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Cyclical pattern in international financial flows to the semi-periphery☆

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ABSTRACT

This study reveals that medium-term economic cycles in center countries drive systemic shifts in short-term financial flows to semi-periphery economies. Our theoretical model demonstrates that center countries' economic downturns (upturns) can lead to increased (decreased) short-term net financial inflows to semi-periphery countries as investors seek alternative opportunities (return to center markets). However, this substitution effect competes with a volume effect resulting from changes in total global investment.

Confirming the importance of the substitution effect, panel data analysis for 1970–2020 establishes that portfolio investments increase when center economies decline. Additional findings show that: (1) foreign direct investments are less sensitive to these cycles than portfolio flows; (2) periphery countries tend to follow a procyclical pattern; and (3) stronger financial and trade ties with center economies amplify the substitution effect.

1. Introduction

Over the past five decades, international financial flows have exhibited cyclical patterns that transcend individual crisis episodes, signaling structural principles governing global capital allocation (Forbes & Warnock, 2012; Kaminsky, 2017; Miranda-Agrippino & Rey, 2022). This study examines how CLIF cycles – encompassing synchronized financial and industrial medium-term cycles in major center economies – influence international financial allocation decisions and shape unexpected patterns of financial flows to semi-periphery countries. As illustrated in Fig. 1, the Gross Domestic Product (GDP)-weighted mean of the CLIF cycles and the sum of all financial inflows to the semi-periphery move in opposite directions. This pattern reveals three periods of abrupt rises and then plunges in financial flows corresponding to major financial crises (Nguyen, Castro, & Wood, 2022; Peeters & Defraigne, 2023).

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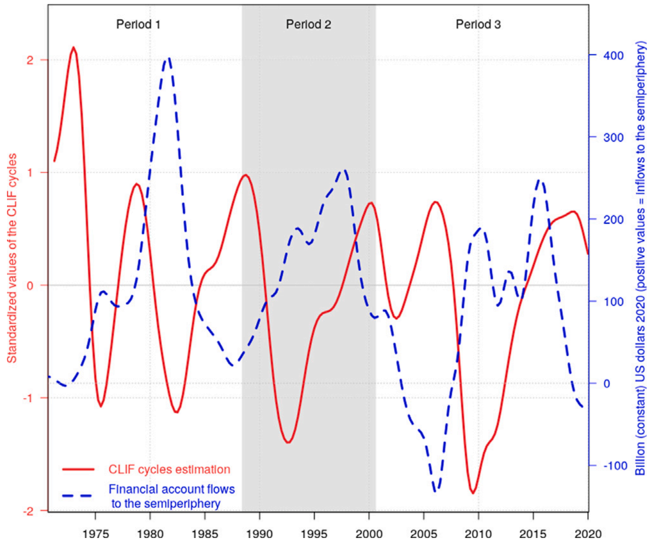

Fig. 1. CLIF cycles and financial flows to the semi-periphery.

Since the 2008 Global Financial Crisis, a thriving literature on financial cycles has emerged, beginning with domestic financial cycle analysis (Borio, 2014; Claessens, Kose, & Terrones, 2011; Drehmann, Borio, & Tsatsaronis, 2012). This literature subsequently extended to the global financial cycle (Miranda-Agrippino & Rey, 2022; Passari & Rey, 2015; Rey, 2015, 2016). This literature demonstrates that financial cycles operate at significantly longer frequencies than traditional business cycles, typically spanning 15–20 years and characterized by joint fluctuations in credit, asset prices, and leverage (Borio, 2014; Drehmann et al., 2012). Likewise, historical analysis reveals that credit booms and busts have been central features of advanced economies for over a century, with medium-term credit expansion serving as a robust predictor of banking crises (Borio, 2014; Schularick & Taylor, 2012). Recent evidence shows increased synchronization of financial cycles across countries since the 1980s, coinciding with financial liberalization and the rise of global banking (Adarov, 2022; Juhro, Iyke, & Narayan, 2024). Our study extends this literature by incorporating medium-term cycle indicators as state variables in portfolio optimization models and examining their impact on international financial flows.

