Gold and tax capitalization: A natural experiment

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ABSTRACT

This research examines whether U.S. income taxes are capitalized into gold coin prices. For years, the American Eagle (Eagle) was the sole gold coin to be IRA eligible. The Taxpayer Relief Act of 1997 expanded eligibility to include all other gold coins beginning on January 1, 1998, except the South African Krugerrand (Rand). In this natural quasi-experiment, we examine whether gold coin prices reacted to the change in IRA-eligibility. Results are largely consistent with the capitalization of implicit taxes in gold coin prices. When legislation allowing IRA eligibility of both the Canadian Maple Leaf (Maple) and the Rand was introduced, the prices of both coins increased relative to the Eagle. When final legislation excluded the Rand from IRA eligibility, but not the Maple, the Rand's price declined while the Maple's did not. The findings contribute to the tax capitalization literature and the effects of interjurisdictional taxation in integrated global markets.

1. Introduction

This research explores whether individual-level taxes are capitalized into gold coin prices. Specifically, we examine whether the Taxpayer Relief Act of 1997 (TRA), which expanded IRA eligibility to all 24-karat (24k) gold coins and bars beginning on January 1, 1998, affected gold coin prices (Pub. L. 105–34, §304, Aug. 5, 1997, 111 Stat. 831). Prior research has shown positive abnormal returns around tax-law changes from tax capitalization (Guenther, 1994). Tax capitalization arises when investor after-tax cash-flow expectations change contemporaneously with a change in investor-level taxes and lead to a change in investment prices. Much of the early research focused on taxable and tax-exempt bonds, which provide a clear setting to examine tax capitalization and implicit taxes (Ang, Bhansali, & Xing, 2010; Atwood, 2003; Fortune, 1988; Miller, 1977). The tax-exempt bond investor pays an implicit tax so that the after-tax returns are equivalent to those of a taxable bond. IRA investments are generally comparable to a tax-free investment (Scholes et al., 2015); thus, when a gold coin becomes IRA eligible, investors may be willing to pay a higher price today, an implicit tax, in return for the tax benefits of IRA eligibility.

The research into whether investors' taxes are capitalized in securities prices has coalesced around an unambiguous 'yes'—dividend and capital gains taxes are capitalized into equity prices. The results are generally robust regardless of setting - preferred stocks (Dunbar & Veliotis, 2012; Engel, Erickson, & Maydew, 1999; Erickson & Maydew, 1998), dividend taxes (Ayers, Bryan Cloyd, & Robinson, 2002; Dhaliwal, Krull, & Li, 2007; Dhaliwal, Krull, Li, & Moser, 2005; Guenther & Sansing, 2010) or capital gains taxes (Ayers, Li, & Robinson, 2008; Dai, Maydew, Shackelford, & Zhang, 2008; Guenther & Willenborg, 1999; Lang & Shackelford, 2000). In addition, other less direct taxes, such as withholding taxes (Howard, Pancak, & Shackelford, 2016), and pass-through tax credits, are capitalized into asset prices (Edwards & Shevlin, 2011). As the research has progressed, refinements in empirical tests and findings include: which investor groups' taxes matter (Guenther & Sansing, 2006, 2010); the cross-sectional differences that matter (Dai, Shackelford, Zhang, & Chen, 2013; Sikes & Verrecchia, 2015; Stinson & Ricketts, 2016); and whether firms and investors simultaneously respond to tax-law changes (Blouin, Raedy, & Shackelford, 2011; Campbell, Chyz, Dhaliwal, & Schwartz Jr, 2013; Hanlon & Hoopes, 2014).

The research has primarily focused on a single capital market to control cross-sectional differences, but has begun to relax this constraint and explore whether tax-law changes in one taxing jurisdiction (e.g. U.S.) proliferate into investment prices in an integrated global market (IGM) (Amiram & Frank, 2016; Blouin, Hail, & Yetman, 2009; Desai & Dharmapala, 2011). It is in a similar vein that we examine how a change in IRA eligibility affects the price of investment gold,[1] which is traded in an IGM, yet our setting differs from extant research in several ways.

First, gold is a physical commodity; its value is tied to its scarcity, transportability, and ease of convertibility into local currencies worldwide. Gold's worldwide acceptance as a store of value makes it a worldwide medium-of-exchange. It is also a risk hedge, an industrial production input, a personal adornment, and a shadow currency in some developing economies with uncertain financial markets. Gold also serves a macroeconomic role affecting the balance of payments among countries (Erb & Harvey, 2013).

Second, from 1919 to 2015, worldwide gold prices were set twice daily by the London Bullion Market Association (LBMA), based on worldwide changes in supply and demand. Nonetheless, local conditions can affect the local demand and prices, which are considered in the next LBMA price setting iteration. To the extent that taxes affect the local demand and prices, it may affect the LBMA price and ripple throughout the global market.

Third, U.S. gold sales are dominated by retail sales.[2] This differs from traditional securities markets, where buyers' bids and sellers' offers are matched. Finally, while IRA investing provides real tax advantages, there is no evidence that IRA eligibility is capitalized into asset prices. Given gold's unique investment characteristics, whether a change in IRA eligibility will affect gold coin prices is not obvious.

The TRA expanded the list of IRA-eligible gold coins to include all 99.9% pure (24k) gold coins and bars beginning on January 1, 1998 (P. L. 105–34, §304). Before this date, only the Eagle was IRA eligible (I.R.C. §408(m)(3)). Except for the Rand, which is 91.67% pure (22 karats) like the Eagle, all commonly traded gold coins became IRA eligible. The TRA also lowered the maximum long-term capital gains (LTCG) rate from 28 to 20% (P.L. 105–34, §311, 111 Stat 831). Collectibles, which includes gold, were excluded from the LTCG rate reduction (P.L. 105–34, §311, 111 Stat 833; I.R.C. §1(h)(4)). Thus, the Rand became tax-disadvantaged not only among gold coins but also subject to a higher LTCG rate than competing investments. This setting provides a quasi-experimental design to study tax capitalization combining pretest, post-test and matched pairs. During our study period, the Eagle is always IRA eligible, the Rand is never IRA eligible, and all other gold coins became IRA eligible on January 1, 1998. We focus on the Canadian Gold Maple (Maple) as the treatment condition since it is commonly traded in the U. S., and the daily closing prices for the Eagle, Rand, and Maple are available on AMEX throughout the study period.[3] Focusing on these three coins also allows us to examine tax capitalization in a highly controlled setting.[4]

Using the AMEX gold spot price as a proxy for the baseline global gold commodity price, the U.S. daily premium paid over the spot price is determined for the Eagle, Rand, and Maple. Initially, premiums are calculated for three roughly equal periods. Period 1 covers January 9 through June 19, 1997, the period before the bill (which ultimately became law) on IRA eligibility was introduced in the Senate.[5] Period 2 covers June 20 through December 31, 1997, the period after the bill's introduction in the Senate and before the effective date. Period 3 covers January 1 through June 18, 1998, the period following the law's effective date. We test whether the Maple exhibited a premium increase across the three periods. Everything else being equal, IRA-eligible gold coins should have a lower before-tax return (e.g. higher premium) than

gold coins that are IRA ineligible. If tax capitalization holds in this setting, we expect that the premium difference between the Maple and the Rand will *increase* and the premium difference between the Maple and Eagle will *decrease*. However, there are several reasons why we may see no tax capitalization in gold coins.

