make adjustments less frequent (in partial contravention of congressional intent) and more volatile when they do occur (in complete frustration of Congress's expectations and of any plausible legislative purpose underlying a statutory directive to adjust monetary penalties for inflation). Rounding according to increases rather than entire penalties will facilitate more frequent (or at least more regular) adjustments, and with far less "whiplash" than under existing law.

If Congress does reexamine the Inflation Adjustment Act, it should take advantage of institutional diversity within the United States government. The Inflation Adjustment Act exempted four statutes: the Internal Revenue Code of 1986, the Tariff Act of 1930, the Occupational Safety and Health Act of 1970, and the Social Security Act.[95] The agencies in charge of these statutes are not strangers to the exercise of adjusting civil monetary penalties for changes in inflation. Indeed, the Department of Labor, where OSHA resides, is responsible for calculating and reporting the Consumer Price Index through its Bureau of Labor Statistics. For their part, the Internal Revenue Service and the Social Security Administration are among the federal government's most voracious

[93] *See* 2003 GAO Report, *supra* note 7, at 33, 38.
[94] Inflation Adjustment Act, *supra* note 2, § 5(a).
[95] *See id.* § 4(1).

"consumers" of CPI data.[96] These agencies have extensive familiarity with the CPI as the federal government's preferred measure of inflation.

Agencies responsible for the statutes exempted from the Inflation Adjustment Act have had their own experiences, positive and negative, in implementing their own inflation adjustments free from the constraints of the Inflation Adjustment Act. The record of the Internal Revenue Service is especially instructive.[97] Some tax penalties automatically adjust for inflation because they are based on a percentage of the taxpayer's overall liability. For example, the penalty for failure to pay tax obligations is "0.5 percent of the amount of such tax if the failure is for not more than 1 month, with an additional 0.5 percent for each additional month or fraction thereof during which such failure continues, not exceeding 25 percent in the aggregate."[98] Penalties of this sort automatically adjust in response to inflation. But the Internal Revenue Code is also filled with civil penalties based on a fixed dollar amount. For instance, the penalty for failure to file a partnership return "is the product of $195, multiplied by the number of" partners.[99] Like penalties covered by the Inflation Adjustment Act, those penalties are vulnerable to erosion due to inflation over time.

If any federal agency is uniquely, appropriately equipped to adjust civil monetary penalties to reflect inflation and to ensure that deterrent effects remain robust despite changes in consumer prices and the broader economy, that agency is the Internal Revenue Service. The IRS is familiar with the use of CPI to adjust many parts of the Internal Revenue Code.[100] The Code uses the CPI to adjust tax

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[96] *See generally* Jim Chen, *The Price of Macroeconomic Imprecision: How Should the Law Measure Inflation?*, 54 Hastings L.J. 1375 (2003).

[97] *See generally* United States General Accountability Office, *Tax Compliance: Inflation Has Significantly Decreased the Value of Some Penalties*, GAO-07-1062 (Aug. 2007) [hereinafter 2007 GAO Report]; Michael C. Durst, *Inflation and the Tax Code: Guidelines for Policymaking*, 73 Minn. L. Rev. 1217 (1989).

[98] I.R.C. § 6651(a)(2).

[99] I.R.C. § 6698(b).

[100] *See generally*, *e.g.*, *In 2012, Many Tax Benefits Increase Due to Inflation Adjustments*, IR-2011-104, Oct. 20, 2011 (available online at http://www.irs.gov/newsroom/article/0,,id=248485,00.html).

brackets,[101] the standard deduction,[102] the personal exemption,[103] and itemized deductions such as Hope and Lifetime Learning Credits.[104]

To be sure, the IRS's institutional capacity should not be equated with actual institutional performance. Although the IRS has the technical capability and the legal authority (by virtue of the exemption of the Internal Revenue Code from the Inflation Adjustment Act) to implement its own inflation adjustments, the IRS has not implemented such adjustments to civil penalties.[105] The result is a considerable loss of revenue to the Treasury and a corresponding dilution of the effectiveness of fixed-amount civil monetary penalties in federal income tax law. At first glance, this record of institutional performance hardly serves to recommend the Internal Revenue Service as the agency of first resort if Congress were to tap the latent expertise of the federal government in developing and implementing effective inflation-based adjustments of civil monetary penalties. The truth remains, though, that dollar-denominated penalties under the Internal Revenue Code serve the same legislative purposes as their counterparts throughout the rest of the federal government: to deter conduct targeted by civil monetary penalties and, perhaps secondarily, to raise revenue for the United States. The pervasiveness of statutory references to the CPI within the Internal Revenue Code and the overall impact of inflation on income taxation should enable the Internal Revenue Service, under appropriate congressional authorization, to supply helpful guidance to other federal agencies.

Finally, if Congress does amend the Inflation Adjustment Act, it may wish to consider designating a single agency to guide other agencies in applying the Act or (in the case of exempt statutes) in fashioning inflation adjustments not subject to the Act. The Bureau of Labor Statistics in the Department of Labor develops and updates the CPI. The Internal Revenue Service in the Department of Treasury has more experience applying the CPI than perhaps any other agency.

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[101] I.R.C. § 1(f)(3).
[102] I.R.C. § 64(c)(4).
[103] I.R.C. § 151(d)(4).
[104] I.R.C. § 25A(h).
[105] *See* 2007 GAO Report, *supra* note 97, at 3-4.

## V. Conclusion

Adjusting civil monetary penalties is indisputably sound legal policy. Neither Congress nor the executive branch has contested the goals of the Inflation Adjustment Act. The language of that statute, however, has undermined the attainment of those goals. The only cure lies in legislative amendment. Congress should consider amending the Inflation Adjustment Act to eliminate the inflation gap that arises from the initial 10 percent cap on initial adjustments, to eliminate the CPI lag arising from the Act's directive that agencies ignore six to 18 months of CPI data when making adjustments, and to restore rationality to the statute's rounding provisions — if necessary, by repealing those rounding provisions in their entirety.