The influence of large economies on rapid changes in international financial flows has drawn attention from academic literature (Davis & Zlate, 2023; Dées & Galesi, 2021; Miranda-Agrippino & Rey, 2022; Morais, Peydró, Roldán-Peña, & Ruiz-Ortega, 2019), international financial institutions (BIS, 2021; Gelos, Patelli, & Shim, 2024; OECD, 2024), central bankers (Davis & Zlate, 2022; Escayola, McQuade, Schroeder, & Tirpak, 2024), and specialized newspapers. Evidence confirms that the global financial cycle explains a substantial share of cross-border financial flows and risky asset price movements (Davis & Zlate, 2023; Miranda-Agrippino & Rey, 2022), with US monetary policy serving as an important driver (Dées & Galesi, 2021; Elliott, Meisenzahl, & Peydró, 2024; London & Silvestrini, 2025), although studies challenge the importance of this global cycle (Cerutti, Claessens, & Rose, 2019b).[2] This global financial cycle operates through multiple transmission channels including bank leverage adjustments, portfolio rebalancing effects, and risk appetite changes that systematically affect emerging market economies regardless of their exchange rate regimes (Elliott et al., 2024; Passari & Rey, 2015; Rey, 2016). Building on this framework, and in contrast to conventional short-term procyclical dynamics between center country financial stress and reduced short-term inflows to semi-periphery economies (Forbes & Warnock, 2012; Fratzscher, 2012; Shim & Shin, 2021), our empirical analysis reveals a systemic medium-term countercyclical pattern between these inflows and CLIF cycles over the 1970–2020 period.

The heterogeneous responses to global financial shocks have prompted extensive research, with studies examining both push factors from center countries and pull factors from recipient economies (Cerutti, Claessens, & Puy, 2019a; Forbes & Warnock, 2012, 2021; Fratzscher, 2012). While conventional wisdom suggests that exchange rate flexibility provides insulation from external shocks, recent evidence indicates that this protection varies across country groups and time periods (Cerutti et al., 2019b; Obstfeld, Ostry, & Qureshi, 2018; Scheubel et al., 2025). Countries' integration into global financial networks systematically affects their vulnerability to external financial cycles (Dées & Galesi, 2021; Elliott et al., 2024; London & Silvestrini, 2025; Morais et al., 2019). Our study contributes to this literature by examining how different country positions within global financial hierarchies affect their sensitivity to medium-term cycles in center economies.

Our contribution to the literature is threefold. First, we develop a novel theoretical framework integrating portfolio optimization with medium-term CLIF cycles and an updated center-periphery classification, revealing substitution and volume effects as

[2] For a more in-depth discussion of the empirical characteristics of the *global financial cycle* and associated stylized facts on international financial flows, see Miranda-Agrippino and Rey (2022) and Scheubel, Stracca, and Tille (2025).

drivers of financial flow movements. Second, we employ spatial econometric analysis to test our theoretical predictions using comprehensive data spanning over fifty years, demonstrating the importance of long-term perspectives in understanding financial flow patterns. Third, we provide new empirical evidence of systematic countercyclical financial flows to semi-periphery countries, challenging conventional procyclical assumptions. Using panel data spanning 1970–2020, we show that net financial inflows to semi-periphery countries exhibit countercyclical patterns relative to CLIF cycles through dominant substitution effects, suggesting that international investors systematically reallocate capital toward semi-periphery markets during periods of reduced profitability in center economies. This creates medium-term cyclical dependencies that help explain the clustering of financial difficulties in these economies. Our findings also highlight that portfolio investments and bank loans exhibit high sensitivity to CLIF cycles, while FDIs shows more modest responsiveness and lacks statistical significance. Periphery countries display distinctly procyclical patterns, suggesting volume effects dominate substitution mechanisms for countries positioned at the bottom of global financial hierarchies. Decomposing CLIF cycles reveals that the marginal effect of financial cycles drives countercyclical dynamics while the marginal effect of industrial cycles generates procyclical influences, with financial components dominating overall patterns. Spatial econometric estimates support that semi-periphery countries with large *financial* connections to center economies are more likely to experience larger countercyclical financial inflows, while *trade* relations tend to compensate this pattern and can even lead to procyclical patterns.

The remainder of this study is organized as follows. Section 2 develops a two-country model, introduces the methodology and data, and discusses main aggregate results. Section 3 extends the study with a multipolar model and analyzes transmission channels. Empirical results incorporating various heterogeneities are examined in Section 4. Section 5 discusses some robustness checks, and Section 6 concludes.

2. Two-country model and aggregate effect

This section analyzes the impact of medium-term cycles in center economies on international short-term financial flows between the center and the semi-periphery *considered as a whole.*[3]

2.1. Center and semi-periphery

The distinction between center, semi-periphery and periphery countries is based on their respective role in the international division of labor and global value chains. It is a framework based on the center-periphery approach developed by Braudel (1975) and Wallerstein (1974). The central notion is that countries can be ordered depending on their economic development stages and capacity to generate added value. Center economies, including Germany, Japan, Switzerland, Luxembourg, and the US, control high-value-added activities through Multinational Enterprises (MNEs) possessing significant intangible assets. These countries maintain diversified production structures, advanced technological capabilities, and sophisticated financial markets. Semi-periphery economies, such as South Africa, Mexico, Brazil, Malaysia, Qatar, Greece, and the Baltic countries, occupy an intermediate position. These nations participate in International Production Networks (IPNs) through inward FDI and outsourcing, with more diversified export structures than periphery economies, though their firms exercise limited control over global production networks. Periphery economies, including Ethiopia, Niger, Yemen, Laos, and Nepal, concentrate on low-value-added activities, primarily in agriculture, raw materials, and basic services.[4]

