Corporate Basis and Demand for U.S. Dollar Assets

Grace Xing Hu * Zhan Shi † Ganesh Viswanath-Natraj ‡ Junxuan Wang § ¶

This version: February 14, 2025

Abstract

The corporate basis measures price differences between bonds issued in U.S. dollars and foreign currencies by the same entity. We introduce a novel decomposition into credit spread and convenience yield components, capturing investor demand for risky and safe dollar assets. With a comprehensive dataset of corporate bond issuance and pricing, we employ bond market liquidity, investor sentiment, and monetary policy as instruments to identify shocks to the demand for dollar assets. A negative shock to risky dollar asset demand shifts investors toward safe dollar assets and is associated with U.S. dollar appreciation and a subsequent decline in real economic activity.

Keywords: Dollar Asset Demand, Credit Spread, Covered Interest Rate Parity, Bond Market Liquidity

JEL Classifications: E44, F30, F31, F32, F41, G11, G12, G15, G18, G20

*hux@pbcsf.tsinghua.edu.cn., PBC School of Finance, Tsinghua University

†shizh@pbcsf.tsinghua.edu.cn., PBC School of Finance, Tsinghua University

‡ganesh.viswanath-natraj@wbs.ac.uk, Warwick Business School

§j.wang@jbs.cam.ac.uk, University of Cambridge

¶We would like to thank Rodrigo Barria, Lorenzo Bretscher, Hui Chen, Andrea Gamba, Zhe Geng (discussant), Arie Gozluklu, Bing Han, Brandon Yueyang Han (discussant), Harald Hau (discussant), Marcin Kacperczyk, Tao Liu (discussant), Francis Longstaff, Dong Lou, Yiming Ma, Quan Qi (discussant), Giulio Rossetti, David Skeie and Haonan Zhou (discussant); seminar participants at Renmin University, Singapore Management University, Tsinghua University, Xiamen University, Warwick Business School, Zhejiang University, 53rd MMF Annual Meeting, 2023 Asian Meeting of the Econometric Society, 2023 China International Conference in Macroeconomics, 2024 China International Conference in Finance, 2022 CIFER Annual Meeting, 2023 European Finance Association Annual Meeting, 2022 Finance Management Annual Meeting, 2023 FMA European Conference, 39th Conference of the French Finance Association, 2023 IFABS Annual Meeting, and 2022 New Zealand Finance Meeting for helpful comments and suggestions. We would also like to thank Gerardo Ferrara, Philippe Mueller and Tsvetelina Nenova for help with the data. We thank Gordon Y. Liao for kindly sharing his codes. All errors are our own.

1 Introduction

The corporate basis measures price discrepancies between corporate bonds issued in different currencies by the same entity. Under a no-arbitrage condition, corporate bond yields should equalize across markets after hedging currency risk. However, since the global financial crisis (GFC), the corporate basis between the U.S. dollar (USD) and foreign currencies has exhibited substantial time variation, driven by factors such as the demand for dollar assets and the scarcity of dollars in cross-border financing (Figure 1).

Previous research primarily examines the corporate basis from the issuers' perspective, linking its variation to firms' currency preferences in debt financing (Liao, 2020; Caramichael et al., 2021; Galvez et al., 2021). However, there is limited empirical evidence on its relevance for corporate bond investors, largely due to the lack of accurate data on their hedging practices. This paper shifts the focus to global bond market investors—key players in currency hedging (Sialm and Zhu, 2024; Liao and Zhang, 2025).

By introducing a novel three-way decomposition of the corporate basis, we disentangle the economic forces driving its variation, particularly the distinct demand for safe and risky U.S. dollar assets, as well as the scarcity of U.S. dollars in cross-border markets. Specifically, we decompose the corporate basis into three components:

- **Credit Spread Differential:** Measures the difference in credit spreads between corporate bonds denominated in non-USD currencies and their USD-denominated counterparts, capturing the relative riskiness of dollar-denominated corporate debt.
- **Convenience Yield Differential:** Represents the yield spread between foreign government bonds and U.S. Treasuries, reflecting the perceived safety of dollar-denominated debt relative to other sovereign issuers.
- **Cross-Currency Basis:** Defined as the difference between synthetic and direct dollar funding costs in foreign exchange (FX) swap markets, quantifying the degree of dollar scarcity and the relative cost of obtaining dollars in cross-border markets.

Through this decomposition, we identify shocks to the demand for both risky and safe dollar-denominated assets, using bond market liquidity, investor sentiment, and monetary policy as instruments. Our key contribution is to document a substitution effect between these two asset classes. Additionally, we extend our analysis to examine the effects of dollar asset demand shocks on exchange rates and their implications for real economic activity.

We begin our analysis by estimating the decomposition of the corporate basis. Our dataset consists of 30,926 corporate bonds issued between January 2004 and March 2021 across six major funding currencies: the Australian Dollar (AUD), Canadian Dollar (CAD), Swiss Franc (CHF), Euro (EUR), British Pound (GBP), and Japanese Yen (JPY), relative to the U.S. dollar. Building on Liao (2020), we apply cross-sectional regression analyses to control for issuer-specific characteristics and extract three key components of the corporate basis: the credit spread differential (CSD), the convenience yield differential (CYD), and the cross-currency basis (CCB).

By aggregating the pricing of both corporate and government bonds at the currency level, our methodology enhances the sensitivity of the estimates to market-wide demand shocks.[1] Consequently, variations in CSD and CYD capture shifts in the aggregate demand for risky and safe U.S. dollar assets, respectively.

Based on these estimates, we identify a substitution effect between risky and safe dollar assets. As motivating evidence, we use foreign investors' net acquisitions of these assets, based on data from the Treasury International Capital (TIC) system, a comprehensive record of monthly cross-border transactions involving U.S. assets facilitated by U.S.-based broker-dealers. Our analysis reveals a significant surge in foreign demand for safe dollar assets during the 2008 Global Financial Crisis and the European debt crisis of 2011-2012, alongside a sharp divestment from risky dollar assets. These findings reinforce our narrative of a substitution effect.

To formally establish the substitution effect, we employ a structural Vector Autoregression (SVAR) model to examine the intertemporal comovement of the corporate basis's components. Our identification strategy utilizes external instruments (IV) to isolate the causal impact of shocks on the credit spread (CSD) and convenience yield (CYD), following the methodology in Gertler and Karadi (2015). Since CSD is defined in relative terms, we develop two instrumental variables—relative illiquidity and relative investor sentiment in the U.S. corporate bond market.

The liquidity instrument is based on the difference in illiquidity between USD and non-USD corporate bonds. We use the Hasbrouck (2009) measure of effective transaction costs, which estimates bid-ask spreads by inferring trade direction indicators through a Gibbs sampling approach. This method improves upon traditional low-frequency liquidity proxies, particularly in OTC bond markets where trade reporting is incomplete. We aggregate these transaction cost estimates at the currency level and construct our IV as the difference between non-USD and USD illiquidity measures. A positive IV value indicates higher transaction costs for non-USD bonds, suggesting a liquidity-driven shift in demand towards USD-denominated corporate bonds.

The sentiment instrument is constructed using bond yield spreads net of estimated default and liquidity risks, following Gilchrist and Zakrajšek (2012) and López-Salido et al. (2017). This measure captures variations in corporate bond spreads that reflect shifts in investor risk appetite beyond fundamental credit risk. Specifically, we compute

1. Chaudhary et al. (2023) show that the impact of demand shocks on bond prices becomes more pronounced at higher levels of aggregation. Similarly, Li and Lin (2022) provide supporting evidence from the stock market.

the relative sentiment between U.S. and international credit markets by comparing these adjusted bond yield spreads across jurisdictions. A lower relative spread indicates stronger investor optimism and risk tolerance in the U.S. corporate bond market, while a higher spread signals increased risk aversion.

These instruments are chosen based on their capacity to influence demand for USD-denominated corporate bonds while remaining exogenous to factors affecting the appetite for safe dollar assets and dollar scarcity in cross-border markets.

Additionally, we construct an instrument for CYD based on U.S. monetary policy surprises. This instrument is derived from a principal components analysis of high-frequency fluctuations in federal funds rates and Eurodollar futures interest rates around scheduled Federal Open Market Committee (FOMC) announcements (Nakamura and Steinsson, 2018). We hypothesize that a contractionary shift in U.S. monetary policy elevates the yields from holding Treasury securities (Yellen, 2011) and reinforces perceptions of U.S. economic stability (Caballero et al., 2017), thereby raising demand for Treasuries among international investors. As a result, we expect investors to reallocate toward safe dollar assets, thereby reducing their demand for risky dollar assets.

Our IV estimates provide strong evidence of the substitution effect between risky and safe dollar assets. Using bond illiquidity and sentiment as instruments for the CSD shock, we find that a one standard deviation increase in USD credit spreads relative to those in foreign currencies (18.2 basis points) leads to a 3.56 basis point rise in CYD. Conversely, when using monetary policy surprises as an instrument for CYD shocks, we establish that a one standard deviation increase in CYD (18 basis points) induces an 11.18 basis point decline in CSD. These results confirm the proposed substitution effect between the two asset classes.

Next, we explore how shocks in the demand for both risky and safe dollar-denominated assets impact the foreign exchange market. Our analysis reveals that while both types of demand shocks significantly influence USD exchange rates, their effects move in opposite directions. Specifically, a one standard deviation increase in CSD leads to a 1.94% depreciation of the USD, whereas a one standard deviation increase in demand for safe dollar assets results in a 5.61% appreciation. Additionally, our historical decomposition of exchange rate variation shows that the relative importance of safe and risky dollar asset demand fluctuates across financial crises. During the GFC and COVID-19, for example, USD appreciation was primarily driven by declining demand for risky assets rather than an increase in safe asset demand.

Taken together, our findings are consistent with Jiang et al. (2021), who show that an increase in the safety and convenience of U.S. Treasuries leads to an appreciation of the U.S. dollar. However, our three-way decomposition extends their framework by distinguishing between the effects of safe and risky dollar asset demand on exchange rate movements. By isolating these channels, we provide a more granular understanding of how shifts in investor preferences drive fluctuations in the U.S. dollar.

Lastly, we find that a negative shock to the demand for risky dollar assets spills over into other financial markets, including equities and commodities, as well as key macroeconomic indicators such as the Consumer Price Index (CPI), industrial production, unemployment rates, real Gross Domestic Product (GDP), real investment, and real consumption. These findings are consistent with existing research on the effects of intermediary constraints across multiple asset classes (He et al., 2017), as well as theoretical and empirical work linking credit spreads to macroeconomic activity (Gilchrist and Zakrajšek, 2012; Gertler and Karadi, 2015; López-Salido et al., 2017).

To validate our findings, we conduct a comprehensive set of robustness tests. These tests address potential confounding supply-side factors, time variation in the substitutability between safe and risky dollar assets, and the impact of alternative interest rate benchmarks. Given the central role of corporate basis decomposition in our empirical analysis, we further explore alternative methods for estimating CSD beyond the primary cross-sectional regression approach. These include a bottom-up aggregation of firm-level measures, benchmarking CSD against AAA U.S. corporate bond indices, distinguishing between offshore and onshore issuance, differentiating financial and non-financial bond issuers, and implementing a pairwise matched bond estimation framework. Our results remain robust across all these alternative specifications.

Related Literature. Our study contributes to the literature on covered interest parity (CIP) deviations and the corporate basis (Du, Tepper, et al., 2018; Liao, 2020; Caramichael et al., 2021). Du, Tepper, et al. (2018) document persistent CIP deviations following the GFC, while subsequent studies attribute these deviations to banking regulations, heterogeneous funding costs, interest rate differentials, monetary policy, and effective funding rates in OTC markets.[2]

Our paper builds on Liao (2020), which decomposes the corporate basis into a credit spread and CIP component, with the credit spread measured as the difference between corporate bond yields and LIBOR swap rates. We extend this framework by introducing a three-way decomposition that separately identifies the credit spread, the convenience yield differential (CYD), and the cross-currency basis (CCB). This refined decomposition allows us to analyze the interplay between these components and how shifts in demand for safe versus risky dollar assets drive corporate basis dynamics.[3] The inclusion of a convenience yield component aligns with Diamond and Van Tassel (2022), who highlight

2. See, for example, Borio et al. (2016), Avdjiev et al. (2019), Rime et al. (2022), Abbassi and Bräuning (2021), Bräuning and Ivashina (2020), Viswanath-Natraj (2020), Cenedese et al. (2021), Cerutti et al. (2021), Augustin et al. (2024), and Zeev and Nathan (2024).

3. Unlike Liao (2020), we define the credit spread as the difference between corporate and government bond yields. The sum of our credit spread and convenience yield components corresponds to the credit spread in Liao (2020). For further details, see Section 2.

differences in convenience yields as a key driver of corporate basis variation.

Our study also relates to the literature on the U.S. Treasury premium, which examines how changes in Treasury ownership, banking regulations, and sovereign default risk affect Treasury market pricing (Du, Im, et al., 2018; Jiang et al., 2021; Augustin et al., 2021; Klingler and Sundaresan, 2020; Duffie, 2020; Vissing-Jorgensen, 2021; He, Nagel, et al., 2022). Du, Im, et al. (2018) measure the Treasury premium as the differential convenience yield between U.S. and non-U.S. government bonds, while Jiang et al. (2021) show that rising demand for safe dollar assets leads to U.S. dollar appreciation. Our contribution is to refine this perspective by disentangling demand for safe versus risky dollar assets within the corporate bond market. Specifically, we show that the credit spread differential (CSD) captures a distinct channel through which declining demand for risky dollar assets contributes to dollar appreciation, separate from the traditional safe asset demand channel.

Lastly, our work connects to research on bond market frictions and corporate bond pricing (Bao et al., 2011; Dick-Nielsen et al., 2012; Friewald et al., 2012; Friewald and Nagler, 2019; He, Khorrami, et al., 2022). While most studies focus on the U.S. market, Huang et al. (2024) demonstrate that bond illiquidity plays a critical role in pricing errors across countries. We extend this literature by providing evidence that relative liquidity conditions in U.S. corporate bond markets drive cross-border demand for risky dollar assets. Moreover, our instruments—measures of bond illiquidity and market sentiment—serve as strong predictors of the credit spread differential between USD- and non-USD-denominated corporate bonds.

The remainder of the paper is structured as follows. Section 2 outlines our framework for estimating the corporate basis and describes the data sources. Section 3 presents our empirical findings on the substitution effect between safe and risky dollar assets, as well as the impact of shocks to risky dollar asset demand on exchange rates and economic activity. Section 4 concludes.

2 Definitions and Data

2.1 Decomposition of Corporate Basis

Consider corporate bonds denominated in EUR and USD. To measure the yield disparity across currencies, we define the corporate basis, Ψ_t, as the difference between the yield on an EUR-denominated corporate bond and the synthetic yield of a USD-denominated corporate bond from the same issuer, adjusted for exchange rate risk through hedging with a forward contract. Mathematically, this is expressed in Eq. (1). The synthetic USD yield is obtained by taking the yield on the USD-denominated corporate bond, $y_{\$,t}$, and adjusting for the FX forward-spot spread, $f_t - s_t$, which reflects the cost of hedging the currency risk.

Rearranging the terms, Eq. (2) decomposes the corporate basis into two components. The first term captures the credit spread differential, the difference in credit spreads between EUR- and USD-denominated corporate bonds. This component reflects variation in the demand for risky assets across currencies. The second term represents the U.S. Treasury premium, which accounts for the relative attractiveness of U.S. Treasuries compared to government bonds in EUR. This premium incorporates factors such as global demand for safe assets and regulatory constraints affecting U.S. Treasury markets.

To further refine the decomposition, Eq. (3) breaks down the U.S. Treasury premium into two distinct components. The first term is the convenience yield differential, which captures the relative expensiveness of U.S. Treasuries compared to risk-free government bonds in EUR. This component measures the safety and liquidity advantages associated with U.S. Treasuries. The second term is the cross-currency basis, which reflects FX market frictions and the relative cost of obtaining U.S. dollars through FX swaps.

$$\Psi_t = \underbrace{y_{e,t}}_{\text{EUR-denominated bond yield}} - \underbrace{(y_{\$,t} + f_t - s_t)}_{\text{FX-hedged USD-denominated bond yield}} \tag{1}$$

$$= \underbrace{\left[(y_{e,t} - y^G_{e,t}) - (y_{\$,t} - y^G_{\$,t})\right]}_{\text{Credit spread differential}} + \underbrace{\left[(y^G_{e,t} + s_t - f_t) - y^G_{\$,t}\right]}_{\text{U.S. Treasury premium}} \tag{2}$$

$$= \underbrace{\left[(y_{e,t} - y^G_{e,t}) - (y_{\$,t} - y^G_{\$,t})\right]}_{\text{Credit spread differential}} + \underbrace{\left[(y^G_{e,t} - y^{rf}_{e,t}) - (y^G_{\$,t} - y^{rf}_{\$,t})\right]}_{\text{Convenience yield differential}} + \underbrace{\left[(y^{rf}_{e,t} + s_t - f_t) - y^{rf}_{\$,t}\right]}_{\text{Cross-currency basis}} \tag{3}$$

Our focal point in this paper is the decomposition in Eq. (3), which separates the corporate basis into three key components: (i) the credit spread differential (CSD), measuring the relative riskiness of USD-denominated corporate debt, (ii) the convenience yield differential (CYD), reflecting the demand for safe U.S. Treasuries, and (iii) the cross-currency basis (CCB), capturing the cost of dollar liquidity in international markets. This framework allows us to attribute movements in the corporate basis to shifts in investor demand for safe versus risky dollar assets, as well as FX market frictions.

To estimate these components empirically, we distinguish between risk-free rates ($y^{rf}_{e,t}$ and $y^{rf}_{\$,t}$) and government bond yields ($y^G_{e,t}$ and $y^G_{\$,t}$) in EUR and USD, respectively. By separating the convenience yield of U.S. Treasuries from broader sovereign risk considerations, this decomposition provides a granular view of how demand for different types of dollar assets impacts the corporate basis and its macroeconomic implications. We provide further details on the estimation of each component below.

Credit Spread Differential (CSD). CSD measures the difference in credit spreads between corporate bonds denominated in foreign currencies and those denominated in

USD. A decrease in CSD indicates lower demand for risky USD assets, leading to a higher excess return (relative to non-defaultable bonds) for holding USD-denominated corporate debt.

Convenience Yield Differential (CYD). CYD captures the relative expensiveness of U.S. Treasuries compared to non-U.S. government bonds. Specifically, it is the difference between the yield spread on non-U.S. government bonds and the yield spread on U.S. Treasuries relative to risk-free rates. An increase in CYD reflects a stronger preference for safe USD assets, reducing the excess return on U.S. Treasuries.

Cross-Currency Basis (CCB). CCB is the difference between the synthetic dollar funding cost ($y^{rf}_{e,t} + s_t - f_t$) and the direct dollar funding cost ($y^{rf}_{\$,t}$). A positive CCB indicates that foreign investors are willing to pay a premium to obtain dollar funding via FX swaps, signaling dollar scarcity and high funding costs in FX markets.

As discussed in Section 2.3, we implement this three-way decomposition for each currency. Since the literature on demand elasticity suggests that asset prices respond more to shifts in aggregate demand (Chaudhary et al., 2023; Li and Lin, 2022), we expect shocks to the relative demand for risky and safe dollar assets to drive variations in CSD and CYD, respectively.

A decline in CSD primarily reflects a reduction in demand for risky dollar assets, often associated with increased risk aversion among bond investors, such as during financial crises. Likewise, an increase in CYD indicates heightened demand for safe dollar assets.

We note that our decomposition of the corporate basis differs from Liao (2020), in which the CSD is defined as $(y_{e,t} - y^{rf}_{e,t}) - (y_{\$,t} - y^{rf}_{\$,t})$, and is equivalent to the sum of our CSD and CYD in Eq. (3). By calculating credit spreads using government bond as the benchmark rate, our decomposition enables us to separate the components reflecting the demand for safe and risky dollar assets. Our measure is consistent with industry practice. For example, credit spreads quoted in the *Wall Street Journal* and major U.S. (investment-grade) corporate bond indices, such as Bloomberg Barclays, ICE BofA, and FTSE IG, are all calculated using government bond yields as a benchmark.[4]

2.2 Data

2.2.1 Corporate Bond Data

Bond Issuer Characteristics. Our corporate bond dataset is constructed using bond issuance information from the SDC Platinum Global New Issues database. This database

4. The option-adjusted spreads (OAS) in the three indices are all based on government bond rates, and the ICE BofA offer a separate variable named "LIBOR OAS" besides the standard "OAS" variable.

provides detailed characteristics for each issue, including the notional principal, maturity date, coupon structure, currency of denomination, issuer's country of origin, and indicators for option-like features.

We apply the following filtering criteria to ensure consistency and relevance: (1) The bond must be denominated in one of the seven major funding currencies: AUD, CAD, CHF, EUR, GBP, JPY, or USD. (2) The ultimate parent of the issuer must have outstanding bonds in multiple currencies, with at least one USD-denominated bond. (3) The bond must be unsecured, non-puttable, non-convertible, non-perpetual, and have fixed-rate coupons. (4) The issuer must not belong to a government-related sector, such as a municipal government, national government, or municipal agency. (5) The bond must have an initial maturity of at least one year and a notional principal of at least $50 million.

The filtered sample of debt issues is merged with secondary market pricing data. We obtain month-end price quotes from Bloomberg, a widely used data source for international corporate bond market research (Valenzuela, 2016; Liao, 2020; Geng, 2021). Price quotes are linked to bond characteristics using ISIN. Due to sparse pricing observations before 2004, our sample covers the period from January 2004 to March 2021.

To assign credit ratings, we follow the methodology of Dick-Nielsen et al. (2012). We first retrieve ratings from Standard & Poor's Global Ratings. If unavailable, we use Moody's Default & Recovery Database. If the rating remains missing, we turn to other agencies listed in Bloomberg, such as Fitch and Dominion. Finally, we compute yield-to-maturity and winsorize it at the 1% level within each currency-month to remove outliers.

The final dataset consists of 30,926 bonds issued by 3,376 entities, with a total notional value of $23.6 trillion. Following Liao (2020), we identify bond issuers based on the borrower ultimate parent's 6-digit CUSIP. Specifically, we link the 3,376 residency-based entities to their immediate parents using the UPCUSIP variable from the SDC database.

Table 1 presents the monthly average of bond counts, notional values (in billion dollars), and the number of ultimate issuers by rating and maturity categories. On average, our sample contains approximately 6,970 bond-month observations, representing bonds with a total notional value of $5,282 billion issued by 929 firms each month. The A-rated category and the 3-7 year maturity group account for the largest share in both issuance volume and outstanding notional. The average time to maturity across all bond-month observations is around five years, motivating our focus on CYD and CCB at the five-year maturity in our analysis.

Cross-Border Issuance. In our sample, USD-denominated corporate bonds account for approximately 40% (2,798) of all bonds and 47% ($2,508 billion) of the total outstanding notional value. In terms of currency ranking, USD-denominated bonds are followed by those issued in EUR, JPY, GBP, CAD, CHF, and AUD, respectively. Notably, foreign firms issue over 43% of all USD-denominated bonds, collectively representing 47% of the total notional value of USD bonds. Among other currencies, CHF-denominated corporate bonds exhibit the highest share of foreign issuance, with over 86% of these bonds issued by non-Swiss companies, likely reflecting Switzerland's role as a hub for international corporations.

Figure 2 provides a visual representation of cross-border corporate bond issuance, based on outstanding amounts at the end of our sample period (March 2021). Our analysis focuses on issuers headquartered in the U.S., Eurozone, UK, Switzerland, Canada, Australia, and Japan. In the figure, the size of each purple circle represents the aggregate notional value of bonds issued by firms in a given region, with U.S. firms unsurprisingly accounting for the largest share of global corporate bond issuance, followed by issuers in the Eurozone, Japan, and the UK.

The thickness of the arrows reflects the volume of USD-denominated bonds issued by foreign firms, particularly from the Eurozone and UK to the U.S. The darkness of the arrows further indicates the proportion of foreign currency bonds issued by a region that are denominated in USD. The results highlight that USD-denominated bonds dominate foreign currency bond markets across all surveyed countries, except Australia, where issuance in USD and EUR is roughly equal. Overall, USD bonds lead the global corporate bond market, with EUR-denominated bonds as the second-largest category.

2.2.2 Default-free Interest Rates and Exchange Rates

Government bond yields, fixed rates of interest rate swaps, cross-currency swap basis (calculated using LIBOR rates), and spot exchange rates are obtained from Bloomberg. We extract data for tenors of 1, 2, 5, 7, 10, 12, 15, 20, and 30 years when available. The calculation of both the CYD and CCB components follows Eq. (3) and is consistent with Du, Tepper, et al. (2018) and Du, Im, et al. (2018).

One concern with using LIBOR swap rates is the associated credit risk, as LIBOR represents an unsecured lending rate.[5] In the U.S., LIBOR has been replaced by the Secured Overnight Financing Rate (SOFR), which reflects the cost of borrowing cash overnight, collateralized by U.S. Treasury securities, and thus minimizes credit risk. Similar replacements have occurred globally, with countries adopting their respective benchmarks akin to SOFR: Australia's AUD Overnight Index Average (AONIA), Canada's Canadian Overnight Repo Rate Average (CORRA), Switzerland's Swiss Average Rate Overnight (SARON), the Euro Area's Euro short-term rate (ESTR), the U.K.'s Sterling Overnight

5. Additionally, the credibility of LIBOR was compromised by manipulation scandals in 2012, leading to its discontinuation for new transactions after December 31, 2021.

Index Average (SONIA), and Japan's Tokyo Overnight Average Rate (TONA). Although Bloomberg provides historical data for these rates back to before 2004, their longest maturity is currently only 12 months. Consequently, our baseline analysis employs 5-year LIBOR rates, while our robustness tests utilize the new benchmarks with a 1-year maturity.

2.2.3 Supplementary Data

Treasury International Capital (TIC). We utilize the TIC database to provide quantitative evidence on the demand for dollar-denominated assets, specifically through monthly net purchases of U.S. long-term securities by foreign residents. The TIC data consists of two components in the Treasury SLT filing: external liabilities and external claims. We extract data on the aggregate monthly purchases and sales of U.S. securities by foreign countries at the asset class level.

Historical data on net purchases of U.S. assets are obtained from *Securities (A): U.S. Transactions with Foreign-Residents in Long-Term Securities*. To estimate foreign investors' net purchases of USD corporate bonds, we refer to *Corporate Bonds: U.S. Corporate Bonds (Long-term), Net Purchases*. Similarly, for U.S. Treasuries, we use *Treasury Bonds and Notes, Net Purchases*.[6]

Bond Illiquidity. To construct a measure of aggregate illiquidity for each corporate bond market, we supplement fixed-income and currency market data with information from multiple sources. We include all bonds covered by the ICE BofA Global Corporate Index and High Yield Index to ensure a representative sample for each currency.[7]

To quantify bond illiquidity, we estimate the Hasbrouck (2009) measure, which infers bid-ask spreads from daily price movements. Specifically, Hasbrouck's measure models transaction costs as the impact of order flow on bond prices, overcoming limitations of low-frequency liquidity proxies. Because corporate bond trades are infrequent, direct bid-ask spreads are often unavailable; instead, Hasbrouck's approach relies on a Gibbs sampling method to infer trade direction from observed price changes. We compute this measure at the bond-month level and aggregate it to the currency level to construct our final illiquidity metric.

6. Two limitations of the TIC data are noted in Bertaut and Judson (2014). First, the data records transactions based on the country of the initial cross-border counterparty, not the ultimate buyer, actual seller, or security issuer. Second, some types of cross-border securities flows that bypass standard broker-dealer and other TIC reporter channels are not captured. Despite these limitations, TIC data still offers valuable insights into the aggregate transactions of foreign investors in U.S. Treasuries and corporate bonds.

7. Huang et al. (2024) compare the Bloomberg corporate bond data, our primary data source, with the ICE BofA data. For bonds appearing in both databases, they find that average credit spreads closely match each other regardless of currency denomination.

Sentiment. We measure investor sentiment following Gilchrist and Zakrajšek (2012) and López-Salido et al. (2017), using bond yield spreads net of estimated default and liquidity risks. Our estimated spread serves as a proxy for sentiment, capturing variations in corporate bond spreads that reflect shifts in investor risk appetite beyond fundamental credit risk. All else equal, a lower bond yield spread indicates greater investor optimism and risk tolerance, while a higher spread signals heightened risk aversion. To construct this measure, we estimate the distance to default for each bond by matching month-end corporate bond prices from the ICE BofA database with issuer balance sheet and equity data from Compustat NA (for the U.S. and Canada) and Compustat Global (for other countries).

