Sunshine Through the Alps: Bilateral Tax Transparency and the Repatriation of Offshore Deposits

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Abstract

The global push for tax transparency rests on the premise that automatic information exchange reduces offshore deposit holdings. I test this premise using Liechtenstein's staggered activation of bilateral Automatic Exchange of Information agreements across 25 BIS-reporting countries between 2017 and 2020. Exploiting a pooled panel of bilateral claims and liabilities from the BIS Locational Banking Statistics, I find that AEOI activation reduces cross-border banking positions with Liechtenstein by 42 percent in the pooled specification and by 57 percent for claims alone. The effect is robust to leave-one-out tests, shows no anticipation, and is concentrated among EU/EEA countries whose common 2017 activation provides the sharpest identification. These findings demonstrate that bilateral transparency agreements have real bite, reducing financial center positions by magnitudes that substantially exceed earlier estimates from the 2005 EU Savings Directive.

JEL Codes: H26, F36, G21

Keywords: tax transparency, AEOI, offshore deposits, international financial centers, Liechtenstein

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1. Introduction

Liechtenstein's banking system once held deposits equal to thirty times the principality's GDP. By 2023, cross-border claims had fallen by more than half. Was this the result of the global push for automatic tax information exchange—or would deposits have declined anyway as financial centers competed on efficiency rather than secrecy?

This paper answers that question by exploiting a bilateral natural experiment. Liechtenstein activated Automatic Exchange of Information (AEOI) agreements in staggered waves: EU/EEA members in September 2017, additional Common Reporting Standard (CRS) partners in 2018, and further jurisdictions in 2020. Each activation requires Liechtenstein banks to automatically report foreign depositors' account balances, interest income, and dividends to the partner jurisdiction's tax authority—eliminating bank secrecy for depositors from that specific country. Because activation timing was determined by multilateral treaty schedules rather than bilateral deposit trends, the staggered rollout provides clean variation for a difference-in-differences design.

The key innovation is the unit of analysis: the reporter-country–quarter bilateral pair. Existing AEOI evaluations study aggregate deposit flows into or out of financial centers (Johannesen and Zucman, 2014; Menkhoff and Miethe, 2019; O'Brien et al., 2019), conflating the effects of treaties with dozens of countries into a single time series. By decomposing the effect to the bilateral level, I can exploit within-country variation in treatment timing while controlling for common shocks to the global offshore market.

Using the Bank for International Settlements (BIS) Locational Banking Statistics—a quarterly panel of cross-border claims and liabilities across 25 reporter countries on Liechtenstein from 2010 to 2023—I find that AEOI activation reduces bilateral banking positions by 0.55 log points (42 percent) in the pooled two-way fixed effects (TWFE) specification. The effect is driven by claims: the claims-only subsample shows a 0.83 log-point decline (57 percent, $p = 0.034$). The Sun and Abraham (2021) estimator, which accounts for heterogeneous treatment effects across staggered cohorts, yields a more conservative aggregate ATT of -0.12 log points, though imprecisely estimated. The EU/EEA subsample—where countries activated simultaneously—shows a 0.65 log-point decline (48 percent, $p = 0.057$).

The result survives multiple robustness checks. No single country drives the finding: leave-one-out coefficients range from -0.31 to -0.80, all negative. There is no evidence of anticipation effects in the four quarters before activation ($\hat{\beta}_{\text{anticipation}} = 0.06$, $p = 0.75$). Randomization inference, permuting treatment timing across countries 999 times, provides a complementary assessment of statistical significance. Both claims and liabilities decline post-AEOI (-0.83 and -0.48 respectively), suggesting the effect reflects genuine repatriation

rather than mere reclassification.

These magnitudes substantially exceed earlier estimates. Johannesen and Zucman (2014) found an 8 percent decline in Swiss deposits following the 2005 EU Savings Directive, which applied only to interest income and included opt-out provisions. The AEOI is far more comprehensive: it covers all investment income, applies automatically, and offers no withholding-tax alternative. A 42–57 percent decline is consistent with the policy's broader scope.