2.2. Portfolio optimization problem

I consider a portfolio optimization problem of an investor i allocating funds between the semi-periphery and the center at every period t.[5] The investor seeks to maximize their return $R_{i,t+1}$ in $t+1$ by determining the optimal investment shares θ_{cit} and θ_{sit} for the center and semi-periphery respectively, where $\theta_{sit} + \theta_{cit} = 1$. Defining $\theta^*_{it} = \left\{\theta^*_{sit}, \theta^*_{cit}\right\}$, the optimization problem is:

$$\theta^*_{it} = \arg\max_{\theta_{it}} \mathcal{O}(\theta_{it}) \quad \text{with} \quad \mathcal{O}(\theta_{it}) \equiv E\left[R_{i,t+1}(\theta_{it}) - \lambda_i Risk_{i,t+1}(\theta_{it}) \,\middle|\, I_{it}\right], \tag{1}$$

where $Risk_{it}$ is a function used by the investor to promote a diversification strategy to diminish exposure to risks (e.g., default risk), λ_i is a risk-aversion coefficient, and I_{it} is the information available to investor i at time t. This is a mean–variance optimization scenario, which offers good approximations to most common portfolio utility functions (see Das, Markowitz, Scheid, & Statman, 2010; Levy &

[3] Section 3 considers a multipolar approach and develops a N-country portfolio optimization model to study the transmission channels as sources of heterogeneities.

[4] The framework offers analytical advantages over other economic classifications for studying medium-term international dynamics: while income-based approaches do not capture development stages (e.g., Qatar's high income per capita), traditional advanced/emerging/developing categories lack systematic criteria for analyzing 50-year economic interactions, and classifications based on exchange rate regimes or capital openness reflect very different economic realities and are limited by timespan and country coverage. The center-periphery framework specifically focuses on countries' productive capabilities and integration into international production networks, providing a more relevant lens for analyzing how economic cycles in advanced economies influence financial flows. The categorization enables examination of how differential productive capacities, rather than just income levels or policy regimes, shape cross-border financial linkages and dependencies. Details on the data-driven classification of countries used in the empirical part can be found in Appendices A and C.1.

[5] The simplification that the investor re-allocates their portfolio at every period aims to exclude the transaction costs from the analysis to streamline the problem, and does not change the core results.

Markowitz, 1979; Markowitz, 1991, for more details). The return function is $R_{i,t+1} = \theta_{sit} r_{s,t+1} + \theta_{cit} r_{c,t+1}$ where r_{st+1} and r_{ct+1} are the returns in the semi-periphery and center. I consider the percentage return such that the total return is given by the product of $r_{i,t+1}$ by amount invested q_{it}. The risk function is modeled as a weighted sum of the squared shares: $E\left[Risk_{i,t+1} \,|\, I_{it}\right] = \frac{1}{2}\left(\sigma_{sit}\theta_{sit}^2 + \sigma_{cit}\theta_{cit}^2\right)$, with σ_{sit} and σ_{cit} two exogenous indicators of how investor i perceives the relative average risk to invest in the areas. All other things being equal, the higher σ_{sit} is, the more the semi-periphery is perceived as at risk, and the larger the investments to the center are. The sum $\sigma_{sit} + \sigma_{cit}$ is normalized to one. Therefore, λ_i captures the overall risk-aversion and σ_{sit} represents only the *relative* risk to invest in the semi-periphery.

An investor can form their expectations of the returns $r_{s,t+1}$ and $r_{c,t+1}$ in different ways. I model these returns as functions of the CLIF cycles, noted A_t.[6] For simplicity, other factors are considered exogenous and included in terms κ_{sit} and κ_{cit} for the semi-periphery and center respectively. For the center, I assume that $E_i\left[r_{c,t+1}\right] = \kappa_{cit} + f_i(A_t)$ where f_i is monotonically increasing with A_t, that is $f_i' = \frac{d}{dA_t} f_i > 0$. The time difference between two periods (e.g., 6 months) is viewed as small relative to the average wavelength of the CLIF cycles (around 10–15 years). The investor i is aware of the cycles but does not impact them. For the semi-periphery, I model the expectation as follows[7]:

$$E_i\left[r_{s,t+1}\right] = \kappa_{sit} + \eta_i\theta_{sit} + \epsilon f_i(A_t), \tag{2}$$

The parameter ϵ captures the relative influence of CLIF cycles on returns in the semi-periphery compared to their influence on returns in the center. If $\epsilon = 1$, CLIF cycles affect returns equally in both regions. When $\epsilon < 1$, CLIF cycles have a relatively larger influence on center returns compared to semi-periphery returns. In the case where $\epsilon < 0$, economic downturns in the center are associated with procyclical decreases in center returns but countercyclical increases in semi-periphery returns. Our empirical results suggest that $\epsilon < 1$ for the semi-periphery as a whole, indicating that CLIF cycles have a more pronounced impact on center economies than on semi-periphery countries.