Monetary Policy Surprises. We employ the methodology developed by Nakamura and Steinsson (2018) to construct U.S. monetary policy shocks. This approach involves analyzing the first principal component of changes in five interest rates: the Federal funds rate immediately following the FOMC meeting, the expected Federal funds rate after the next FOMC meeting, and the three-month Eurodollar rates for two, three, and four quarters ahead, specifically within a 30-minute window of scheduled FOMC announcements. Our high-frequency monetary policy shock measure is used in Acosta (2022), and we aggregate this data to a monthly frequency, with a default value of 0 during periods without scheduled monetary policy announcements.

2.3 Estimation of the Corporate Basis Components

Corporate Basis. We estimate the corporate basis by comparing the promised returns on bonds while controlling for currency, maturity, and other characteristics. Following Liao (2020), we implement the following cross-sectional regression:[8]

$$X_{i,t} = \alpha_{c,t} + \beta_{f,t} + \gamma_{m,t} + \delta_{r,t} + \epsilon_{i,t}, \tag{4}$$

where $X_{i,t}$ represents the credit spread of bond i after adjusting for exchange rate risk relative to the U.S. dollar. The credit spread, $CS_{i,t}$, is defined as the corporate bond yield net of the government bond yield for bond i with the same maturity at time t. For non-USD-denominated bonds, we account for differences in safe asset demand and funding costs by including the CYD and CCB components:

8. We exclude bond-month observations if the remaining maturity is less than one year or below 10% of the full maturity to mitigate illiquidity concerns.

$$X_{i,t} = \begin{cases} CS_{i,t} & \text{for USD-denominated bonds,} \\ CS_{i,t} + \text{CYD}_{c,t}^{(\tau)} + \text{CCB}_{c,t}^{(\tau)} & \text{for non-USD-denominated bonds.} \end{cases} \quad (5)$$

Here, τ represents the bond's time to maturity. For non-USD bonds, the inclusion of the CYD and CCB components ensures that the comparison accounts for differences in safe asset demand and funding costs.

To control for heterogeneity, the specification includes multiple fixed effects. Firm-level fixed effects, $\beta_{f,t}$, account for issuer characteristics. Maturity fixed effects, $\gamma_{m,t}$, are controlled using four buckets: 1–3 years, 3–7 years, 7–10 years, and beyond 10 years. Rating fixed effects, $\delta_{r,t}$, group bonds into four categories: AAA & AA, A, BBB, and BB or below. Currency fixed effects, $\alpha_{c,t}$, capture systematic differences in credit spreads across currencies after controlling for observable bond attributes.

At the aggregate level, the corporate basis between currency c and the USD is estimated as the difference in currency fixed effects:

$$\Psi_{c,t} = \alpha_{c,t} - \alpha_{\text{USD},t}. \quad (6)$$

This formulation isolates the excess return associated with issuing bonds in a foreign currency rather than in USD while accounting for differences in bond characteristics.

Credit Spread Differential (CSD). The CSD measures differences in corporate bond credit spreads across currencies. To ensure robustness and mitigate estimation biases, we employ two primary estimation methods.

The first method derives CSD as a residual from our decomposition framework, defined as:

$$CSD_{c,t}^{Dec} = \Psi_{c,t} - \text{CYD}_{c,t}^{(5y)} - \text{CCB}_{c,t}^{(5y)}, \quad (7)$$

where we focus on the 5-year maturity to align with the average corporate bond maturity in our sample. This decomposition-based approach relies on independent estimates of CYD and CCB.

The second method estimates CSD using a cross-sectional regression that explicitly controls for bond-level characteristics:

$$CS_{i,t} = \alpha'_{c,t} + \beta'_{f,t} + \gamma'_{m,t} + \delta'_{r,t} + \epsilon'_{i,t}. \quad (8)$$

The CSD between currency c and USD is then computed as:

$$\text{CSD}^{Reg}_{c,t} = \alpha'_{c,t} - \alpha'_{USD,t}. \tag{9}$$

Figure 3 provides a robustness check by comparing alternative CSD constructions. The figure shows a high correlation between the decomposition-based estimate (CSD^{Dec}) and the regression-based estimate (CSD^{Reg}), with correlation coefficients ranging from 0.92 to 0.97 across all currency pairs. These findings confirm the consistency of our CSD estimates.

Given this strong consistency, we primarily adopt the regression-based estimate (CSD^{Reg}) in our analysis. This approach is preferred because it explicitly controls for bond-level characteristics, enhancing the precision of our estimates. However, the decomposition-based approach (CSD^{Dec}) remains valuable for validation and is used where appropriate.

To confirm that our findings are not sensitive to the choice of estimation method, we conduct several robustness tests, detailed in Appendix B. Specifically, we assess the impact of alternative default-free benchmarks on CSD^{Dec}, examine how bond issuance dynamics affect CSD^{Reg}, and test whether the substitution effect is concentrated in specific bond groups, such as financial versus non-financial issuers or onshore versus offshore markets. These tests confirm that our results are not driven by estimation choices, reinforcing the reliability of both CSD measures.

Convenience Yield Differential (CYD). Following Jiang et al. (2021), we measure CYD as the difference between the yield spread of non-U.S. and U.S. government bonds. The yield spread of a government bond is defined as the difference between its yield and the fixed rate of a maturity-matched interest rate swap, which serves as the risk-free rate in the local currency.[9]

Cross-Currency Basis (CCB). Since we exclude corporate bonds with less than one year to maturity, CCB in our setting cannot be directly estimated from currency forward rates. Instead, we follow Du, Tepper, et al. (2018) by using spreads on LIBOR cross-currency basis swaps to quantify long-horizon CCB. The cross-currency swap involves a currency swap as well as exchanges of cash flow linked to floating interbank rates and thus offers a measure for long-term CIP deviations.

9. To maintain consistency across our analysis, we align the maturities of the CCB, CYD, and corporate bonds using a linear interpolation method. This method is applied across maturities of 1, 2, 5, 7, 10, 12, 15, 20, and 30 years, depending on data availability. For government bonds, the specific maturities used for interpolation are determined by the actual available data. For example, Australian government bond maturities include 1, 2, 3, 5, 7, 10, 20, and 30 years, requiring an adjusted interpolation approach.

2.3.1 Summary Statistics

Figure 1 illustrates the monthly time series of the corporate basis for currency pairs involving USD and non-USD currencies (AUD, CAD, CHF, EUR, GBP, and JPY) from January 2004 to March 2021. The corporate basis, defined as the difference between the yield on non-U.S. corporate bonds and the hedged yield on U.S. corporate bonds, exhibits distinct negative spikes during major financial crises, particularly the GFC and Covid-19. These declines suggest either rising hedging costs or reduced demand for risky dollar assets. Prior to the GFC, the corporate basis remained close to zero, but it deviated significantly and displayed heightened volatility in the aftermath of the crisis.

Turning to its components, Table 2 presents summary statistics for the three components of the corporate basis across different periods: Pre-GFC (January 2004–November 2007), the GFC (December 2007–May 2009), and the post-GFC era (June 2009–March 2021). The time series of each component is plotted in Figure 4.

First, the CSD, which reflects demand for risky dollar assets, experienced a sharp decline during the GFC, indicating a lower appetite for risk due to rising hedging costs and heightened FX risk. The most pronounced negative shifts in CSD occurred in JPY- and CHF-denominated bonds, followed by EUR, GBP, CAD, and AUD. Second, the CYD exhibited a downward trend after the GFC, suggesting a decline in the uniqueness of U.S. safe assets. Notably, CYD spiked during the GFC, signaling a surge in demand for safe USD assets, but its rise during Covid-19 was more muted. This pattern is consistent with the *dash for dollars* phenomenon rather than an increased preference for U.S. Treasuries, aligning with findings from Ma et al. (2022), He, Nagel, et al. (2022), and Cesa-Bianchi et al. (2023). Finally, the CCB, which captures dollar liquidity stress in global financial markets, remained close to zero before the GFC but has been persistently elevated since.

Table 3 presents results from our variance decomposition analysis, quantifying the relative contributions of CSD, CYD, and CCB to corporate basis fluctuations. We find that CSD is the dominant driver, with its variance-to-corporate basis variance ratio averaging $\frac{\text{var(CSD)}}{\text{var}(\Psi)} = 1.36$. In contrast, CCB and CYD contribute significantly less to overall variation. A key finding is the negative covariance between CSD and CYD, which averages -0.65 and represents the second-largest determinant of corporate basis variance. While CSD and CCB also exhibit negative co-movement, its influence is less pronounced. Overall, the combined contributions of CYD and CCB are relatively small, reinforcing that the negative covariance between CSD and CYD plays a critical role in corporate basis fluctuations. This finding highlights the substitution effect between demand for risky and safe dollar assets, a key mechanism driving corporate basis dynamics over the sample period.

3 Empirical Evidence

3.1 Substitution Effect between Safe and Risky Dollar Assets

3.1.1 Holdings-Level Evidence

We begin our analysis with holdings-level data to illustrate the substitution effect between foreign investors' demand for safe and risky dollar assets. To capture foreign investors' overall transactions in U.S. assets, we rely on TIC S-form data, focusing on private investors' holdings of U.S. corporate bonds and Treasuries during two major crises: the 2008 financial crisis and the 2011–2012 European debt crisis.

Figure 5 presents our findings. Net purchases of U.S. assets are normalized by one standard deviation of monthly net purchases from January 2004 to March 2021, with the VIX included as an indicator of financial market stress. The top panel shows a clear substitution effect during the 2008 financial crisis. In March 2008, following Bear Stearns' collapse, foreign investors reduced their holdings of U.S. corporate bonds while increasing their investments in U.S. Treasuries. This trend intensified between July and November 2008, as financial market stress peaked and the VIX surged, with foreign investors further reducing corporate bond holdings and shifting into Treasuries.

The bottom panel of Figure 5 examines the European debt crisis. During this period, foreign investors significantly increased their U.S. Treasury holdings while reducing their exposure to U.S. corporate bonds. This trend was particularly evident from August to September 2011, as heightened financial stress drove a steady reallocation towards Treasuries at the expense of corporate bonds.

These patterns provide strong evidence of a substitution effect at the holdings-level: during periods of financial distress, foreign investors shift from risky to safe dollar assets, reducing their corporate bond holdings while increasing their exposure to U.S. Treasuries.

3.1.2 Decomposition of the Corporate Basis

We demonstrate the substitution effect between the demand for safe and risky dollar assets through our decomposition of the corporate basis. The top panel of Figure 6 presents a time-series plot of the cross-currency mean of CYD and CSD from January 2004 to March 2021. The correlation between CSD and CYD is strongly negative throughout the sample, with a correlation of -0.48 in levels (i.e., without first differencing) and -0.46 in monthly changes, highlighting a robust substitution effect.

During the GFC, this negative correlation becomes even more pronounced, reaching -0.82 in levels over the entire crisis period and -0.57 for monthly changes. This reflects a strong *flight to safety* among global investors, marked by a sharp decline in CSD and a corresponding increase in CYD. A similar pattern emerges during the Covid-19 pandemic, where CSD drops significantly, while CYD rises more moderately. The relatively muted increase in CYD suggests a reduced specialness of U.S. Treasuries during the pandemic, consistent with findings from Cesa-Bianchi et al. (2023), Ma et al. (2022), and He, Nagel, et al. (2022).

The substitution effect remains evident even after excluding the GFC and Covid-19 periods. When these crisis periods are omitted, the correlation between monthly changes in CSD and CYD remains statistically significant at -0.33 (1% level), confirming the persistence of this relationship across the full sample.

Further evidence is provided in the subsequent panels of Figure 6, which display time-series plots of CSD and CYD for each of the six non-USD currencies in our study. Across all currencies, we observe a consistent negative co-movement between CSD and CYD, reinforcing the substitution effect between risky and safe dollar assets.

3.1.3 SVAR: Baseline Estimation

To formally examine the simultaneous dynamics of CSD, CYD, and CCB, we estimate a Structural Vector Autoregression (SVAR) model, as specified in Eq. (10):

$$AY_t = A_0 + \sum_{j=1}^{N} A_j Y_{t-j} + \epsilon_t, \tag{10}$$

where $Y_t = [CSD_t; CYD_t; CCB_t]'$ represents the vector of endogenous variables, and ϵ_t is a vector of orthogonal structural innovations, each with a mean of zero.

The lag order N is set to one, as determined by the Bayesian Information Criterion (BIC). The structural shock vector ϵ_t includes shocks to the demand for risky dollar assets (ϵ_t^{CSD}), safe dollar assets (ϵ_t^{CYD}), and cross-border dollar liquidity (ϵ_t^{CCB}). Applying the inverse of matrix A, denoted as A^{-1}, to both sides of Eq. (10) yields the reduced-form representation:

$$Y_t = C_0 + CY_{t-1} + B\epsilon_t. \tag{11}$$

Here, matrix $B = A^{-1}$, while C_0 and C are computed as $A^{-1}A_0$ and $A^{-1}A_1$, respectively. This formulation allows us to analyze the effects of structural shocks on the endogenous variables.

In our baseline specification, we assume a contemporaneous causal structure where CSD affects both CYD and CCB, while CYD also influences CCB. Figure 7 presents the impulse response functions (IRFs) following a one-unit shock to each variable, averaged across all sampled currencies. The IRFs, estimated using 1,000 bootstrap replications, confirm the existence of a substitution effect between safe and risky dollar assets, as evidenced by the negative co-movement between CSD and CYD in response to shocks to

CSD.[10]

Quantitatively, a one standard deviation increase in CSD (18.2 basis points) leads to a 4.2 basis point reduction in CYD. Additionally, positive shocks to both CSD and CYD result in contemporaneous reductions in CCB. Specifically, a one standard deviation increase in CSD (18.2 basis points) and CYD (18 basis points) leads to decreases in CCB of 2.46 and 2.50 basis points, respectively.

3.1.4 SVAR-IV Estimation

A key limitation of the unrestricted SVAR model is its implicit assumption that causality flows from CSD to both CYD and CCB. To more robustly identify the causal effects of each corporate basis component, we adopt an alternative specification by incorporating external instruments that uniquely isolate shocks to these components.

For instrument validity, the instruments Z_t^{CSD} and Z_t^{CYD} must satisfy relevance and exclusion criteria. Specifically, an instrument for CSD must be strongly associated with fluctuations in the demand for risky dollar assets while remaining exogenous to factors influencing the demand for safe dollar assets and cross-border dollar liquidity. Formally, we require Z_t^{CSD} to be correlated with ϵ_t^{CSD} but orthogonal to other structural shocks, as specified in Eq. (12):

$$E[Z_t^{CSD}\epsilon_t^{\text{CSD}}] = \phi; \quad E[Z_t^{CSD}\epsilon_t^{\text{CYD}}] = 0; \quad \text{and} \quad E[Z_t^{CSD}\epsilon_t^{\text{CCB}}] = 0. \tag{12}$$

Similarly, an instrument for CYD must be associated with shifts in the demand for safe dollar assets while remaining exogenous to factors affecting risky dollar asset demand and dollar scarcity. Formally, Z_t^{CYD} must be correlated with ϵ_t^{CYD} but orthogonal to other shocks, as outlined in Eq. (13):

$$E[Z_t^{CYD}\epsilon_t^{\text{CSD}}] = 0; \quad E[Z_t^{CYD}\epsilon_t^{\text{CYD}}] = \phi; \quad \text{and} \quad E[Z_t^{CYD}\epsilon_t^{\text{CCB}}] = 0. \tag{13}$$

To identify structural shocks, we employ three instruments. Credit market illiquidity and sentiment serve as instruments for CSD, capturing time-series variation in the demand for risky dollar assets. For CYD, we use monetary policy surprises, reflecting shifts in the demand for safe dollar assets. Further details on our estimation methodology are provided in Appendix A.

Credit-Market Illiquidity. We construct an instrument based on the differential illiquidity between USD and non-USD corporate bonds. We posit that the relative liquidity of USD versus non-USD corporate bonds, as proxied by our IV, influences the demand

10. While IRFs at the individual currency level also support these findings, they are omitted due to space constraints.

for USD corporate bonds, which is captured by the CSD.[11] Moreover, we argue that this liquidity differential is exogenous to the shocks that influence the demand for safe dollar assets (CYD).

Following Hasbrouck (2009), we infer effective transaction costs in both USD and non-USD corporate bond markets using Eq. (14):

$$r_{i,u} = c_{i,t} \cdot \Delta D_{i,u} + \beta r^M_{i,u} + \epsilon_{i,u}, \tag{14}$$

where $r_{i,u}$ and r^M_u are the returns on bond i and the market return, respectively, on day u in month t, D is a sell-side trade indicator, and c represents half the effective bid-ask spread.[12] To overcome the limitations of the Roll (1984) model, we employ Gibbs sampling to infer the latent trade direction indicators D_u. Monthly estimation of Eq. (14) provides an estimate of effective transaction costs, denoted as $Gibbs_{i,t} = 2\hat{c_{i,t}}$. [13]

In alignment with Bao et al. (2011), we aggregate $Gibbs_{i,t}$ at the currency level each month and denote it as $Gibbs_{c,t}$.[14] Figure 8a illustrates the time series of the aggregate illiquidity measure for each currency. Consistent with Huang et al. (2024), the U.S. corporate bond market generally exhibits higher levels of illiquidity compared to other currencies throughout our sample period. Notably, large spikes in illiquidity measures occur for all currencies during the GFC and the Covid-19 pandemic, with transaction costs of USD bonds escalating more significantly than those of other currencies, particularly during the Covid-19 crisis.[15]

We define a non-USD liquidity proxy by averaging the currency-level illiquidity measures, capturing liquidity variations in the international corporate bond market. We finalize the construction of our illiquidity IV by calculating the difference between $Gibbs_{non-usd,t}$ and $Gibbs_{usd,t}$, which represents the relative illiquidity of international versus U.S. corporate bond markets. An increase in this IV indicates greater transaction costs for non-USD

11. Empirical studies supporting our assumption include Bretscher et al. (2024), who document a pronounced preference among active investors (e.g., mutual funds) for bonds with higher liquidity. Further support comes from Goldstein et al. (2017) and Cai et al. (2019), who show that bond illiquidity amplifies mutual fund fragility by increasing the sensitivity of fund performance to flows and magnifying the price impact of herding behavior.

12. Alternative corporate bond liquidity measures exist, but we use the Hasbrouck (2009) approach for two reasons. First, unlike the U.S. corporate bond market, OTC bond transactions outside the U.S. had limited regulatory reporting requirements until recent years. Second, Schestag et al. (2016) show that this measure outperforms other low-frequency corporate bond liquidity proxies based on daily pricing data in the U.S. market.

13. The Gibbs sampling procedure follows a structured sequence to estimate latent trade direction indicators. We adopt the approach of Hasbrouck (2009), initializing the sampler with reasonable starting values to enhance convergence, while ensuring that its limiting behavior remains invariant to initial conditions.

14. We include a currency-month in our IV only if there are at least 10 security-level observations for that currency in the month.

15. This pattern is supported by studies documenting a sharp deterioration in U.S. corporate bond liquidity following the Covid-19 outbreak (Gilchrist et al., 2024; Haddad et al., 2021; Kargar et al., 2021; O'Hara and Zhou, 2021).

corporate bonds relative to USD-denominated ones, suggesting a positive shock to the demand for risky dollar assets.

Sentiment. We construct an instrument to capture shifts in investor sentiment within corporate bond markets. Investor sentiment reflects variations in risk appetite beyond fundamental credit risk, influencing the compensation required by investors to bear credit risk. Periods of high sentiment are characterized by lower yield spreads, indicating greater investor optimism and risk tolerance, while periods of low sentiment correspond to heightened risk aversion and wider credit spreads. This mechanism suggests that changes in sentiment affect the demand for risky dollar assets, which we aim to capture through our sentiment-based IV.

To construct our IV, we adapt the regression model from Gilchrist and Zakrajšek (2012) and López-Salido et al. (2017), incorporating an additional variable to account for liquidity risk at the security level:

$$\log CS_{i,t} = \alpha_i + \beta_1 DFT_{i,t} + \beta_2 ILLQ_{i,t} + \gamma' Z_{i,t} + \epsilon_{i,t}, \tag{15}$$

where $CS_{i,t}$ represents the corporate bond yield spread, $DFT_{i,t}$ proxies for default risk using the distance-to-default metric, and $ILLQ_{i,t}$ captures bond-specific illiquidity. The vector $Z_{i,t}$ includes additional controls such as bond characteristics and issuer fundamentals. This model isolates the component of credit spreads driven by factors beyond default risk and illiquidity, providing a cleaner measure of investor sentiment.

We estimate Eq. (15) using investment-grade corporate bond data from the ICE BofA database across all currencies. To obtain a sentiment proxy, we define $Senti_{c,t}$ as the difference between observed yield spreads and their fitted values from Eq. (15), aggregated at the currency level:

$$Senti_{c,t} = \frac{1}{N_c} \sum_{i \in c} CS_{i,t} - \frac{1}{N_c} \sum_{i \in c} \hat{CS}_{i,t}, \tag{16}$$

where N_c denotes the number of bonds in currency c at time t. A higher $Senti_{c,t}$ indicates that actual credit spreads exceed their predicted values, implying greater risk aversion, while a lower $Senti_{c,t}$ suggests heightened investor optimism and risk tolerance.

Figure 8b presents the time series of the sentiment measure. Unlike bond illiquidity, there is no systematic divergence between USD and non-USD sentiment proxies. Even during the Covid-19 period, $Senti_{usd,t}$ remains aligned with other currencies, suggesting that liquidity risk is well controlled in our sentiment estimation. Following a methodology similar to our illiquidity IV, we aggregate $Senti_{c,t}$ across all non-USD currencies and define the sentiment-based IV as the difference between the non-USD and USD sentiment proxies. An increase in this IV implies that investors exhibit more positive sentiment towards USD-denominated bonds, as they demand higher risk compensation for non-USD corporate bonds relative to USD bonds. This suggests a positive shock to the demand for risky dollar assets.

Finally, to construct shock series for both the sentiment and bond illiquidity IVs, we extract the residual innovations from an AR(1) process applied to the differences between the corresponding non-USD and USD measures. These extracted shocks are introduced as separate external instruments for CSD within the SVAR framework. Figure 8c illustrates the time series of both sentiment and bond illiquidity shock IVs.

Monetary Policy. We construct an instrument for CYD using high-frequency identification of monetary policy surprises around scheduled Federal Open Market Committee (FOMC) announcements, following Nakamura and Steinsson (2018).

We posit that foreign demand for safe dollar assets is directly influenced by U.S. monetary policy. Specifically, a tightening of U.S. monetary policy raises yields on U.S. Treasuries, making them more attractive to unlevered international investors,[16] such as UK pension funds, which may view these low-risk assets as sufficient to meet their nominal return targets. Additionally, contractionary monetary policy signals economic discipline and strengthens perceptions of U.S. stability (Caballero et al., 2017), particularly during periods of global stress (Bekaert et al., 2013). These dynamics reinforce the role of U.S. Treasuries as a global safe asset, thereby increasing demand for safe dollar assets.

Conversely, an easing of U.S. monetary policy reduces Treasury yields, prompting investors to seek higher-yielding alternatives. This shift reallocates capital away from safe dollar assets and into riskier asset classes. To isolate the causal impact of these mechanisms on the demand for safe dollar assets, we employ identified monetary policy shocks as an external instrument. Figure 8d displays the time series of the monetary policy shock series.

3.1.5 SVAR-IV Results

The results of our SVAR-IV estimation using all three instruments are displayed in Figure 9. Figure 9a explores the impact of CSD on CYD, employing the IRF derived from a negative shock to CSD using the illiquidity shock IV. The first-stage F-statistic is 48, with an R^2 of 0.19, indicating a robust instrument. The positive first-stage coefficient aligns with our hypothesis that an increase in the relative illiquidity of the USD corporate bond market (CSD $\downarrow$) correlates with higher U.S. corporate bond spreads relative to non-U.S. spreads. This shift suggests a substitution effect where global investors move towards safer dollar assets (CYD $\uparrow$), accompanied by an increase in the premium for borrowing

16. Even for levered international investors, higher U.S. interest rates reduce the appeal of borrowing in low-yield currencies to finance riskier investments. Instead, they may prefer to deploy capital directly into Treasuries, avoiding leverage while securing better returns.

dollars in FX swap markets (CCB ↑). Quantitatively, a one standard deviation decrease in CSD (18.2 basis points) corresponds to increases of 3.56 basis points in CYD and 1.65 basis points in CCB.[17]

Figure 9b details the results using corporate bond sentiment as an IV. The first-stage F-statistic of 263 and an R^2 of 0.56 confirm the strength of the instrument. The positive first-stage coefficient indicates that a decline in sentiment in the USD corporate bond market—relative to sentiment in global corporate bond markets—leads to an increase in the expected returns on USD corporate bonds. As risk appetite declines, investors demand a higher risk premium to hold USD corporate bonds, causing their spreads to widen (CSD ↓). Similar to the illiquidity shock IV, this effect promotes a shift towards safer dollar assets (CYD ↑) and an increase in the dollar borrowing premium (CCB ↑). A one standard deviation decrease in CSD (18.2 basis points) induced by the sentiment shock leads to a 1.70 basis point increase in CYD and a 2.36 basis point increase in CCB.

Figure 9c presents the results from using a monetary policy surprise as an IV for a CYD shock. The first-stage F-statistic of 17 and an R^2 of 0.08 indicate a suitable instrument. Consistent with a positive first-stage coefficient, a tightening of U.S. monetary policy increases the demand for U.S. Treasuries (CYD ↑), which in turn decreases the demand for risky dollar assets (CSD ↓). Quantitatively, a one standard deviation increase in CYD (18 basis points) leads to an 11.18 basis point decrease in CSD. Additionally, the effects on CCB are found to be insignificant both in the short and long run, consistent with the observed weak correlation between CYD and CCB across the sample.

3.1.6 Robustness Tests

We conduct several robustness tests to confirm the validity of our main findings, with detailed results presented in Appendix B. Below, we summarize the key tests.

Supply Effects. We address the potential concern that supply-side dynamics in the corporate bond market could influence CSD, given that our interpretation of CSD shocks assumes demand-driven effects while holding supply constant. To test this, we first examine the correlation between changes in the relative notional amounts outstanding for non-USD versus USD corporate bonds and changes in CSD. The correlation coefficient, a negligible -0.03, suggests that pricing discrepancies between USD- and non-USD-denominated bonds (captured by CSD) are not systematically affected by corporate bond supply.

To further control for supply-side factors, we incorporate variables representing the relative outstanding amounts of non-USD to USD corporate bonds into our SVAR model.

17. Unreported results, including tests of the substitution effect by excluding the GFC period and using illiquidity shock IVs derived only from firms that have issued both USD and non-USD corporate bonds, confirm the robustness of these findings.

Even after controlling for issuance dynamics, our SVAR results confirm a robust demand-driven substitution effect between risky and safe dollar assets.

Time-Varying Substitution between CSD and CYD. A potential concern is that our interpretation of shocks to CSD and CYD as shifts in the relative demand for risky and safe dollar assets may instead reflect changes in their substitutability. Specifically, the observed effects may not be driven by investor demand (e.g., quantity adjustments) but rather by fluctuations in the ease of substitution between safe and risky dollar assets.

To address cross-sectional variation in substitutability, we re-estimate CSD separately for corporate bonds rated AAA and BBB. Given that AAA-rated bonds are more substitutable with safe assets, this test allows us to assess whether the substitution effect is concentrated in higher-rated bonds. Our findings confirm that the effect is present across both ratings categories, reinforcing the robustness of our baseline results.

Next, we account for time-variation in substitutability by incorporating a measure of substitution elasticity between safe and risky bonds developed by Nenova (2024), which is based on global fund holdings.[18] While controlling for time-varying substitutability leads to a marginal attenuation of the substitution effect, our results remain robust and consistent with the baseline findings.

Alternative Measures of Risk-Free Rates. A potential concern is that LIBOR, an unsecured lending rate, incorporates credit risk, which may correlate with interest rate swap (IRS) rates and introduce bias in our results.

To address this, we examine alternative benchmark rates with minimal credit risk, such as the Secured Overnight Financing Rate (SOFR), which reflects the cost of collateralized borrowing in OTC markets. Our SVAR findings remain robust when substituting LIBOR with SOFR, confirming that a negative shock to the demand for risky dollar assets leads to a shift towards safe dollar assets and a corresponding widening of CIP deviations.

Other Approaches to Estimating CSD. We explore alternative methods for estimating the corporate basis and CSD beyond our primary cross-sectional regression approach.