First, as Sikes and Verrecchia (2015) state:

> [I]n a large economy characterized by many investors, no particular investor's investment attributes can affect price because an individual investor's demand is too small in relation to the economy as a whole. It is the weighted average tax rate of all investors, … that determines the extent to which … taxes are capitalized. (p 1335).

If the average tax rate of all worldwide gold investors is impounded, then the tax capitalization effects of a gold coin's IRA eligibility may be too small to measure. The combined U.S. investment and industrial gold purchases in 1998 were 2.8% of the worldwide demand for all gold purchases (World Gold Council, 1999). Thus, almost 98% of global gold purchases were not affected by the TRA change.

Second, for the two years preceding our study period and for more than a year after, gold prices were declining, resulting in losses for some investors. Holding gold outside an IRA provides certain tax advantages when prices are declining—losses are deductible and shared with the taxing authority (Sikes & Verrecchia, 2012). When gold is purchased within an IRA, the losses are not deductible and are fully borne by the taxpayer. Based on the price trends at the time, investors may have been less willing to purchase gold in an IRA and bear the full burden of any losses.

Third, holding gold in an IRA incurs significant transaction costs. IRA gold must be held by a third-party administrator, who typically charges a set-up fee, trading commissions, annual maintenance fees, and storage fees. The costs associated with gold IRAs are higher than investments in gold surrogates (e.g. gold equities or mutual funds) and physical gold purchased outside an IRA. In addition, gold IRA benefits are diminished if a taxpayer holds the gold until death (Poterba, 2002), as it does not receive a stepped-up basis and the beneficiary pays taxes on the IRA distributions (I.R.C. §408(d)). Therefore, whether the tax advantage of IRA eligibility is capitalized into gold coin premiums is an empirical question.

Our results are consistent with taxes being capitalized into gold coin premiums. As expected, the premium difference between the Maple and Rand significantly increased during Period 2, after the tax bill's introduction, and Period 3, after the effective date. However, unexpectedly, the results are driven by a decrease in the Rand's premium rather than an increase in the Maple's premium. After the effective date and for much of early 1998, the Rand traded at a discount to the gold spot price, which we expected to be gold's reserve price.

Contrary to expectations, there is no significant change in the premium difference between the Maple and the Eagle in Periods 2 or 3. However, the results are consistent with expectations when we extended the analysis back to include a period (Period 0) from July 1, 1996, to January 8, 1997. In early 1997 (Period 1), a bill was introduced to make all gold coins IRA eligible, including the Rand (H.R. 446, 105th Congress, January 9, 1997, §103). By extending the analysis into 1996, Period 0, we include an earlier period in which no viable legislation on gold coins and IRA eligibility exists.[6] Statistical tests indicate that both the Maple and Rand's premiums significantly increased relative to the Eagle's premium when comparing Period 0 to Period 1. The early 1997 bill that made all gold coins in IRAs eligible, including the Rand, appears to have positively affected both the Maple and Rand's premiums relative to the Eagle. On June 20, 1997, when the final Senate bill was released

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[2] See Table 5, which provides a summary of the gold supply and demand for the two years prior to and the two years after January 1, 1998 when 24k gold became IRA eligible.

[3] While premium differences exist among the coins based on individual or market preferences, we expect that there is a market reserve price, which is either the local spot price as reported by AMEX or the LBMA price that is set twice daily, below which coins will not drop.

[4] See Long Jr (1978) and Chu and Partington (2008) who use a similar approach.

[5] Table 1 provides a legislative history for the gold coin eligibility leading up to the passing of the TRA.

[6] A bill (H.R. 3615) was introduced on June 11, 1996 that expanded the list of gold coins that were IRA eligible. Relevant parts of the bill were not voted out of committee. The time covered by Period 0 is similar in length to Periods 1, 2, and 3, the primary periods of interest in the study.

(S. 949, 105th Congress, June 20, 1997, §304) and the Rand was excluded from IRA eligibility, the Rand's premium declined while the Maple's premium held steady. Thus, the gold coin premiums reacted to the legislative proposal in January 1997 and earlier than we originally anticipated. Our results are robust to various alternative model specifications, time periods, various controls and an extension of the treatment group to include all IRA-eligible one-ounce gold coins and bars.

Additional post-hoc analysis indicates a marked increase in gold coin demand in the U.S. leading up to and contemporaneous with the January 1, 1998, effective date. While gold prices hit new lows in 1998, prices did experience a rally in early 1998 with prices hitting the yearly high on April 24 (Klapwijk, le Roux, Walker, and Newman 1999). The gold price increases coincided with the extended IRA contribution period, which allows IRA contributions up to April 15 to be deducted on the prior year tax return. In late 1997 to early 1998, official global gold coin production increased 23% to satisfy a 120% increase in U.S. gold coin demand. One-ounce gold bars, which also became IRA eligible, experienced supply shortages (Klapwijk, le Roux, Walker, & Newman, 1999; Murray, Klapwijk, le Roux, & Walker, 1998), and U.S. imports of investment gold increased 132% in 1998—a then historic all-time high (Butterman & Amey, 2005; U.S. Geological Survey (USGS), 2018). Therefore, contemporaneous with the change in gold coin IRA eligibility, U.S. demand for gold coins increased, the inventory of one-ounce IRA-eligible gold bars dried up, overseas gold imports into the U.S. increased, and yet the premium and demand for the Rand declined (Klapwijk et al., 1999; Murray et al., 1998).

Our study contributes to the implicit tax literature by examining gold and the tax benefits associated with IRA eligibility. This is the first paper that we are aware of that examines whether IRA eligibility affects investment prices. Our results are consistent with taxes being capitalized into IRA eligible gold investments. Amiram and Frank (2016) provide that:

> [a]n interesting new avenue of research to pursue incorporates the tax capitalization literature in an open capital market. As the global capital markets continue to integrate, understanding the effects of tax capitalization will be critical to understanding…prices… in a global setting. (p. 719).

In an IGM, tax changes in one market should be reflected in worldwide prices and demand, as investors rebalance their portfolios (Amiram & Frank, 2016; Guenther & Sansing, 2006; Kenchington, 2019).[7] Our results and analysis are consistent with gold prices and demand reflecting the U.S. change in IRA eligibility for gold.

The next section of the paper provides a background on the U.S. taxation of gold coins. The following sections develop the hypothesis and analyze the gold coin pricing data.