In addition to assuming that returns are a function of A_t, the parameter η_i models how the amount invested in the semi-periphery can affect returns (e.g., due to wealth effects or herding behavior). For simplicity, θ_{sit} is assumed to evolve between 0 and 1, but never to reach such extreme values; $0 < \theta_{sit} < 1$. In addition, the parameters must be such that $\lambda_i > 2\eta_i$ for the objective function $\mathcal{O}$ to be concave. Under such conditions, the solution to the maximization problem is[8]:

$$\theta_{sit}^* = \underbrace{\frac{\lambda_i - \lambda_i\sigma_{sit} + (\kappa_{sit} - \kappa_{cit})}{\lambda_i - 2\eta_i}}_{=\,\delta_{0,it}} + \underbrace{\frac{-(1-\epsilon)}{\lambda_i - 2\eta_i}}_{=\,\delta_{1,it}} f_i(A_t). \tag{3}$$

Key features of this solution include:

1. The optimal investment share θ_{sit}^* likely varies countercyclically with the CLIF cycles, unless ϵ is very high and returns in the semi-periphery are highly procyclical with A_t (e.g., due to large trade exposure and openness to the center). Specifically, this holds when $\epsilon < 1$, so that $\delta_{1,it} < 0$.
2. Higher perceived risk in the semi-periphery (high σ_{sit}) or lower profitability (low $\kappa_{sit} - \kappa_{cit}$) reduce investments in the area.
3. For extremely risk-averse investors, $\theta_{sit}^* \approx 1 - \sigma_{sit} = \sigma_{cit}$. The only driving force in the decision is the relative perceived risks in the two areas.
4. Higher η_i (e.g. due to a large wealth effect, low absorption capacities) leads to more investments in the semi-periphery and increased volatility in θ_{sit}^*.[9]

An additional observation can be made on how CLIF cycles impact investment decisions via changes in investor risk-aversion. Considering λ_i and σ_{sit} as functions of A_t, and assuming $\eta_i = 0$, the derivative of θ_{sit}^* by A_t can be written as follows[10]:

$$\frac{\partial\theta_{sit}^*}{\partial A_t} = -\underbrace{\frac{\partial\sigma_{sit}^*}{\partial A_t}}_{>0} + \frac{E_i\left[r_{c,t+1} - r_{s,t+1}\right]}{\lambda_i^2}\underbrace{\frac{\partial\lambda_i^*}{\partial A_t}}_{<0} + \delta_{1,it}\underbrace{\frac{\partial f}{\partial A_t}}_{>0}. \tag{4}$$

The first term on the right-hand side indicates that, during the downward phases of the CLIF cycles, investor i considers the center as increasingly more risky relative to the semi-periphery. However, this relationship may be more complex in practice. For countries with large values of ϵ (e.g., some semi-periphery and periphery countries highly exposed to the center during downward CLIF cycle phases), investors might "rush to quality" and σ_{sit}^* would increase countercyclically even if return drops originate from the center, because expected return reductions are more drastic for these highly exposed countries. Our empirical results support this alternative pattern, particularly for periphery countries and highly trade-connected semi-periphery countries. Nevertheless, this

6 The construction and estimation methodology for CLIF cycles are detailed in Section 2.5.1.

7 Alternative expectation modeling approaches are possible, including adaptive expectations or rational forward-looking forecasts. The chosen approach allows for diverse investor expectations while capturing the influence of CLIF cycles.

8 See Appendix B.1 for the demonstration and details. The extreme cases with $\theta_{sit} = 0$ or 1 are incorporated and discussed in this appendix.

9 We have $\text{sign}\left(\frac{\partial^2}{\partial\eta_i\partial X}\theta_{sit}^*\right) = \text{sign}\left(\frac{\partial}{\partial X}\theta_{sit}^*\right)$, with $X \in \left\{\lambda_i, \sigma_{sit}, \kappa_{sit}, \kappa_{cit}, \epsilon, \eta_i, A_t\right\}$. Note that this relation only holds when the objective function is concave, that is when $\lambda_i > 2\eta_i$. Another condition must be added regarding the derivatives of θ_{sit}^* with λ_i. If $\theta_{sit}^* < 1 - \sigma_{sit} < 2\theta_{sit}^*$, we have that $\frac{\partial}{\partial\lambda_i}\theta_{sit}^* > 0$ while $\frac{\partial^2}{\partial\eta_i\partial\lambda_i}\theta_{sit}^* < 0$.