# Mathematical Appendix

## I. Observing, Reporting, and Forecasting Inflation

### *A. Inflation, over time and on average*

Like interest on loans or savings, inflation compounds over time. As a formal matter, inflation over a period of time can be expressed as a multiplicative sequence of annual inflation rates:

Total inflation over *n* years = $\pi = \prod_{k=1}^{n}(1+\pi_k)$

Consistent with conventional notation in the literature of macroeconomics, the Greek letter $\pi$ represents inflation. This report does not use $\pi$ in the more commonplace sense as the ratio of a circle's circumference to its diameter. $\pi_k$ represents the inflation rate in the k-*th* year.

Throughout this report, the actual level of inflation that occurs during a particular period of time is not disputed. The Inflation Adjustment Act measures inflation according to the CPI. Since actual inflation is undisputed, one way to simply analysis, especially in forecasting future inflation, is to assume a constant rate of inflation that is consistent with historical levels and not overly optimistic or otherwise misleading for purposes of projecting future inflation. This is very similar to the familiar problem of calculating compound interest over a period of time, on the assumption that interest remains fixed throughout the period. Total inflation over the temporal interval defined by *k*=1 and *k*=*n* may be stated in terms of average annual inflation, $\bar{\pi}$, a term that will be defined later:

Total inflation as the compounding of $\bar{\pi}$ over *n* years = $\pi = (1+\bar{\pi})^n$

$$\pi = \prod_{k=1}^{n} (1+\pi_k) = (1+\bar{\pi})^n$$

The Inflation Adjustment Act uses annual changes in CPI as its measure of inflation. In other words, $\pi_k = CPI_k$ , and $\Delta\pi_k = \Delta CPI_k$:

$$\pi = \prod_{k=1}^{n} (1+\Delta CPI_k)$$

The average annual inflation over any given period is the geometric mean of this product, minus 1:

$$Average\ annual\ inflation = \bar{\pi} = [\prod_{k=1}^{n} (1+\Delta CPI_k)]^{\frac{1}{n}} - 1$$

Equivalently:

$$Average\ annual\ inflation = \bar{\pi} = \sqrt[n]{\prod_{k=1}^{n} (1+\Delta CPI_k)} - 1$$

If *n*, the total number of years, is defined as the difference between later year *b* and earlier year *a*, the previous relationships can be restated thus:

$$n = b - a$$
$$\pi = (1+\bar{\pi})^{b-a}$$
$$\pi = \sqrt[b-a]{\prod_{k=1}^{n}(1+\Delta CPI_k)} - 1$$

The CPI is reported as a ratio of the price of a market basket of consumer goods, relative to an index of 100 for a base year. Total inflation over that period is the ratio of the later CPI value to the earlier CPI value:

$$Total\ Inflation = \pi = \frac{CPI_b}{CPI_a}$$

where $CPI_a$ refers to CPI in the earlier base year and $CPI_b$ refers to CPI in the later target year. Average annual inflation is the $(b - a)$-th root of this ratio, minus 1:

$$Average\ annual\ inflation = \bar{\pi} = \sqrt[b-a]{\frac{CPI_b}{CPI_a}} - 1$$

*B. Estimating annual inflation*

Computing a geometric mean is probably not the most intuitive mathematical operation for the casual observer. Casual estimates of annual inflation based on the ratio of CPI values for different years routinely make the mistake of taking the ratio and dividing by the number of years between the earlier and the later year. This is a valid method for computing an *arithmetic* mean, but not for computing the *geometric* mean. But the natural logarithm of the ratio of CPI values for different years, divided by the number of years, is a good and useful approximation:

$$\bar{\pi} \approx \frac{\ln(CPI_b / CPI_a)}{b-a} = \frac{\ln(CPI_b) - \ln(CPI_a)}{b-a}$$

Why this is so warrants a brief mathematical excursion. Euler's constant, $e$ (approximately 2.718), is the base of natural logarithms. It is defined as the limit of $(1 + 1/x)^x$ as $x$ increases toward infinity. Formally:

$$e = \lim_{x \to \infty} (1 + \frac{1}{x})^x$$

Moreover:

$$e^y = \lim_{x \to \infty} (1 + \frac{y}{x})^x$$

Previous equations have established that inflation over an interval of multiple years can be expressed in either of the following two ways:

$$\pi = (1 + \bar{\pi})^{b-a}$$
$$\pi = \frac{CPI_b}{CPI_a}$$

The first of these equations expresses the effect of compounding an average annual inflation rate, $\bar{\pi}$, over $b - a$ years. The second equation expresses inflation as the ratio of a later CPI figure ($CPI_b$) to CPI for an earlier, baseline year ($CPI_a$). The values of $CPI_a$ and $CPI_b$ are known. Those values facilitate a solution for the value of $\bar{\pi}$:

$$(1 + \bar{\pi})^{b-a} = \frac{CPI_b}{CPI_a}$$
$$ln\,[(1 + \bar{\pi})^{b-a}] = ln(\frac{CPI_b}{CPI_a})$$
$$(b-a) \cdot ln(1+\bar{\pi}) = ln(CPI_b) - ln(CPI_a)$$
$$ln(1+\bar{\pi}) = \frac{ln(CPI_b) - ln(CPI_a)}{b-a}$$

For small values of $\bar{\pi}$, the expression $ln(1+\bar{\pi})$ is a good approximation of $\bar{\pi}$ itself. For example, if $\bar{\pi}$ is 0.01, the error [as defined by $\bar{\pi}/ln(1+\bar{\pi})$ is 0.00497; if $\bar{\pi}$ is 0.10 the error is 0.0469. A table of all values from 0.01 to 0.10 follows:

| Natural log of 1+n = ln(1+n) | n | ln(1+n)/n | 1-ln(1+n)/n |
|---|---|---|---|
| 0.009950 | 0.01 | 0.995033 | 0.004967 |
| 0.019803 | 0.02 | 0.990131 | 0.009869 |
| 0.029559 | 0.03 | 0.985293 | 0.014707 |
| 0.039221 | 0.04 | 0.980518 | 0.019482 |
| 0.048790 | 0.05 | 0.975803 | 0.024197 |
| 0.058269 | 0.06 | 0.971148 | 0.028852 |
| 0.067659 | 0.07 | 0.966552 | 0.033448 |
| 0.076961 | 0.08 | 0.962013 | 0.037987 |
| 0.086178 | 0.09 | 0.957530 | 0.042470 |