2. Gold coins: background and taxation

One of the primary vehicles for individuals to invest in physical gold is nation-minted gold coins. Except for the Rand and the Eagle, all nation-minted gold coins are 24k. The Rand and Eagle are 22*k* due to the addition of other metals to enhance durability. Regardless of purity, all one-ounce gold coins contain one troy ounce of gold. The Eagle, Rand,

and Maple are the primary coins traded in the U.S.,[8] with daily AMEX closing prices available starting in early 1982 for the Maple, with the Rand following closely thereafter (Maidenberg, 1982). The Eagle was minted starting in 1986 and daily prices were reported on AMEX shortly thereafter. Beginning June 24, 1997, daily pricing data for the Austrian Gold Philharmonic (Phil), and the Australian Gold Kangaroo (Kanga), the China Gold Panda (Panda), and the Isle of Man Cat (Cat) are also available on AMEX.[9] While no hard evidence exists, conversations with gold dealers and other anecdotal evidence suggest regional preferences for gold coins.[10] The Eagle, Maple, and Rand dominate North America trading, the Phil and Rand are primarily traded in Europe, the Kanga is primarily traded in Asia, and the Panda and Cat are generally considered numismatic purchases. The circulations of these other coins are smaller than the circulations of the Eagle, Maple, and Rand.[11]

Before 1998, gold coins were taxed at the LTCG rate of 28%, the same as other capital assets held more than one year. The TRA lowered the LTCG rate to 20% but left the collectibles rate unchanged at 28%.[12] Before 1998, only the Eagle was IRA eligible. The TRA allowed all 24k gold coins to be IRA eligible beginning on January 1, 1998. The Rand, at 22k, was the only major nation-minted gold coin excluded. Allowing gold coins to be invested in an IRA provides valuable tax advantages (Smith & Singleton, 2015).

3. Theory and hypothesis development

For illustrative purposes, suppose two coins, the Rand and the Eagle, are equivalent except the Rand is owned outside an IRA and the Eagle is owned within an IRA. Both assets are sold after n periods and the IRA will be distributed. The after-tax accumulation for a Rand is represented by the following formula:

$$Rand_A = I(1 + R_{bt-R})^n(1 - t) + tI \tag{1}$$

where $Rand_A$ is after-tax accumulation, I is the initial asset, R_{bt-R} is the before-tax return on the $Rand_A$, n is the number of periods the investment is held, and t is the investor's tax rate. The after-tax accumulation for the Eagle[13] is:

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[7] We primarily focus on the average tax rate investor since gold is traded in an IGM and, during our study period, spot gold prices are set twice daily by the LBMA. Nonetheless, the change in IRA eligibility for gold coins only affects U.S. individual IRA investors (i.e., the marginal investors), who are the impetus for any results (Ayers et al., 2002; Dhaliwal, Erickson, & Li, 2005; Dhaliwal, Li, & Trezevant, 2003).

[8] It was estimated in 1994 that over 37% of the Rand's total circulation of about 44 million coins was held in the U.S. (Tyler, 1994). The Rand's 1994 U.S. circulation of about 16 million coins was larger than the entire 1997 circulation for the Eagle (5.9 million) or the Maple (about 14.3 million).

[9] Coincidentally, the availability of the AMEX pricing data for these coins in June 1997 followed the January 1997 bill (H.R. 446) that made nation-minted coins traded on an electronic trading service IRA eligible.

[10] Regional gold coin preferences appear to be correlated with minting country proximity. These regional preferences are similar to the home country and regional preferences found in the equities markets (Coval & Moskowitz, 1999; Strong & Xu, 2003) and may explain the large initial premium differences between the Eagle/Maple and the Rand.

[11] The Phil, Kanga, and Panda had total worldwide circulations in 1997 of approximately 3.5, 2.1 and 1.1 million coins, respectively. The circulation for the Panda is speculative since limited government data is available from this time. No circulation data is available for the Cat.

[12] Before 1998, the term 'collectibles' only appeared in IRC §408(m)(3), which excluded collectibles from being held in IRAs. The TRA incorporated the 'collectibles' definition into IRC §1 when the capital gains rate was lowered to 20% and the collectibles rate was kept at 28%. The committee reports indicate that collectibles were not included in the rate reduction because lowering the rate on collectibles would have no economic stimulus effect (GPO, 2015).

[13] In a traditional IRA, an investor contributes before-tax dollars and pays tax on withdrawals at the marginal tax rate and the after-tax accumulation is represented by the formula: $I(1 + R)^n - I(1 + R)^n(t)$. In a Roth IRA, an investor contributes after-tax dollars and pays no tax on withdrawals and the after-tax accumulation is represented by the formula: $I(1-t)(1 + R)^n$, which is equivalent to the traditional IRA accumulation, assuming a temporally stable tax rate (Scholes et al., 2015).

$$Eagle_A = I(1 + R_{bt-E})^n \qquad\qquad (2)$$

where $Eagle_A$ is the after-tax accumulation and R_{bt-E} is the before-tax return on the Eagle. If we assume that the before-tax returns on the Rand and the Eagle are equivalent, then Eqs. (1) and (2) show that when $t > 0$, then $Eagle_A > Rand_A$. Everything else being equal, investors will prefer the Eagle to the Rand and bid up the Eagle's price to reflect equivalent after-tax returns. That is, the Eagle's 'bid-up' price will include an implicit tax and the after-tax returns on the Eagle and the Rand will be equivalent in equilibrium, characterized by the following equation:

$$R_{at-E} = R_{at-R} = R_{bt-R}\,(1 - t_i) \qquad\qquad (3)$$

To achieve equivalent after-tax returns, the price of the Eagle (Rand) will be higher (lower) to reflect the tax benefits (costs) capitalized.[14] Using both the Eagle and Rand as controls for IRA eligibility, we expect that upon becoming IRA eligible the Maple's premium will increase relative to the premiums of both the Rand and the Eagle, which leads to our hypothesis:

H1. The Maple will exhibit positive premium effects relative to the Eagle and the Rand after becoming IRA eligible.

As discussed above, there are several reasons why gold coins may not respond to the change in IRA eligibility. Therefore, whether IRA eligibility is capitalized into gold coin prices is ambiguous and an empirical question.

4. Data, methodology, and results

4.1. Dataset

AMEX end-of-day prices are available from 1986 for the Eagle, Maple, Rand, and spot price as reported by Bloomberg Professional Services. Beginning June 24, 1997, daily prices for the Phil, Kanga, Panda, and Cat are also available. The Eagle, Maple, and Rand are the most widely traded coins in the U.S. during the study period and the focus of this study. The 18-month study period is divided into three periods. Period 1 runs from January 9 through June 19, 1997. Period 1 covers the period before U.S. Senate Bill 949 (S. 949), which ultimately became law, was introduced and expanded IRA eligibility to all 24k gold coins beginning on January 1, 1998. In Period 1, it is assumed that the gold coin market reflects the status quo—Eagles are IRA eligible and all other gold coins are IRA ineligible.[15] Period 2 covers June 20 through December 31, 1997, which is the period following S. 949's introduction expanding IRA eligibility and the January 1, 1998, effective date. IRA investments must be made directly through the IRA, which precludes investors from purchasing gold coins in 1997 and contributing the coin to an IRA in 1998. If IRA eligibility affects gold coin premiums, ex-ante

we expect that any observable changes will occur shortly after the January 1, 1998, effective date.

Period 3 covers January 1 through June 18, 1998.[16] During Period 3, Maples and all 24k gold coins are newly eligible as IRA investments. If IRA eligibility is reflected in gold premiums, the price for Maples will increase relative to the Eagle and the Rand in response to increased Maple demand. Period 3 partially coincides with an IRA contribution period; IRA contributions made between January 1 and April 15, 1998, are deductible on an individual 's 1997 income tax return. Table 1 provides a summary of all U.S. Senate and House bills introduced in 1997 that relate to gold coins, IRAs and the experimental periods.