10 This comes from Eq. (3), after highlighting the terms $r_{c,t+1}$ and $r_{s,t+1}$.

exception appears less applicable to the semi-periphery as a whole based on our findings. The second term supports that, as long as the expected returns are higher in the center than in the semi-periphery, the downward phases of the CLIF cycles induces a rise in the risk-aversion of the investor which itself leads to an increase in the investment share to the semi-periphery. The third term is the main effect discussed in Eq. (3). This suggests that changes in risk perception and risk-aversion throughout the CLIF cycles might be an additional channel that contributes to a countercyclical investment share in the semi-periphery θ^*_{sit}.

2.3. Investments

The investment in the semi-periphery by investor i is $\phi_{sit} = q_{it}\theta^*_{sit}$ where q_{it} is the total amount of money invested by them. The total investment in the semi-periphery is the sum of the investments for all investors: $\phi_{st} = \sum_i \phi_{sit}$. Considering q_{it} as exogenous and independent of A_t, the total investment in the semi-periphery can be expressed as follows: $\phi_{st} = \left(\sum_i q_{it}\delta_{0,it}\right) + \left(\sum_i q_{it}\delta_{1,it}\right) f(A_t)$.[11] Because $\delta_{1,it} < 0$ (assuming $\epsilon < 1$), financial investments to the semi-periphery evolve countercyclically with A_t. Therefore, it is clear that the share of investments to the semi-periphery θ^*_{sit} decreases with A_t as well as ϕ_{st} when q_{it} is fixed.

When considering that the capital to invest q_{it} might change throughout the CLIF cycles, the situation is more complex. Considering that q_{it} can be decomposed into two components, with only one depending on A_t such that $q_{it} = \tilde{q}_{it} + g_{it}(A_t)$ with $g'_{it} = \frac{d}{dA_t} g_{it} > 0$ and $\frac{d}{dA_t}\tilde{q}_{it} = 0$, the variation of ϕ_{st} throughout the CLIF cycles is given by[12]:

$$\frac{\partial \phi_{st}}{\partial A_t} = \underbrace{\sum_i \theta^*_{sit}\frac{\partial q_{it}}{\partial A_t}}_{\text{volume effect}} + \underbrace{\sum_i q_{it}\frac{\partial \theta^*_{sit}}{\partial A_t}}_{\text{substitution effect}} = \underbrace{\sum_i \underbrace{\theta^*_{sit}}_{>0} \underbrace{\frac{\partial g_i}{\partial A_t}}_{\gtrsim 0}}_{>0} + \underbrace{\underbrace{\left(\sum_i \delta_{1,it} q_{it}\right)}_{<0} \underbrace{\frac{\partial f}{\partial A_t}}_{>0}}_{<0} . \tag{5}$$

Changes in financial investments to the semi-periphery can be explained by two major effects. On the one side, the *volume effect* is the procyclical increase in financial investment to the semi-periphery throughout the CLIF cycles caused by the procyclical rise in the amount (volume) of investable financial funds in the center. This effect can be viewed as the changes in financial investments in the semi-periphery when the share of the investments in the two areas is kept constant. It is likely that for most of the financial investors from the center, their ability and willingness to invest increases during the upward phases of the CLIF cycles (that is $\frac{\partial q_{it}}{\partial A_t} > 0$). Even if q_{it} does not increase with A_t for every investor i (symbolized by $\gtrsim$ rather than $>$ in Eq. (5)), because the investors from the center represent the bulk of the investment capacities during the period investigated for this study, the aggregate impact is that the volume effect leads to a procyclical increase in financial investments to the semi-periphery. On the other side, the *substitution effect* is the countercyclical rise in financial investments to the semi-periphery that results from changes in the investment shares. It derives from the countercyclical variation of investment shares in Eq. (3). This can be regarded as a process of substitution between the two areas as places to invest, seeing the total amount invested in the global economy constant. These two effects oppose one another such that a theoretical investigation alone does not propose a definitive answer to the dominant direction of influence of the CLIF cycles on financial investment in the semi-periphery.