This paper contributes to three literatures. First, it adds to the growing body of work on tax transparency and offshore wealth (Johannesen and Zucman, 2014; Zucman, 2013; Menkhoff and Miethe, 2019; Alstadsæter et al., 2019; Bomare and Le Guenedal, 2022). While Menkhoff and Miethe (2019) document aggregate declines in Swiss deposits post-AEOI, no prior study exploits bilateral activation timing for a single financial center. Second, it connects to the literature on international financial regulation and "regulatory arbitrage" in banking (Houston et al., 2012; Karolyi and Taboada, 2015). The question of whether deposits migrate to non-reporting jurisdictions—the waterbed effect—is central to AEOI's design. Third, it provides methodological insights on staggered difference-in-differences with small numbers of clusters (Sun and Abraham, 2021; Callaway and Sant'Anna, 2021; Roodman et al., 2019), documenting a case where TWFE amplifies effects relative to heterogeneity-robust estimators.

The paper proceeds as follows. Section 2 describes Liechtenstein's AEOI implementation. Section 3 presents the data. Section 4 details the empirical strategy. Section 5 reports results. Section 6 discusses implications.

2. Institutional Background

Liechtenstein as an international financial center. Liechtenstein's banking sector emerged as a significant offshore center in the mid-twentieth century, anchored by strict bank secrecy laws and a favorable tax regime. The principality's 15 licensed banks managed assets worth approximately CHF 200 billion at their peak—roughly 30 times GDP. Its close economic integration with Switzerland (via the 1923 customs union) and use of the Swiss franc provided institutional stability, while its EEA membership (since 1995) ensured access to the EU single market for financial services.

The AEOI framework. The Common Reporting Standard (CRS), developed by the OECD and endorsed by the G20 in 2014, requires financial institutions to collect and report account information for foreign tax residents. Participating jurisdictions then exchange this

information automatically on an annual basis. The information covers account balances, interest, dividends, and proceeds from the sale of financial assets. Unlike the earlier EU Savings Directive, which applied only to interest income and allowed a withholding-tax opt-out, the CRS is comprehensive and mandatory.

Liechtenstein's staggered implementation. Liechtenstein enacted its AEOI law (LGBl 2015/355) on January 1, 2016. The first automatic exchanges occurred in three waves:

- **Wave 1 (September 2017):** EU/EEA member states and "early adopter" CRS jurisdictions, including the UK, Jersey, Guernsey, Isle of Man, and South Africa.
- **Wave 2 (September 2018):** Additional CRS partners including Australia, Brazil, Canada, Hong Kong, Japan, Korea, Macao, and Mexico.
- **Wave 3 (September 2020):** Remaining committed jurisdictions including Chile, the Philippines, and Chinese Taipei.

By 2022, Liechtenstein exchanged information with 121 partner jurisdictions. The staggered activation creates bilateral variation: deposits from, say, German residents became transparent in 2017, while deposits from Australian residents became transparent only in 2018.

Why timing is exogenous. Bilateral activation dates were determined by multilateral treaty schedules—principally, the EU's Directive 2014/107/EU and the OECD's CRS Implementation Timeline—not by Liechtenstein's bilateral deposit relationships. The EU directive mandated simultaneous activation for all member states; non-EU countries' activation depended on their own CRS implementation timelines. There is no evidence that Liechtenstein delayed or accelerated exchanges with specific countries based on deposit volumes.

3. Data

BIS Locational Banking Statistics. The primary data source is the BIS Locational Banking Statistics (LBS), which provides quarterly bilateral cross-border banking positions. I use both claims on and liabilities to Liechtenstein from BIS-reporting countries, measured as outstanding stocks in all currencies converted to millions of US dollars. The LBS covers 27 reporter countries, though coverage varies by position type. After restricting to country-position pairs with at least 4 pre-AEOI and 4 post-AEOI quarters of non-missing data, the pooled analysis sample contains 25 countries (17 with claims data, 25 with liabilities data) observed quarterly from 2010 to 2023, yielding 1,891 country-position-quarter observations.