A demonstration of this relationship between $ln(1+\bar{\pi})$ and $\bar{\pi}$ begins with a modest rearrangement of our original definition of average annual inflation:

$$\pi = (1 + \bar{\pi})^{b-a}$$

$$\pi = (1 + \frac{\overline{\pi} \cdot (b-a)}{(b-a)})^{b-a}$$

As ($b - a$) increases, this quantity approaches $e$ raised to the quantity, $\overline{\pi} \cdot (b-a)$:

$$\lim_{(b-a)\to\infty} (1 + \frac{\overline{\pi} \cdot (b-a)}{(b-a)})^{b-a} = e^{\overline{\pi} \cdot (b-a)}$$

$$(1 + \overline{\pi})^{b-a} \approx e^{\overline{\pi} \cdot (b-a)}$$

$$(b-a) \cdot ln(1 + \overline{\pi}) \approx \overline{\pi} \cdot (b-a)$$

$$ln(1 + \overline{\pi}) \approx \overline{\pi}$$

To determine the *exact* value of $\overline{\pi}$, the previous exercise in algebraic rearrangement merely needs to proceed to its logical conclusion:

$$ln(1+\overline{\pi}) = \frac{ln(CPI_b) - ln(CPI_a)}{b-a}$$

$$1+\overline{\pi} = exp(\frac{ln(CPI_b) - ln(CPI_a)}{b-a})$$

$$\overline{\pi} = exp(\frac{ln(CPI_b) - ln(CPI_a)}{b-a}) - 1$$

where *exp(x)* is equivalent to *e*, Euler's constant, raised to the power of *x*.

This definition of *e* permits the convenient division into two steps of the admittedly awkward process of calculating average annual inflation: (1) taking the natural logarithm of the ratio of target-year CPI to base-year CPI and (2) dividing that result by the number of years that have passed:

$$\overline{\pi} \approx \frac{\ln(CPI_b / CPI_a)}{b-a} = \frac{\ln(CPI_b) - \ln(CPI_a)}{b-a}$$

This estimate may be readily converted to the exact geometric mean by raising *e* to this power and then subtracting 1:

$$\overline{\pi} = \exp(\frac{\ln(CPI_b / CPI_a)}{b-a}) - 1 = \sqrt[b-a]{\frac{CPI_b}{CPI_a}} - 1$$

## *C. Table of actual annual inflation*



9-14-2012

U.S. Department Of Labor
Bureau of Labor Statistics
Washington, D.C. 20212

Consumer Price Index

All Urban Consumers - (CPI-U)