Three main scenarios emerge regarding the direction of influence of the CLIF cycles on financial investments to the semi-periphery:

(1) Procyclical investment if semi-periphery returns are highly procyclical ($\epsilon \geq 1$ and therefore $\sum_i q_{it}\delta_{1,it} > 0$). In such a scenario, investment to the semi-periphery contracts during the downward phases of the CLIF cycles regardless of the volume effect.
(2) Procyclical investment if the volume effect dominates the substitution effect ($\sum_i \theta^*_{sit}\frac{\partial q_{it}}{\partial A_t} > \sum_i q_{it}\left|\frac{\partial \theta^*_{sit}}{\partial A_t}\right|$).
(3) Countercyclical investment if the substitution effect dominates the volume effect ($\epsilon < 1$ and $\sum_i \theta^*_{sit}\frac{\partial q_{it}}{\partial A_t} < \sum_i q_{it}\left|\frac{\partial \theta^*_{sit}}{\partial A_t}\right|$.

The methodology explained in Section 2.4 introduces an identification strategy to determine which of these scenarios illustrates the best the pattern of short-term financial flows between the center and semi-periphery between the 1970s and early 2020s. Results discussed in Section 2.6 suggest that financial investments to the semi-periphery evolve *countercyclically* with the CLIF cycles.

2.4. Methodology

The empirical strategy relies on the closed form solution of the optimization problem for a panel data model. The dependent variable ϕ_{nt} represents international short-term net financial inflows to the semi-periphery country n at period t, with a total of N_s countries. The DGP, derived from a linearization of Eq. (3), can be written as follows:

$$\text{DGP 1}: \phi_{nt} = \alpha_n + \beta^A A_t + \beta X_{nt} + \varepsilon_{nt}, \tag{6}$$

where α_n is a country fixed effect parameter, β^A represents the coefficient of influence of CLIF cycles on international financial investments, X_{nt} is a vector of macroeconomic variables (detailed in Section 2.5.3), and ε_{nt} is the normally distributed disturbance

[11] $\delta_{0,it}$ and $\delta_{1,it}$ are defined in Eq. (3) as $\delta_{0,it} = \frac{\lambda_i - \lambda_i\sigma_{sit} + (\kappa_{sit} - \kappa_{cit})}{\lambda_i - 2\eta_i}$ and $\delta_{1,it} = -\frac{(1-\epsilon)}{\lambda_i - 2\eta_i}$.

[12] See Appendix B.2 for details on the decomposition of q_{it}, and the reasons for assuming that $g'_{it} > 0$.

(or error term). α_n and βX_{nt} capture the domestic factors that could impact the financial flows and are independent of the CLIF cycles. If investment profitability in the semi-periphery is very procyclical with A_t (i.e, $\epsilon > 1$) and/or the volume effect is larger than the substitution effect, β^A would be positive. Conversely, with a small volume effect relative to the substitution effect and $\epsilon < 1$, β^A is negative and equals $-\left(\sum_i \frac{(1-\epsilon)}{\lambda_i - 2\eta_i} q_{it}\right)\frac{\partial f}{\partial A_t}$.

This empirical strategy relies on assumptions, four notable ones are discussed here.

Assumption 1 ($A1$). The CLIF cycles are exogenous.

This implies that medium-term cycles in semi-periphery and periphery countries have, at most, a modest impact on the center economies and CLIF cycles. While this assumption might seem strong, based on the respective sizes and developments of their financial markets, it is likely that most of the influence comes from center leader economies.[13] Additionally, the absorption capacities and controls on international investments vary importantly in favor of center countries. Absorption capacity refers to the amount of external financial resources that a country is capable to manage and spend, actually and efficiently, without producing negative macroeconomic side effects (e.g., large increase in inflation and/or real effective exchange rate), within their borders.[14]

Another assumption comes from the modeling of the decision-making process:

Assumption 2 ($A2$). Investors maximize their expected returns in each period independently.

The assumption that investors are independent of one another and individually optimize their returns (e.g., they are not influenced by other investors' decisions and expectations) does not lead to major difficulties. This is because each investor reacts to changes in CLIF cycles so that they integrate this dimension that reflects some herd behaviors. Additionally, the DGP incorporates several macroeconomic independent variables. Therefore, this modeling choice should not impact the empirical validity of the results. The assumption that investors optimize their returns, while neither perfectly realistic nor constraint free, is a practical choice with limited modeling and empirical implications. Considering short-term financial flows, the assumption that investors "re-invest" at every period can be viewed as equivalent to the assumption that *transaction costs are low enough*.[15]

Two additional assumptions emerge from the transition from the theoretical model of Section 2 to DGP 1. The first assumption is related to the volume effect:

Assumption 3 ($A3$). The funds invested evolve procyclically with the CLIF cycles.