First, we employ different default-free benchmarks to calculate CSD while keeping the benchmark rates for CYD unchanged. This mitigates concerns that our baseline approach mechanically induces a negative correlation between CSD and CYD. Additionally, we develop a bottom-up measure of CSD to confirm that our findings are not driven by a specific estimation technique. This approach involves generating regression-based estimates of firm-level CSD and aggregating them at the currency level.

To further validate our CSD estimation, we conduct subsample analyses to ensure

18. The measure used in our analysis is denoted as *Xleast* in Nenova (2024) and was kindly provided by the author.

that the substitution effect is not concentrated in any particular bond group. These tests include: (i) bonds issued only by non-U.S. firms, (ii) bonds excluding firms' local currency issues, (iii) bonds issued exclusively in offshore or onshore markets, and (iv) bonds issued solely by financial or non-financial firms. Lastly, we analyze a subset of issuers with both EUR- and USD-denominated bonds matched by maturity. The CSD estimates derived from these matched bond pairs closely align with our regression-based estimates, reinforcing the robustness of our approach.

3.2 Demand for Dollar Assets and Exchange Rates

The existing literature highlights the critical role of dollar asset demand in shaping exchange rate dynamics. Koijen and Yogo (2020) estimate a global asset demand system and emphasize the significance of latent demand shocks in driving exchange rate variation. Similarly, Jiang et al. (2021) show that demand for safe dollar assets accounts for a substantial portion of U.S. dollar fluctuations. A key advantage of our three-way decomposition is its ability to distinguish between safe and risky dollar asset demand. Leveraging this framework, we analyze how different demand shocks impact exchange rates.

3.2.1 Time-Series Regression

Following the time-series regression approach of Jiang et al. (2021), we first examine the impact of dollar asset demand on the U.S. dollar's value. Our dependent variable is the monthly log change in the real spot dollar value against a basket of currencies, including the AUD, CAD, CHF, EUR, GBP, and JPY. The dependent variable is constructed in two steps: first, we compute real spot rates for each currency relative to the USD using the respective local CPI index; second, we take the equal-weighted average of the log real spot rates across the currency basket. Our main independent variables are the first differences of the three corporate basis components, with additional controls for market risk captured by the CBOE VIX index.

The regression results, presented in Table 4, indicate that the three corporate basis components have distinct effects on the U.S. dollar exchange rate. Overall, we find a negative relationship between the corporate basis and the U.S. dollar. Specifically, a one standard deviation decrease (13.5 basis points) in the corporate basis corresponds to a 0.91 percent (91 basis points) appreciation of the USD. However, this negative relationship is primarily driven by CSD, where a one standard deviation decrease (18.2 basis points) leads to a 1.21 percent appreciation of the USD. In contrast, both CYD and CCB positively impact the U.S. dollar. A one standard deviation increase in CYD (18 basis points) and CCB (10.7 basis points) each results in a 2.37 percent appreciation of the USD. Consequently, the Treasury premium, defined as the sum of CYD and CCB, also contributes to an appreciation of the U.S. dollar, consistent with the exchange rate adjusting to accommodate demand for U.S. safe assets, as outlined in Jiang et al. (2021).

3.2.2 Historical Decomposition

To further validate these findings, we examine how historical fluctuations in risky and safe dollar asset demand have contributed to USD exchange rate movements. Specifically, we apply an SVAR-IV framework to decompose exchange rate variations into components driven by demand shocks to safe and risky dollar assets. This approach allows us to assess the relative importance of each demand channel over time and evaluate how their contributions evolved during key market episodes.

The results, presented in Figure 11, show that shocks to both types of dollar asset demand have played a substantial role in explaining U.S. dollar fluctuations, though their relative contributions vary over time. During the global financial crisis, for example, shocks to risky dollar asset demand had a much larger impact on USD appreciation. Depending on the choice of IV, the contribution of risky dollar asset demand peaks between 50 percent and 73 percent, whereas the contribution of safe dollar asset demand peaks at 55 percent. A similar pattern emerges during the COVID-19 shock, where risky asset demand shocks were the primary drivers of USD appreciation. In contrast, increased demand for safe dollar assets negatively contributed to U.S. dollar fluctuations, signaling a transition from a traditional *flight to safety* to a broader *dash for dollars*.

In Appendix C, we further analyze the historical contributions of risky and safe dollar asset demand through a variance decomposition. Our findings show that CSD and CYD shocks together account for an average of 49 percent of U.S. dollar fluctuations over the sample period. We also compare our decomposition with the approach of Liao (2020), which introduces the measure CSD^{Libor}—a single metric that aggregates both risky and safe dollar asset demand. This alternative measure explains up to 37 percent of U.S. dollar exchange rate variation.

In summary, our findings extend Jiang et al. (2021) by showing that exchange rate dynamics depend not only on demand for safe dollar assets but also on fluctuations in risky dollar asset demand. While increased demand for safe assets strengthens the U.S. dollar, declining demand for risky assets independently contributes to appreciation. By disentangling these effects, our decomposition offers a more granular perspective on exchange rate movements and improves explanatory power.

3.3 Spillovers to Other Asset Markets and Economic Activity

3.3.1 Equity and Commodity Markets

In addition to exchange rates, we examine whether shocks to risky dollar asset demand spill over into equity and commodity markets. We hypothesize that rising illiquidity in the USD corporate bond market relative to the global market constrains investors' risk-bearing capacity, leading to persistent declines in other asset classes. This aligns with intermediary asset pricing theories in He et al. (2017), which emphasize the role of financial intermediaries as marginal investors in pricing a broad range of assets.

To test this hypothesis, we analyze the impact of CSD shocks on the S&P 500 index (SPX), a composite non-U.S. stock index, and the Bloomberg Commodity Index (BCOM). The non-U.S. stock index aggregates the Austrian Traded Index, S&P/TSX Composite Index, Swiss Market Index, Euronext 100 Index, FTSE 100 Index, and Nikkei 225 Index, capturing broad stock market performance across these economies.

Figure A7a shows that a one standard deviation decrease in CSD (18.2 basis points) leads to declines of 7.8%, 9%, and 7.1% in the SPX, the non-U.S. stock index, and BCOM, respectively. Given their monthly return standard deviations of 4.19%, 4.16%, and 4.77%, these effects are economically significant. The results remain robust across alternative instruments, including the sentiment shock IV for CSD, as shown in Figure A7b.

3.3.2 Macroeconomic Activity

Theories of financial frictions suggest that disruptions in credit markets and intermediary balance sheets amplify macroeconomic fluctuations (Gilchrist and Zakrajšek, 2012; Gertler and Karadi, 2015). Consistent with this framework, we hypothesize that fluctuations in the demand for risky dollar assets influence macroeconomic activity by tightening financial conditions and constraining investor risk-bearing capacity.

Our analysis incorporates key macroeconomic indicators, including CPI, industrial production, unemployment, real GDP, real investment, and real consumption. While CPI, industrial production, and unemployment data are available monthly, real GDP and other variables are observed quarterly. Figure A8 presents the impulse response functions (IRFs) of a negative CSD shock on U.S. economic activity, using both the illiquidity and sentiment shock IVs. The results show significant spillovers, with declines in inflation, industrial production, real investment, real consumption, and real GDP, alongside a rise in unemployment.

Appendix D extends the analysis to other economies, including Canada, Japan, the Euro Area, the UK, Switzerland, and Australia. For Switzerland and Australia, industrial production data is only available quarterly, and in Australia, CPI is also reported quarterly. To harmonize these observations, we match quarterly values to the most recent

CSD, CYD, and CCB data. For the IVs, we extract innovations using an AR(1) model at the quarterly frequency. All variables, except the unemployment rate (expressed in percentage terms), are in logs. Consistent with U.S. findings, a negative shock to risky dollar asset demand leads to a deterioration in economic activity across these economies, reflected in lower CPI, industrial production, real GDP, real investment, and real consumption, along with rising unemployment.

These findings reinforce the view that financial frictions play a key role in shaping macroeconomic outcomes by constraining investor balance sheets and limiting credit intermediation, further linking financial shocks to real economic activity.

4 Conclusion

This paper examines the corporate basis as a measure of deviations from no-arbitrage conditions in global credit markets, focusing on the economic forces driving its variation. Departing from the traditional issuer-centric perspective, we analyze the corporate basis through the lens of global bond market investors, who actively hedge currency risk. Our three-way decomposition of the corporate basis disentangles the roles of risky and safe dollar asset demand, as well as dollar scarcity in cross-border funding markets.

Using a comprehensive dataset of 30,926 corporate bonds across six major funding currencies, we document a substitution effect between risky and safe dollar assets. Our IV approach, which leverages corporate bond illiquidity, investor sentiment, and monetary policy shocks as instruments, establishes a causal relationship between shifts in the demand for these assets. We find that a rise in U.S. dollar credit spreads leads to increased demand for safe dollar assets, while an increase in the convenience yield on U.S. Treasuries reduces demand for risky dollar assets. These findings highlight the dynamic interaction between different segments of dollar-denominated assets.

Beyond credit markets, we examine how shocks to the demand for risky and safe dollar assets influence exchange rate dynamics. While both types of demand shocks significantly impact the U.S. dollar, their effects move in opposite directions. A contraction in risky dollar asset demand, reflected in widening dollar credit spreads, leads to U.S. dollar appreciation, consistent with deteriorating global risk sentiment and constrained financial intermediation. Conversely, an increase in demand for safe dollar assets further strengthens the U.S. dollar by raising the convenience yield on U.S. Treasuries and reinforcing the dollar's role as the global safe-haven currency. These shocks also propagate to other asset markets and real economic activity, leading to declines in equity and commodity prices as well as weaker macroeconomic indicators.

In sum, our findings support the U.S. dollar's central role as the international reserve currency and demonstrate how shifts in the demand for risky and safe dollar assets generate systematic effects across financial markets and the broader economy. Future research could further explore the trading behavior and portfolio choices of global investors, examining how shifts in their dollar asset holdings influence currency markets and broader financial conditions.

References

Abbassi, Puriya, and Falk Bräuning. 2021. "Demand effects in the FX forward market: Micro evidence from banks' dollar hedging." *Review of Financial Studies* 34 (9): 4177–4215.

Acosta, Miguel. 2022. "The perceived causes of monetary policy surprises." *Working paper, Federal Reserve Board.*

Augustin, Patrick, Mikhail Chernov, Lukas Schmid, and Dongho Song. 2021. "Benchmark interest rates when the government is risky." *Journal of Financial Economics* 140 (1): 74–100.

———. 2024. "The term structure of covered interest rate parity violations." *Journal of Finance* 79 (3): 2077–2114.

Avdjiev, Stefan, Wenxin Du, Catherine Koch, and Hyun Song Shin. 2019. "The dollar, bank leverage, and deviations from covered interest parity." *American Economic Review: Insights* 1 (2): 193–208.

Bao, Jack, Jun Pan, and Jiang Wang. 2011. "The illiquidity of corporate bonds." *Journal of Finance* 66 (3): 911–946.

Bekaert, Geert, Marie Hoerova, and Marco Lo Duca. 2013. "Risk, uncertainty and monetary policy." *Journal of Monetary Economics* 60 (7): 771–788.

Bertaut, Carol C, and Ruth Judson. 2014. "Estimating US cross-border securities positions: New data and new methods." *FRB International Finance Discussion Paper,* no. 1113.

Borio, Claudio EV, Robert N McCauley, Patrick McGuire, and Vladyslav Sushko. 2016. "Covered interest parity lost: understanding the cross-currency basis." *BIS Quarterly Review September.*

Bräuning, Falk, and Victoria Ivashina. 2020. "Monetary policy and global banking." *Journal of Finance* 75 (6): 3055–3095.

Bretscher, Lorenzo, Lukas Schmid, Ishita Sen, and Varun Sharma. 2024. "Institutional Corporate Bond Pricing." *Review of Financial Studies.*

Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2017. "The Safe Assets Shortage Conundrum." *Journal of Economic Perspectives* 31 (3): 29–46.

Cai, Fang, Song Han, Dan Li, and Yi Li. 2019. "Institutional herding and its price impact: Evidence from the corporate bond market." *Journal of Financial Economics* 131 (1): 139–167.

Caramichael, John, Gita Gopinath, and Gordon Y Liao. 2021. "Us dollar currency premium in corporate bonds." *IMF Working Papers* 2021 (185).

Cenedese, Gino, Pasquale Della Corte, and Tianyu Wang. 2021. "Currency mispricing and dealer balance sheets." *Journal of Finance* 76 (6): 2763–2803.

Cerutti, Eugenio M, Maurice Obstfeld, and Haonan Zhou. 2021. "Covered interest parity deviations: Macrofinancial determinants." *Journal of International Economics* 130:103447.

Cesa-Bianchi, Ambrogio, Czech Robert, and Fernando Eguren-Martin. 2023. "Dash for dollars." *Bank of England Working Paper No. 932.*

Chaudhary, Manav, Zhiyu Fu, and Jian Li. 2023. "Corporate Bond Multipliers: Substitutes Matter." *Available at SSRN 4292266.*

Chen, L., P. Collin-Dufresne, and R.S. Goldstein. 2009. "On the relation between the credit spread puzzle and the equity premium puzzle." *Review of Financial Studies* 22 (9): 3367–3409.

Diamond, William, and Peter Van Tassel. 2022. "Risk-Free Rates and Convenience Yields around the World." *Federal Reserve Bank of New York Staff Reports, No. 1032.*

Dick-Nielsen, Jens, Peter Feldhütter, and David Lando. 2012. "Corporate bond liquidity before and after the onset of the subprime crisis." *Journal of Financial Economics* 103 (3): 471–492.

Du, Wenxin, Joanne Im, and Jesse Schreger. 2018. "The US Treasury premium." *Journal of International Economics* 112:167–181.

Du, Wenxin, Alexander Tepper, and Adrien Verdelhan. 2018. "Deviations from covered interest rate parity." *Journal of Finance* 73 (3): 915–957.

Duffie, Darrell. 2020. "Still the World's Safe Haven?" *Redesigning the US Treasury market after the COVID-19 crisis', Hutchins Center on Fiscal and Monetary Policy at Brookings, available online at https://www. brookings. edu/research/still-the-worlds-safe-haven.*

Friewald, Nils, Rainer Jankowitsch, and Marti G. Subrahmanyam. 2012. "Illiquidity or Credit Deterioration: A Study of Liquidity in the US Corporate Bond Market during Financial Crises." *Journal of Financial Economics* 105 (1): 18–36.

Friewald, Nils, and Florian Nagler. 2019. "Over-the-Counter Market Frictions and Yield Spread Changes." *Journal of Finance* 74 (6): 3217–3257.

Galvez, Julio, Leonardo Gambacorta, Sergio Mayordomo, and Jose Maria Serena. 2021. "Dollar borrowing, firm credit risk, and FX-hedged funding opportunities." *Journal of Corporate Finance* 68 (C): 101945.

Geng, Zhe. 2021. "Foreign Discount in International Corporate Bonds." *Available at SSRN 3968370.*

Gertler, Mark, and Peter Karadi. 2015. "Monetary policy surprises, credit costs, and economic activity." *American Economic Journal: Macroeconomics* 7 (1): 44–76.

Gilchrist, Simon, Bin Wei, Vivian Z Yue, and Egon Zakrajšek. 2024. "The Fed takes on corporate credit risk: An analysis of the efficacy of the SMCCF." *Journal of Monetary Economics,* 103573.

Gilchrist, Simon, and Egon Zakrajšek. 2012. "Credit spreads and business cycle fluctuations." *American Economic Review* 102 (4): 1692–1720.

Goldstein, Itay, Hao Jiang, and David T. Ng. 2017. "Investor flows and fragility in corporate bond funds." *Journal of Financial Economics* 126 (3): 592–613.

Haddad, Valentin, Alan Moreira, and Tyler Muir. 2021. "When Selling Becomes Viral: Disruptions in Debt Markets in the COVID-19 Crisis and the Fed's Response." *Review of Financial Studies* 34 (11): 5309–5351.

Hasbrouck, Joel. 2009. "Trading costs and returns for US equities: Estimating effective costs from daily data." *Journal of Finance* 64 (3): 1445–1477.

He, Zhiguo, Bryan Kelly, and Asaf Manela. 2017. "Intermediary asset pricing: New evidence from many asset classes." *Journal of Financial Economics* 126 (1): 1–35.

He, Zhiguo, Paymon Khorrami, and Zhaogang Song. 2022. "Commonality in Credit Spread Changes: Dealer Inventory and Intermediary Distress." *Review of Financial Studies* 35 (10): 4630–4673.

He, Zhiguo, Stefan Nagel, and Zhaogang Song. 2022. "Treasury inconvenience yields during the covid-19 crisis." *Journal of Financial Economics* 143 (1): 57–79.

Huang, Jing-Zhi, Yoshio Nozawa, and Zhan Shi. 2024. "The Global Credit Spread Puzzle." *Journal of Finance* 80 (1): 101–162.

Jiang, Zhengyang, Arvind Krishnamurthy, and Hanno Lustig. 2021. "Foreign safe asset demand and the dollar exchange rate." *Journal of Finance* 76 (3): 1049–1089.

Kargar, Mahyar, Benjamin Lester, David Lindsay, Shuo Liu, Pierre-Olivier Weill, and Diego Zuniga. 2021. "Corporate Bond Liquidity during the COVID-19 Crisis." *Review of Financial Studies* 34 (11): 5352–5401.

Klingler, Sven, and Suresh M Sundaresan. 2020. "Diminishing Treasury Convenience Premiums: Effects of Dealers' Excess Demand in Auctions." *Available at SSRN 3556502.*

Koijen, Ralph SJ, and Motohiro Yogo. 2020. *Exchange rates and asset prices in a global demand system.* Technical report. National Bureau of Economic Research.

Li, Jiacui, and Zihan Lin. 2022. "Prices Are Less Elastic For Less Diversifiable Demand." *Available at SSRN 4038664.*

Liao, Gordon, and Tony Zhang. 2025. "The hedging channel of exchange rate determination." *Review of Financial Studies* 38 (1): 1–38.

Liao, Gordon Y. 2020. "Credit migration and covered interest rate parity." *Journal of Financial Economics* 138 (2): 504–525.

López-Salido, David, Jeremy C Stein, and Egon Zakrajšek. 2017. "Credit-market sentiment and the business cycle." *Quarterly Journal of Economics* 132 (3): 1373–1426.

Ma, Yiming, Kairong Xiao, and Yao Zeng. 2022. "Mutual Fund Liquidity Transformation and Reverse Flight to Liquidity." *Review of Financial Studies* 35 (10): 4674–4711.

Nakamura, Emi, and Jón Steinsson. 2018. "High-frequency identification of monetary non-neutrality: the information effect." *Quarterly Journal of Economics* 133 (3): 1283–1330.

Nenova, Tsvetelina. 2024. "Global or regional safe assets: evidence from bond substitution patterns." *Available at SSRN 4736704.*

O'Hara, Maureen, and Xing (Alex) Zhou. 2021. "Anatomy of a liquidity crisis: Corporate bonds in the COVID-19 crisis." *Journal of Financial Economics* 142 (1): 46–68.

Rime, Dagfinn, Andreas Schrimpf, and Olav Syrstad. 2022. "Covered interest parity arbitrage." *Review of Financial Studies* 35 (11): 5185–5227.

Roll, Richard. 1984. "A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market." *Journal of Finance* 39 (4): 1127–1139.

Schestag, Raphael, Philipp Schuster, and Marliese Uhrig-Homburg. 2016. "Measuring liquidity in bond markets." *Review of Financial Studies* 29 (5): 1170–1219.

Sialm, Clemens, and Qifei Zhu. 2024. "Currency Management by International Fixed Income Mutual Funds." *Journal of Finance* 79 (6): 4037–4081.

Valenzuela, Patricio. 2016. "Rollover Risk and Credit Spreads: Evidence from International Corporate Bonds." *Review of Finance* 20 (2): 631–661.

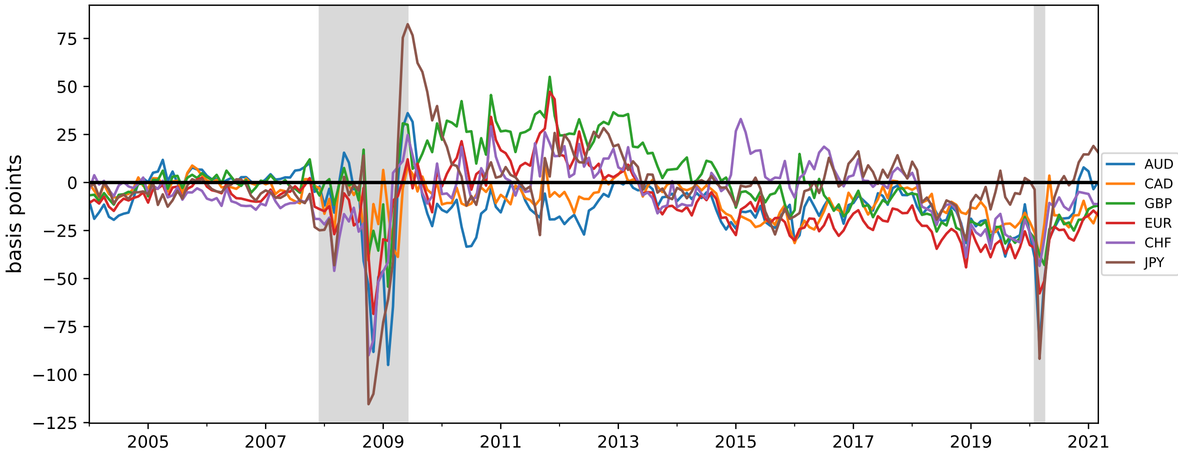
Vissing-Jorgensen, Annette. 2021. "The treasury market in spring 2020 and the response of the federal reserve." *Journal of Monetary Economics* 124:19–47.

Viswanath-Natraj, Ganesh. 2020. "Unconventional Monetary Policy and Covered Interest Rate Parity Deviations: is there a Link?" *Warwick Business School Finance Group Research Paper Series.*

Yellen, Janet L. 2011. "Assessing Potential Financial Imbalances in an Era of Accommodative Monetary Policy." *The 2011 International Conference: Real and Financial Linkage and Monetary Policy.*

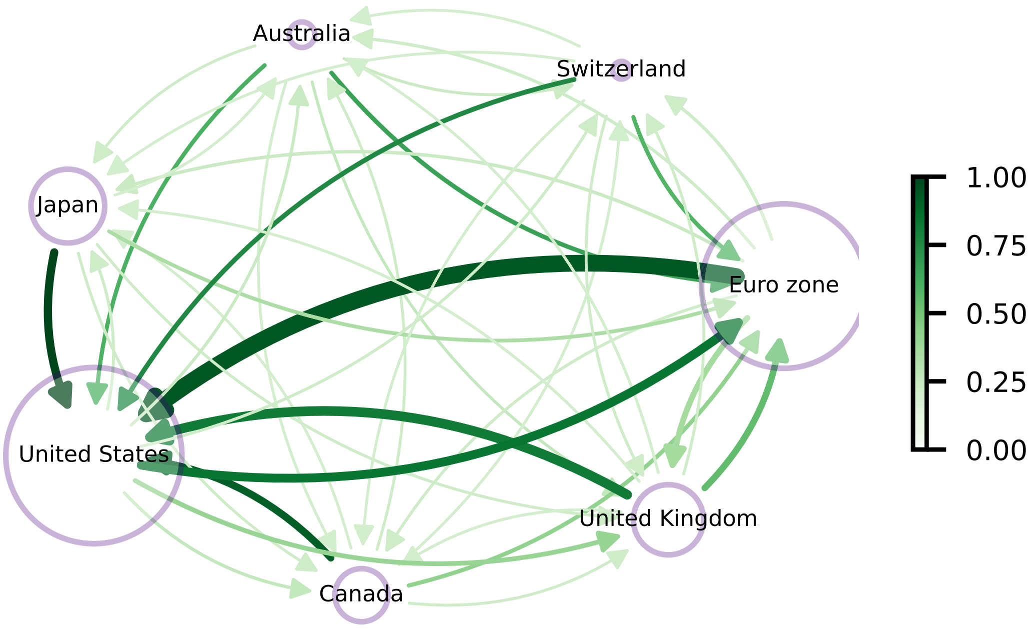
Zeev, Nadav Ben, and Daniel Nathan. 2024. "The widening of cross-currency basis: When increased FX swap demand meets limits of arbitrage." *Journal of International Economics* 152:103984.

Figure 1: Corporate Basis



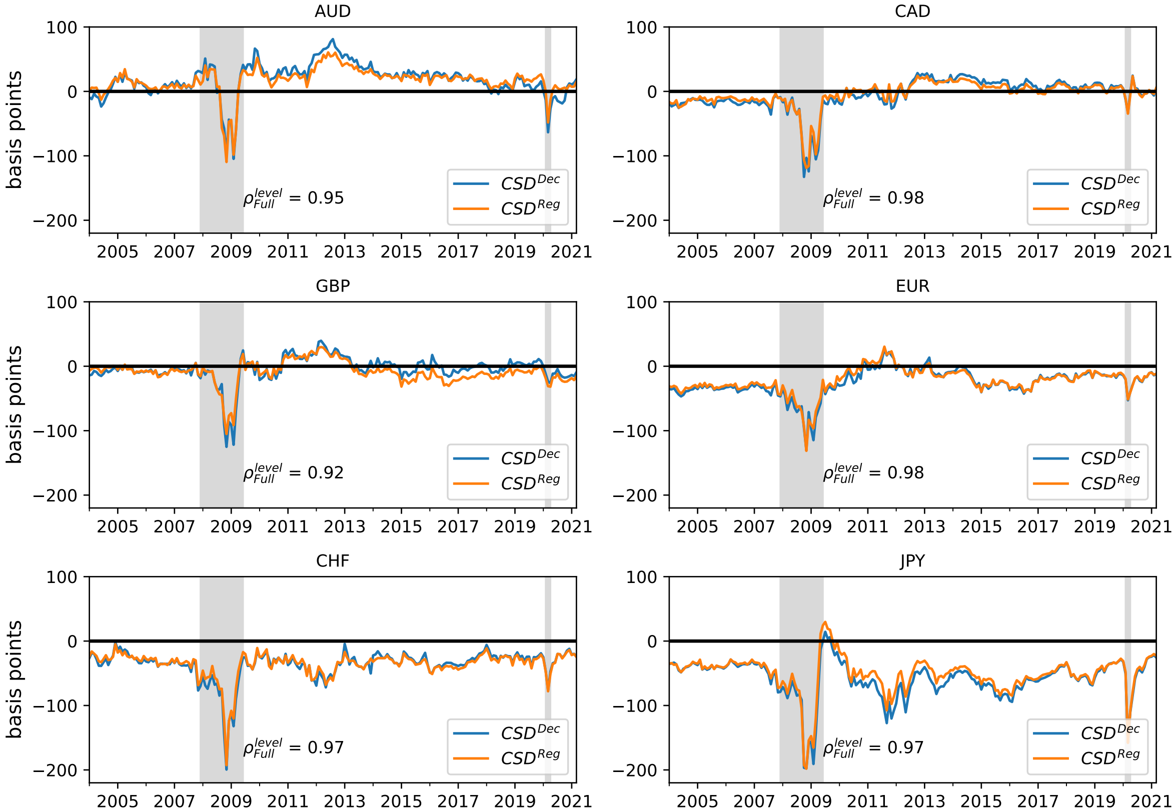
This figure presents the time series of corporate basis by currency. Corporate bases are estimated with cross-sectional regressions in Eq. (4). The sample period ranges from January 2004 to March 2021. Shaded bars denote months designated as recessions by the National Bureau of Economic Research.

Figure 2: Cross-border Bond Issuance



This figure presents the cross-border issuance of corporate bonds with currency denominations in AUD, CAD, CHF, EUR, GBP, JPY, and USD, based on the bond outstanding data in March 2021. Purple circles depicts the total notional principal of outstanding bonds issued by the domestic firms. Green arrows from country/region A to B represents bonds that are issued by firm in L and denominated in the fiat currency of K: their size reflects the absolute amount of bonds in that category, and their color depth indicates the proportion of A's foreign currency bonds that are denominated in the currency of country/region B.