U.S. city average

All items

1982-84=100

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Annual Avg. | Percent change Dec- Dec | Percent change Avg- Avg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1913 | 9.8 | 9.8 | 9.8 | 9.8 | 9.7 | 9.8 | 9.9 | 9.9 | 10.0 | 10.0 | 10.1 | 10.0 | 9.9 | | |
| 1914 | 10.0 | 9.9 | 9.9 | 9.8 | 9.9 | 9.9 | 10.0 | 10.2 | 10.2 | 10.1 | 10.2 | 10.1 | 10.0 | 1.0 | 1.0 |
| 1915 | 10.1 | 10.0 | 9.9 | 10.0 | 10.1 | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.3 | 10.1 | 10.1 | 2.0 | 1.0 |
| 1916 | 10.4 | 10.4 | 10.5 | 10.6 | 10.7 | 10.8 | 10.8 | 10.9 | 11.1 | 11.3 | 11.5 | 11.6 | 10.9 | 12.6 | 7.9 |
| 1917 | 11.7 | 12.0 | 12.0 | 12.6 | 12.8 | 13.0 | 12.8 | 13.0 | 13.3 | 13.5 | 13.5 | 13.7 | 12.8 | 18.1 | 17.4 |
| 1918 | 14.0 | 14.1 | 14.0 | 14.2 | 14.5 | 14.7 | 15.1 | 15.4 | 15.7 | 14.8 | 14.3 | 14.5 | 15.1 | 20.4 | 18.0 |
| 1919 | 14.5 | 14.2 | 14.4 | 14.7 | 14.9 | 14.9 | 17.4 | 17.7 | 17.8 | 18.1 | 18.5 | 18.9 | 17.3 | 14.5 | 14.6 |
| 1920 | 19.3 | 19.5 | 19.7 | 20.3 | 20.6 | 20.9 | 20.8 | 20.3 | 20.0 | 19.9 | 19.8 | 19.4 | 20.0 | 2.6 | 15.6 |
| 1921 | 19.0 | 18.4 | 18.3 | 18.1 | 17.7 | 17.6 | 17.7 | 17.7 | 17.5 | 17.5 | 17.4 | 17.3 | 17.9 | -10.8 | -10.5 |
| 1922 | 16.9 | 16.9 | 16.7 | 16.7 | 16.7 | 16.7 | 16.8 | 16.6 | 16.6 | 16.7 | 16.8 | 16.9 | 16.8 | -2.3 | -6.1 |
| 1923 | 16.8 | 16.8 | 16.8 | 16.9 | 16.9 | 17.0 | 17.2 | 17.1 | 17.2 | 17.3 | 17.3 | 17.3 | 17.1 | 2.4 | 1.8 |
| 1924 | 17.3 | 17.2 | 17.1 | 17.0 | 17.0 | 17.0 | 17.1 | 17.0 | 17.1 | 17.2 | 17.2 | 17.3 | 17.1 | 0.0 | 0.8 |
| 1925 | 17.3 | 17.2 | 17.3 | 17.2 | 17.3 | 17.5 | 17.7 | 17.7 | 17.7 | 17.7 | 18.0 | 17.9 | 17.5 | 3.5 | 2.3 |
| 1926 | 17.9 | 17.9 | 17.8 | 17.9 | 17.8 | 17.7 | 17.5 | 17.4 | 17.5 | 17.6 | 17.7 | 17.7 | 17.7 | -1.1 | 1.1 |
| 1927 | 17.5 | 17.4 | 17.3 | 17.3 | 17.4 | 17.6 | 17.3 | 17.2 | 17.3 | 17.4 | 17.3 | 17.3 | 17.4 | -2.3 | -1.7 |
| 1928 | 17.3 | 17.1 | 17.1 | 17.1 | 17.2 | 17.1 | 17.1 | 17.1 | 17.3 | 17.2 | 17.2 | 17.1 | 17.1 | -1.2 | -1.7 |
| 1929 | 17.1 | 17.1 | 17.0 | 16.9 | 17.0 | 17.1 | 17.3 | 17.3 | 17.3 | 17.3 | 17.3 | 17.2 | 17.1 | 0.6 | 0.8 |
| 1930 | 17.1 | 17.0 | 16.9 | 17.0 | 16.9 | 16.8 | 16.6 | 16.5 | 16.4 | 16.5 | 16.4 | 16.1 | 16.7 | -6.4 | -2.3 |
| 1931 | 15.9 | 15.7 | 15.6 | 15.5 | 15.3 | 15.1 | 15.1 | 15.1 | 15.0 | 14.9 | 14.7 | 14.6 | 15.2 | -9.3 | -9.0 |
| 1932 | 14.3 | 14.1 | 14.0 | 13.9 | 13.7 | 13.6 | 13.6 | 13.5 | 13.4 | 13.3 | 13.2 | 13.1 | 13.7 | -10.3 | -9.9 |
| 1933 | 12.9 | 12.7 | 12.6 | 12.6 | 12.6 | 12.7 | 13.1 | 13.2 | 13.2 | 13.2 | 13.2 | 13.2 | 13.0 | 0.8 | -5.1 |
| 1934 | 13.2 | 13.3 | 13.3 | 13.3 | 13.3 | 13.4 | 13.4 | 13.4 | 13.4 | 13.5 | 13.5 | 13.4 | 13.4 | 1.5 | 3.1 |
| 1935 | 13.4 | 13.7 | 13.7 | 13.8 | 13.8 | 13.7 | 13.7 | 13.7 | 13.7 | 13.7 | 13.8 | 13.8 | 13.7 | 3.0 | 2.2 |
| 1936 | 13.8 | 13.8 | 13.7 | 13.7 | 13.7 | 13.8 | 13.9 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 13.9 | 1.4 | 1.5 |
| 1937 | 14.1 | 14.1 | 14.2 | 14.3 | 14.4 | 14.4 | 14.5 | 14.5 | 14.6 | 14.6 | 14.5 | 14.4 | 14.4 | 2.9 | 3.6 |
| 1938 | 14.2 | 14.1 | 14.1 | 14.2 | 14.1 | 14.1 | 14.1 | 14.1 | 14.1 | 14.0 | 14.0 | 14.0 | 14.1 | -2.8 | -2.1 |
| 1939 | 14.0 | 13.9 | 13.9 | 13.8 | 13.8 | 13.8 | 13.8 | 13.8 | 14.1 | 14.0 | 14.0 | 14.0 | 13.9 | 0.0 | -1.4 |
| 1940 | 13.9 | 14.0 | 14.0 | 14.0 | 14.0 | 14.1 | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 14.1 | 14.0 | 0.7 | 0.7 |
| 1941 | 14.1 | 14.1 | 14.2 | 14.3 | 14.4 | 14.7 | 14.7 | 14.9 | 15.1 | 15.3 | 15.4 | 15.5 | 14.7 | 9.9 | 5.0 |
| 1942 | 15.7 | 15.8 | 16.0 | 16.1 | 16.3 | 16.3 | 16.4 | 16.5 | 16.5 | 16.7 | 16.8 | 16.9 | 16.3 | 9.0 | 10.9 |
| 1943 | 16.9 | 16.9 | 17.2 | 17.4 | 17.5 | 17.5 | 17.4 | 17.3 | 17.4 | 17.4 | 17.4 | 17.4 | 17.3 | 3.0 | 6.1 |
| 1944 | 17.4 | 17.4 | 17.4 | 17.5 | 17.5 | 17.6 | 17.7 | 17.7 | 17.7 | 17.7 | 17.7 | 17.8 | 17.6 | 2.3 | 1.7 |
| 1945 | 17.8 | 17.8 | 17.8 | 17.8 | 17.9 | 18.1 | 18.1 | 18.1 | 18.1 | 18.1 | 18.1 | 18.2 | 18.0 | 2.2 | 2.3 |