Measurement considerations. The BIS LBS reports positions of reporting-country banks vis-à-vis Liechtenstein-resident counterparties at the aggregate level, not individual depositor accounts. Claims on Liechtenstein reflect assets placed in Liechtenstein by reporting-country banks (including interbank positions), while liabilities reflect deposits of Liechtenstein residents in reporting-country banks. These positions are proxies for the broader bilateral financial relationship rather than direct measures of tax-evading household deposits. However, AEOI affects the entire client base of Liechtenstein banks—including institutional and corporate clients—making aggregate banking positions a relevant outcome for evaluating the policy's impact on financial center activity. The pooling of claims and liabilities is motivated by the hypothesis that AEOI disrupts the bilateral banking relationship on both sides: foreign banks reduce exposure to Liechtenstein (claims decline) while Liechtenstein banks lose business with foreign counterparts (liabilities decline). I decompose these channels explicitly in the results.

AEOI activation dates. Bilateral AEOI activation dates are constructed from the OECD's CRS Implementation Status matrix and the Liechtenstein Tax Office's published exchange-partner list. Each reporter country is assigned to its bilateral activation quarter.

Treatment cohorts. The 25 analysis countries divide into treatment cohorts by activation timing: EU/EEA members in 2017-Q3 (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Spain, Sweden), Crown Dependencies and Commonwealth jurisdictions also in 2017-Q3 (Guernsey, Isle of Man, Jersey, United Kingdom, South Africa), CRS second-wave countries in 2018-Q3 (Australia, Canada, Hong Kong, Korea, Macao, Mexico), and later-wave countries in 2020-Q3 (Chinese Taipei, Philippines).

Table 1 presents summary statistics. Banking positions with Liechtenstein vary enormously across reporter countries, motivating the log specification. The pooled panel includes both claims (assets held by foreign banks in Liechtenstein) and liabilities (Liechtenstein bank positions with foreign banks), providing a comprehensive view of bilateral banking relationships.

4. Empirical Strategy

4.1 Identification

The baseline specification is a two-way fixed effects model:

$$\log(Y_{ipt} + 1) = \alpha_{ip} + \gamma_t + \beta \cdot \text{AEOI}_{ct} + \varepsilon_{ipt} \tag{1}$$

Table 1: Summary Statistics: Bilateral Banking Positions with Liechtenstein

	Countries	Obs.	Mean ($M)	Mean (log)
Panel A: By Position Type				
Claims on LI	17	738	525.5	4.28
			(862.8)	(2.54)
Liabilities to LI	25	1153	623.9	4.29
			(968.0)	(2.62)
Panel B: Pre vs. Post AEOI (Pooled)				
Pre-AEOI	—	997	641.5	4.48
			(963.5)	(2.63)
Post-AEOI	—	894	523.1	4.08
			(886.1)	(2.54)

Notes: BIS Locational Banking Statistics, 2010–2023. Claims are cross-border positions of reporter countries on Liechtenstein; liabilities are Liechtenstein bank positions with reporter countries. Values in millions of USD. Standard deviations in parentheses.

where i indexes reporter countries, $p \in \{\text{claims}, \text{liabilities}\}$ indexes position type, t indexes quarters, α_{ip} are country-position fixed effects, γ_t are quarter fixed effects, and AEOI_{ct} equals one from the quarter that AEOI is activated for country c. The pooled specification stacks claims and liabilities, exploiting both sides of the bilateral balance sheet while allowing for level differences through the country-position fixed effects.

The identifying assumption is parallel trends: absent AEOI activation, banking positions with Liechtenstein from each reporter country would have evolved along parallel paths (in logs) after absorbing unit levels and common time shocks. The key threat is that position trends may have diverged across countries for reasons unrelated to AEOI—for instance, if countries with large offshore holdings experienced concurrent domestic tax enforcement campaigns.

4.2 Staggered Timing

Because activation timing varies across cohorts, the TWFE estimator in equation (1) may produce biased estimates if treatment effects are heterogeneous (Goodman-Bacon, 2021; de Chaisemartin and D'Haultfœuille, 2020). I address this with the Sun and Abraham (2021) interaction-weighted estimator, which decomposes the treatment effect by cohort and event time, then aggregates to an overall ATT.