I assume that the total amounts of money invested in the global economy by investors increases with A_t because the expected total returns of most investors (weighted by the risks) increase during favorable periods in center economies (see Appendix B.2). This reflects a procyclical influence of the medium-term cycles on financial inflows to semi-periphery countries through the volume effect. This assumption does not have a direct influence on the quality of the estimations. It has an indirect effect on their interpretation. Based on A3, a negative estimate for β_t^A corroborates the existence of a countercyclical effect of the CLIF cycles on the financial inflows due to a stronger substitution effect relative to the volume effect. A positive estimate suggests either the opposite (a stronger volume effect) or a procyclical substitution effect. The last assumption concerns the linearization process needed to obtain DGP 1:

Assumption 4 ($A4$). Higher order terms of the CLIF cycles can be ignored.

Large higher order terms ignored due to the linearization process (for example, for the second order, a term proportional to A_t^2) could bias the estimations for β_t^A. However, as A_t models medium-term influences, this simplification should not alter the overall influence and interpretation of the empirical strategy.

Conditional on A1–4, we can assess hypotheses on the macroeconomic influences of CLIF cycles on financial inflows to semi-periphery countries: The most important of which can be formulated as follows:

Hypothesis 1 ($H1$). The influence of the CLIF cycles on financial inflows to the semi-periphery is dominated by a countercyclical substitution effect.

This hypothesis suggests that the countercyclical components of the substitution effect (e.g., investments in the semi-periphery become relatively more profitable during the downward phases of CLIF cycles) outweigh both procyclical components of the substitution effect (e.g., due to a decline in export prices of some semi-periphery countries caused by downturns in CLIF cycles) and the volume effect in determining financial inflows to semi-periphery countries.

[13] A Granger (non-)causality test was performed to test A1. The hypothesis of non-causality of the financial flows of semi-periphery countries on CLIF cycles was not rejected, while the hypothesis of non-causality (confirming the potential for causation) of cycles on financial flows was rejected. Detailed results are presented in Appendix D.1.

[14] The argument can be summarized by the following relation:

$$\frac{\text{international investments by C in SP}}{\text{absorption capacity of SP}} > \frac{\text{international investments by SP in C}}{\text{absorption capacity of C}}, \tag{7}$$

with C for center and SP for semi-periphery economies. As an example, macroeconomic absorption capacity is measured in GDP under the Cohesion Policy rules in the European Union which limits the transfer of funds to a maximum of 3.8% of the respective country's GDP.

[15] Transaction costs can be included in Eq. (1) as a cost to variations in θ_{sit}. For example, we can consider a new model with the return function given by $R'_{i,t+1} = \theta_{sit} r_{s,t+1} + \theta_{cit} r_{c,t+1} - \tau|\theta_{sit} - \theta_{si,t-1}|$, where τ models transaction costs. As long as these costs are low, the main conclusions of the model remain unchanged.

Table 1
Main data, their uses and references used for baseline scenarios.

Indicators	Data	Sources and links
Center-periphery axis	Current GDP per capita	See GDP and population
	Natural rent indicator	World Bank link
	% of the population under 14, % of urban population	World Bank [link], UN Population Division Data [link]
	Education index	Prados de la Escosura (2015)
Leader-follower axis	PPP and current GDP	World Bank [link], Maddison Project Database 2020 [link]
	Total and urban population	World Bank [link], UN Population Division Data [link]
	Global Fortune 500 index	Fortune website/magazines [link]
Financial Cycles[a]	Credit to private non-financial sector (market values), credit-to-GDP ratio	Bank for International Settlements (BIS) data [link]
	Real residential prices	BIS data [link]
Industrial Cycles[a]	Gross capital formation	World Bank [link]
	Capacity utilization (in %)	FRED [link], Organization for Economic Co-operation and Development (OECD) link, METI link
	unemployment rate	FRED link, OECD link
Financial Flows	Financial account, portfolio investments, FDI, other investments	International Monetary Fund (IMF) data [link]
Demographic regressors	Population, % of the population under 14, under-five mortality, life expectancy, fertility rate, adolescent fertility rate, dependency ratio, % of urban population	World Bank [link], UN Population Division Data [link], Penn World Table [link]
Economic regressors[b] (extended)[c]	Natural rent index, real GDP per capital, % of agriculture in GDP, human capital and education index. Extended also includes: Gross capital formation, % of gross capital formation in GDP, % of industry in GDP, % of the manufacturing sector in GDP, electricity consumption per capita, real GDP, GDP in PPP	World Bank [link], Penn World Table [link], Barro-Lee Dataset [link], Our World in Data [link], Prados de la Escosura (2015), Historical National Accounts [link], OECD [link], EUKLEMS Database [link], 10 sector database [link], Economic Transformation Database [link], World Input–Output Database [link]
Transmission channel matrices (TCMs)[d]	International trade (W^{trade})	UN Comtrade database [link]
	Geographic distances between capitals (W^{geo})	World Cities Database [link]
	Disbursements on external debt, PPG (W^{fin}) and % of external long-term PPG debt in United States (US) dollars (W^{cur})	World Bank IDS database [link]