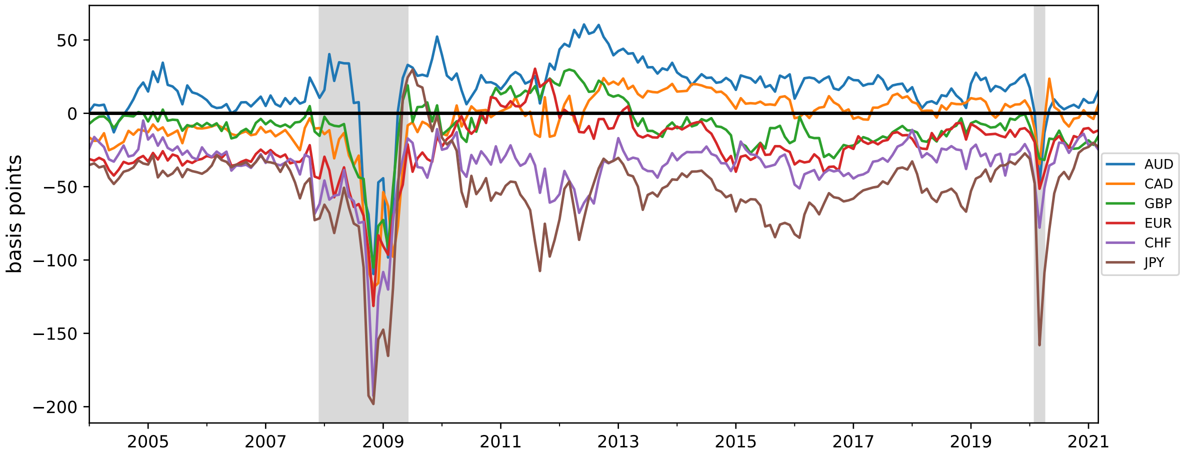
Figure 3: Alternative Estimates of Credit Spread Differential



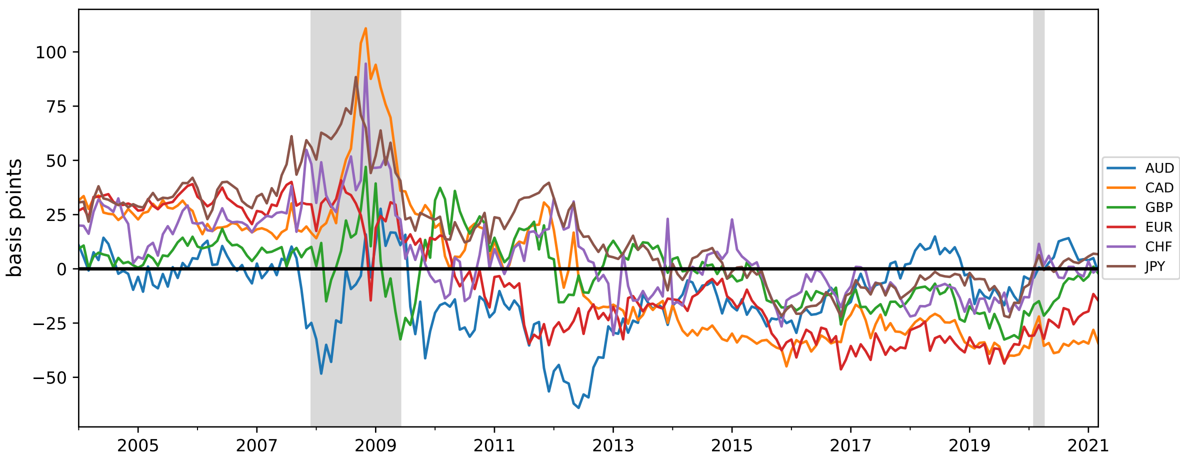
This figure compares the decomposition-based estimate of CDS (CSD^{Dec}) and regression-based estimate (CSD^{Reg}). CSD^{Dec} is derived from the decomposition as presented in Eq. (3) and thus involves the estimate of corporate basis, CYD and CCB. CSD^{Reg} is directly estimated from the cross-sectional regression of Eq. (8). The sample period ranges from January 2004 to March 2021. Shaded bars denote months designated as recessions by the National Bureau of Economic Research.

Figure 4: Decomposition of Corporate Basis

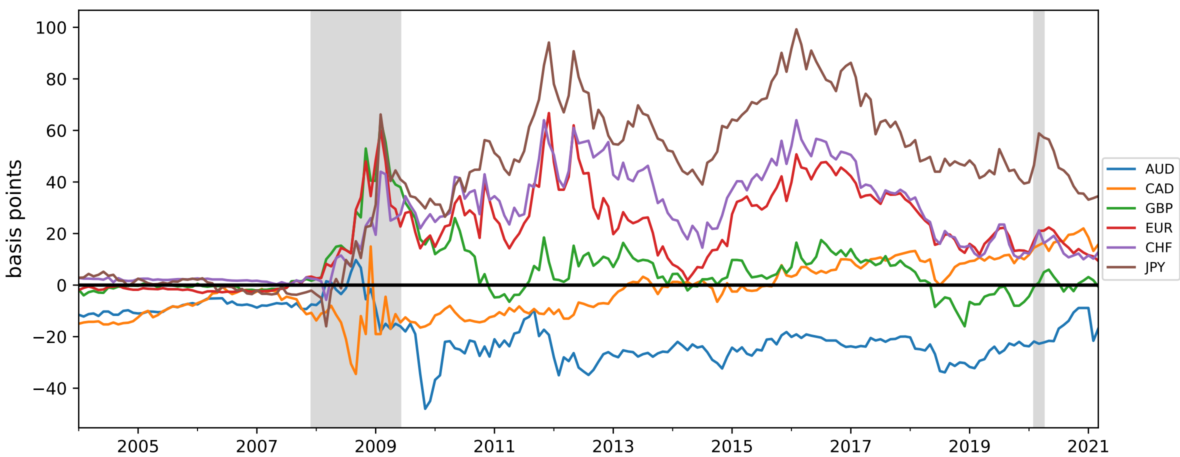
(a) Credit Spread Differential (CSD)



(b) Convenience Yields Differential (CYD, 5-year)



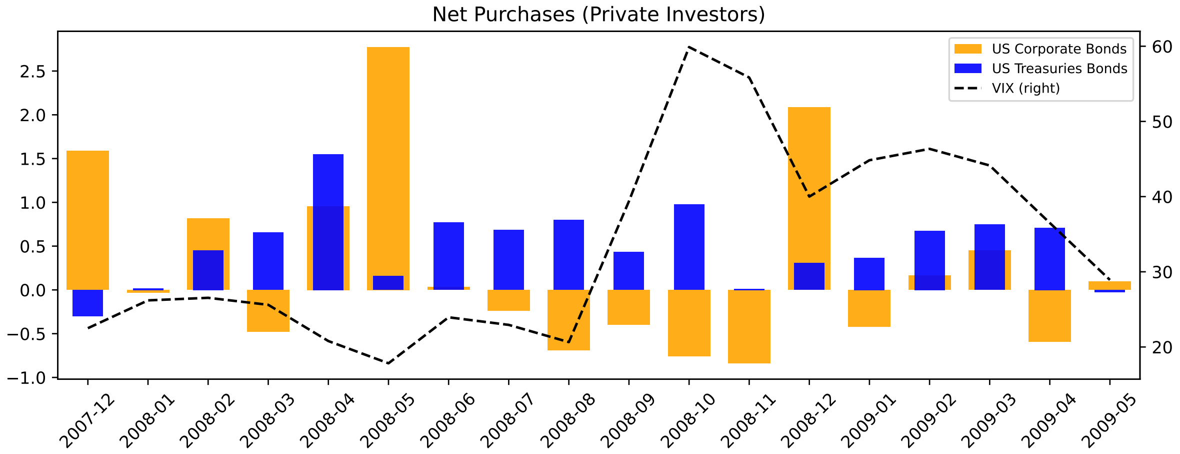
(c) Cross-currency Basis (CCB, 5-year)



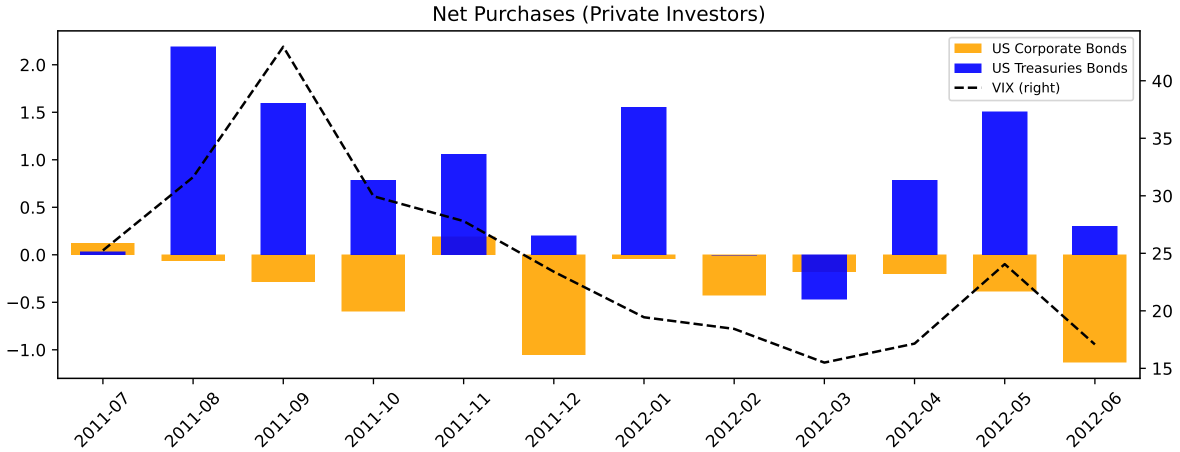
This figure presents the time series of corporate basis components: CSD, CYD (5-year maturity) and CCB (5-year maturity). The sample period ranges from January 2004 to March 2021. Shaded bars denote months designated as recessions by the National Bureau of Economic Research.

Figure 5: Holdings-Level Evidence

(a) Foreign Investors' Net Purchases of U.S. Assets

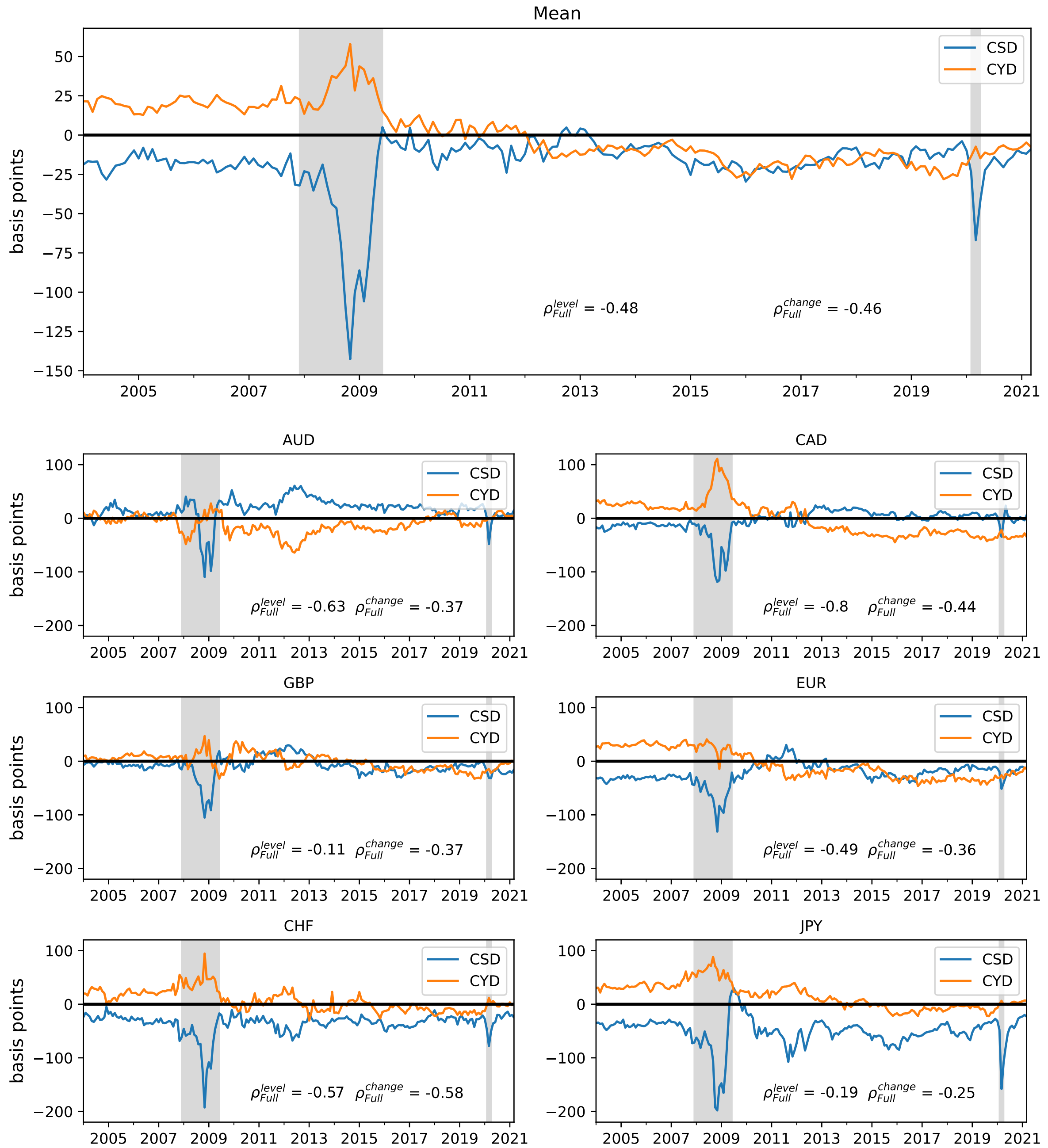


(b) Foreign Investors' Net Purchases of U.S. Assets



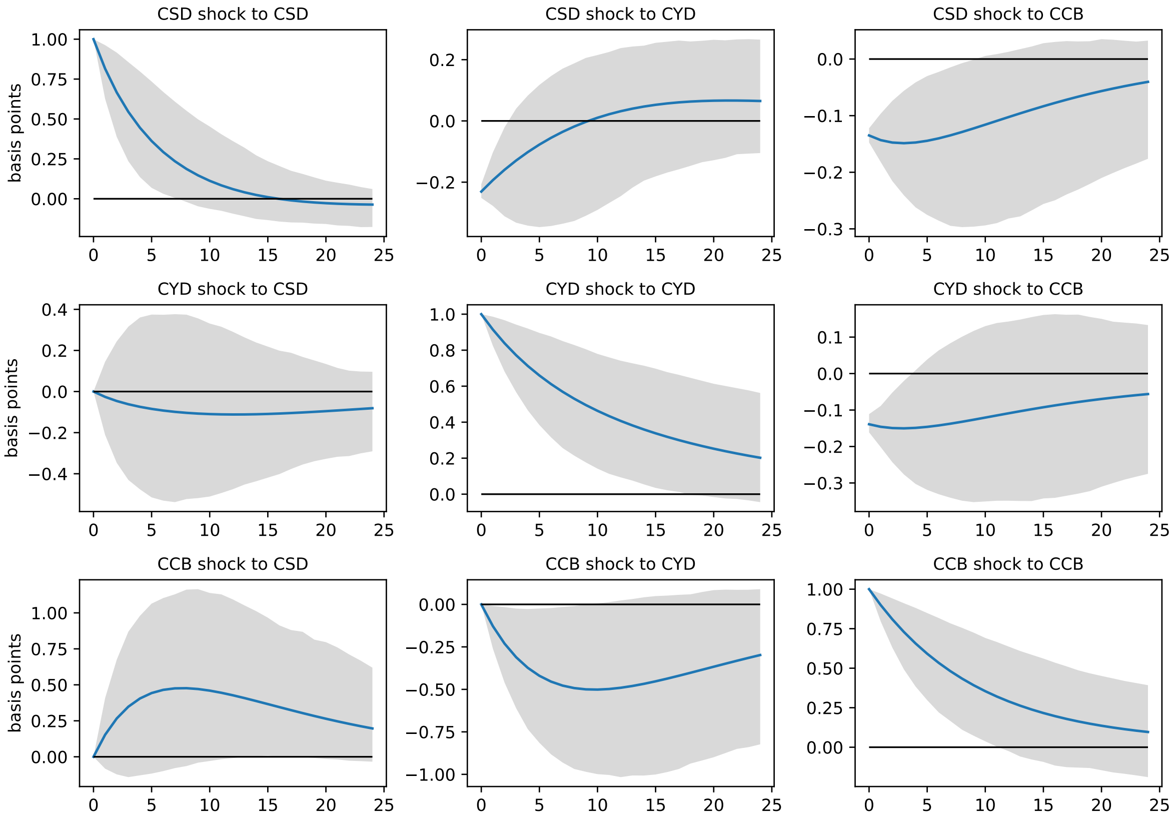
This figure presents holdings-level evidence on foreign investors' net purchases of U.S. assets. Panel A shows foreign investors' net purchases of U.S. assets during the 2008 Global Financial Crisis, while Panel B presents these purchases during the European Debt Crisis. Net purchases are scaled by one standard deviation of the monthly net purchases from January 2004 to March 2021. Data is sourced from the TIC S Form - Securities (A): U.S. Transactions with Foreign Residents in Long-Term Securities. The VIX values are also included in each panel, with corresponding values shown on the right y-axis.

Figure 6: Substitution Effect Between Safe and Risky Dollar Assets



This figure illustrates the co-movement between our estimates of CSD and CYD from January 2004 to March 2021. Panel A reports the cross-currency average of CSD and CYD, while Panel B presents individual time series for each currency. Correlation coefficients are provided for both levels and first differences of CSD and CYD. Shaded regions indicate U.S. recessions as defined by the National Bureau of Economic Research.

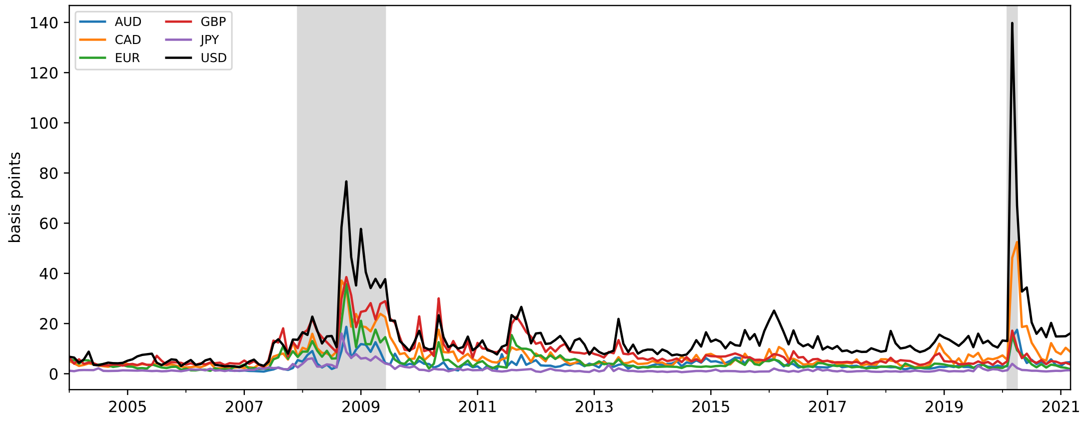
Figure 7: IRF of the Unrestricted SVAR Model (Mean)



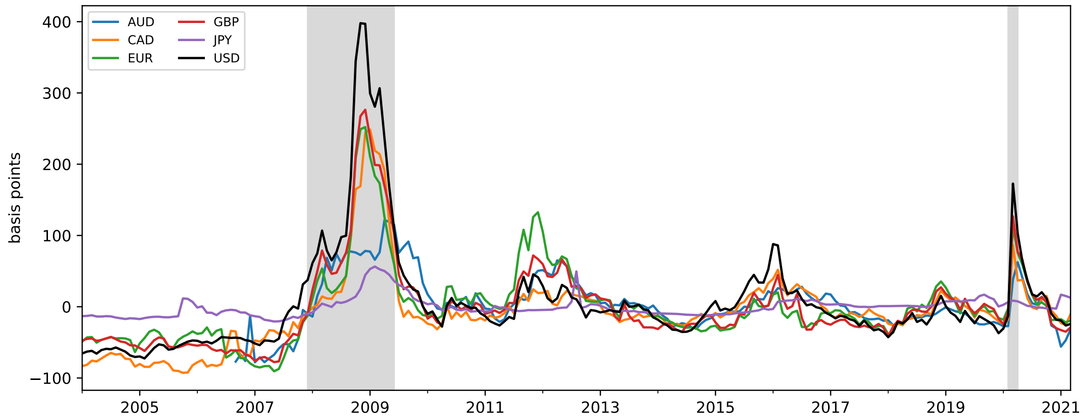
This figure presents the impulse response function (IRF) of one unit corresponding shock to each variable in the corporate basis decomposition. The plots are based on 1,000 wild bootstraps. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the cross-currency mean of CSD, CYD and CCB.

Figure 8: Instrumental Variables

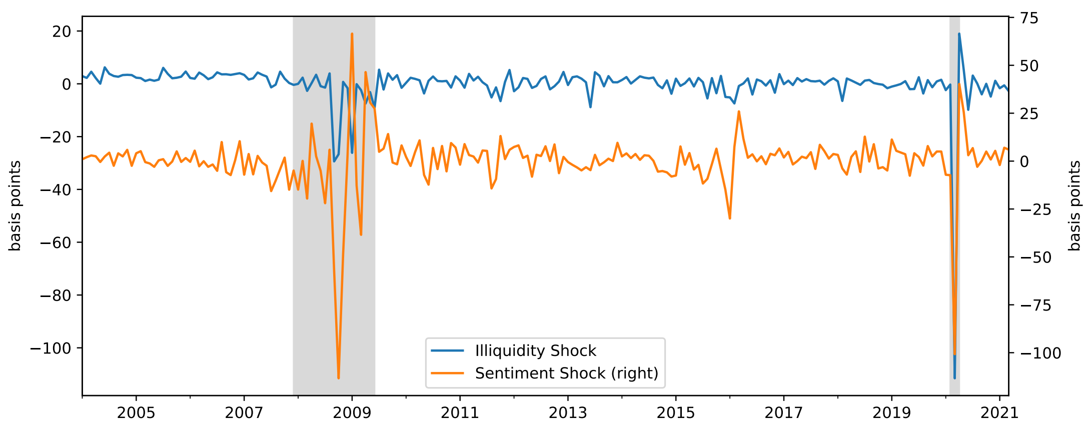
(a) Illiquidity Measure (*Gibbs*)



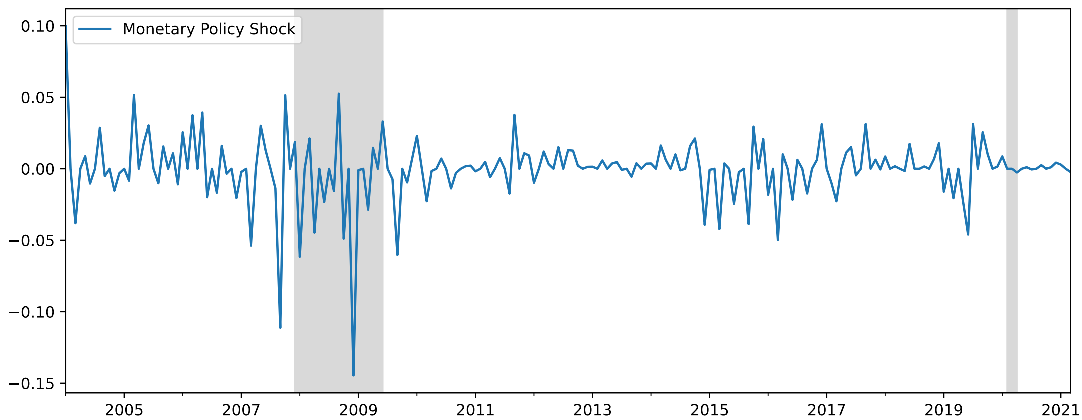
(b) Sentiment Measure (*Senti*)



(c) Instrumental Variables for CSD



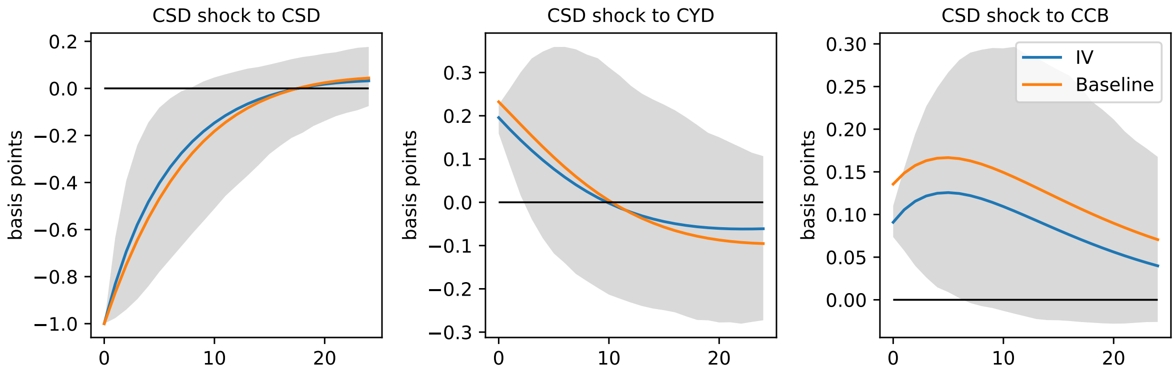
(d) Instrumental Variables for CYD: Monetary Policy Shock



This figure presents the time series of instrumental variables for CSD and CYD. Panel A presents the corporate bond illiquidity aggregated at the currency level, with security-level illiquidity quantified by the Hasbrouck's (2009) Gibbs measure. Panel B presents the time variation in sentiment for each corporate bond market, where bond market sentiment is measured using the methodology of López-Salido et al. (2017). Panel C displays the time series of the instruments for illiquidity shocks and sentiment shocks. These instruments are constructed by first aggregating the currency-specific measures to a non-USD one. The innovation from the difference between the non-USD and the USD measures is then derived from a AR(1) model. Panel D presents the time series of monetary policy shock, following the method proposed by Nakamura and Steinsson (2018). The sample period ranges from January 2004 to March 2021. Shaded bars denote months designated as recessions by the National Bureau of Economic Research.

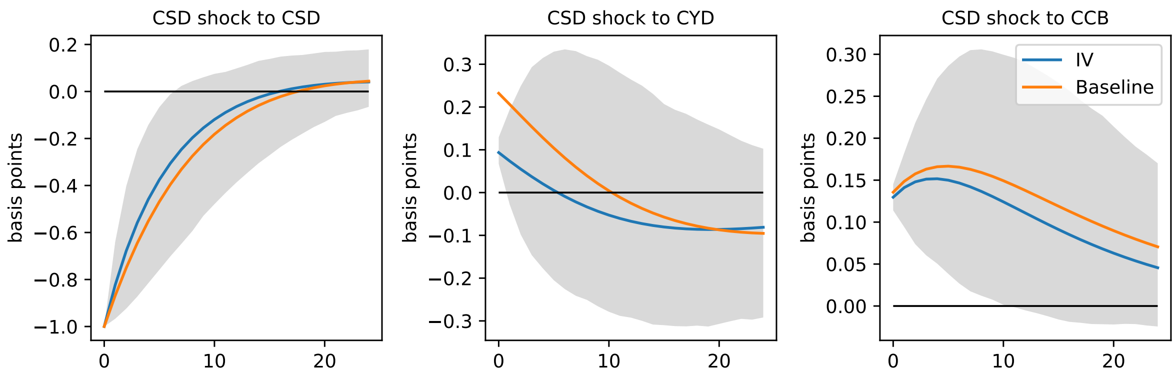
Figure 9: IRF of the SVAR Model with Instrumental Variables

(a) IRF of the CSD Shock with Illiquidity IV (Mean)



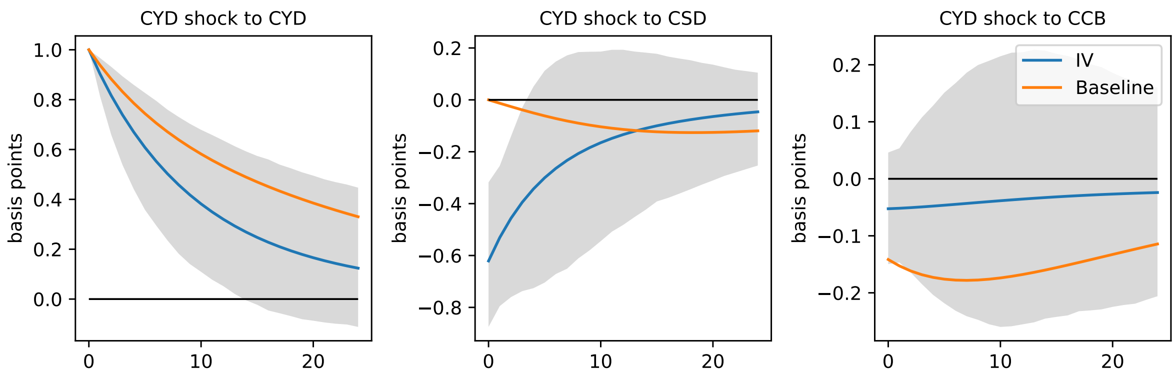
First-stage regression: Coefficient: 0.42; F-statistics: 48; R^2: 0.19.