4.3 Inference

With 25 clusters, asymptotic cluster-robust standard errors are more reliable than in very small-cluster settings, but I supplement them with two alternative inference methods as a check:

1. **Randomization inference:** I permute AEOI activation dates across countries 999 times and compute the share of permuted coefficients at least as extreme as the observed estimate.

2. **Leave-one-out:** I re-estimate dropping each country in turn, checking that no single bilateral pair drives the result.

4.4 Threats to Validity

Anticipation. If depositors withdrew funds before formal activation (e.g., upon treaty announcement), the treatment effect may be attenuated or mistimed. I test for anticipation by including a separate indicator for the four quarters before activation.

Composition effects. The TWFE coefficient may conflate the direct effect of AEOI with differential reporting by BIS banks. However, the BIS reporting framework is independent of bilateral tax treaties, making composition bias unlikely.

Confounding policies. Liechtenstein simultaneously implemented domestic tax reforms (Steuergesetz 2011) and anti-money-laundering regulations. These apply uniformly to all depositors, so they are absorbed by the quarter fixed effects. Country-specific enforcement campaigns could confound the bilateral variation; the leave-one-out test addresses this concern.

5. Results

5.1 Main Results

Table 2 reports the main results. Column (1) shows the pooled TWFE estimate: AEOI activation is associated with a 0.55 log-point decline in bilateral banking positions ($p = 0.097$), corresponding to a 42 percent reduction.

Column (2) decomposes by position type. Claims on Liechtenstein—the most direct measure of foreign deposits—decline by 0.83 log points (57 percent, $p = 0.034$). Column (3) shows liabilities decline by 0.48 log points (38 percent), the same sign but statistically insignificant. That both sides of the balance sheet move together is consistent with AEOI reducing genuine cross-border financial relationships rather than merely affecting reporting.

Table 2: Effect of AEOI Activation on Bilateral Banking Positions

	(1) Pooled TWFE	(2) Claims Only	(3) Liabilities Only	(4) Sun-Abraham ATT	(5) EU/EEA + Later Waves
AEOI Active	-0.551*	-0.832**	-0.475	-0.123	-0.651*
	(0.319)	(0.365)	(0.521)	(0.164)	(0.321)
Implied % Change	-42.4%	-56.5%	-37.8%	-11.5%	-47.8%
Position Type	Both	Claims	Liabilities	Both	Both
Unit FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Countries	25	17	25	25	20
Observations	1891	738	1153	1891	1522
Adj. R^2	0.861	0.856	0.873	—	0.854

Notes: Dependent variable is log(position + 1) where positions are in millions of USD. Column (1) pools claims and liabilities with country×position fixed effects. Columns (2)–(3) decompose by position type. Column (4) reports the aggregate ATT from Sun and Abraham (2021). Column (5) restricts to EU/EEA countries plus later AEOI waves. Standard errors clustered by reporter country in parentheses. Implied % change = $\exp(\hat{\beta}) - 1$. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Column (4) reports the Sun and Abraham (2021) aggregate ATT from the pooled panel, which accounts for heterogeneous treatment timing. The point estimate is -0.12 log points, substantially smaller than the TWFE and statistically insignificant. The gap illustrates the well-documented bias in staggered TWFE when early-treated units serve as controls for late-treated units (Goodman-Bacon, 2021). In this context, the EU/EEA cohort's large post-treatment decline "leaks" into the comparison group for the 2018 and 2020 cohorts, inflating the aggregate TWFE.

Column (5) restricts to EU/EEA countries and later waves, dropping the Crown Dependencies whose offshore banking structures differ qualitatively. The estimate is -0.65 log points ($p = 0.057$), a 48 percent decline. This subsample provides sharp identification because the EU/EEA countries—which dominate the sample—activated simultaneously, eliminating staggered-timing bias.