Fig. 1 presents monthly average gold coin prices from May 31, 1996, through July 31, 1998. Gold prices began declining in early 1996. During the 18-month study period, the Eagle and Maple declined more

Table 1
1997 TRA legislative history for gold coin IRA eligibility.

Congressional report	Date introduced	Implications	Experimental period
House of Representatives 446 (H.R. 446)	1/09/1997	Provided an exception to gold coins as IRA investments that are (a) certified by a grading service, (b) traded on an electronic trading service, and (c) legal tender in issuance country. Both the Maple and the Rand are IRA eligible under this bill. Excluded collectibles from any capital gains tax reduction.	Period 1: The first period covers January 9, 1997, through June 19, 1997
Senate Bill 2 (S. 2)	1/21/1997		
Senate Bill 197	1/22/1997	Similar to H.R. 446.	
Senate Bill 252	1/30/1997	Similar to S. 2.	
Senate Bill 949 (S. 949)	6/20/1997	Provided an IRA investment exception to gold coins that are 24k. Also excluded collectibles from the capital gains tax rate reduction. The Senate Report was included into H.R. 2014. The Maple is made IRA eligible, the Rand is not.	Period 2: The second period covers June 20, 1997, through December 31, 1997
House of Representatives 2014 (H.R. 2014)	6/24/1997	Similar to S. 949 and became Public Law No: 105–34 on August 5, 1997.	
The Taxpayer Relief Act of 1997 (TRA)	1/1/1998	The effective date for the expansion of allowable gold coins as IRA investments becomes effective January 1, 1998. The Rand continues to be IRA ineligible.	Period 3: The third period covers January 1, through June 18, 1998

The table provides an overview of the 1997 legislation affecting the taxation of gold coins and IRA eligibility.

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[14] If we assume that the premium difference at the beginning of Period 1 between the Eagle and the Maple [Eagle and the Rand] is fully attributable to the implicit tax on the Eagle, then the implicit tax on the Eagle from IRA eligibility relative to the Maple [Rand] is 0.46% [2.75%]. The percentages are the difference between the coin prices divided by price of the Maple or the Rand and represent the lower and upper bounds of the implicit tax on IRA eligibility. Alternatively, using equations 1 and 2 and assuming an annual average rate of return on gold and an average investors tax rate, the implicit tax can be estimated. The average annual rate of return on gold for the ten years preceding (1988–1997) and the ten years following (1998–2007) the change in IRA eligibility on gold coins is 3.64%. The lowest U.S. individual tax bracket for 1997 tax year was 10% and the highest was 39.6%, however, using the 28% top marginal tax rate for collectibles seems reasonable. Given these parameters, we estimate a 1.02% implicit tax premium for gold coins being IRA eligible.

[15] Sensitivity tests examine our assumption for Period 1 by extending the time observed back into 1996, before the introduction of any gold coin tax-law changes.

[16] June 18, 1998 was chosen so that the length of Period 3 is similar to the lengths of Periods 1 and 2. Sensitivity tests examined whether the results are sensitive to the window length— they were not.
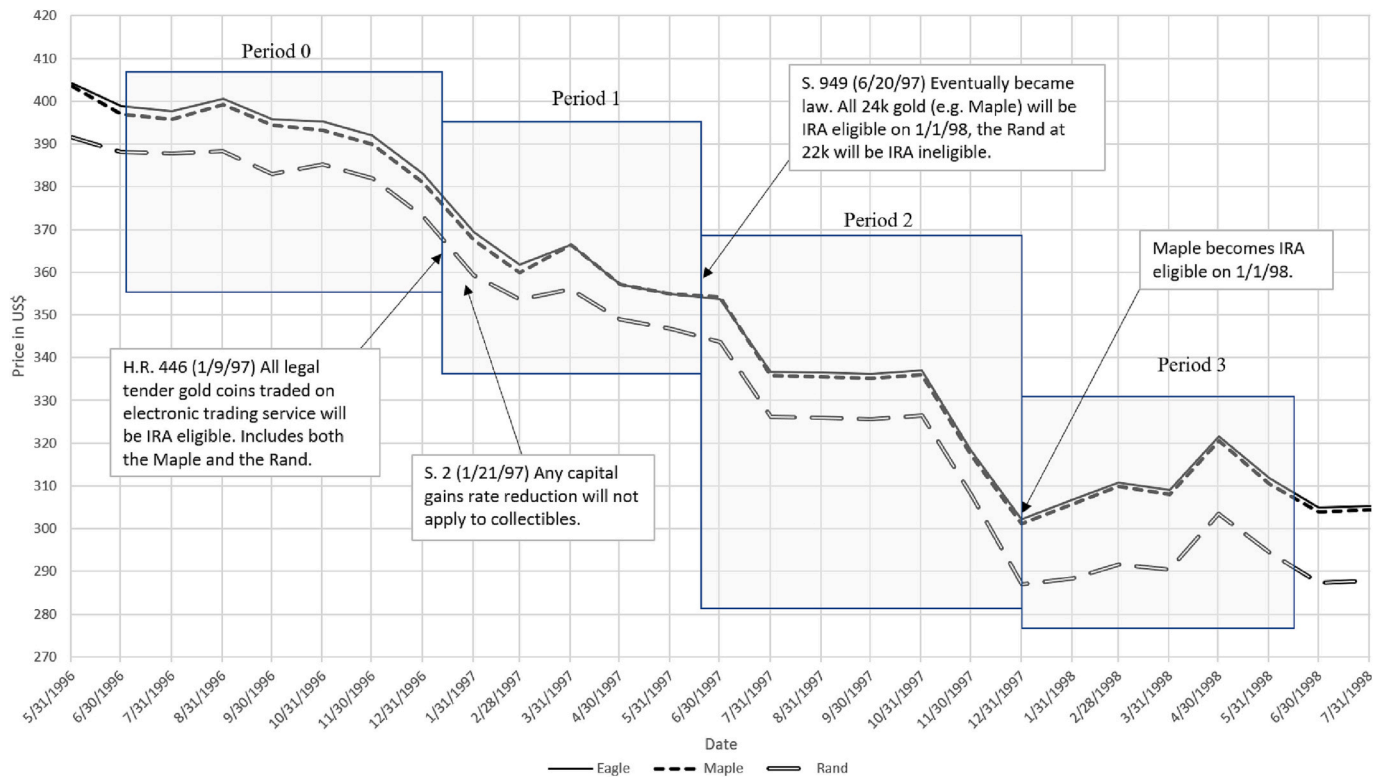
Fig. 1. Monthly average gold coin prices from May 31, 1996, to July 31, 1998.
The figure provides the average monthly prices for each gold coin as reported by AMEX for the study period. The Eagle and the Maple (the top two lines) trade at a premium to the Rand. During the study period, July 1, 1996, to June 18, 1998, gold prices are generally declining—the Eagle's price declined 19.3%, the Maple declined 19.2%, and the Rand declined 26.8%. In late 1997, at about the time of the tax-law change, the Rand's price appears to decrease more than that of the Eagle or the Maple.

than 19% and the Rand declined nearly 27%. The Eagle and the Maple trade at about a $10 to $15 premium to the spot price during the study period. The Rand trades at a premium of $0 to $5 from January 1 to December 9, 1997, and then drops to about a $5 discount to the spot price from December 10, 1997 to June 18, 1998. Table 2 provides the descriptive statistics for the Eagle, Maple, and Rand for each of four periods.