(b) IRF of the CSD Shock with Sentiment IV (Mean)



First-stage regression: Coefficient: 0.42; F-statistics: 263; R^2: 0.56.

(c) IRF of the CYD Shock with Monetary Policy IV (Mean)

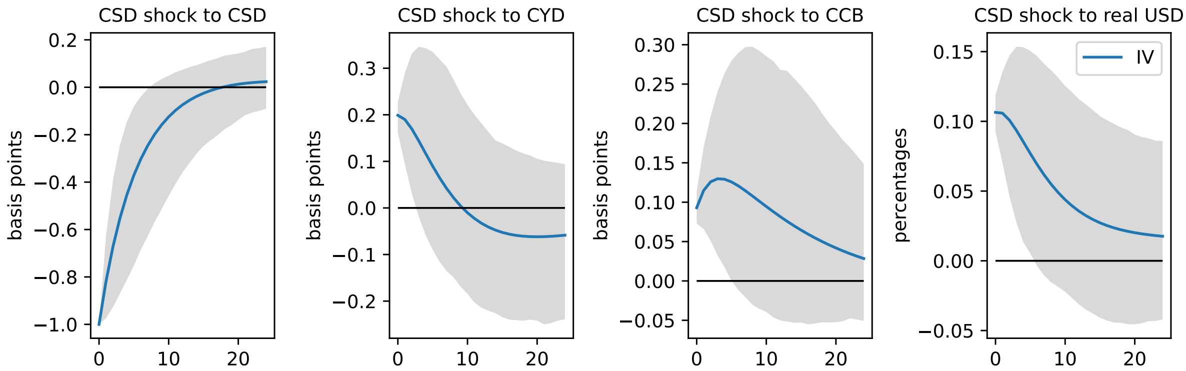


First-stage regression: Coefficient: 59.60; F-statistics: 17; R^2: 0.08.

This figure presents the impulse response function (IRF) of one negative/positive unit CSD shock (Panel A and B)/CYD shock (Panel C) to each variable in the corporate basis decomposition. Panels A, B and C are based on 1,000 wild bootstraps with the illiquidity shock IV, sentiment shock IV and monetary policy shock IV, respectively. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the cross-currency mean of CSD, CYD and CCB.

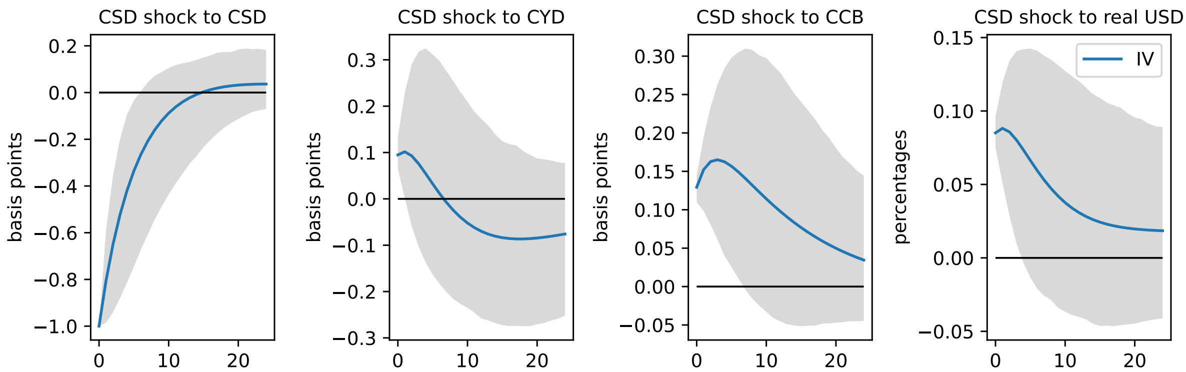
Figure 10: IRF of SVAR Model Incorporating the FX Market

(a) IRF of the CSD Shock with Illiquidity IV (Mean)



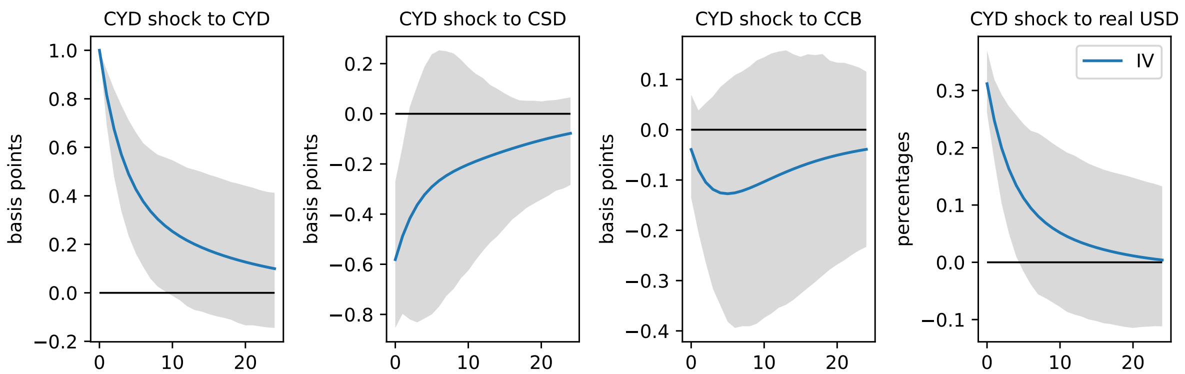
First stage regression: Coefficient: 0.42; F-statistics: 48; R^2: 0.19.

(b) IRF of the CSD Shock with Sentiment IV (Mean)



First stage regression: Coefficient: 0.42; F-statistics: 263; R^2: 0.56.

(c) IRF of the CYD Shock with Monetary Policy IV (Mean)

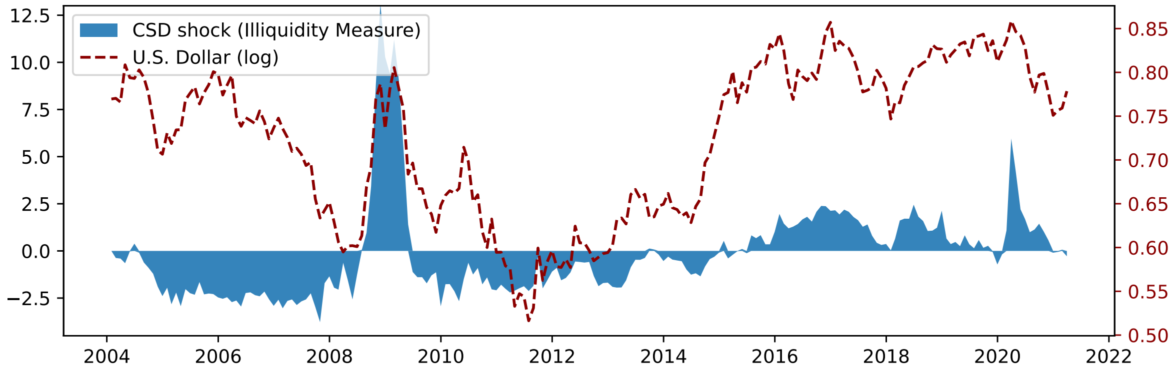


First stage regression: Coefficient: 61.56; F-statistics: 19; R^2: 0.09.

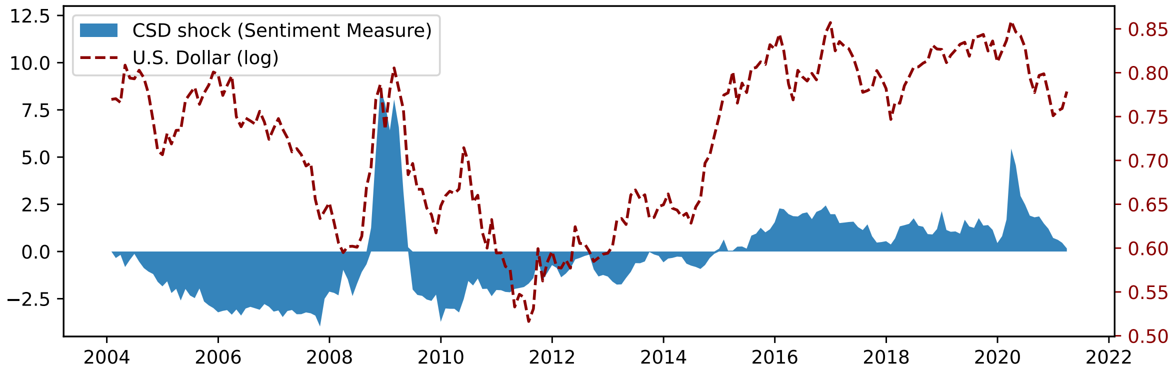
This figure presents the impulse response function (IRF) of one negative/positive unit CSD shock (Panel A and B)/CYD shock (Panel C) to the real USD exchange rate as well as the corporate basis components. Panels A, B and C are based on 1,000 wild bootstraps with the illiquidity shock IV, sentiment shock IV and monetary policy shock IV, respectively. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the cross-currency mean of CSD, CYD, CCB, and the log of the real spot dollar value against a basket of currencies.

Figure 11: Historical Decomposition of the U.S. Dollar

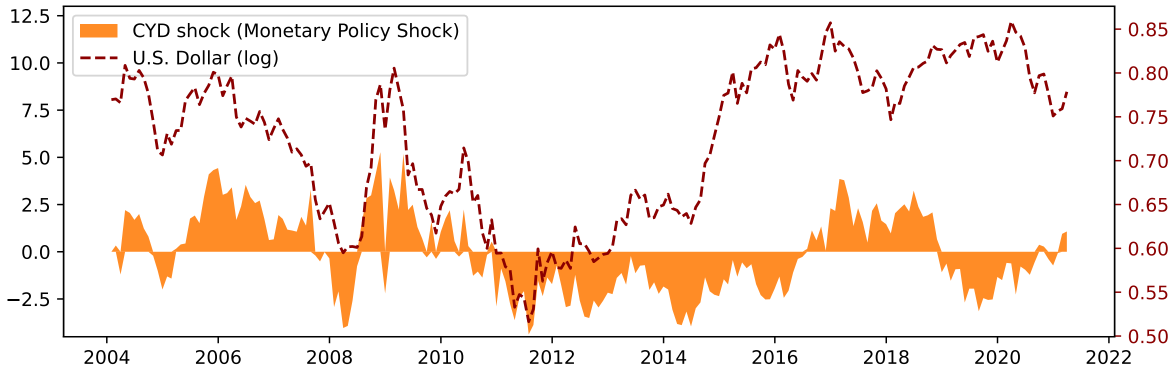
(a) Historical Decomposition of the CSD Shock with Illiquidity IV (Mean)



(b) Historical Decomposition of the CSD Shock with Sentiment IV (Mean)



(c) Historical Decomposition of the CYD Shock with Monetary Policy IV (Mean)



This figure presents the historical decomposition of CSD shock (Panel A and B)/CYD shock (Panel C) to the U.S. dollar. The dashed red line in each panel represents the log of the U.S. dollar. The monthly sample is from January 2004 to March 2021 with the cross-currency mean of CSD, CYD, CCB, and the log of the real spot dollar value against a basket of currencies.

Table 1: Corporate Bond Information - Currency Level

	Issues	Notional	Firms		Issues	Notional	Firms
All				**USD**			
Total	6,969.6	5,281.7	929.1	Total	2,798.0	2,508.0	587.1
Rating				**Rating**			
AAA&AA	2,066.9	1,792.2	166.1	AAA&AA	641.0	748.8	102.8
A	2,780.5	1,933.6	347.4	A	1,032.5	884.6	199.0
BBB	1,694.4	1,248.0	357.5	BBB	852.3	677.5	220.7
HY (BB and below)	427.9	307.9	159.3	HY (BB and below)	272.2	197.1	115.3
Maturity				**Maturity**			
1-3 yrs	1,742.5	1,414.8	522.8	1-3 yrs	725.3	687.1	306.3
3-7 yrs	2,744.1	2,196.3	703.8	3-7 yrs	1061.7	972.6	420.4
7-10 yrs	1,194.9	893.1	468.7	7-10 yrs	499.3	444.8	278.0
10+ yrs	1,288.1	777.5	340.0	10+ yrs	511.7	403.5	184.3
% by Foreign Firms				**% by Foreign Firms**	43.5%	47.0%	55.4%
AUD				**CAD**			
Total	230.6	69.9	72.7	Total	259.9	108.7	75.6
Rating				**Rating**			
AAA&AA	147.3	50.2	30.7	AAA&AA	66.4	32.5	22.7
A	58.7	14.0	28.7	A	93.6	40.3	27.6
BBB	23.5	5.4	14.5	BBB	95.4	34.6	25.1
HY (BB and below)	1.2	0.2	0.9	HY (BB and below)	4.5	1.3	2.9
Maturity				**Maturity**			
1-3 yrs	81.5	23.2	41.9	1-3 yrs	70.2	32.5	39.6
3-7 yrs	102.6	33.3	49.1	3-7 yrs	96.4	48.5	49.4
7-10 yrs	36.7	10.6	20.6	7-10 yrs	31.6	12.0	21.8
10+ yrs	9.9	2.8	5.6	10+ yrs	61.7	15.6	22.4
% by Foreign Firms	69.2%	56.7%	72.2%	**% by Foreign Firms**	35.3%	28.9%	48.2%
CHF				**EUR**			
Total	287.8	68.3	105.6	Total	1,679.7	1,900.0	386.2
Rating				**Rating**			
AAA&AA	150.3	34.0	42.5	AAA&AA	491.1	718.1	83.7
A	95.7	23.3	41.5	A	650.3	682.8	151.5
BBB	37.4	9.7	23.7	BBB	435.1	411.6	125.0
HY (BB and below)	4.4	1.3	3.2	HY (BB and below)	103.3	87.5	54.6
Maturity				**Maturity**			
1-3 yrs	83.5	21.1	58.3	1-3 yrs	428.1	517.5	206.5
3-7 yrs	136.5	32.9	72.4	3-7 yrs	778.1	904.8	292.0
7-10 yrs	41.0	9.4	29.0	7-10 yrs	287.4	318.7	149.9
10+ yrs	26.8	4.8	16.3	10+ yrs	186.2	158.9	89.9
% by Foreign Firms	86.7%	79.2%	86.4%	**% by Foreign Firms**	34.0%	31.5%	51.2%

Continued on next page

Table 1. (Continued)

	Issues	Notional	Firms		Issues	Notional	Firms
GBP				**JPY**			
Total	456.5	289.5	195.1	Total	1,257.1	337.6	113.5
Rating				**Rating**			
AAA&AA	157.1	88.1	55.1	AAA&AA	413.7	120.6	33.9
A	158.5	112.2	73.4	A	691.1	176.4	57.3
BBB	124.7	80.3	67.5	BBB	126.0	28.9	23.1
HY (BB and below)	16.1	8.9	11.1	HY (BB and below)	26.2	11.6	4.8
Maturity				**Maturity**			
1-3 yrs	86.3	49.1	61.4	1-3 yrs	267.6	84.2	74.1
3-7 yrs	131.6	77.3	91.0	3-7 yrs	437.2	126.9	86.2
7-10 yrs	60.1	39.7	52.1	7-10 yrs	238.9	57.9	55.9
10+ yrs	178.5	123.3	94.1	10+ yrs	313.4	68.6	30.7
% by Foreign Firms	65.0%	65.0%	65.0%	**% by Foreign Firms**	9.1%	10.9%	39.1%

This table summarizes the corporate bond sample at the currency level. It reports the monthly average number of bonds, total notional principal (in billions of dollars), and the number of unique issuers. The sample is segmented by currency of issuance, credit rating, and years to maturity. Additionally, the table provides the share of bonds issued by foreign firms for each category. The sample period spans January 2004 to March 2021.

Table 2: Summary Statistics of CCB, CYD, and CSD

		Full Sample Jan 04 to Mar 21	Pre-GFC Jan 04 to Nov 07	GFC Dec 07 to May 09	Post-GFC Jun 09 to Mar 21
		CCB			
AUD	Mean	-18.91***	-8.72***	-4.71**	-24.09***
	SEs	(0.66)	(0.29)	(1.91)	(0.51)
CAD	Mean	-2.29***	-8.22***	-14.04***	1.15
	SEs	(0.73)	(0.71)	(2.45)	(0.83)
GBP	Mean	5.89***	-0.75***	26.40***	5.49***
	SEs	(0.79)	(0.18)	(4.65)	(0.72)
EUR	Mean	19.82***	-1.49***	24.30***	26.31***
	SEs	(1.14)	(0.17)	(4.34)	(1.05)
CHF	Mean	24.51***	1.95***	15.50***	33.12***
	SEs	(1.26)	(0.09)	(3.26)	(1.20)
JPY	Mean	40.60***	0.22	16.51***	57.02***
	SEs	(2.02)	(0.38)	(5.34)	(1.42)
Average	Mean	11.60***	-2.84***	10.66***	16.50***
	SEs	(0.74)	(0.12)	(2.71)	(0.64)
		CYD			
AUD	Mean	-11.11***	0.66	-8.70	-15.31***
	SEs	(1.19)	(1.10)	(5.39)	(1.41)
CAD	Mean	-1.69	23.48***	56.78***	-17.43***
	SEs	(2.21)	(0.81)	(7.61)	(1.77)
GBP	Mean	-0.74	7.58***	8.65**	-4.69***
	SEs	(1.03)	(0.61)	(4.20)	(1.27)
EUR	Mean	-5.55***	30.67***	25.60***	-21.49***
	SEs	(1.87)	(0.61)	(2.84)	(1.22)
CHF	Mean	6.56***	21.83***	43.47***	-3.17***
	SEs	(1.35)	(1.28)	(3.65)	(1.02)
JPY	Mean	15.81***	35.08***	61.13***	3.69***
	SEs	(1.63)	(1.14)	(2.65)	(1.28)
Average	Mean	0.55	19.88***	31.16***	-9.73***
	SEs	(1.25)	(0.55)	(2.83)	(0.83)
		CSD			
AUD	Mean	16.56***	9.46***	-14.11	22.79***
	SEs	(1.51)	(1.27)	(11.53)	(1.19)
CAD	Mean	-4.54***	-13.58***	-51.67***	4.43***
	SEs	(1.48)	(0.69)	(8.90)	(0.81)
GBP	Mean	-9.35***	-6.30***	-37.93***	-6.73***
	SEs	(1.26)	(0.67)	(8.13)	(1.23)
EUR	Mean	-22.92***	-31.42***	-65.21***	-14.75***
	SEs	(1.40)	(0.61)	(6.06)	(1.15)
CHF	Mean	-35.94***	-28.58***	-77.85***	-33.06***
	SEs	(1.42)	(1.34)	(9.60)	(0.95)
JPY	Mean	-51.36***	-38.75***	-96.80***	-49.78***
	SEs	(2.05)	(1.11)	(13.02)	(2.00)
Average	Mean	-17.92***	-18.19***	-57.26***	-12.85***
	SEs	(1.27)	(0.66)	(9.00)	(0.74)

This table reports summary statistics for CSD (CSD^{Reg}), CYD (5-year maturity), and CCB (5-year maturity). The statistics include the mean value (in basis points) and heteroscedasticity-robust standard errors (SEs). The sample spans January 2004 to March 2021, with sub-periods defined as Pre-GFC (Jan 2004–Nov 2007), GFC (Dec 2007–May 2009), and Post-GFC (June 2009–March 2021). Statistical significance is denoted as *** (1% level), ** (5% level), and * (10% level).

Table 3: Variance Decomposition of Corporate Basis Movement

	$\frac{var(CSD)}{var(\Psi)}$	$\frac{var(CYD)}{var(\Psi)}$	$\frac{var(CCB)}{var(\Psi)}$	$\frac{2cov(CSD,CYD)}{var(\Psi)}$	$\frac{2cov(CSD,CCB)}{var(\Psi)}$	$\frac{2cov(CCB,CYD)}{var(\Psi)}$
AUD	1.27	0.50	0.09	-0.58	0.01	-0.04
CAD	1.71	0.67	0.34	-0.93	-0.53	-0.15
GBP	0.72	0.63	0.21	-0.50	-0.21	0.00
EUR	1.05	0.59	0.42	-0.58	-0.37	-0.05
CHF	1.43	0.94	0.24	-1.36	-0.32	0.18
JPY	1.09	0.14	0.14	-0.20	-0.24	0.06
Average	1.36	0.37	0.15	-0.65	-0.34	0.01

This table presents the variance decomposition results of the corporate basis across currencies. The variance of the corporate basis is decomposed into the variances of CSD, CYD, and CCB, along with their pairwise covariances. The sample consists of monthly observations from January 2004 to March 2021.

Table 4: Effects on the FX Market: Evidence of OLS Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\Psi$	-6.71***					
	(2.47)					
ΔU.S. Treasury Premium		15.84***	9.60***			
		(2.29)	(2.95)			
ΔCSD			-6.66***		-6.46***	-5.26***
			(1.80)		(1.83)	(1.89)
ΔCYD				13.15***	7.53*	7.31**
				(3.65)	(3.87)	(3.70)
ΔCCB				22.14***	15.09***	14.41***
				(3.96)	(5.53)	(5.27)
Δlog(VIX)						0.01**
						(0.01)
constant	6.20	7.45	7.29	6.67	6.63	6.49
	(13.61)	(12.63)	(11.86)	(12.48)	(11.80)	(11.92)
$R\hat{2}$	0.06	0.18	0.24	0.19	0.24	0.26
N	206	206	206	206	206	206

This table reports regression results on the determinants of monthly changes in the logarithm of the real spot USD exchange rate against a currency basket. Independent variables include the corporate basis (Ψ), U.S. Treasury premium, CSD, CYD, and CCB in Mean, along with the logarithm of VIX. Innovations are measured as simple changes, with all variables expressed in basis points. Newey–West standard errors, calculated with a 5-month lag, are shown in parentheses. The sample spans January 2004 to March 2021. Statistical significance is denoted by *** (1% level), ** (5% level), and * (10% level).

Internet Appendix to

"Corporate Basis and Demand for U.S. Dollar Assets"

(Not for publication)

We provide a roadmap of each section of our Appendix.

1. Appendix A details the SVAR-IV estimation approach used to identify the substitution effect between safe and risky dollar assets.
2. Appendix B presents robustness tests, including supply effects, time-varying substitutability, and alternative measures of risk-free rates.
3. Appendix C conducts a historical decomposition of CSD and CYD shocks, comparing their contribution to exchange rate variation with that of CSD^{Libor}.
4. Appendix D analyzes the broader economic and financial implications of CSD shocks, covering real economic activity, equity and commodity markets, and U.S. macroeconomic variables such as industrial production, unemployment, and real investment.

A SVAR-IV Estimation

We follow the SVAR-IV method in Gertler and Karadi (2015). In our setting, the reduced-form VAR representation is given by:

$$\begin{bmatrix} CSD_t \\ CYD_t \\ CCB_t \end{bmatrix} = \begin{bmatrix} c_{10} \\ c_{20} \\ c_{30} \end{bmatrix} + \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix} \begin{bmatrix} CSD_{t-1} \\ CYD_{t-1} \\ CCB_{t-1} \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix} \begin{bmatrix} \epsilon_t^{\text{CSD}} \\ \epsilon_t^{\text{CYD}} \\ \epsilon_t^{\text{CCB}} \end{bmatrix}. \tag{17}$$

A.1 IV-CSD

First stage regression. Let u^{CSD}, u^{CYD} and u^{CCB} be the reduced form residual for the CSD, CYD and CCB, respectively. The first stage extracts the variation in the u^{CSD} that is due to the IV. We estimate β as $cov(b_{11}\epsilon_t^{\text{CSD shock}}, Z_t^{CSD})/var(Z_t^{CSD})$ based on the assumption of external instrumentals as specified by Eq. (12):

$$u_t^{CSD} = \beta Z_t^{CSD} + w_t. \tag{18}$$

Second stage regression. To identify the effect of the instrument on CYD and CCB, we need to estimate the ratio b_{21}/b_{11} and b_{31}/b_{11} from the two stage least squares regression of u_t^{CYD} and u_t^{CCB} on $\widehat{u_t^{CSD}}$, where $\widehat{u_t^{CSD}}$ is fitted value from the first stage regression. We estimate $\gamma_1 = b_{21}/b_{11}$ and $\gamma_2 = b_{31}/b_{11}$ under the identifying assumption that shocks to CYD and CCB are transmitted through the instrument's effect on CSD:[19]

$$\begin{aligned} u_t^{CYD} &= \gamma_1 \widehat{u_t^{CSD}} + w_t \\ u_t^{CCB} &= \gamma_2 \widehat{u_t^{CSD}} + w_t \end{aligned} \tag{19}$$

Lastly, we normalize b_{11} to 1. Parameters b_{21} and b_{31} are therefore equal to γ_1 and γ_2, respectively.

19. Proofs:
$\gamma_1 = cov(u_t^{CYD}\widehat{u_t^{CSD}})/var(\widehat{u_t^{CSD}})$
$cov(u_t^{CYD}, \widehat{u_t^{CSD}}) = cov(b_{21}\epsilon_t^{\text{CSD}}, \beta Z_t^{CSD}) = b_{21}\beta cov(\epsilon_t^{\text{CSD}}, Z_t^{CSD})$
$var(\widehat{u_t^{CSD}}) = \beta^2 var(Z_t^{CSD})$

$$\gamma_1 = \frac{b_{21}\beta cov(\epsilon_t^{\text{CSD}}, Z_t^{CSD})}{\beta^2 var(Z_t^{CSD})} = \frac{b_{21} cov(\epsilon_t^{\text{CSD}}, Z_t^{CSD})}{\beta var(Z_t^{CSD})}$$

Replacing $\beta = cov(b_{11}\epsilon_t^{\text{CSD}}, Z_t^{CSD})/var(Z_t^{CSD})$ We can get $\gamma_1 = b_{21}/b_{11}$. Under the same procedure, we also can get $\gamma_2 = b_{31}/b_{11}$.

A.2 IV-CYD

Our application of the monetary policy shock as an IV for CYD follows a similar two-stage procedure.

First stage regression. The first stage captures the variation in u^{CYD} that can be attributed to the IV. We estimate β as $cov(b_{22}\epsilon_t^{\text{CYD}}, Z_t^{CYD})/var(Z_t^{CYD})$.

$$u_t^{CYD} = \beta Z_t^{CYD} + w_t.$$

Second stage regression. To identify the effect of the instrument on CSD and CCB, we need to estimate the ratio b_{12}/b_{22} and b_{32}/b_{22} from the two stage least squares regression of u_t^{CSD} and u_t^{CCB} on $\widehat{u_t^{CYD}}$, where $\widehat{u_t^{CYD}}$ is fitted value from the first stage regression. We estimate $\gamma_1 = b_{12}/b_{22}$ and $\gamma_2 = b_{32}/b_{22}$ under the identifying assumption that shocks to CSD and CCB are transmitted through the instrument's effect on CYD.

$$u_t^{CSD} = \gamma_1 \widehat{u_t^{CYD}} + w_t$$
$$u_t^{CCB} = \gamma_2 \widehat{u_t^{CYD}} + w_t$$

Lastly, we normalize b_{22} to 1. Parameters b_{12} and b_{32} are therefore equal to γ_1 and γ_2, respectively.

B Robustness Tests

B.1 Supply Effects

Our measures of CSD focus on the pricing effects of currency on corporate bonds, emphasizing the demand side. By employing instrumental variables (IVs) that capture demand-side variation, we establish a robust demand channel. However, a potential concern is whether our baseline results are influenced by changes in the supply of corporate bonds.

To address this, we examine the impact of supply on CSD by constructing a time series of corporate bond notional amounts outstanding for each currency using issuance-level data from the SDC New Issues database. We compute the log changes in outstanding amounts for each currency, then take the difference between non-USD and USD log changes and average these differences to measure the relative change in overall supply between non-USD and USD corporate bonds.