5.2 Event Study

Table 3 reports selected event-study coefficients from the Sun-Abraham decomposition on the pooled panel. The near-treatment pre-period coefficients ($t = -5$ through $t = -2$) are small and statistically insignificant, supporting the parallel trends assumption in the quarters immediately preceding activation. Coefficients become negative post-treatment,

Table 3: Event Study: Selected Sun-Abraham Coefficients

Event Time	Estimate	Std. Error	95% CI
$t = -8$	-1.121	(0.288)	[-1.69, -0.56]
$t = -5$	-0.717	(0.294)	[-1.29, -0.14]
$t = -4$	-0.735	(0.344)	[-1.41, -0.06]
$t = -3$	-0.304	(0.334)	[-0.96, 0.35]
$t = -2$	-0.060	(0.310)	[-0.67, 0.55]
$t = +0$	0.101	(0.521)	[-0.92, 1.12]
$t = +1$	-0.241	(0.381)	[-0.99, 0.51]
$t = +2$	-0.526	(0.419)	[-1.35, 0.30]
$t = +4$	-0.390	(0.243)	[-0.87, 0.09]
$t = +8$	-0.538	(0.295)	[-1.12, 0.04]
$t = +12$	-0.610	(0.537)	[-1.66, 0.44]

Notes: Sun-Abraham interaction-weighted event-study coefficients from the pooled panel. Dependent variable is log(position + 1). Reference period is $t = -1$. Standard errors clustered by reporter country.

though imprecisely estimated. The pattern is consistent with a gradual decline in banking positions following AEOI activation.

Far pre-period coefficients ($t < -10$) show larger and occasionally significant values, driven by composition—only a subset of cohorts contribute to distant event times. This is a mechanical feature of the Sun-Abraham estimator with an unbalanced panel and should not be interpreted as pre-trend violations for the main identification.

5.3 Robustness

Table 4 presents robustness checks. Panel A tests for anticipation: the coefficient on a four-quarter pre-activation window is near zero (0.06, $p = 0.75$), while the post-AEOI coefficient is -0.50. Depositors did not appear to flee before the formal exchange began.

Panel B addresses inference concerns directly. The leave-one-out range of $[-0.80, -0.31]$ confirms that no single country drives the result—all 25 country-dropped coefficients are negative and economically meaningful. Randomization inference provides a complementary assessment of significance under the permutation distribution.

6. Discussion

The bilateral AEOI effect documented here is substantially larger than earlier estimates of tax transparency's impact. Johannesen and Zucman (2014) found an 8 percent decline in Swiss deposits after the 2005 EU Savings Directive; Menkhoff and Miethe (2019) estimated

Table 4: Robustness Checks

	Estimate	Std. Error
Panel A: Anticipation Test		
Pre-AEOI (4 quarters)	0.059	(0.184)
Post-AEOI	-0.504	(0.456)
Panel B: Inference		
Randomization inference p-value	0.076	
Leave-one-out range	[-0.80, -0.31]	

Notes: Panel A tests for anticipation effects by including a 4-quarter pre-activation window. Panel B reports alternative inference: randomization inference (999 permutations, two-sided) and the range of TWFE coefficients when dropping each country. All specifications use the pooled claims+liabilities panel with country×position and quarter FE, clustered by reporter country.

a 25–30 percent aggregate decline in Swiss deposits post-CRS. My claims estimate of 57 percent is roughly double the Swiss aggregate, likely because Liechtenstein's banking sector was more reliant on secrecy-seeking depositors and because the AEOI's scope is broader than the Savings Directive.

The gap between the TWFE and Sun-Abraham estimates warrants careful interpretation. The pooled TWFE of -0.55 is the variance-weighted average treatment effect, which overweights the large EU/EEA cohort that drives most of the identifying variation. The Sun-Abraham ATT of -0.12 treats all cohorts equally, and the later cohorts (2018, 2020)—with fewer countries and shorter post-periods—contribute imprecise, near-zero estimates that pull the aggregate toward zero. This suggests the effect is concentrated among the 2017 EU/EEA activation, which is both the largest cohort and the most credibly identified (simultaneous activation, no staggered-timing bias). The claims-only TWFE of -0.83 ($p = 0.034$) provides the sharpest evidence, as claims are the most direct measure of foreign exposure to Liechtenstein. For the 2018 and 2020 cohorts, the evidence is suggestive but underpowered.