4.2. Variables, model specifications, and statistical tests

To test IRA eligibility on gold coin prices we use an ANOVA test. The dependent measure is the gold coin's premium to the spot price.[17] There are two main effects: treatment condition and time period. The treatment condition has three levels: The Eagle, which is always IRA eligible, the Rand, which is never IRA eligible, and the Maple, which becomes IRA eligible on January 1, 1998. The Eagle and the Rand are control groups, and the Maple is the treatment condition. The other main effect, time period, captures the difference in premium changes over three time periods. The interaction between the treatment condition and time period is the primary focus. To test the hypothesis, we use contrasts to determine whether the premium difference between the Maple and the Eagle (Rand) differs between Periods 2 and 3. We hypothesize that the Maple premium will increase relative to both the Eagle and the Rand. Specifically, since the Eagle premium is typically higher than the Maple and the Rand premium is typically lower, the premium difference between the Maple and the Eagle will decrease between Periods 2 and 3

and the premium difference between the Maple and the Rand will increase.

4.3. Estimation results

Table 3, Panel A provides the ANOVA results. The model is statistically significant (F = 913.9, p = 0.000) as are the main effects for *Treatment* (F = 3,222.1, p = 0.000), *Periods* (F = 108.8, p = 0.000), and the *Treatment*Periods* interaction (F = 150.4, p = 0.000). To understand the nature of the interaction, we contrast the premium differences between the Maple and both the Rand and the Eagle for all periods. The results are presented in Table 3, Panel B. There is no significant difference in premiums paid for the Maple relative to the Eagle between Periods 1 and 2 (t = −0.97, p = 0.334), Periods 2 and 3 (p = 0.859), nor Periods 1 and 3 (t = −1.10, p = 0.271). Our primary predictions focus on the differences between Periods 2 and 3—the periods when the Maple went from IRA ineligibility to IRA eligibility. While the direction of the premium change is as predicted, the premium differences between the Maple and the Eagle are insignificant and do not support our hypothesis.

There are, however, significant differences in the premiums paid for the Maple relative to the Rand between Periods 1 and 2 (t = −4.17, p = 0.00), Periods 2 and 3 (t = −16.26, p = 0.00), and Periods 1 and 3 (t = −19.42, p = 0.00). Specifically, the premium difference between the Maple and the Rand increased significantly between all periods. Our hypothesis specifically predicts a difference between Periods 2 and 3, which is supported. Nonetheless, the results are driven by the declining premium for the Rand rather than by an increasing premium for the Maple, contrary to what we expected ex-ante. We estimate that the Rand's before-tax return increased about 2.4% from Period 2 to Period 3 to offset its higher tax rate relative to IRA-eligible gold coins. It was not

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[17] Some tests indicate that the dependent measure, premium, is skewed. The regressions were re-estimated using the logarithm of the premium. The results are comparable to the results without the logarithm adjustment.

Table 2
Descriptive statistics on coin premiums: coin price – AMEX gold spot price.

	Period 0 7/1/96 to 1/8/97		Period 1 1/9/97 to 6/19/97		Period 2 6/20/97 to 12/31/97		Period 3 1/1/98 to 6/19/98	
Eagle	Prem	% of Spot	Prem	% of Spot	Prem	% of Spot	Prem	% of Spot
Mean	13.61	3.57%	13.03	3.74%	12.71	4.02%	13.58	4.57%
Med	14.00	3.68%	13.55	3.89%	12.88	4.07%	12.70	4.27%
Max	14.85	3.90%	17.00	4.88%	15.55	4.92%	26.00	8.75%
Min	11.25	2.96%	3.50	1.01%	7.12	2.25%	10.40	3.50%
S.D *n*	0.81	138	2.00	111	1.19	139	2.80	119
Maple								
Mean	11.81	3.10%	12.48	3.58%	11.75	3.71%	12.53	4.22%
Med	12.00	3.15%	12.35	3.55%	11.88	3.76%	11.70	3.94%
Max	13.75	3.61%	17.45	5.01%	15.80	5.00%	25.00	8.41%
Min	5.80	1.52%	3.50	1.01%	6.12	1.94%	9.40	3.16%
S.D. *n*	0.73	138	2.12	111	1.24	139	2.77	119
Rand								
Mean	2.82	0.74%	3.95	1.14%	1.39	0.44%	(4.83)	(1.62%)
Med	4.00	1.05%	4.00	1.15%	2.25	0.71%	(5.70)	(1.92%)
Max	4.01	1.05%	14.75	4.24%	5.15	1.63%	15.25	5.13%
Min	(2.05)	(0.54%)	(4.50)	(1.29%)	(8.85)	(2.80%)	(9.35)	(3.15%)
S.D. *n*	2.11	138	2.27	117	2.82	139	3.77	119
Eagle, Maple, and Rand								
Mean	9.39	2.48%	9.82	2.82%	8.62	2.72%	7.09	2.39%
Med	12.00	3.15%	12.00	3.45%	11.76	3.72%	11.65	3.92%
Max	14.85	3.90%	17.45	5.01%	15.80	5.00%	26.00	8.75%
Min	(2.05)	(0.54%)	(4.50)	(1.29%)	(8.85)	(2.80%)	(9.35)	(3.15%)
S.D. *n*	4.92	414	4.67	333	5.48	417	9.02	357

The table presents the premiums for the Eagle, Maple, and Rand for each of the four periods. The premium is the daily closing price minus the daily closing spot price of gold. The percentages are relative to the average gold spot price for the applicable period. Over all four periods, the Eagle and the Maple trade at a higher premium than does the Rand. Notably, the Rand trades at a discount to the AMEX gold commodity price during Period 3.

expected that the premium difference between Periods 1 and 2 for the Maple and the Rand would increase significantly since the tax benefits were not available until Period 3; nonetheless, it did.

An alternative specification expands the number of periods from three to four—adding a zero time period extending back into 1996. In the three-period model, the first period includes House of Representatives Bill 446 (H.R. 446), a bill proposed on January 9, 1997, that would have expanded IRA eligibility to all gold coins for which pricing data is available on an electronic trading service, making both the Maple and Rand IRA eligible. The new period (Period 0) extends back to July 1, 1996, into a previous congressional session and before H.R. 446's introduction. If H.R. 446 influences premiums, both the Maple and Rand premiums will increase from Period 0 to Period 1 relative to the Eagle. Upon becoming ineligible, the Rand's premium should decline in Period 2. Fig. 2 graphs the marginal means of the three coins over the four periods. The results of the four-period model are presented in Table 4, Panels A and B.[18]

The results for Period 0 to Period 1 support that the premiums converged as expected. The premium difference between the Maple and the Eagle from Period 0 to Period 1 converged ($t = 3.18$, p = 0.00). Similarly, the premium difference between the Rand and the Eagle converged between Periods 0 and 1 ($t = 4.34$, p = 0.00). These results indicate that differences between the Eagle and the Maple occurred earlier than we originally hypothesized, but consistent with our hypothesis and an implicit tax theory. When it appeared that both the Rand and the Maple would be IRA eligible, their premiums significantly increased. When S. 949 was introduced, continuing IRA eligibility for the Maple, its premium did not change; but the Rand, which now would be IRA ineligible, experienced a premium decline. This result is

particularly compelling. An intervention is introduced for both the Maple and Rand and premiums go up; the intervention is removed for the Rand and Rand premiums decline, while the Maple's do not.[19]

4.4. Sensitivity analysis

Various sensitivity tests were performed to examine the veracity of the results to alternative specifications. We re-estimated our results using a linear mixed-effects model (LMM), which controls for both fixed and random effects. One ANOVA assumption is that observations are independent. In our analysis, the end-of-day gold prices are not likely to be independent from one day to the next and results may be biased—LMM controls for this lack of independence. The results using LMM are qualitatively similar to all the ANOVA results reported in Tables 3 and 4 and even a bit stronger. For the remainder of our sensitivity tests we use the LMM—the likelihood-ratio tests rejected the null hypothesis that OLS is a better fit than LMM. Nonetheless, the results for the LMM and ANOVA are consistent.