| 1946 | 18.2 | 18.1 | 18.3 | 18.4 | 18.5 | 18.7 | 19.8 | 20.2 | 20.4 | 20.8 | 21.3 | 21.5 | 19.5 | 18.1 | 8.3 |
| 1947 | 21.5 | 21.5 | 21.9 | 21.9 | 21.9 | 22.0 | 22.2 | 22.5 | 23.0 | 23.0 | 23.1 | 23.4 | 22.3 | 8.8 | 14.4 |
| 1948 | 23.7 | 23.5 | 23.4 | 23.8 | 23.9 | 24.1 | 24.6 | 24.5 | 24.5 | 24.4 | 24.2 | 24.1 | 24.1 | 3.0 | 8.1 |
| 1949 | 24.0 | 23.8 | 23.8 | 23.9 | 23.8 | 23.9 | 23.7 | 23.8 | 23.9 | 23.7 | 23.8 | 23.6 | 23.8 | -2.1 | -1.2 |
| 1950 | 23.5 | 23.5 | 23.6 | 23.6 | 23.7 | 23.8 | 24.1 | 24.3 | 24.4 | 24.6 | 24.7 | 25.0 | 24.1 | 5.9 | 1.3 |
| 1951 | 25.4 | 25.7 | 25.8 | 25.8 | 25.9 | 25.9 | 25.9 | 25.9 | 26.1 | 26.2 | 26.4 | 26.5 | 26.0 | 6.0 | 7.9 |
| 1952 | 26.5 | 26.3 | 26.3 | 26.4 | 26.4 | 26.5 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.5 | 0.8 | 1.9 |
| 1953 | 26.6 | 26.5 | 26.6 | 26.6 | 26.7 | 26.8 | 26.8 | 26.9 | 26.9 | 27.0 | 26.9 | 26.9 | 26.7 | 0.7 | 0.8 |
| 1954 | 26.9 | 26.9 | 26.9 | 26.8 | 26.9 | 26.9 | 26.9 | 26.9 | 26.8 | 26.8 | 26.8 | 26.7 | 26.9 | -0.7 | 0.7 |
| 1955 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.8 | 26.8 | 26.9 | 26.9 | 26.9 | 26.8 | 26.8 | 0.4 | -0.4 |
| 1956 | 26.8 | 26.8 | 26.8 | 26.9 | 27.0 | 27.2 | 27.4 | 27.3 | 27.4 | 27.5 | 27.5 | 27.6 | 27.2 | 3.0 | 1.5 |
| 1957 | 27.6 | 27.7 | 27.8 | 27.9 | 28.0 | 28.1 | 28.3 | 28.3 | 28.3 | 28.3 | 28.4 | 28.4 | 28.1 | 2.9 | 3.3 |
| 1958 | 28.6 | 28.6 | 28.8 | 28.9 | 28.9 | 28.9 | 29.0 | 28.9 | 28.9 | 28.9 | 29.0 | 28.9 | 28.9 | 1.8 | 2.8 |
| 1959 | 29.0 | 28.9 | 28.9 | 29.0 | 29.0 | 29.1 | 29.2 | 29.2 | 29.3 | 29.4 | 29.4 | 29.4 | 29.1 | 1.7 | 0.7 |
| 1960 | 29.3 | 29.4 | 29.4 | 29.5 | 29.5 | 29.6 | 29.6 | 29.6 | 29.6 | 29.8 | 29.8 | 29.8 | 29.6 | 1.4 | 1.7 |
| 1961 | 29.8 | 29.8 | 29.8 | 29.8 | 29.8 | 29.8 | 30.0 | 29.9 | 30.0 | 30.0 | 30.0 | 30.0 | 29.9 | 0.7 | 1.0 |
| 1962 | 30.0 | 30.1 | 30.1 | 30.2 | 30.2 | 30.2 | 30.3 | 30.3 | 30.4 | 30.4 | 30.4 | 30.4 | 30.2 | 1.3 | 1.0 |
| 1963 | 30.4 | 30.4 | 30.5 | 30.5 | 30.5 | 30.6 | 30.7 | 30.7 | 30.7 | 30.8 | 30.8 | 30.9 | 30.6 | 1.6 | 1.3 |
| 1964 | 30.9 | 30.9 | 30.9 | 30.9 | 30.9 | 31.0 | 31.1 | 31.0 | 31.1 | 31.1 | 31.2 | 31.2 | 31.0 | 1.0 | 1.3 |
| 1965 | 31.2 | 31.2 | 31.3 | 31.4 | 31.4 | 31.6 | 31.6 | 31.6 | 31.6 | 31.7 | 31.7 | 31.8 | 31.5 | 1.9 | 1.6 |
| 1966 | 31.8 | 32.0 | 32.1 | 32.3 | 32.3 | 32.4 | 32.5 | 32.7 | 32.7 | 32.9 | 32.9 | 32.9 | 32.4 | 3.5 | 2.9 |
| 1967 | 32.9 | 32.9 | 33.0 | 33.1 | 33.2 | 33.3 | 33.4 | 33.5 | 33.6 | 33.7 | 33.8 | 33.9 | 33.4 | 3.0 | 3.1 |
| 1968 | 34.1 | 34.2 | 34.3 | 34.4 | 34.5 | 34.7 | 34.9 | 35.0 | 35.1 | 35.3 | 35.4 | 35.5 | 34.8 | 4.7 | 4.2 |
| 1969 | 35.6 | 35.8 | 36.1 | 36.3 | 36.4 | 36.6 | 36.8 | 37.0 | 37.1 | 37.3 | 37.5 | 37.7 | 36.7 | 6.2 | 5.5 |
| 1970 | 37.8 | 38.0 | 38.2 | 38.5 | 38.6 | 38.8 | 39.0 | 39.0 | 39.2 | 39.4 | 39.6 | 39.8 | 38.8 | 5.6 | 5.7 |
| 1971 | 39.8 | 39.9 | 40.0 | 40.1 | 40.3 | 40.6 | 40.7 | 40.8 | 40.8 | 40.9 | 40.9 | 41.1 | 40.5 | 3.3 | 4.4 |
| 1972 | 41.1 | 41.3 | 41.4 | 41.5 | 41.6 | 41.7 | 41.9 | 42.0 | 42.3 | 42.3 | 42.4 | 42.5 | 41.8 | 3.4 | 3.2 |
| 1973 | 42.6 | 42.9 | 43.3 | 43.6 | 43.9 | 44.2 | 44.3 | 45.1 | 45.2 | 45.6 | 45.9 | 46.2 | 44.4 | 8.7 | 6.2 |
| 1974 | 46.6 | 47.2 | 47.8 | 48.0 | 48.6 | 49.0 | 49.4 | 50.0 | 50.6 | 51.1 | 51.5 | 51.9 | 49.3 | 12.3 | 11.0 |
| 1975 | 52.1 | 52.5 | 52.7 | 52.9 | 53.2 | 53.6 | 54.2 | 54.3 | 54.6 | 54.9 | 55.3 | 55.5 | 53.8 | 6.9 | 9.1 |
| 1976 | 55.6 | 55.8 | 55.9 | 56.1 | 56.5 | 56.8 | 57.1 | 57.4 | 57.6 | 57.9 | 58.0 | 58.2 | 56.9 | 4.9 | 5.8 |
| 1977 | 58.5 | 59.1 | 59.5 | 60.0 | 60.3 | 60.7 | 61.0 | 61.2 | 61.4 | 61.6 | 62.0 | 62.1 | 60.6 | 6.7 | 6.5 |
| 1978 | 62.5 | 62.9 | 63.4 | 63.9 | 64.5 | 65.2 | 65.7 | 66.0 | 66.5 | 67.1 | 67.4 | 67.7 | 65.2 | 9.0 | 7.6 |
| 1979 | 68.3 | 69.1 | 69.8 | 70.6 | 71.5 | 72.3 | 73.1 | 73.8 | 74.6 | 75.2 | 75.9 | 76.7 | 72.6 | 13.3 | 11.3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 77.8 | 78.9 | 80.1 | 81.0 | 81.8 | 82.7 | 82.7 | 83.3 | 84.8 | 84.8 | 85.5 | 86.3 | 82.4 | 12.5 | 13.5 |
| 1981 | 87.0 | 87.9 | 88.5 | 89.1 | 89.8 | 90.6 | 91.6 | 92.3 | 93.2 | 93.4 | 93.7 | 94.0 | 90.9 | 8.9 | 10.3 |