We first compute the correlation between the relative changes in notional amounts and changes in CSD. The correlation coefficient is only -0.03 and statistically insignificant, suggesting that supply changes do not systematically affect CSD. Next, we incorporate the difference in log notional amounts between non-USD and USD bonds into our baseline SVAR models. Figure A1 presents these results, confirming that the substitution effect persists even when controlling for bond supply. Furthermore, Figure A1c shows that a positive shock in demand for safe dollar assets induces a negative demand shock for risky dollar assets, leading to an increased relative supply of non-USD corporate bonds compared to USD corporate bonds.

B.2 Time-Varying Substitutability Between CSD and CYD

A potential concern is that shocks to CSD and CYD might reflect changes in the substitutability between safe and risky dollar assets rather than shifts in investor demand.

To control for cross-sectional variation, we estimate CSD separately for AAA- and BBB-rated corporate bonds, denoted as CSD (AAA) and CSD (BBB), respectively. Since AAA-rated corporate bonds are more liquid and have lower credit risk, they should serve as closer substitutes for government bonds than BBB-rated corporate bonds. Figure A2a plots the impulse response functions (IRFs) of CYD on CSD (AAA) and CSD (BBB). To ensure comparability, we standardize CYD, CSD (AAA), CSD (BBB), and CCB by their respective standard deviations. As expected, the substitution effect is stronger for AAA-rated bonds: a one standard deviation increase in CYD leads to a 0.84 standard deviation decrease in CSD (AAA), compared to only a 0.65 standard deviation decrease in CSD (BBB).

Next, we examine time variation in substitutability by incorporating the *Xleast* measure from Nenova (2024) into our Structural Vector Autoregression (SVAR) model. This measure, based on global fund holdings, captures the elasticity of substitution between safe and risky bonds. [20]

To ensure consistency, we aggregate CSD, CYD, and CCB to quarterly frequency to match the sample period of *Xleast*. Figures A2b and A2c report the IRF of a CSD shock on CYD, with and without *Xleast*. While controlling for time-varying substitutability slightly attenuates the substitution effect, it remains robust.

B.3 Alternative Measures of Risk-Free Rates

Our baseline analysis uses LIBOR as the benchmark risk-free rate, though LIBOR embeds some credit risk related to bank solvency. To test the robustness of our findings, we replace LIBOR with alternative nearly risk-free rates: the Secured Overnight Financing Rate (SOFR) for the U.S., the Canadian Overnight Repo Rate Average (CORRA) for Canada, the Euro Short-Term Rate (ESTR) for the Euro Area, the Sterling Overnight

20. We thank Tsvetelina Nenova for providing the *Xleast* data, which spans quarterly from 2000 to 2020.

Index Average (SONIA) for the UK, and the Tokyo Overnight Average Rate (TONA) for Japan. These rates are widely used in money markets and derivatives markets to replace LIBOR.

Due to data limitations, this robustness test covers only CAD, EUR, GBP, and JPY. Additionally, for consistency, we estimate corporate basis components only at the one-year maturity.

Figure A3a presents summary statistics for CSD, CYD, and CCB based on these alternative risk-free rates. The correlation between monthly changes in CSD and CYD remains significantly negative (-0.34, statistically significant at the 1% level). The correlation in levels decreases to -0.04 and is no longer statistically significant. Figures A3b and A3c display the IRF of a CSD shock using the illiquidity and sentiment IVs, respectively. A negative shock to risky dollar asset demand leads to a shift toward safe dollar assets and a widening of CCB, consistent with our baseline findings.

B.4 Alternative Regression-Based Estimates of CSD

To further validate our CSD estimates, we test several alternative regression specifications.

First, we augment Eq. (8) with additional controls to mitigate omitted variable bias. Specifically, we introduce interaction terms between maturity and credit rating buckets, denoted as "CSD with M*R."

Second, we restrict the sample to non-U.S. firms to examine whether our results are driven by bonds issued in the U.S. We denote this specification as "CSD with non-U.S."

Third, we construct a bottom-up measure of CSD by estimating firm-level CSDs and aggregating them at the currency level. We label this "Bottom-up CSD."

Fourth, we replace government bond yields with AAA corporate bond yields for each currency to compute credit spreads, following Chen et al. (2009). We refer to this as "CSD with AAA Yield."

Fifth, we compute CSD using LIBOR-based credit spreads, in line with Liao (2020), labeled "CSD with LIBOR-based." This controls for potential mechanical correlations between CSD and CYD due to shared government bond yields.

Sixth, we exclude local currency bonds and require issuers to have at least one USD-denominated bond. This specification, "CSD without LocalCurrency," ensures comparability across firms.

Seventh, we differentiate between offshore and onshore bond issuances. A bond is classified as "offshore issued" if it is issued in a market different from the parent firm's home country; otherwise, it is classified as "onshore issued."

Finally, we estimate CSD separately for financial and non-financial firms, labeled as "CSD with Financial" and "CSD with Non-Financial."

Figure A4a compares these alternative CSD measures to our baseline estimates. All approaches yield similar trends, confirming the robustness of our results. Figure A4b reports the IRF of a negative one-unit CSD shock to CYD across different specifications. The results consistently support the substitution effect between safe and risky dollar assets.

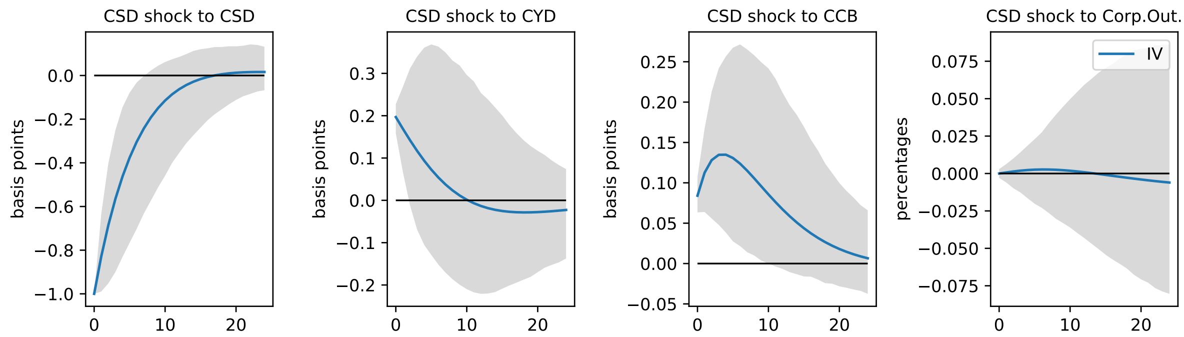
B.5 CSD Based on Matched Bonds

To further validate our estimation of CSD, we compare our regression-based CSD estimates with an alternative measure based on matched EUR- and USD-denominated bonds issued by the same firm. We calculate CSD as the credit spread difference between these bonds while ensuring similar remaining maturities and durations.

Figure A5 plots the CSD estimates derived from matched bond pairs against those obtained from Eq. (8). The two measures closely align, reinforcing the reliability of our baseline approach. These matched bond estimates serve as a model-free validation of CSD that does not rely on cross-sectional regression adjustments for maturity effects.

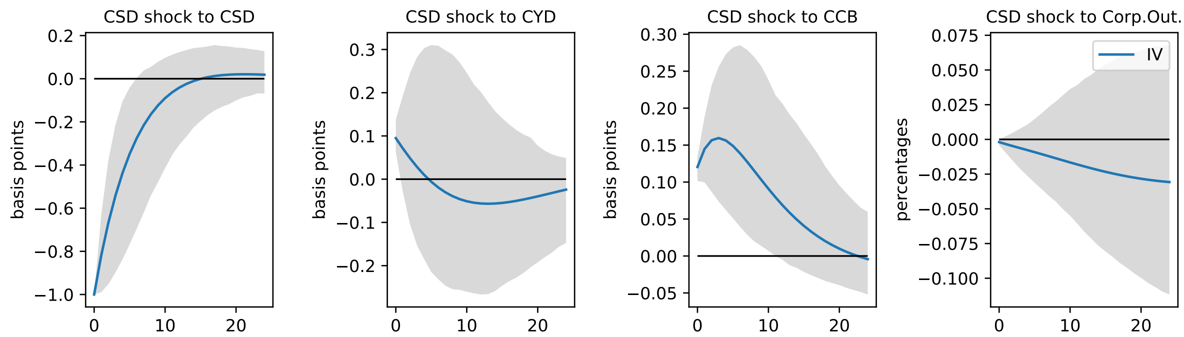
Figure A1: IRF of SVAR Model Incorporating Bond supply

(a) IRF of the CSD Shock with Illiquidity IV (Mean)



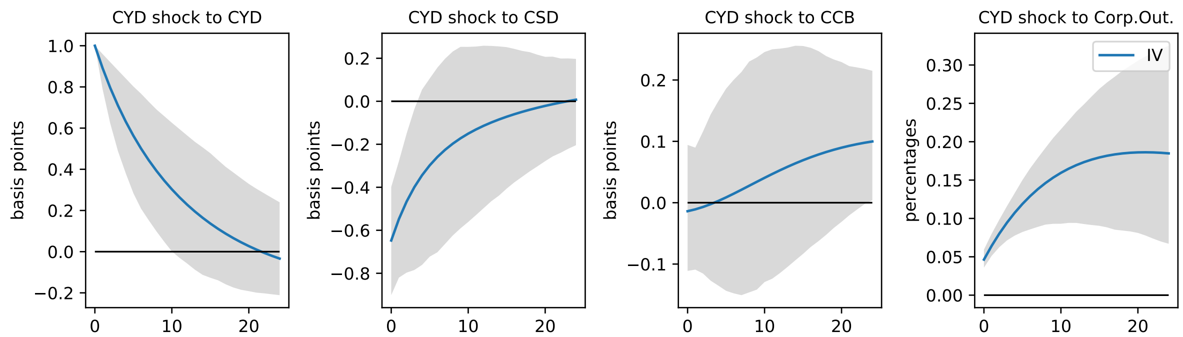
First stage regression: Coefficient: 0.42; F-statistics: 48; R^2: 0.19.

(b) IRF of the CSD Shock with Sentiment IV (Mean)



First stage regression: Coefficient: 0.42; F-statistics: 258; R^2: 0.56.

(c) IRF of the CYD Shock with Monetary Policy IV (Mean)

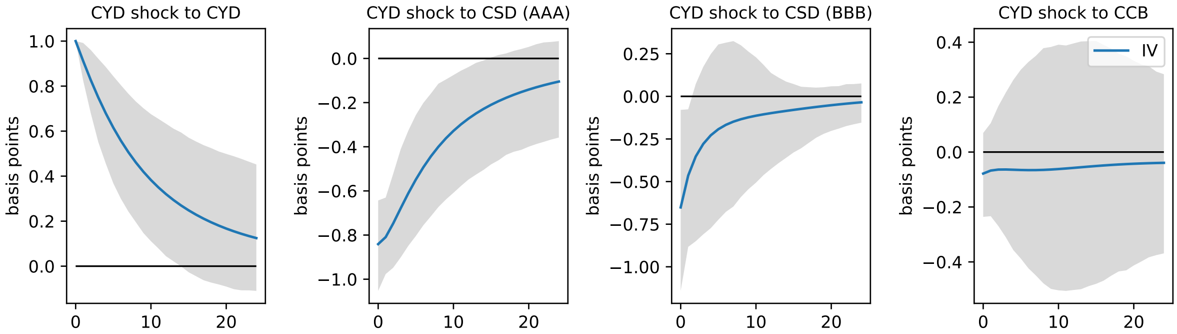


First stage regression: Coefficient: 59.47; F-statistics: 17; R^2: 0.08.

This figure presents the impulse response function (IRF) of a one-unit negative or positive CSD shock (Panels A and B) and a CYD shock (Panel C) on bond supply and corporate basis components. Panels A, B, and C are based on 1,000 wild bootstraps using the illiquidity shock IV, sentiment shock IV, and monetary policy shock IV, respectively. The solid lines represent the mean IRF, while the shaded areas indicate the 95% confidence bands. The monthly sample spans from January 2004 to March 2021 and includes the cross-currency mean of CSD, CYD, and CCB, as well as the mean difference in the logarithm of corporate bonds outstanding denominated in non-USD and USD.

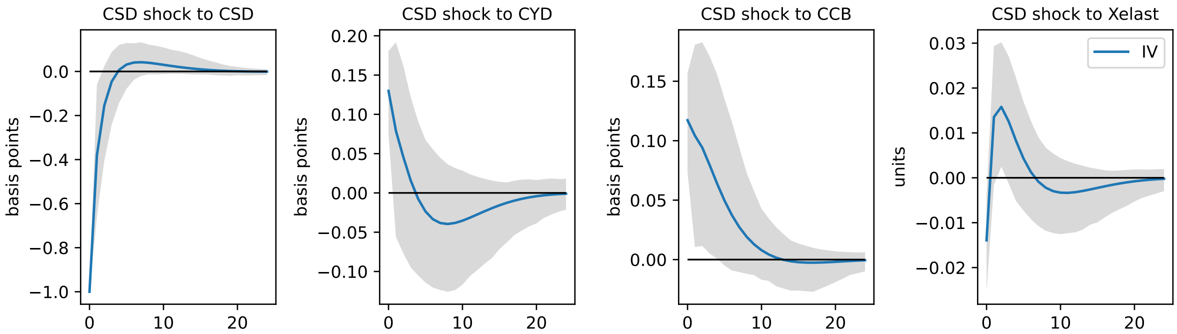
Figure A2: IRF of the SVAR Model with Instrumental Variables

(a) Cross-sectional Analysis: IRF of the CYD Shock with Monetary Policy IV (Mean)



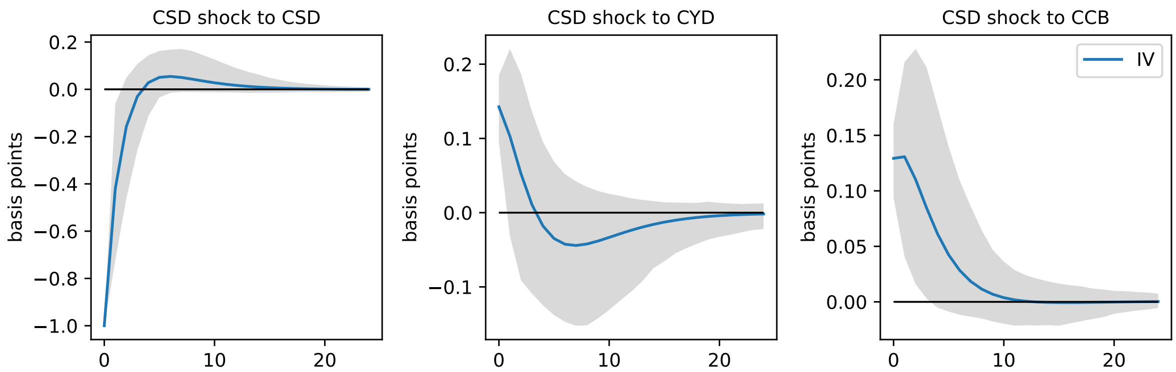
First-stage regression: Coefficient: 3.44 F-statistics: 18.89; R^2: 0.08.

(b) Time-series Analysis: IRF of the CSD Shock with Illiquidity IV (Mean)



First-stage regression: Coefficient: 0.53; F-statistics: 23.59; R^2: 0.31.

(c) Time-series Analysis: IRF of the CSD Shock with Illiquidity IV (Mean)

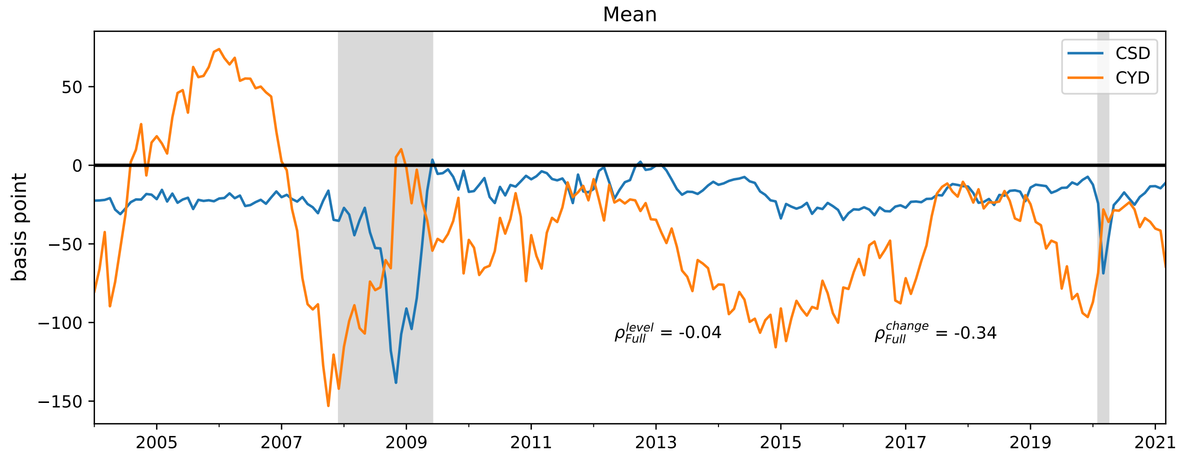


First-stage regression: Coefficient: 0.55; F-statistics: 25.52; R^2: 0.33.

Panel A presents the impulse response function (IRF) of a one-standard-deviation positive CYD shock on CSD (AAA), CSD (BBB), and CCB, all scaled by their respective standard deviations. Panel A is based on 1,000 wild bootstraps using the monetary policy shock IV, with monthly data from January 2004 to March 2021. Panels B and C present the IRF of a one-unit negative CSD shock on CYD, CCB, and Xleast (the substitution elasticity between safe and risky bonds, as constructed by Nenova (2024)). These panels are based on 1,000 wild bootstraps using the illiquidity shock IV, with a quarterly sample from 2007 to 2020. The solid lines represent the mean IRF, while the shaded areas indicate the 95% confidence bands.

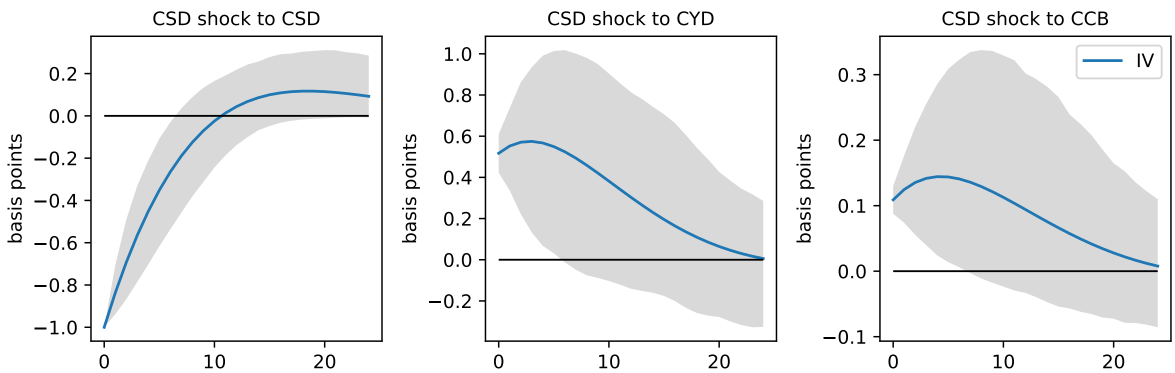
Figure A3: Robustness check using Alternative Risk-Free Rates (ARR)

(a) Substitution Effect using Alternative Risk-Free Rates (ARR)



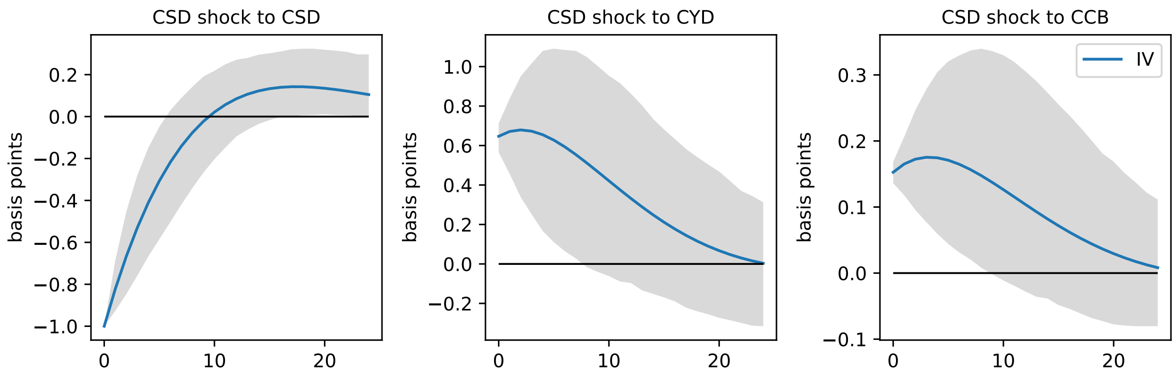
SVAR Model Analysis using Alternative Risk-Free Rates (ARR) (Mean)

(b) IRF of the CSD Shock with Illiquidity IV



First stage regression: Coefficient: 0.40; F-statistics: 52; R^2: 0.20.

(c) IRF of the CSD Shock with Sentiment IV

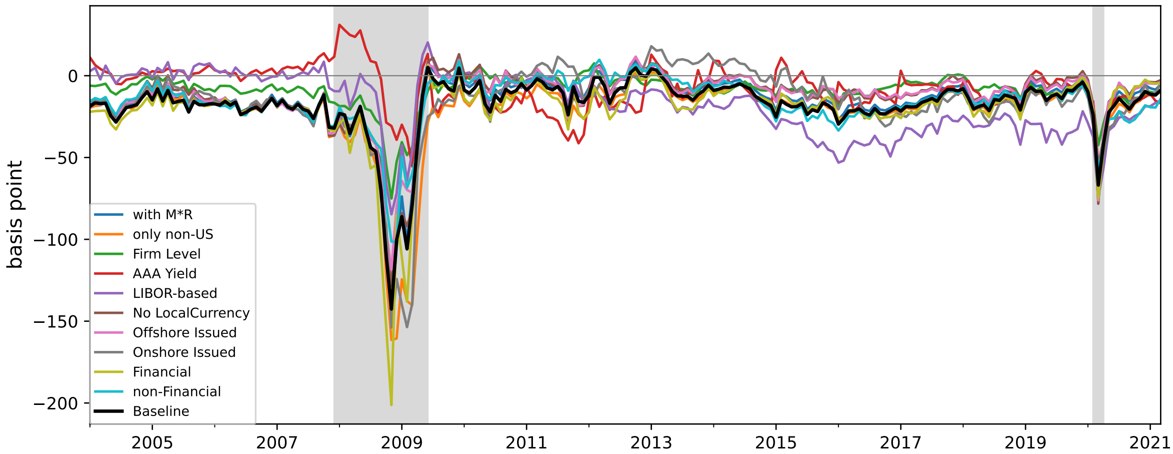


First stage regression: Coefficient: 0.39; F-statistics: 264; R^2: 0.56.

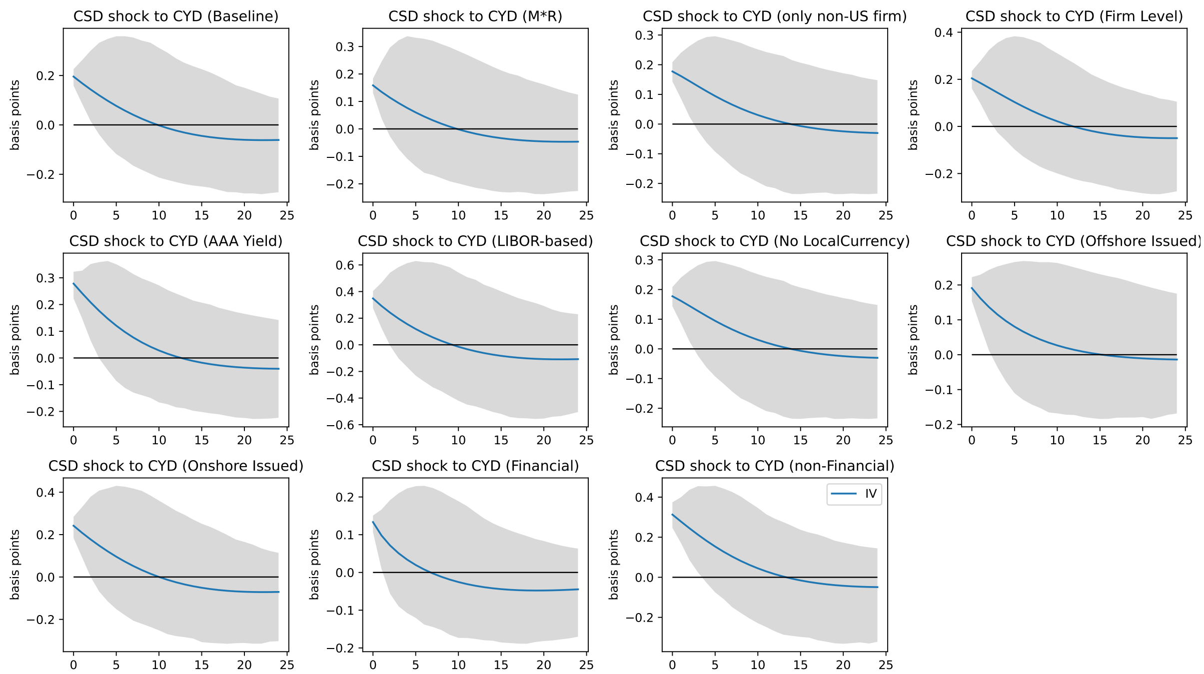
Panel A presents the substitution effect using CSD and CYD_{ARR}. Panels B and C replicate the SVAR model analysis using ARR as the risk-free benchmark. The instrumental variables used are the illiquidity shock IV and sentiment shock IV for the CSD shock, respectively. The sample period spans from January 2004 to March 2021 and includes CAD, EUR, GBP, and JPY. Shaded areas represent recession periods during the GFC and COVID-19, as defined by NBER business cycle dates.

Figure A4: Alternative Measures of CSD

(a) Alternative Measurement

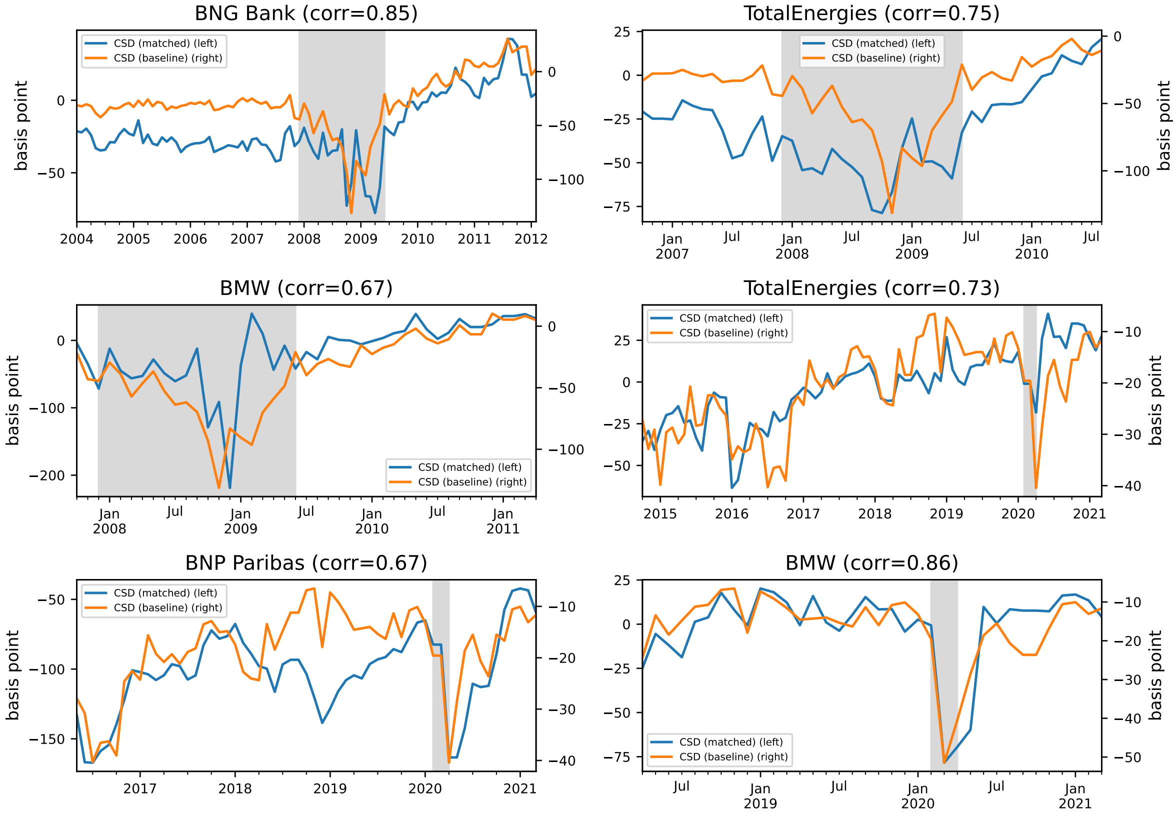


(b) SVAR Model Analysis with Illiquidity IV (Mean)



Panel A compares the baseline CSD (black measure) with eight alternative measures. The *with M*R* measure incorporates interaction terms between maturity and rating buckets in the cross-sectional regression. The *only non-US* measure estimates CSD using only the non-U.S. firms' sample. The *Firm Level* measure represents the mean value of firm-level CSD estimates. The *AAA yield* measure calculates CSD using credit spreads measured as the bond yield net of the AAA bond yield. The *LIBOR-based* measure calculates CSD using credit spreads relative to maturity-matched LIBOR rates. The *No LocalCurrency* measure excludes bonds issued in firms' local currency. The *Offshore Issued* measure includes bonds issued in a market different from the parent firm's nationality, while the *Onshore Issued* measure includes bonds issued in the same market as the parent firm's nationality. The *Financial* and *Non-Financial* measures present CSD estimates using only financial firms and non-financial firms, respectively. Panel B examines the substitution effect between CSD and CYD using both the baseline and alternative CSD measures. Each subfigure reports the impulse response functions (IRF) of a one-unit negative CSD shock to CYD, based on 1,000 wild bootstraps using the illiquidity shock IV. The monthly sample spans from January 2004 to March 2021. Shaded bars in Panel A indicate months classified as recessions by the National Bureau of Economic Research.