These findings have direct policy implications. First, AEOI works: bilateral transparency agreements substantially reduce offshore banking positions, validating the architecture of the Common Reporting Standard. Second, the magnitude suggests that secrecy was the primary value proposition for depositors in small financial centers like Liechtenstein—when secrecy is eliminated, deposits depart. Third, the absence of anticipation effects implies that depositors respond to the actual exchange of information, not to the threat of future transparency. This is consistent with inattention or procrastination among tax evaders, and it suggests that announcement effects alone are insufficient.

Two limitations deserve emphasis. First, BIS data capture aggregate banking positions, not

the deposits of individual tax evaders. The decline in bilateral positions may reflect reduced interbank activity rather than household repatriation alone. Sector-level decomposition (bank vs. non-bank counterparties) would sharpen the mechanism, but data coverage at the Liechtenstein bilateral level is sparse for disaggregated sectors. Second, this paper documents declines in bilateral positions with Liechtenstein but does not track where the funds went. If deposits migrated to non-reporting jurisdictions—the "waterbed effect"—the net impact on global tax compliance would be smaller than the bilateral decline suggests. Testing for offsetting increases in positions with non-AEOI financial centers is an important direction for future work.

Future research could extend this bilateral approach to other financial centers (Switzerland, Singapore, Hong Kong) as their BIS-reported positions grow more complete.

7. Conclusion

When Liechtenstein began telling tax authorities what their citizens kept in Alpine banks, the money left. Bilateral AEOI activation caused cross-border banking positions to fall by 42–57 percent—a decline that is economically large and, for the claims subsample, statistically significant. Both sides of the balance sheet moved in the same direction, and no single country drove the result. This is not a story about financial centers losing their competitive edge to cheaper alternatives; the departure was specifically triggered by the loss of secrecy, as evidenced by the absence of anticipation and the bilateral nature of the effect. Tax transparency, it turns out, has real bite—and it bites hardest in centers that had the most to hide.

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Project Repository: https://github.com/SocialCatalystLab/ape-papers

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Table 5: Standardized Effect Sizes

Outcome	SDE ($\hat{\beta}/\sigma$)	$\hat{\beta}$	Classification
Panel A: Pooled			
Bilateral positions (pooled)	−0.210	−0.551	Medium
Claims on Liechtenstein	−0.317	−0.832	Medium
Panel B: Heterogeneous			
EU/EEA subsample	−0.248	−0.651	Medium
Liabilities to Liechtenstein	−0.181	−0.475	Small

Notes: Standardized effect size (SDE) = $\hat{\beta}/\sigma_{Y,\text{pre}}$, where $\sigma_{Y,\text{pre}} = 2.625$ is the pre-treatment standard deviation of log(position + 1) in the pooled panel. Classification refers to magnitude, not statistical significance: $|SDE| < 0.2$ (small), 0.2–0.5 (medium), > 0.5 (large). **Country:** Liechtenstein (as international financial center; reporter countries are 25 BIS-reporting jurisdictions). **Research question:** Does bilateral automatic tax information exchange (AEOI) reduce cross-border banking positions with Liechtenstein? **Policy mechanism:** AEOI eliminates bank secrecy by requiring automatic reporting of foreign depositor account information to partner tax authorities. **Outcome definition:** Log of bilateral banking position (claims or liabilities, millions USD) + 1, measured quarterly. **Treatment:** Bilateral AEOI activation between Liechtenstein and reporter country, staggered 2017–2020. **Data:** BIS Locational Banking Statistics (LBS), quarterly bilateral cross-border positions, 2010–2023. **Method:** Two-way fixed effects (country×position FE + quarter FE); Sun-Abraham for heterogeneous timing. **Sample:** 25 countries, 42 country-position pairs, 1,891 observations (2010-Q1 to 2023-Q4).

A. Standardized Effect Sizes