| 1982 | 94.3 | 94.6 | 94.5 | 94.9 | 95.8 | 97.0 | 97.5 | 97.7 | 97.9 | 98.2 | 98.0 | 97.6 | 96.5 | 3.8 | 6.2 |
| 1983 | 97.8 | 97.9 | 97.9 | 98.6 | 99.2 | 99.5 | 99.9 | 100.2 | 100.7 | 101.0 | 101.2 | 101.3 | 99.6 | 3.8 | 3.2 |
| 1984 | 101.9 | 102.4 | 102.6 | 103.1 | 103.4 | 103.7 | 104.1 | 104.5 | 105.0 | 105.3 | 105.3 | 105.3 | 103.9 | 3.9 | 4.3 |
| 1985 | 105.5 | 106.0 | 106.4 | 106.9 | 107.3 | 107.6 | 107.8 | 108.0 | 108.3 | 108.7 | 109.0 | 109.3 | 107.6 | 3.8 | 3.6 |
| 1986 | 109.6 | 109.3 | 108.8 | 108.6 | 108.9 | 109.5 | 109.5 | 109.7 | 110.2 | 110.3 | 110.4 | 110.5 | 109.6 | 1.1 | 1.9 |
| 1987 | 111.2 | 111.6 | 112.1 | 112.7 | 113.1 | 113.5 | 113.8 | 114.4 | 115.0 | 115.3 | 115.4 | 115.4 | 113.6 | 4.4 | 3.6 |
| 1988 | 115.7 | 116.0 | 116.5 | 117.1 | 117.5 | 118.0 | 118.5 | 119.0 | 119.8 | 120.2 | 120.3 | 120.5 | 118.3 | 4.4 | 4.1 |
| 1989 | 121.1 | 121.6 | 122.3 | 123.1 | 123.8 | 124.1 | 124.4 | 124.6 | 125.0 | 125.6 | 125.9 | 126.1 | 124.0 | 4.6 | 4.8 |
| 1990 | 127.4 | 128.0 | 128.7 | 128.9 | 129.2 | 129.9 | 130.4 | 131.6 | 132.7 | 133.5 | 133.8 | 133.8 | 130.7 | 6.1 | 5.4 |
| 1991 | 134.6 | 134.8 | 135.0 | 135.2 | 135.6 | 136.0 | 136.2 | 136.6 | 137.2 | 137.4 | 137.8 | 137.9 | 136.2 | 3.1 | 4.2 |
| 1992 | 138.1 | 138.6 | 139.3 | 139.5 | 139.7 | 140.2 | 140.5 | 140.9 | 141.3 | 141.8 | 142.0 | 141.9 | 140.3 | 2.9 | 3.0 |
| 1993 | 142.6 | 143.1 | 143.6 | 144.0 | 144.2 | 144.4 | 144.4 | 144.8 | 145.1 | 145.7 | 145.8 | 145.8 | 144.5 | 2.7 | 3.0 |
| 1994 | 146.2 | 146.7 | 147.2 | 147.4 | 147.5 | 148.0 | 148.4 | 149.0 | 149.4 | 149.5 | 149.7 | 149.7 | 148.2 | 2.7 | 2.6 |
| 1995 | 150.3 | 150.9 | 151.4 | 151.9 | 152.2 | 152.5 | 152.5 | 152.9 | 153.2 | 153.7 | 153.6 | 153.5 | 152.4 | 2.5 | 2.8 |
| 1996 | 154.4 | 154.9 | 155.7 | 156.3 | 156.6 | 156.7 | 157.0 | 157.3 | 157.8 | 158.3 | 158.6 | 158.6 | 156.9 | 3.3 | 3.0 |
| 1997 | 159.1 | 159.6 | 160.0 | 160.2 | 160.1 | 160.3 | 160.5 | 160.8 | 161.2 | 161.6 | 161.5 | 161.3 | 160.5 | 1.7 | 2.3 |
| 1998 | 161.6 | 161.9 | 162.2 | 162.5 | 162.8 | 163.0 | 163.2 | 163.4 | 163.6 | 164.0 | 164.0 | 163.9 | 163.0 | 1.6 | 1.6 |
| 1999 | 164.3 | 164.5 | 165.0 | 166.2 | 166.2 | 166.2 | 166.7 | 167.1 | 167.9 | 168.2 | 168.3 | 168.3 | 166.6 | 2.7 | 2.2 |
| 2000 | 168.8 | 169.8 | 171.2 | 171.3 | 171.5 | 172.4 | 172.8 | 172.8 | 173.7 | 174.0 | 174.1 | 174.0 | 172.2 | 3.4 | 3.4 |
| 2001 | 175.1 | 175.8 | 176.2 | 176.9 | 177.7 | 178.0 | 177.5 | 177.5 | 178.3 | 177.7 | 177.4 | 176.7 | 177.1 | 1.6 | 2.8 |
| 2002 | 177.1 | 177.8 | 178.8 | 179.8 | 179.8 | 179.9 | 180.1 | 180.7 | 181.0 | 181.3 | 181.3 | 180.9 | 179.9 | 2.4 | 1.6 |
| 2003 | 181.7 | 183.1 | 184.2 | 183.8 | 183.5 | 183.7 | 183.9 | 184.6 | 185.2 | 185.0 | 184.5 | 184.3 | 184.0 | 1.9 | 2.3 |
| 2004 | 185.2 | 186.2 | 187.4 | 188.0 | 189.1 | 189.7 | 189.4 | 189.5 | 189.9 | 190.9 | 191.0 | 190.3 | 188.9 | 3.3 | 2.7 |
| 2005 | 190.7 | 191.8 | 193.3 | 194.6 | 194.4 | 194.5 | 195.4 | 196.4 | 198.8 | 199.2 | 197.6 | 196.8 | 195.3 | 3.4 | 3.4 |
| 2006 | 198.3 | 198.7 | 199.8 | 201.5 | 202.5 | 202.9 | 203.5 | 203.9 | 202.9 | 201.8 | 201.5 | 201.8 | 201.6 | 2.5 | 3.2 |
| 2007 | 202.416 | 203.499 | 205.352 | 206.686 | 207.949 | 208.352 | 208.299 | 207.917 | 208.490 | 208.936 | 210.177 | 210.036 | 207.342 | 4.1 | 2.8 |
| 2008 | 211.080 | 211.693 | 213.528 | 214.823 | 216.632 | 218.815 | 219.964 | 219.086 | 218.783 | 216.573 | 212.425 | 210.228 | 215.303 | 0.1 | 3.8 |
| 2009 | 211.143 | 212.193 | 212.709 | 213.240 | 213.856 | 215.693 | 215.351 | 215.834 | 215.969 | 216.177 | 216.330 | 215.949 | 214.537 | 2.7 | -0.4 |
| 2010 | 216.687 | 216.741 | 217.631 | 218.009 | 218.178 | 217.965 | 218.011 | 218.312 | 218.439 | 218.711 | 218.803 | 219.179 | 218.056 | 1.5 | 1.6 |
| 2011 | 220.223 | 221.309 | 223.467 | 224.906 | 225.964 | 225.722 | 225.922 | 226.545 | 226.889 | 226.421 | 226.230 | 225.672 | 224.939 | 3.0 | 3.2 |
| 2012 | 226.665 | 227.663 | 229.392 | 230.085 | 229.815 | 229.478 | 229.104 | 230.379 | | | | | | | |