Figure A5: Credit Spread Differential Based on Matched Pairs of Bond



This figure presents CSD estimates at the bond pair level. The bond pair-level (matched) CSD is defined as the credit spread difference between a EUR-denominated bond and a USD-denominated bond issued by the same firm, with similar remaining maturity and duration. The title of each subfigure indicates the parent firm's name and the correlation between the matched CSD and the baseline CSD for the EUR-USD currency pair. Shaded bars denote months classified as recessions by the National Bureau of Economic Research.

C Historical Decomposition

To further analyze the role of risky and safe dollar asset demand in driving U.S. dollar fluctuations, we conduct a historical decomposition using an SVAR-IV framework. This approach allows us to assess the relative contributions of demand shocks to safe and risky dollar assets over time and evaluate how these factors shaped key market episodes.

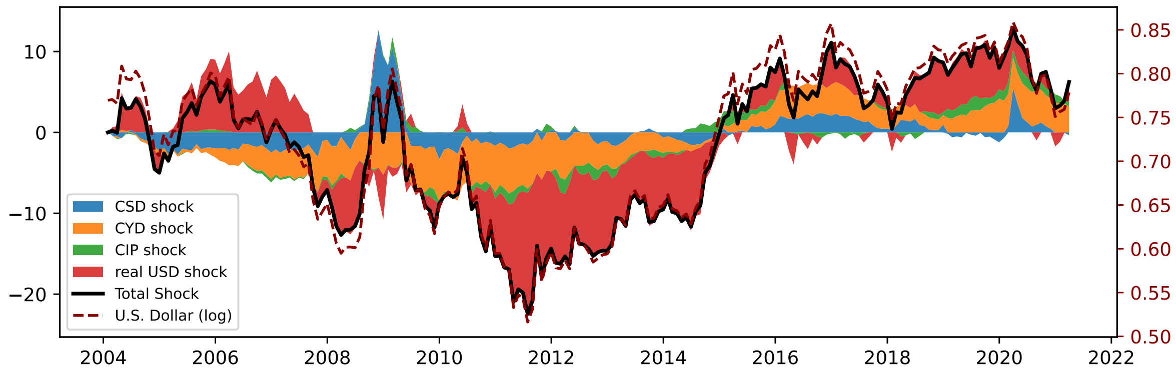
Building on Liao (2020), we extend his Libor-based CSD measure (CSD^{Libor}) by decomposing it into separate CSD and CYD components. This refinement enables a more precise identification of the distinct roles played by demand for risky and safe dollar assets. We compare the historical contributions of CSD and CYD shocks with those of CSD^{Libor} in explaining variations in the U.S. dollar exchange rate. The historical decomposition is estimated using an SVAR model under the standard zero restriction assumption, where earlier-ordered variables can contemporaneously influence later-ordered variables. Specifically, we estimate two SVAR models: one with the variable order $[CSD_t; CYD_t; CCB_t; realUSD]$ and another with $[CSD_t^{Libor}; CCB_t; realUSD]$.

Figures A6a and A6b present the historical decompositions of the two models. When using CSD^{Libor}, the estimated contribution of U.S. dollar shocks is larger on average. This is because CSD^{Libor} aggregates both risky and safe dollar asset demand, potentially masking the opposing effects of these components. While individual shocks to CSD and CYD influence the U.S. dollar, they can offset each other when combined into a single measure.

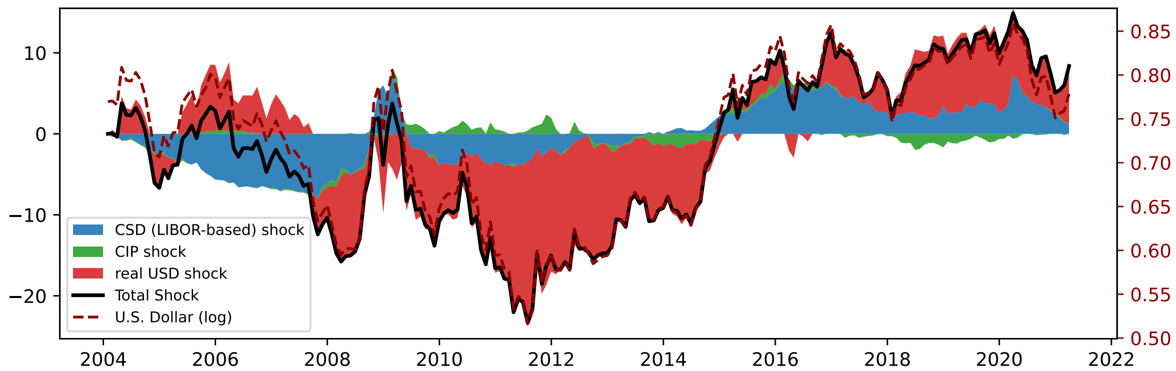
Figure A6c further highlights the importance of distinguishing between risky and safe dollar asset demand. Our decomposition reveals that the combined contribution of CSD and CYD shocks to U.S. dollar fluctuations is significantly greater than that of CSD^{Libor} shocks, particularly during key financial episodes such as the 2008–2014 post-GFC period and the 2020–2021 COVID-19 crisis. These findings highlight the need for a more granular approach to understanding exchange rate movements and suggest that models aggregating risky and safe dollar asset demand into a single measure may underestimate their true impact.

Figure A6: Historical Decomposition of the U.S. Dollar Using the Unrestricted SVAR Model

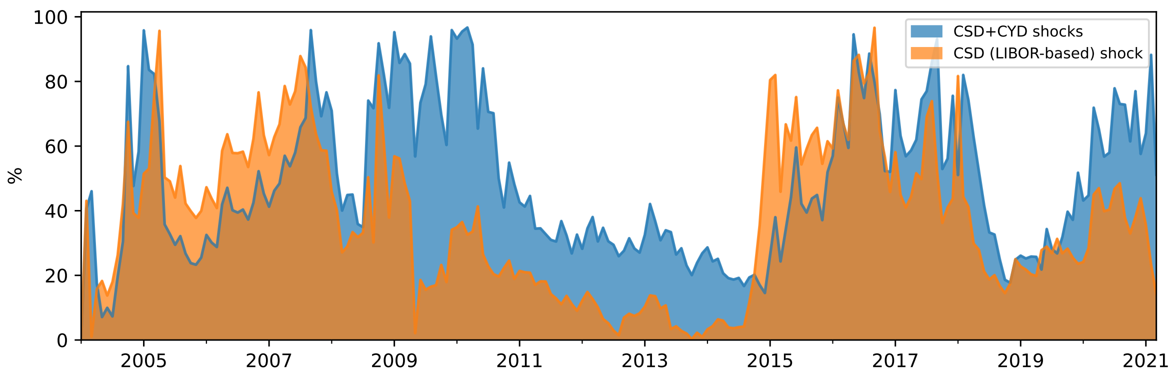
(a) Historical Decomposition of the Unrestricted SVAR Model I



(b) Historical Decomposition of the Unrestricted SVAR Model II



(c) Total Historical Contribution to the Variation of the U.S. Dollar



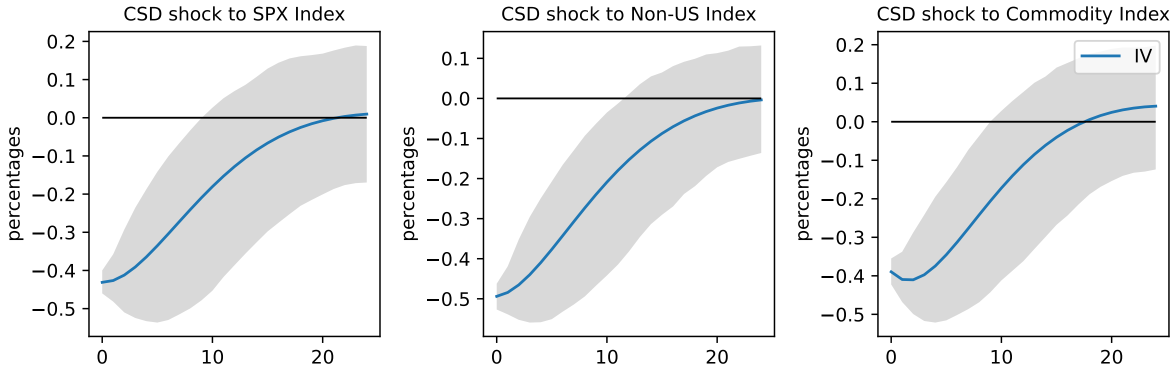
This figure presents the historical decomposition of shocks to the U.S. dollar. Panel A shows the decomposition using the variable ordering $[CSD_t; CYD_t; CCB_t; realUSD]$, while Panel B follows the ordering $[CSD_t^{Libor}; CCB_t; realUSD]$. The dashed red line in both panels represents the logarithm of the U.S. dollar. Panel C illustrates the absolute percentage contribution of the $CSD + CYD$ shock from Panel A and the CSD_t^{Libor} shock from Panel B relative to the total absolute sum of contributions from all shocks to the U.S. dollar. The monthly sample spans January 2004 to March 2021, incorporating the cross-currency mean of CSD, CYD, and CCB, along with the log of the real spot U.S. dollar exchange rate against a basket of currencies.

D Real Economic Activity and Financial Markets

D.1 Equity and Commodity Markets

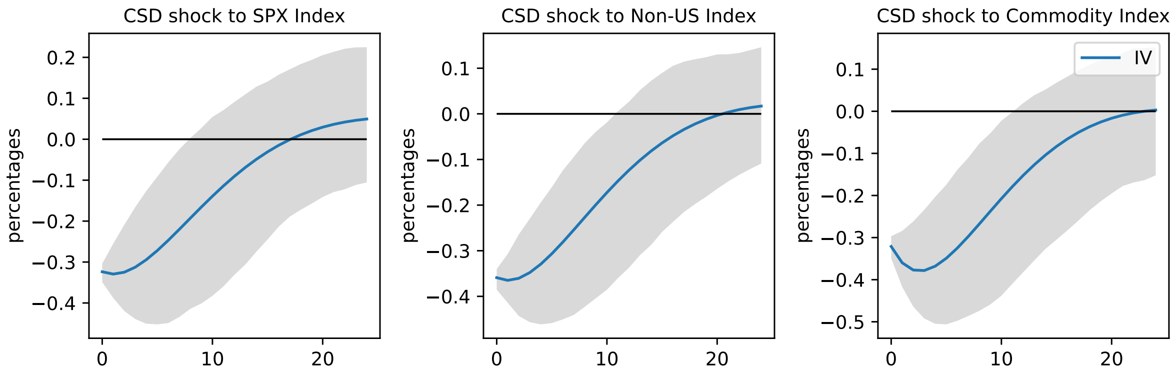
Figure A7: IRF of the CSD Shock with the Other Assets Classes (Mean)

(a) IRF of the CSD Shock with Illiquidity IV (Mean)



First stage regression: Coefficient: 0.42; F-statistics: 49; R^2: 0.19.

(b) IRF of the CSD Shock with Sentiment IV (Mean)



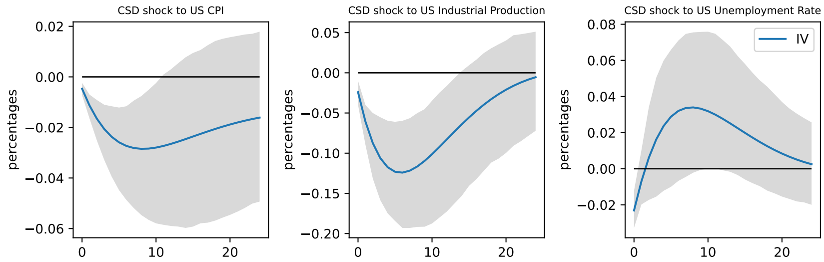
First stage regression: Coefficient: 0.39; F-statistics: 215; R^2: 0.51.

This figure presents the impulse response function (IRF) of one negative unit CSD shock (Panel A and B) to indices of the equity and commodity sectors. Panels A and B are based on 1,000 wild bootstraps with the illiquidity shock IV and sentiment shock IV, respectively. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample spans from January 2004 to March 2021 with the cross-currency mean of CSD, CYD, CCB, the logarithm of SPX (S&P 500) index, the logarithm of international market indices (Austrian Traded Index, S&P/TSX Composite Index, Swiss Market Index, EURONEXT 100, FTSE 100 and Nikkei 225) and the logarithm of the Bloomberg commodity index.

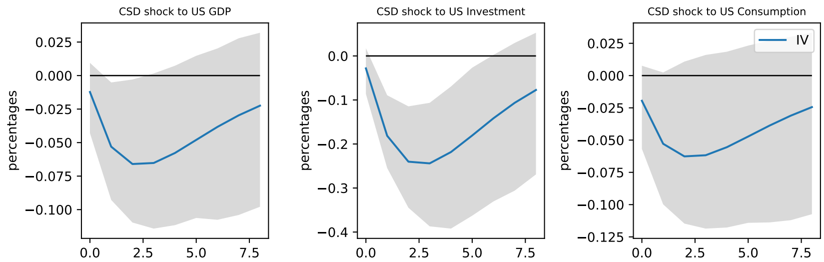
D.2 Economic Activities (U.S.)

Figure A8: IRF of the CSD Shock with the U.S. Macroeconomic Activity (Mean)

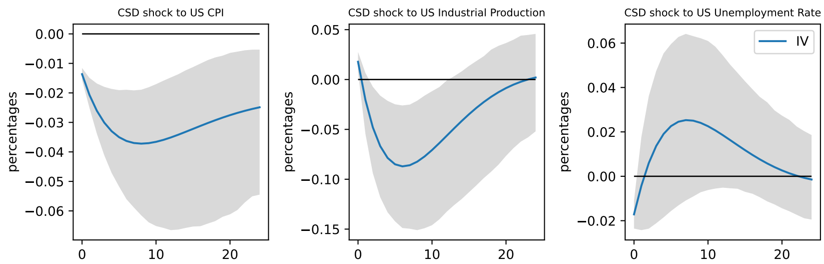
(a) IRF of the CSD Shock with Illiquidity IV: Monthly Variables



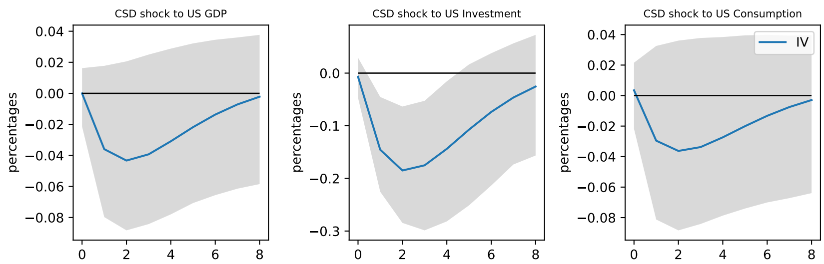
(b) IRF of the CSD Shock with Illiquidity IV: Quarterly Variables



(c) IRF of the CSD Shock with Sentiment IV: Monthly Variables



(d) IRF of the CSD Shock with Sentiment IV: Quarterly Variables



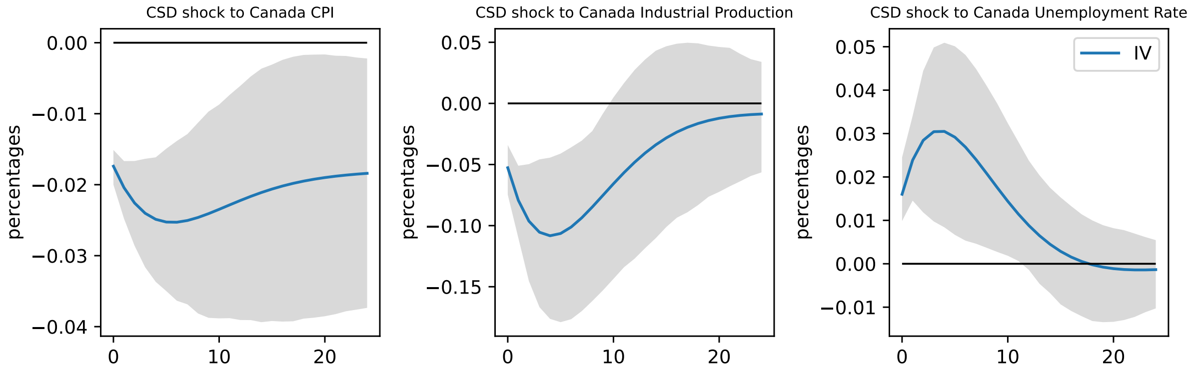
This figure presents the impulse response function (IRF) of one negative unit CSD shock (Panel A through D) to measures of real economic activities. Panels A through D are based on 1,000 wild bootstraps with the illiquidity shock IV and sentiment shock IV, respectively. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample spans from January 2004 to March 2021 with the cross-currency mean of CSD, CYD, CCB, as well as the U.S. CPI, the U.S. Industrial Production, U.S. Unemployment Rate, U.S. Real GDP, U.S. Real Investment and U.S. Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

D.3 Economic Activities (Other Countries)

D.3.1 SVAR with illiquidity IV

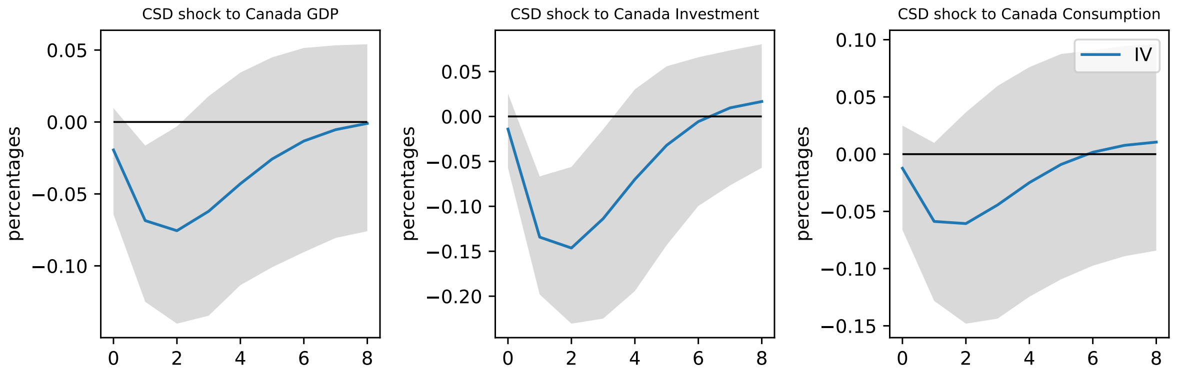
Figure A9: IRF of the CSD Shock with the Canada Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.38; F-statistics: 41; R^2: 0.17.

(b) Quarterly Variables

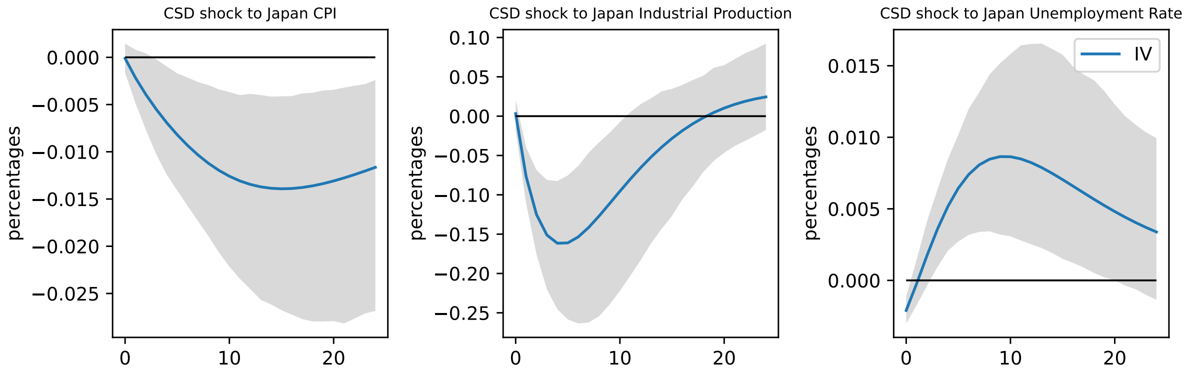


First stage regression: Coefficient: 0.51; F-statistics: 27; R^2: 0.29.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the Gibbs shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the CAD data of CSD, CYD, CCB, Canada CPI, Canada Industrial Production, Canada Unemployment Rate, Canada Real GDP, Canada Real Investment and Canada Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

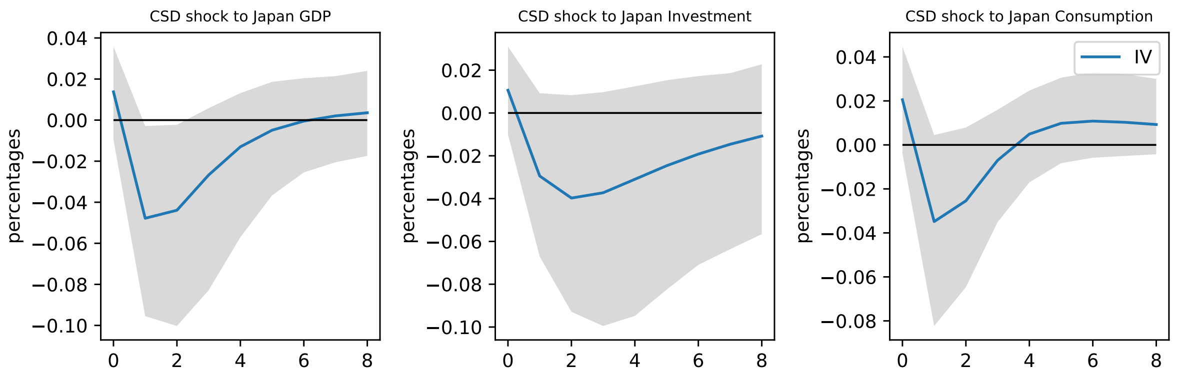
Figure A10: IRF of the CSD Shock with the Japan Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.41; F-statistics: 49; R^2: 0.19.

(b) Quarterly Variables

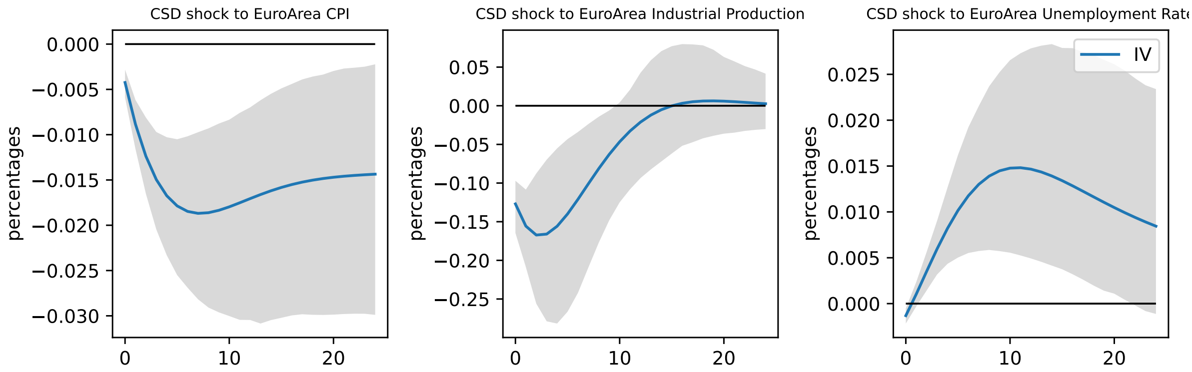


First stage regression: Coefficient: 0.50; F-statistics: 30; R^2: 0.31.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the Gibbs shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the JPY data of CSD, CYD, CCB, Japan CPI, Japan Industrial Production, Japan Unemployment Rate, Japan Real GDP, Japan Real Investment and Japan Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

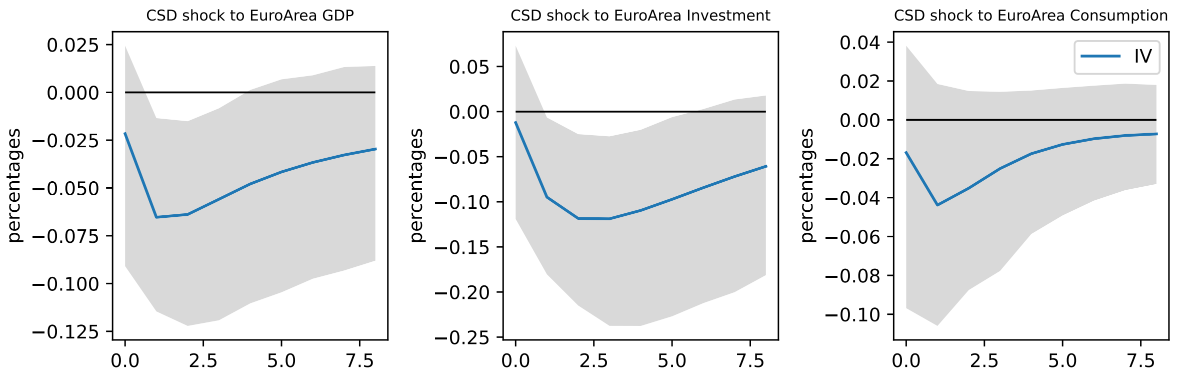
Figure A11: IRF of the CSD Shock with the Euro Area Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.40; F-statistics: 46; R^2: 0.18.

(b) Quarterly Variables

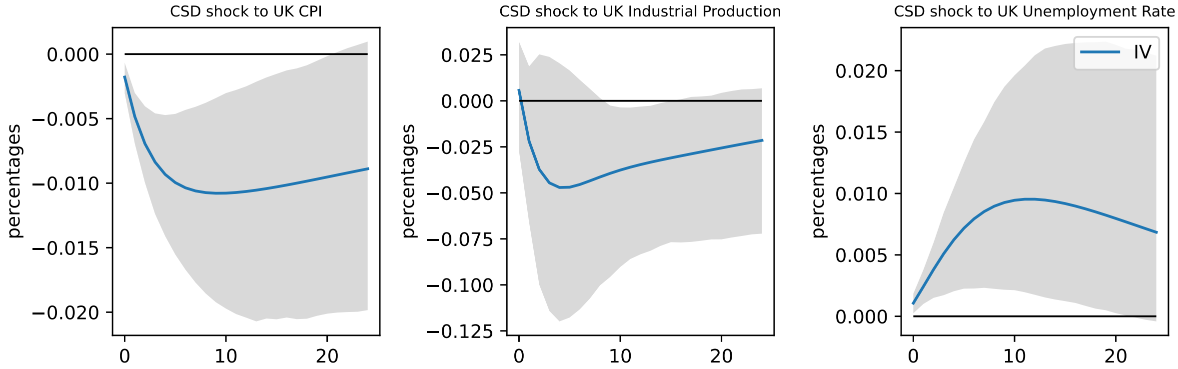


First stage regression: Coefficient: 0.49; F-statistics: 26; R^2: 0.28.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the Gibbs shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the EUR data of CSD, CYD, CCB, Euro Area CPI, Euro Area Industrial Production, Euro Area Unemployment Rate, Euro Area Real GDP, Euro Area Real Investment and Euro Area Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

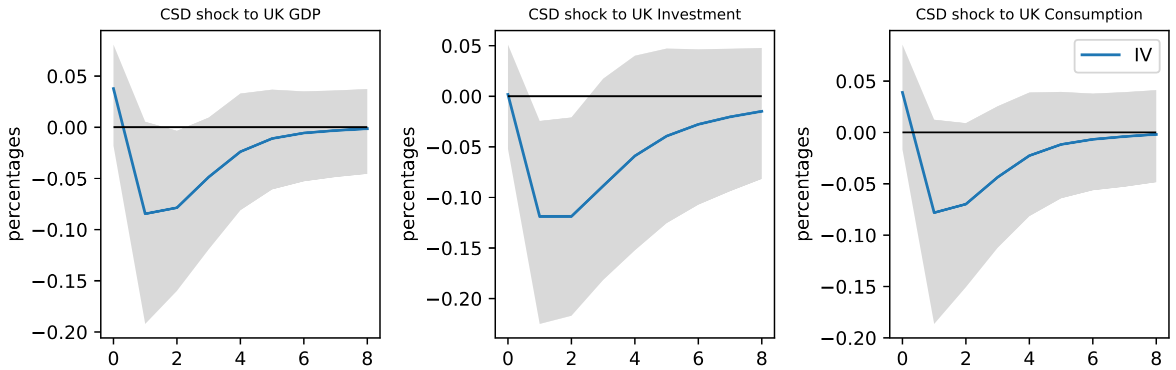
Figure A12: IRF of the CSD Shock with the UK Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.40; F-statistics: 43; R^2: 0.17.