We first examined control variables for country-specific monetary and investment risks. All the golds coins we examine have a currency value in the issuing country and the coin prices may be affected by foreign exchange rates. Gold is often considered as an inflation hedge and its price may be correlated with the issuing country's interest rates. Gold is also just one of many investment alternatives and the price of gold may be correlated with other investment alternatives. We re-estimated our model and included the control variables for the currency exchange rate relative to the British Pound, the 10-year treasury

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[18] The results for the other period contrasts are the same as those reported in Table 3 and are not repeated in Table 4.

[19] Based on the results from Period 0 to Period 1, we estimate that the implicit tax on the Eagle is 0.35 (0.49) percent relative to the Maple (Rand). From Period 1 to Period 2 when the Rand was excluded from IRA eligibility, we estimate the implicit tax on the Eagle (Maple) relative to the Rand is 0.72 (0.59) percent.

Table 3
ANOVA results, three coins, three periods.

Panel A: Full ANOVA model results[1]

	SS	df	MS	F	p-value[2]
Model	43,438.0	8	5429.8	913.9	0.000
Treatment	38,287.0	2	19,143.5	3222.1	0.000
Periods	1293.2	2	646.6	108.8	0.000
Treatment * Periods	3574.8	4	893.7	150.4	0.000
Residual	6523.6	1098	5.94		

Panel B: Planned contrast tests[3]

Period 1 vs period 2	Contrast	t-stat	p-value[2]	95% conf int
$Maple_1 - Eagle_1 = Maple_2 - Eagle_2$	−0.42	−0.97	0.334	−1.29 to 0.44
$Maple_1 - Rand_1 = Maple_2 - Rand_2$	−1.83	−4.17	0.000	−2.69 to −0.97
Period 2 vs Period 3				
$Maple_2 - Eagle_2 = Maple_3 - Eagle_3$	−0.08	−0.18	0.859	−0.92 to 0.77
$Maple_2 - Rand_2 = Maple_3 - Rand_3$	−7.00	−16.26	0.000	−7.85 to −6.16
Period 1 vs Period 3				
$Maple_1 - Eagle_1 = Maple_3 - Eagle_3$	−0.50	−1.10	0.271	−1.39 to 0.39
$Maple_1 - Rand_1 = Maple_3 - Rand_3$	−8.83	−19.42	0.000	−9.73 to −7.94

[1] The dependent variable is a coin's premium—the AMEX daily closing price less the daily AMEX gold spot price. Treatment has three conditions: The Eagle is always IRA eligible; the Rand is never IRA eligible; and, the Maple is only IRA eligible beginning January 1, 1998. Periods covers three time periods: The period leading up to the Senate legislation that was finally adopted and made Maples IRA eligible (January 9 – June 19, 1997); the period June 20 – December 31, 1997, after the legislation was introduced but before the effective date; and a time period following the effective date, January 1 – June 18, 1998.

[2] *p*-value is a two-tailed test.

[3] The contrast tests whether there are differences between the Maple and both the Eagle and the Rand (the control conditions) across the three periods.

yield, the 90-day interbank rate, and total equity market scaled to a 2010 base year. Except for two instances, the untabulated results are consistent with the previous results. When either the 90-day interbank rate or the market equity variables are included in the model, the difference between the Maple's and Eagle's premiums across Period 1 and Period 2 is significant at the 10% level. Both were insignificant before. The price difference between the Maple and the Eagle diverged after the release of the bill that became the TRA. While we previously found no change, this result indicates that the price of the Maple diverged from the Eagle in Period 2 even though it was to be IRA eligible.

We next examined several country-specific macro-level variables including CPI, GDP per capita, and exports scaled by GDP. The results are qualitatively similar to the original results, without exception. In conducting this research, we discovered there are country and region gold coin preferences, like those found in the equities markets (Coval & Moskowitz, 1999; Strong & Xu, 2003). To control for regional preferences, we re-estimated our results controlling for total gold purchases or investment gold purchases by region. When investment gold purchases are included as a control, the difference between the Maple's and the Rand's premiums across Period 0 and Period 1 is now significant (z = 2.40, *p* = 0.016) and in the opposite direction of our earlier results. Similarly, the difference between the Eagle and the Rand in Periods 0 and Period 1 is now insignificant (z = 0.54, *p* = 0.587). Both these results stem from the Rand's premium being almost flat to declining slightly in the first half of 1997, while in all previous tests the Rand's

premiums increased during Period 1 and converged with both the Maple and the Eagle.

We next expanded the treatment condition to include both the Phil and Kanga, which also became IRA eligible. Neither the Phil nor the Kanga are heavily traded in the U.S. and the total coins minted is far less than the Eagle, Maple, and Rand. We did not examine either the Panda or the Cat since both are treated as collectible gold rather than commodity gold. Pricing data for the Phil and the Kanga became available through AMEX beginning on June 24, 1997, and the test is limited to two periods leading up to the January 1, 1998, effective date and the period after. When the Phil and the Kanga are added to the model, the difference between the Eagle and the treatment coins (i.e. Maple, Phil, and Kanga) across Period 2 to Period 3 is significant (z = 5.32, *p* = 0.00), but in a direction not expected—the premium difference increased. The Phil's premium decreased in early December, like the Rand, which led to the divergence in premiums between the treatment group and the Eagle. However, the treatment group's premium was still significantly higher than the Rand's premium, and the treatment groups' premium increase was not as steep as the Rand's decline (z = 9.38, *p* = 0.000).

One possible explanation for the price decline of the Rand and Phil around December 10, 1997, is that the European markets had begun to sell gold, which may have adversely affected the coin prices.[20] However, analysis from the time indicates that the strong U.S. demand helped gold coin prices in Europe stay resilient (Klapwijk et al., 1999). We can find no definitive explanation for the Rand's and Phil's price decline other than speculating that it is a combination of regional preferences for gold coins and the declining European demand for investment gold. To control for the regional and country preference effects we examined the control variables for total or investment gold demand by region in the five-coin model. The results remained qualitatively similar as those reported immediately above. Another possible explanation is gold coins' reliance on a retail system for sales, rather than a buy-sell market system. Dealers' trades are the basis for the AMEX prices. With gold orders taking up to a week for delivery, and the year-end holiday season adding several days to an order's delivery, it is possible that dealers began adjusting inventories in mid-December in anticipation of the expected demand changes with a change in IRA eligibility.[21] We can only speculate that dealers' orders primarily focused on the Eagle and the Maple to the detriment of both the Rand and the Phil.