## II. The mechanics of the Inflation Adjustment Act

### *A. The "inflation gap"*

Annually reported inflation data pose a formidable barrier to analysis. Radical simplification in inflation analysis may be achieved through the expedient of assuming a constant rate of inflation over time. In its 2003 study of the Inflation Adjustment Act, the General Accounting Office estimated that CPI has historically increased by an annual average of 2.5 percent.[106] This report adopts that estimate. All instances of the variable $\bar{\pi}$, representing average annual inflation, that occur in this Mathematical Appendix and report may be interpreted as the constant 0.025.

The magnitude of any initial inflation gap from year a to year b may be expressed through the following equations:

$$\textit{Initial inflation gap} \approx (1+\bar{\pi})^n - 1.1$$

where *n* equals (*b* − *a*), which value has represented the number of years that have elapsed before adjustment.

$$\textit{Amount of the inflation gap for a particular penalty} \approx p \cdot [(1+\bar{\pi})^n - 1.1]$$

where *p* represents the original, unadjusted civil monetary penalty.

As time passes, the Inflation Adjustment Act prevents closure of the inflation gap. The gap created by the 1996 amendment's 10 percent cap, expressed as the ratio of accumulated inflation to 10 percent, does remain constant. But the absolute amount will grow:

$$\textit{Absolute inflation gap over time} \approx p \cdot [(1+\bar{\pi})^n - 1.1] \cdot (1+\bar{\pi})^g$$

where *g* represents the number of subsequent years after the initial adjustment over which inflation grows.

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[106] *See* 2003 GAO Report, *supra* note 7, at 10.

Inasmuch as $(1+\bar{\pi})^n$ is an estimate, it may be more convenient in all instances to express that variable as a power of Euler's constant, *e*. Approximately 2.718, *e* serves as the base of natural logarithms:

$$(1+\bar{\pi})^n \approx e^{\bar{\pi}n}$$

Taking the natural logarithm of both sides and dividing by *n* yields the following approximation (which works better for smaller values of $\bar{\pi}$):

$$\bar{\pi} \approx ln(1+\bar{\pi})$$

For positive values of $\bar{\pi}$, the actual inflation rate falls between the two estimates I have proposed:

$$ln(1+\bar{\pi}) < i < e^{\bar{\pi}} - 1, \bar{\pi} > 0$$

The foregoing formulas are estimates. In specific cases, the cost-of-living adjustment prescribed by § 5(b) of the Inflation Adjustment Act may be formally expressed by the following formulas:

$$\textit{Cost-of-living adjustment} = \frac{CPI_{b-1} - CPI_a}{CPI_a} = \frac{CPI_{b-1}}{CPI_a} - 1$$

where *b* represents the later year and *a* represents the original year by which the cost-of-living adjustment is to be computed.