(b) Quarterly Variables

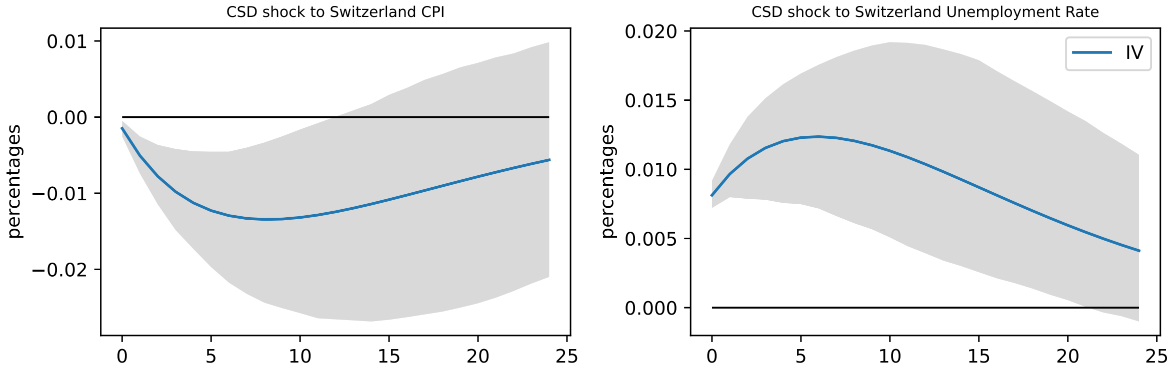


First stage regression: Coefficient: 0.51; F-statistics: 29; R^2: 0.30.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the Gibbs shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the GBP data of CSD, CYD, CCB, UK CPI, UK Industrial Production, UK Unemployment Rate, UK Real GDP, UK Real Investment and UK Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

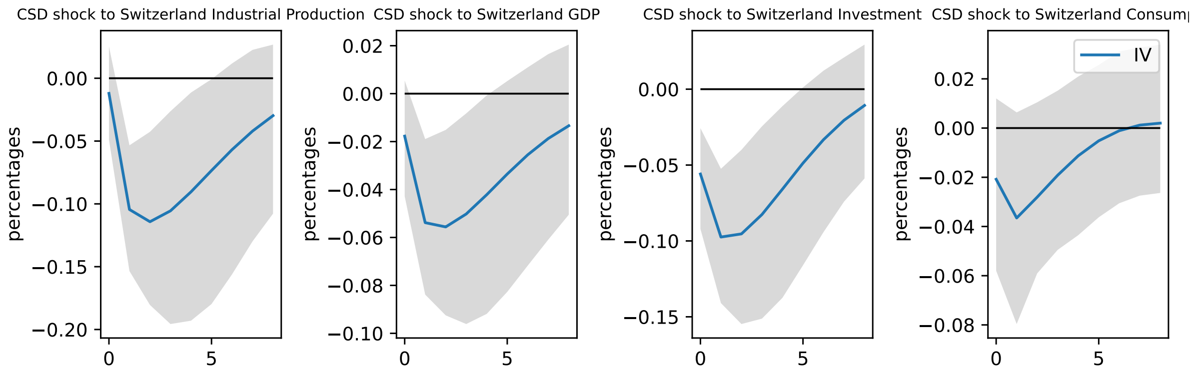
Figure A13: IRF of the CSD Shock with the Switzerland Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.39; F-statistics: 42; R^2: 0.17.

(b) Quarterly Variables

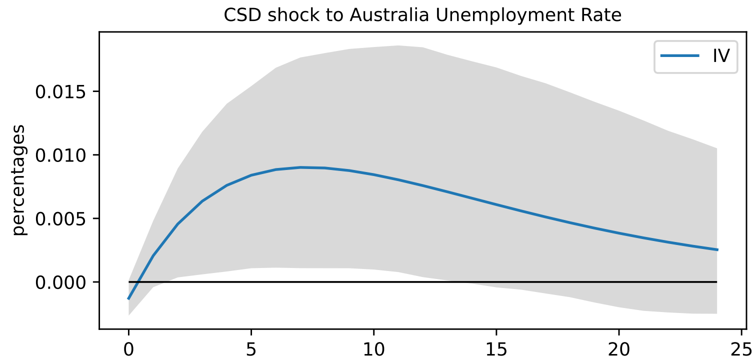


First stage regression: Coefficient: 0.48; F-statistics: 27; R^2: 0.29.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the Gibbs shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the CHF data of CSD, CYD, CCB, Switzerland CPI, Switzerland Industrial Production, Switzerland Unemployment Rate, Switzerland Real GDP, Switzerland Real Investment and Switzerland Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

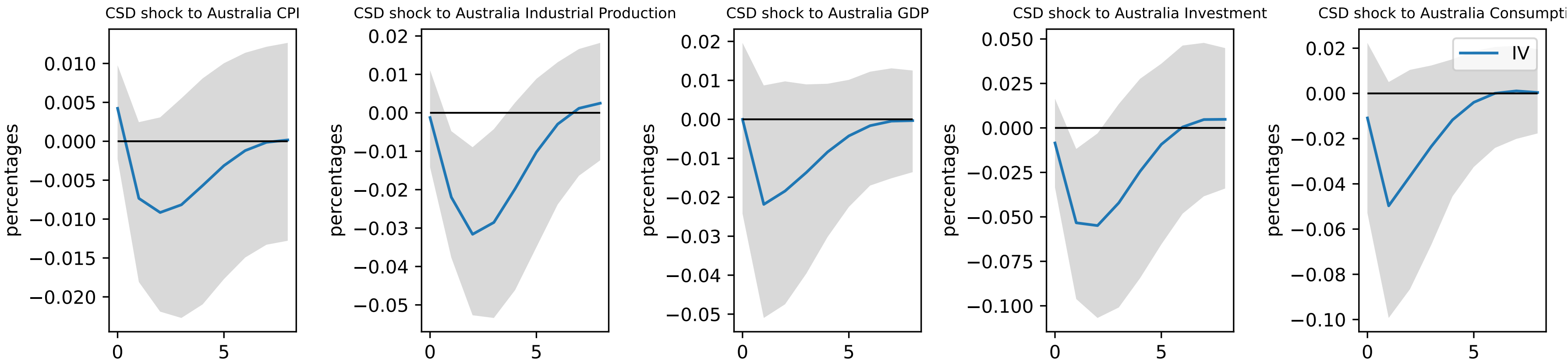
Figure A14: IRF of the CSD Shock with the Australia Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.41; F-statistics: 47; R^2: 0.19.

(b) Quarterly Variables



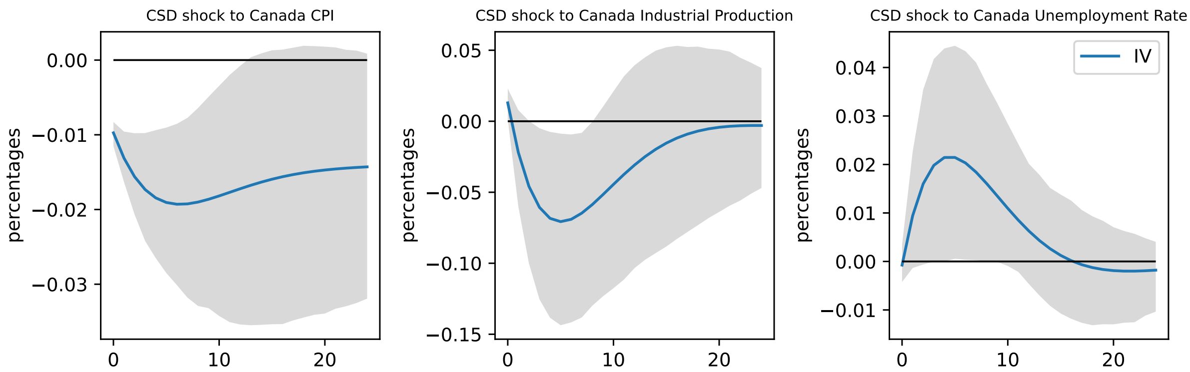
First stage regression: Coefficient: 0.49; F-statistics: 30; R^2: 0.32.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the Gibbs shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the AUD data of CSD, CYD, CCB, Australia CPI, Australia Industrial Production, Australia Unemployment Rate, Australia Real GDP, Australia Real Investment and Australia Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

D.3.2 SVAR with sentiment IV

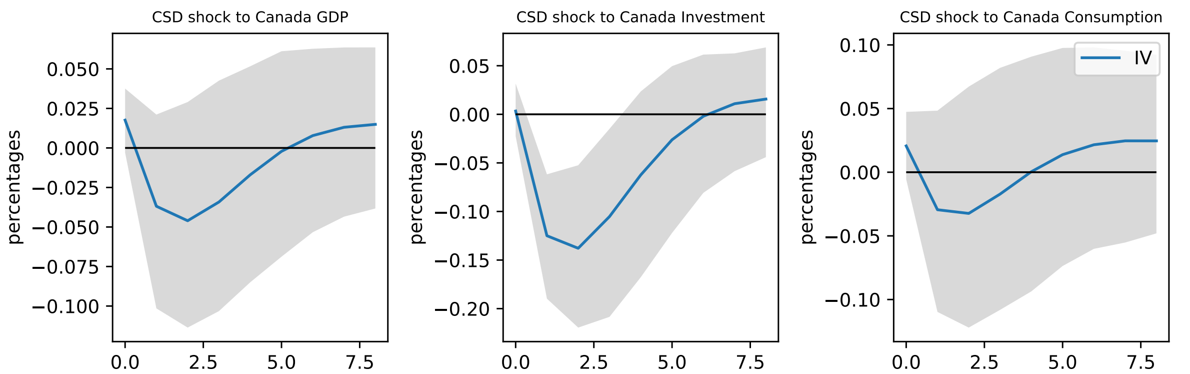
Figure A15: IRF of the CSD Shock with the Canada Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.38; F-statistics: 197; R^2: 0.49.

(b) Quarterly Variables

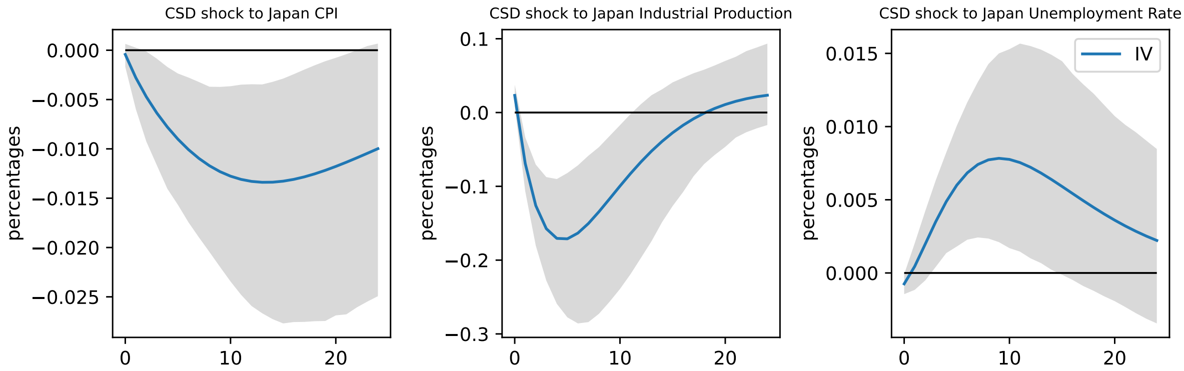


First stage regression: Coefficient: 0.39; F-statistics: 128; R^2: 0.66.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the EBP shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the CAD data of CSD, CYD, CCB, Canada CPI, Canada Industrial Production, Canada Unemployment Rate, Canada Real GDP, Canada Real Investment and Canada Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

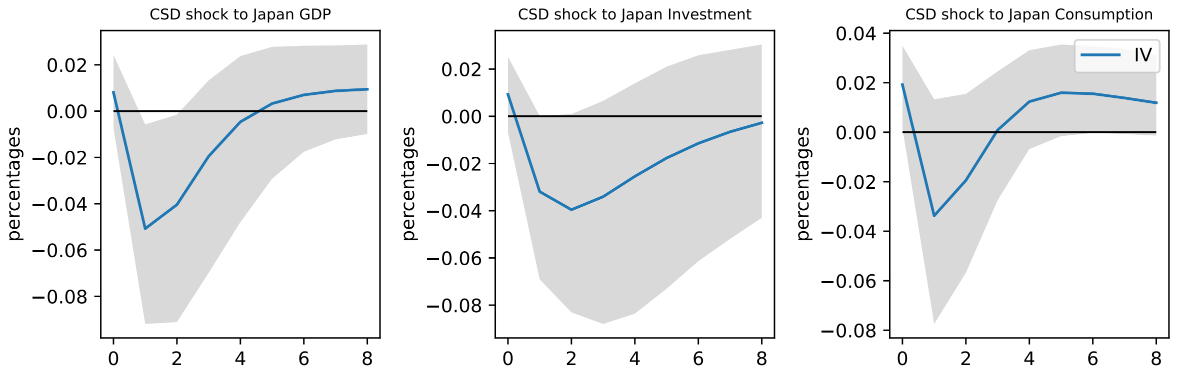
Figure A16: IRF of the CSD Shock with the Japan Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.38; F-statistics: 210; R^2: 0.51.

(b) Quarterly Variables

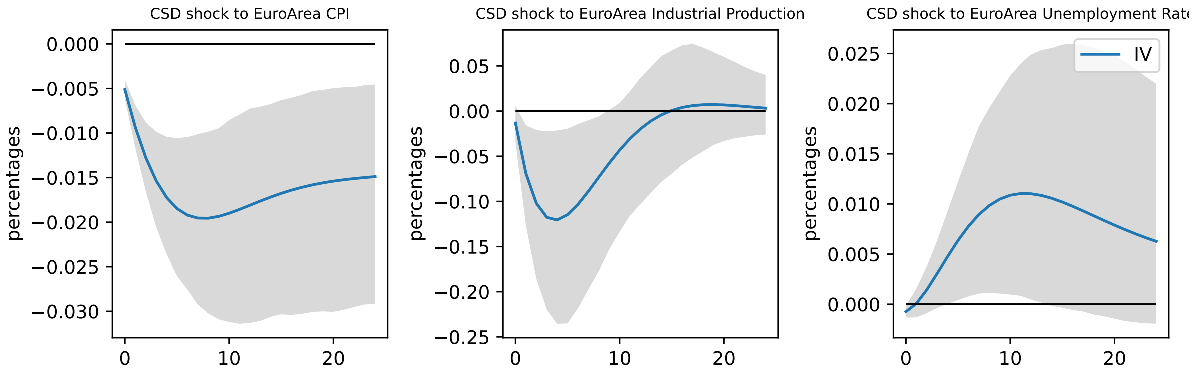


First stage regression: Coefficient: 0.36; F-statistics: 118; R^2: 0.64.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the EBP shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the JPY data of CSD, CYD, CCB, Japan CPI, Japan Industrial Production, Japan Unemployment Rate, Japan Real GDP, Japan Real Investment and Japan Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

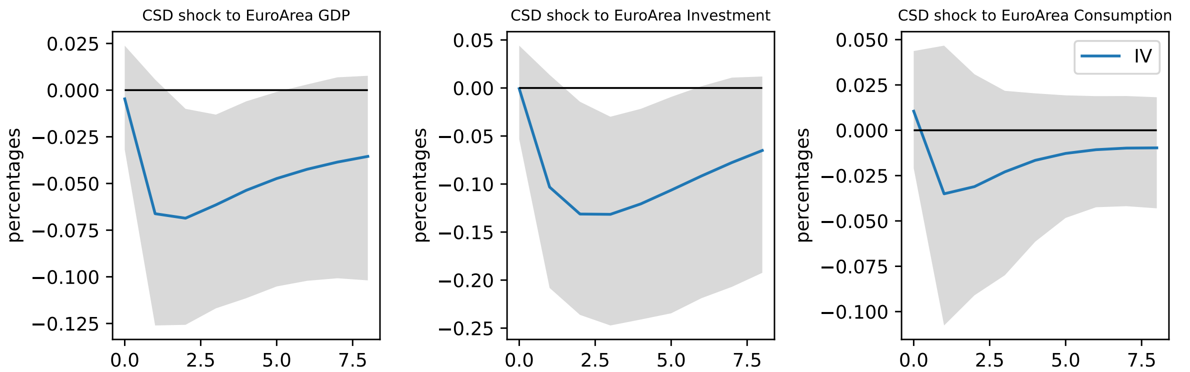
Figure A17: IRF of the CSD Shock with the Euro Area Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.37; F-statistics: 185; R^2: 0.48.

(b) Quarterly Variables

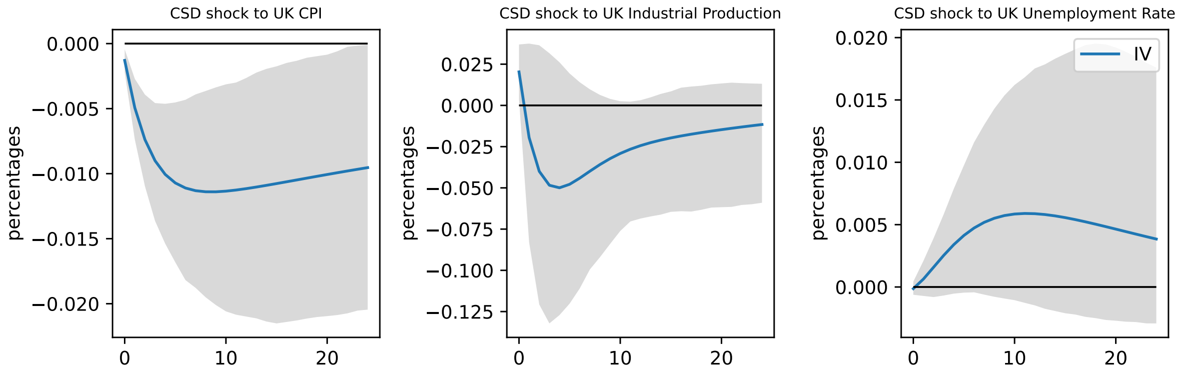


First stage regression: Coefficient: 0.38; F-statistics: 121; R^2: 0.65.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the EBP shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the EUR data of CSD, CYD, CCB, Euro Area CPI, Euro Area Industrial Production, Euro Area Unemployment Rate, Euro Area Real GDP, Euro Area Real Investment and Euro Area Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

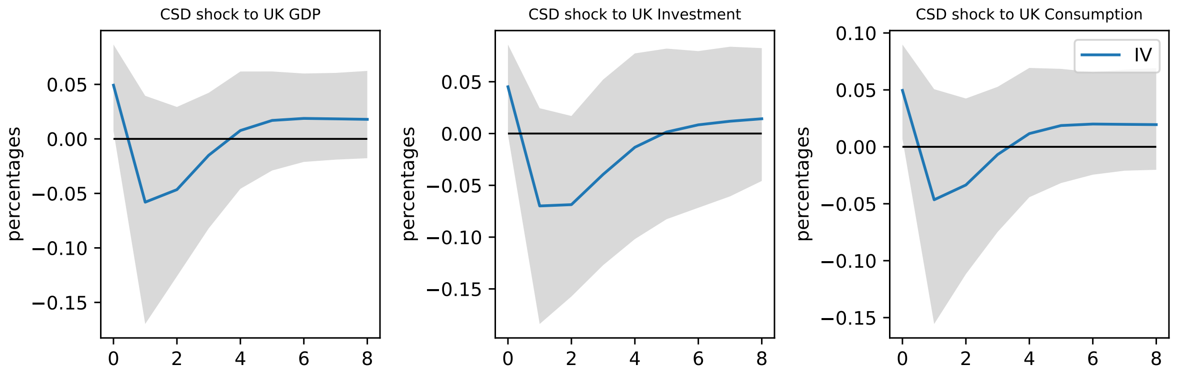
Figure A18: IRF of the CSD Shock with the UK Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.41; F-statistics: 241; R^2: 0.54.

(b) Quarterly Variables

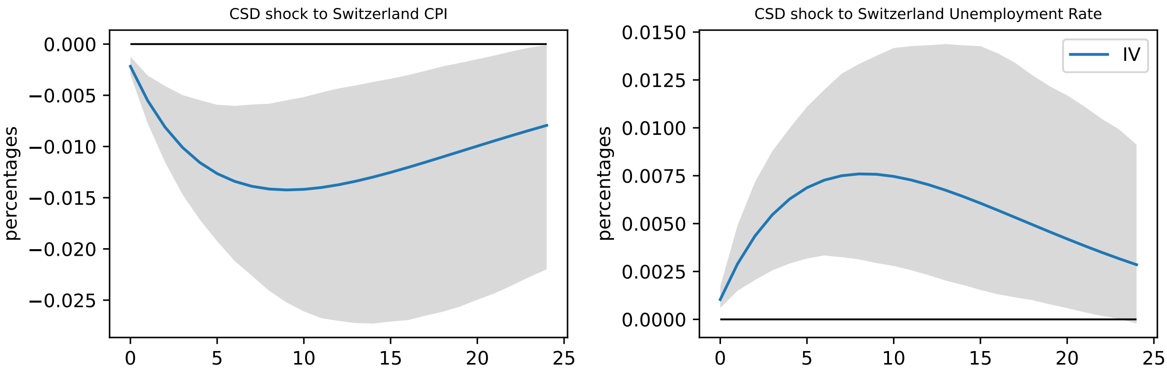


First stage regression: Coefficient: 0.38; F-statistics: 129; R^2: 0.66.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the EBP shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the GBP data of CSD, CYD, CCB, UK CPI, UK Industrial Production, UK Unemployment Rate, UK Real GDP, UK Real Investment and UK Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

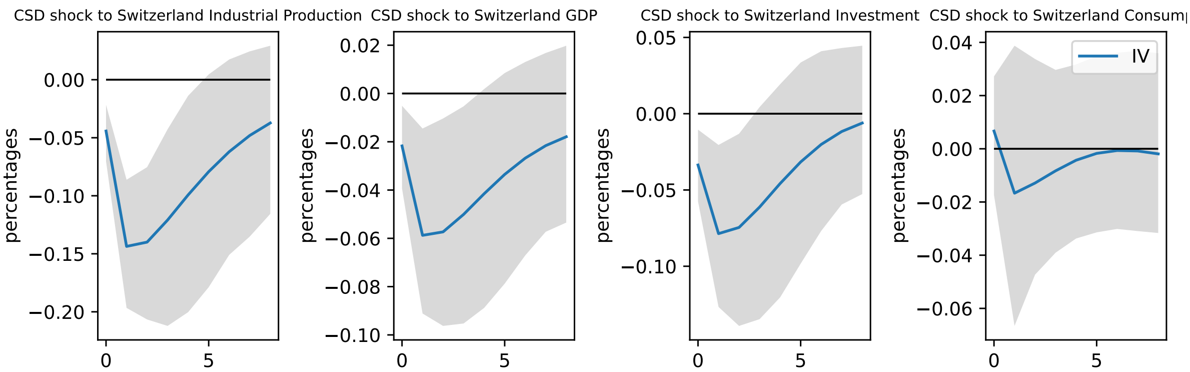
Figure A19: IRF of the CSD Shock with the Switzerland Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.40; F-statistics: 221; R^2: 0.52.

(b) Quarterly Variables

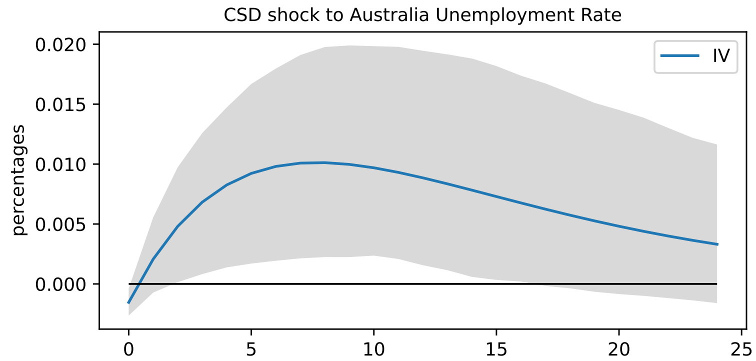


First stage regression: Coefficient: 0.35; F-statistics: 103; R^2: 0.61.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the EBP shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the CHF data of CSD, CYD, CCB, Switzerland CPI, Switzerland Industrial Production, Switzerland Unemployment Rate, Switzerland Real GDP, Switzerland Real Investment and Switzerland Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.

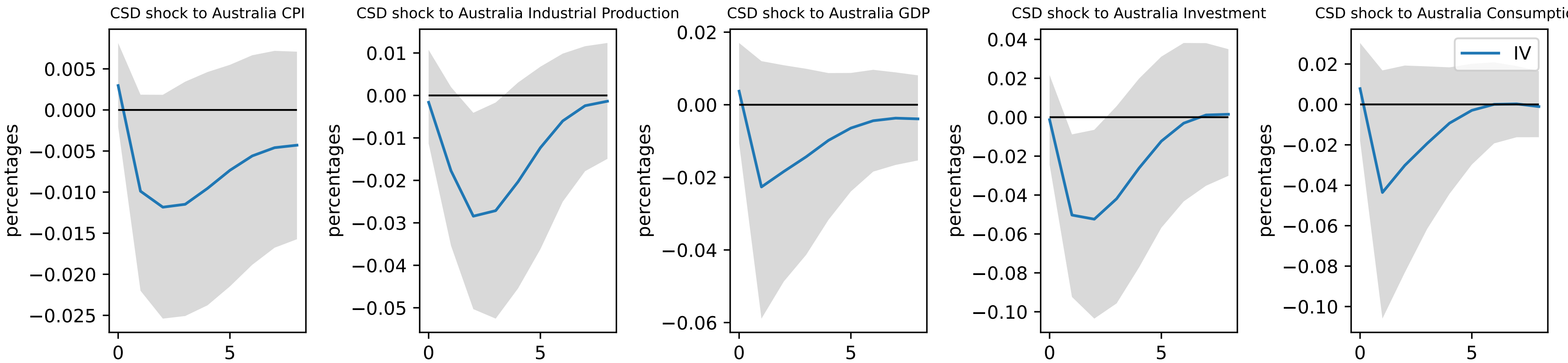
Figure A20: IRF of the CSD Shock with the Australia Macroeconomic Activity

(a) Monthly Variables



First stage regression: Coefficient: 0.41; F-statistics: 244; R^2: 0.54.

(b) Quarterly Variables



First stage regression: Coefficient: 0.33; F-statistics: 87; R^2: 0.57.

This figure presents the impulse response function (IRF) of one negative unit CSD shock to each variable. The plots are based on 1,000 wild bootstraps with the EBP shock IV. The solid lines are the mean value of IRF, and the shaded areas are 95% confidence bands. The monthly sample is from January 2004 to March 2021 with the AUD data of CSD, CYD, CCB, Australia CPI, Australia Industrial Production, Australia Unemployment Rate, Australia Real GDP, Australia Real Investment and Australia Real Consumption. The monthly and quarterly variables are estimated in the SVAR model separately.