4.5. Global and U.S. gold demand trends around the TRA

This study's focus is on changes in gold coin prices contemporaneously with a change in IRA eligibility. While a price change is necessary to demonstrate an effect, it is not sufficient. A simultaneous increase in gold investing in IRAs is necessary to corroborate the results. Unfortunately, no such empirical data exists. However, credible, objective evidence shows that U.S. investment gold demand rose substantially in late 1997 and early 1998 coinciding with the tax law change.[22] Similarly, and in addition to demonstrating an increased gold demand, it is necessary to substantiate that no events inordinately affected the Rand's demand or supply that led to its decline in value.

[20] The nature of when gold coin premium changes occur make it easy to isolate the price changes in the data. In Period 1, prices of both the Maple and the Rand increased in late February and early March, 1997. These premium changes follow the January 9, 1997 bill that would have made both coins IRA eligible. In Period 2, the Rand's premium dropped shortly after June 24, 1997. This is the day that H.R. 2014 was introduced, which ultimately became law and made the Rand IRA ineligible.

[21] We contacted several gold commodity dealers and they confirmed that gold orders can take up to a week and possibly two when the markets are tight.

[22] Silver, platinum, and palladium commodity coins also become IRA eligible in the TRA. There is no country coin pricing or sales data by month available to us for these metals.
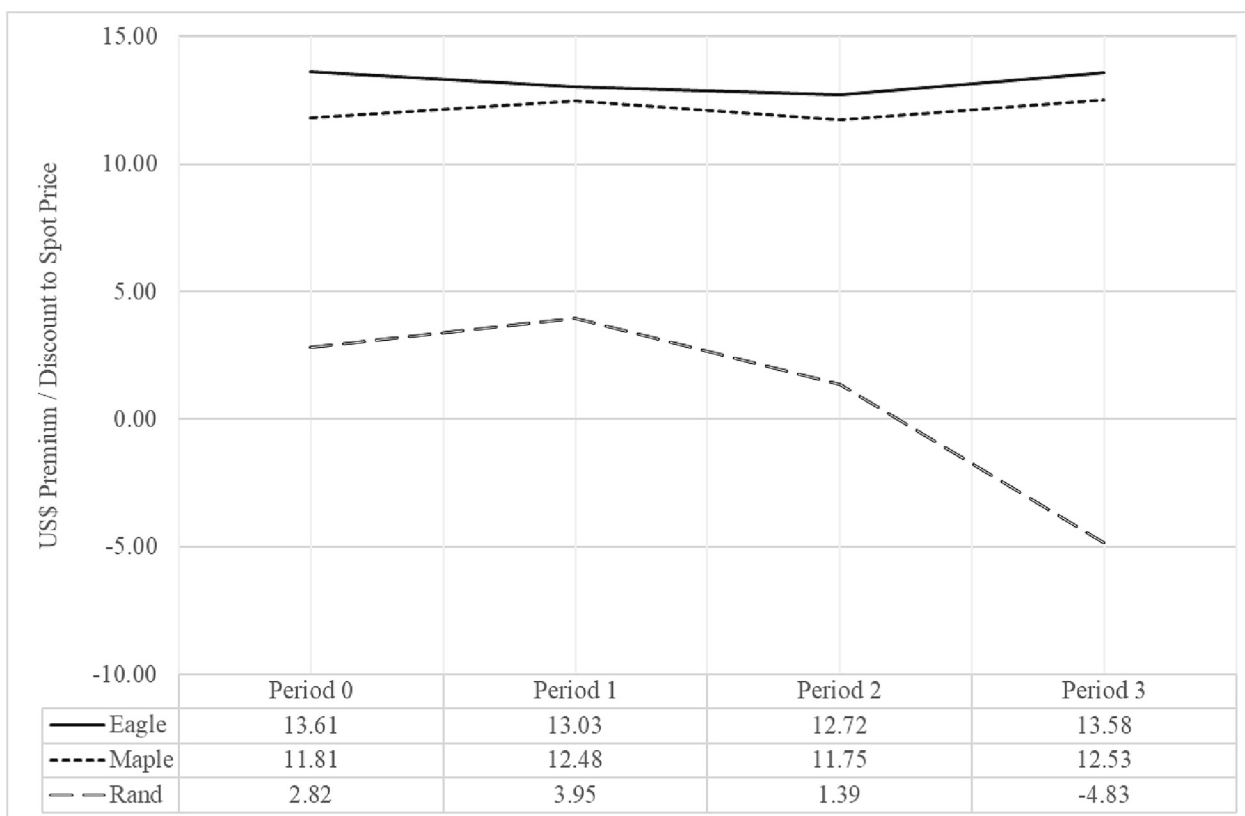
Fig. 2. Daily gold coin premiums (discounts) to the gold spot price from July 1, 1996, 1996 to June 18, 1998.
The figure shows each coin's pricing premium across the four periods examined. Period 0 covers the period from July 1, 1996 to January 8, 1997, the period before any legislation was introduced. Period 1 covers the period from January 9 to June 19, 1997, the period when the existing bill would make both Maples and Rands IRA eligible. Period 2 covers the period from June 20, 1997 to December 31, 1997 and covers the period immediately before the date when all major gold coins, except the Rand, became IRA eligible. Period 3 covers the period January 1, 1998 to June 18, 1998, the period after enactment that allowed all major gold coins to be IRA eligible, except the Rand.

Table 4
ANOVA results, three coins, four periods.

Panel A: Full ANOVA model results[1]				
	SS	df	MS	F	p-value[2]
Model	52,918.9	11	4810.8	994.5	0.000
Treatment	47,353.9	2	23,677.0	4894.5	0.000
Periods	1552.0	3	517.3	106.9	0.000
Treatment * Periods	4075.3	6	679.2	140.41	0.000
Residual	7299.8	1509	4.84		

Panel B: Planned contrast tests[3]				
Period 0 vs period 1	Contrast	t-stat	p-value[2]	95% conf int
$Maple_0 - Eagle_0 = Maple_1 - Eagle_1$	1.26	3.18	0.001	0.48 to 2.04
$Maple_0 - Rand_0 = Maple_1 - Rand_1$	0.46	1.15	0.248	−0.32 to 1.24
$Eagle_0 - Rand_0 = Eagle_1 - Rand_1$	1.71	4.34	0.000	0.94 to 2.50

[1] See Table 3 for a description of the Treatment and Periods variables.
[2] p-value is a two-tailed test.
[3] The contrast tests whether there are differences between the treatment condition (i.e. Maple,) and both the Eagle and the Rand (the control conditions) across the four periods.

In 1985, the Rand was banned from U.S. import in protest of South Africa's Apartheid system. The ban on the Rand was lifted in 1994 (Tyler, 1994). To ascertain if the Rand's demand was negatively impacted by reputational events during our study period, a search was done using Business Source Complete (EBSCOhost) and LexisNexis. The search identified no events specifically tied to the Rand or South Africa during this time. Nonetheless, in late 1997 and early 1998, East Asia (EA) experienced an economic crisis and sold substantial amounts of gold into the world market (World Gold Council, 1998a, 1998b). The implication is that the EA gold sell-off may have significantly increased the supply of Rands relative to other gold coins and biased our results. The evidence suggests this is not the case.