### *B. CPI lag*

The CPI lag created by the Inflation Adjustment Act lends itself to formal mathematical description. Recall the cost-of-living adjustment formula laid out in connection with the discussion of the initial inflation gap:

$$\textit{Cost-of-living adjustment} = \frac{CPI_{b-1} - CPI_a}{CPI_a} = \frac{CPI_{b-1}}{CPI_a} - 1$$

Section 5(b)(1)'s requirement that agencies consult CPI "for the month of June of the calendar year *preceding* [an inflation] adjustment" commits agencies to ignore the most recent year of inflation every time they adjust a civil monetary penalty for inflation. Each round of adjustments under the Act therefore introduces an additional error, equivalent in magnitude to the most recent June-to-June change in CPI:

$$CPI\ lag = \frac{CPI_y}{CPI_{y-1}} - 1 \approx \bar{\pi} = 0.025$$

Over multiple iterations, CPI lag compounds and can become quite considerable. For a prospective period of *s* years, subsequent to an initial adjustment, during which an agency expects to adjust penalties for inflation at a frequency of once every *f* years, the cumulative lag can be predicted with the following equation:

$$Cumulative\,CPI\ lag \approx (1+\bar{\pi})^{\left[\left[\frac{s}{f}\right]\right]} - 1$$

where the double brackets indicate the floor, or "greatest integer," function, which is the largest integer which is less than or equal to *s*/*f*.[107]

### *C. Rounding*

The Inflation Adjustment Act's rounding provisions follow a predictable pattern. The relationship between (1) changes in inflation that would trigger an increase and (2) the amounts by which an adjusted penalty must be adjusted may be expressed as a constant ratio: five-elevenths, or approximately 45.5 percent. The ratio between $5 and $11, between $50 and $110, and between $500 and $1,100, in each instance, is 5/11, or approximately 45.5 percent. The foregoing sentences express a simple mathematical relationship: 1.1 times 5/11 (roughly

[107] *See* http://en.wikipedia.org/wiki/Floor_and_ceiling_functions.

45.5 percent) equals 0.5. The following inequality expresses this relationship in formal fashion:

$$\Delta p \geq 1.1\,p \cdot \frac{5}{11}$$
$$\Delta p \geq 0.5\,p$$

Once this 45.5 percent increase in inflation triggers an adjustment, the Act's rounding provisions force what would have been an already substantial 45.5 percent increase to be implemented, in whiplash-like fashion, as a 90.9 percent increase. As discussed in the main body of this report at Section IV.C, the Pension and Welfare Benefits Administration (PWBA) faced this issue. The PWBA, if faithfully complying with the Inflation Adjustment Act, would not raise its penalties from $11, $110, and $1,100 by 45.5 percent to $16, $160, and $1,600, but rather by 90.9 percent from $11, $110, and $1,100 to $21, $210, and $2,100:

$$p' \geq 1.1\,p + 2 \cdot \frac{5}{11} \cdot 1.1\,p$$
$$p' \geq 1.1\,p + p = 2.1\,p$$
$$\frac{p'}{1.1p} - 1 \geq \frac{2.1p}{1.1p} - 1 \approx 90.9\,\%$$

Having raised the penalty from 1.1*p* to 2.1*p*, the rounding provisions dictate that the next round of PWBA adjustments take place when the cost-of-living adjustment factor reaches 2.1+0.5, or 2.6. The number of years, represented in the following equation by the variable *t*, that must elapse can be calculated thus:

$$(1 + \bar{\pi})^t \geq \frac{2.6}{2.1}$$
$$1.025^t \geq \frac{2.6}{2.1}$$
$$t\,ln(1.025) \geq ln(\frac{2.6}{2.1})$$
$$t \geq ln(\frac{2.6}{2.1}) \,/\, ln(1.025)$$
$$t \approx 8.65$$
$$]]t[[ = 9$$

where, once again, the inverted double brackets indicate the ceiling function, which is the smallest integer that is greater than or equal to *t*. The next integer greater than 8.65 is 9. Therefore, the next PWBA adjustment must take place in 9 years.

The foregoing analysis presupposes that inflation adjustments are not further distorted by the CPI lag feature of the Inflation Adjustment Act. If CPI lag is taken into account, waiting periods (such as 17 or 9 years) should in all events be increased by an additional year.

### *D. The effect of a 10 percent cap on annual inflation adjustments*

Congress may wish to convert the Inflation Adjustment Act's existing 10 percent cap on initial inflation adjustments (which is the source of the "inflation gap") into a 10 percent cap on annual adjustments. This expedient would enable the federal government to harmonize long-dormant civil monetary penalties with contemporary economic conditions, without exposing private parties to the sudden shock of a massive increase. The effect of a 10 percent cap on annual increases can be projected mathematically.

. Let $x$ = past years that have already "expired," $y$ = years in transition "*y*et" to come as we catch up with future inflation adjustments, $\overline{\pi}$ = average inflation rate (which we have consistently stipulated to be 2.5 percent), and $m$ = maximum annual adjustment (presumably 10 percent):

$$(1+\overline{\pi})^x \cdot (1+\overline{\pi})^y = (1+m)^y$$

$$(1+\overline{\pi})^x = \left(\frac{1+m}{1+\overline{\pi}}\right)^y$$

$$y\, ln\left(\frac{1+m}{1+\overline{\pi}}\right) = x\, ln\,(1+\overline{\pi})$$

$$y = x \cdot \frac{ln\,(1+\overline{\pi})}{ln\left(\frac{1+m}{1+\overline{\pi}}\right)}$$

$$y = x \cdot \frac{ln\,(1+\overline{\pi})}{ln\,(1+m) - ln\,(1+\overline{\pi})}$$

Since we have stipulated values for $\overline{\pi}$ and *m*, respectively 2.5 percent and 10 percent, the unwieldy multiplier for *x*, $\frac{ln(1+\overline{\pi})}{ln(1+m)-ln(1+\overline{\pi})}$, may be approximated as 0.3497, or even more simply as 0.35. *ln* (1.025) / [*ln* (1.1) − *ln* (1.025)] ≈ 0.3497. Alternatively, substituting *m* for *ln*(1+*m*) and $\overline{\pi}$ for $ln(1+\overline{\pi})$ — both reasonable maneuvers inasmuch as *m* and $\overline{\pi}$ are both modest numbers — transforms the multiplier simply into 0.025 / (0.10 − 0.025), or ⅓ (approximately 0.3333). Formally:

$$y = x \cdot \frac{\overline{\pi}}{m-\overline{\pi}}$$

In the end, these are gross estimates, and the difference between 0.3333 and 0.3497 should not be dispositive.

With either multiplier, a penalty that languished without adjustment for 11 years can be expected to catch up within 4 years, with no annual adjustment exceeding 10 percent. If $x = 11$, then $y \approx 11 \cdot 0.35$ or $11 \cdot 0.33$. By either multiplier, $y < 4$.