Most EA sales and exports were in the form of scrap gold (e.g. jewelry and ornaments). Since EA gold purchasers prefer 24k gold, Rands are not widely held in EA. The EA gold was melted down and primarily shipped to Europe for processing. Thus, while the EA gold sell-off increased gold supply 11% in 1998, there is no evidence that this event disproportionately impacted the Rand (Klapwijk et al., 1999; Leckey, 1997; Liang, 1998; Moriwaki, 1997; Murray et al., 1998; Searjeant, 1998; World Gold Council, 1999). While the EA gold sales in late 1997 and early 1998 should have negatively affected gold prices, investment gold demand and prices in the U.S. rose. Table 5 provides a summary of gold supply and demand in the U.S. for the years 1996 through 1999.

The U.S. investment gold demand in 1997 was up over 200% from 1996, which was led by a 254% increase in fourth quarter demand over the prior year fourth-quarter. The increased demand was driven by small U.S. retail investors and reversed a multi-year disinvestment trend (Klapwijk et al., 1999, 25–26; Moriwaki, 1997). In 1998, U.S. total gold demand rose to its then historical all-time high of 428 metric tons (World Gold Council, 1999, 2000; Butterman & Amey, 2005; U.S. Geological Survey (USGS), 2018). The increased demand for investment gold led to an increase in U.S. and Canadian gold coin fabrication. Eagle sales grew 136% in 1997, much of it occurring in the fourth quarter, and

Table 5
Gold supply and demand.

	1996	1997	1998	1999
Worldwide gold demand in metric tons	2624 t	2935 t	2712 t	3278 t
U.S. total gold demand in metric tons & percent of [worldwide] demand[1]	345 t [13.2%]	377 t [12.8%]	428 t [15.8%]	460 t [14.0%]
U.S. gold jewelry demand[2] in metric tons & percent of *(US)*	320 t *(92.8%)*	326 t *(86.5%)*	353 t *(82.5%)*	373 t *(81.1%)*
U.S. industry & investment gold demand[2, 3] in metric tons & percent of *(US)*	25 t *(7.2%)*	51 t *(13.5%)*	75 t *(17.5%)*	87 t *(18.9%)*
U.S. industry gold demand in metric tons	13 t	15 t	na[3]	na[3]
U.S. investment gold demand in metric tons	12 t	36 t	na[3]	na[3]

Data obtained from the World Gold Council (WGC) Quarterly Trend Reports. The data includes the amount of gold demand in metric tons and percent of U.S. demand.

[1] U.S. demand is shown in both metric tons and percent of worldwide demand.

[2] The U.S. demand by type is shown both in metric tons and percent of U.S. demand.

[3] In 1998, the WGC discontinued separately reporting gold demand for industry and investment and began reporting a combined number as an investment.

another 120% in 1998 (Klapwijk et al., 1999, 63). Maple sales increased 186% in 1997 and another 7.6% in 1998. Fabrication increases were not limited to the U.S. and Canada, as worldwide official gold coin fabrication increased almost 58% in 1997 and another 23% in 1998, the highest levels since 1991 (Murray et al., 1998, 37). The U.S. gold inventories and production could not keep pace with the increased demand, which gave rise to two unexpected consequences.

The first consequence was a shortage of gold coins and bars in the U. S., which led to a 132% increase in investment gold imports in 1998 (Murray et al., 1998; Klapwijk et al., 1999; Butterman & Amey, 2005; U. S. Geological Survey (USGS), 2018). At a time of flat investment-gold demand in Europe, the gold coin premiums in Europe stayed resilient due to U.S. demand (Klapwijk et al., 1999; Klapwijk, le Roux, Walker, & Newman, 2000). The second consequence was a world-wide mini-rally in gold prices, which began early in 1998 and ended on April 24, 1998. The mini-rally period closely coincided with the traditional IRA investment period and the expansion of IRA gold coin eligibility. The U.S. investment gold rally occurred despite the EA gold sales and lackluster European demand (Klapwijk et al., 1999; World Gold Council, 1999). Even with the unprecedented U.S. demand for investment gold and resulting supply shortages, the Rand's premium dropped over 2% and was trading at a discount to gold's spot price. Comparatively, the Maple's and Eagle's premiums increased over 0.5% and were trading at more than a 4.2% premium to the spot price.

Initially, we expected the demand and price for the Eagle and the Rand to be unaffected by the change in IRA eligibility, and the demand for the Maple to increase, for a static supply. However, the supply and demand effects were much more dynamic. The increase in demand for the Maple and the Eagle led to an increase in supply from the Royal Canadian Mint and the U.S. Mint, respectively. As gold coin demand and supply both shifted in response to the TRA, the expected upward price response may have been tempered, since both U.S. and Canadian mints increased gold coin production to over 600,000 coins per year in 1997. However, the production for the Rand was flat to just over 12,000 coins. In a period of weak global gold demand and no tax benefits from the TRA, the Rand's price declined about eight U.S. dollars and was often trading at a discount to the AMEX spot price. The magnitude of this decline was unanticipated. There are two possible explanations for this finding.

First, the AMEX spot price is a composite price for the gold trades in the U.S. As the demand for IRA-eligible gold coins and bars increased

and short-term supply issues arose, IRA-eligible gold prices increased, which were reflected in a higher AMEX spot price. Thus, the Rand's apparent price decline may be an artifact that the AMEX spot price was increasing relative to the Rand's price.[23] Second, the Rand's Period 3 price is the result of substitution effects, as U.S. investors sold the disfavored Rand and purchased IRA-eligible gold coins.

5. Discussion and implications

This study examines whether a change in IRA eligibility affects gold coin prices. We expect that IRA eligible gold coins will command higher premiums—the prices paid for coins above the spot price. The results show that the Maple's premium increases relative to the Eagle's premium as expected, but earlier than anticipated. The increase occurred during the period in which very early legislation expanding IRA eligibility was first proposed. The results show that the Maple's premium also increased relative to that of the Rand, the only major commodity gold coin to be excluded from IRA eligibility.

The results of this study add to the research in several ways. First, we extend the tax capitalization research into a new arena—gold coins and a change in IRA eligibility. We know of no other research that examines tax capitalization in this setting. Second, in an integrated global market, tax changes in one market should be reflected worldwide as prices adjust to the weighted average tax rate of all investors. Our results are consistent with tax capitalization in an IGM.

Finally, the evidence indicates an increase in U.S. gold imports contemporaneous with the tax change. If prices adjust to reflect after-tax cash-flow expectations around tax-law changes, investors will rebalance their portfolios accordingly (Desai & Dharmapala, 2011). The world-wide increase in gold coin production to meet increased U.S. demand and the increased imports of investment gold into the U.S. are consistent with a portfolio reallocation theory for investment gold contemporaneous with the change in IRA eligibility.

Declaration of Competing Interest

None.

Data availability

Data will be made available on request.

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[23] We thank one of our reviewers for this suggestion for the unexpected price decline of the Rand.

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