Note: Except for ratios or explicitly mentioned, indicators are in real terms and were adjusted for inflation if required by using a global consumer price index (CPI) from the World Bank [link] or an alternative price index contained in the databases when available.
[a] Medium-term cycles are smoothed combination of these data.
[b] Economic regressors were smoothed using Nadarya–Watson estimations to avoid endogeneity biases.
[c] The "extended" economic regressors are not systematically used in the results for three reasons; (i) they are likely to be affected by the CLIF cycles so that the risk of creating an endogeneity bias is larger than with other variables, (ii) the quality of data is not as good as for other regressors, in particular for periphery countries, (iii) they can lead to large multicollinearity between the regressors when the number of countries is not sufficiently large.
[d] This part of the table refers to the transmission channel matrices discussed in Sections 3 and 4. Except for the geographic distances, the transmission channel matrixs (TCMs) were smoothed so that the matrices reflect long-term economic connections between countries and avoid endogenous biases that can emerge if the CLIF cycles affect the TCMs in the short to medium-terms.

2.5. Data and indicators

This section introduces the indicators and data used to build estimates of CLIF cycles, financial flows, and control variables. Given the focus on long-term dynamics and the objective of maximizing both cross-sectional coverage and temporal span, the analysis employs annual frequency data. Table 1 provides an overview of the main data used in this study.

2.5.1. Estimates for CLIF cycles

The CLIF cycles are constructed as the weighted mean of financial and industrial cycles for center leader economies. Due to data limitations, these cycle estimates are only used to characterize center leader economies: the US, Japan, France, the UK and Germany. This section provides details for the US.[16] Data from the BIS, OECD, World Bank, Federal Reserve Economic Data (FRED), and Ministry of Economy Trade & Industry (METI) are utilized.

Following Drehmann et al. (2012) and Borio (2014), financial cycles are estimated using the medium-term average real growth of private banking credit to non-financial sector, private banking credit-to-GDP ratio, and residential property prices. Figs. 2–4

[16] Charts for other countries are in Appendix C.2.

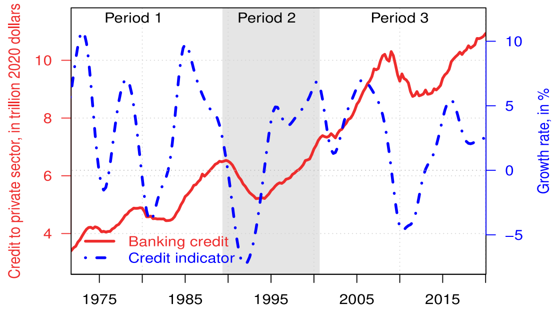

Fig. 2. Credit to private sector in the US.

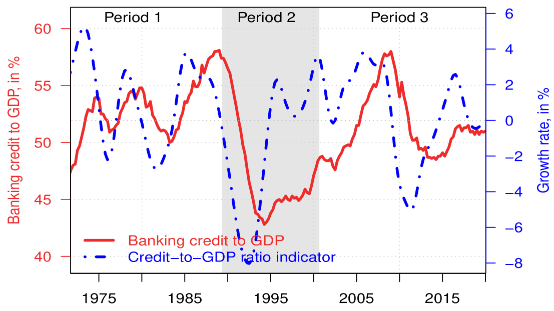

Fig. 3. Credit-to-GDP ratio in the US.

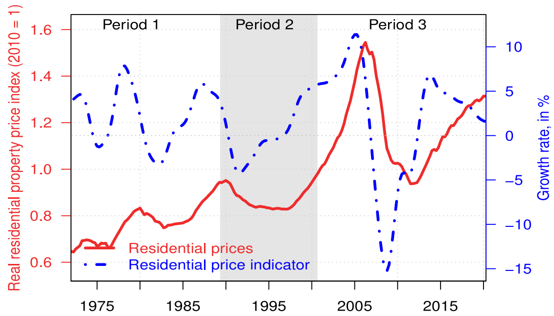

Fig. 4. Residential price in the US.

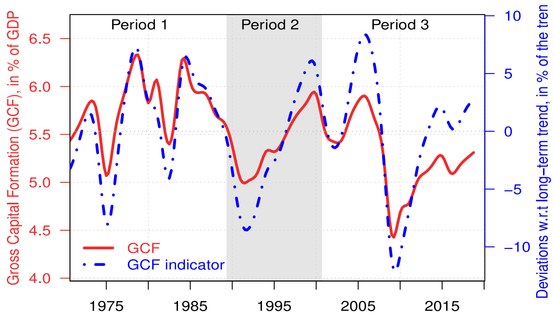

Fig. 5. GCF in the US.

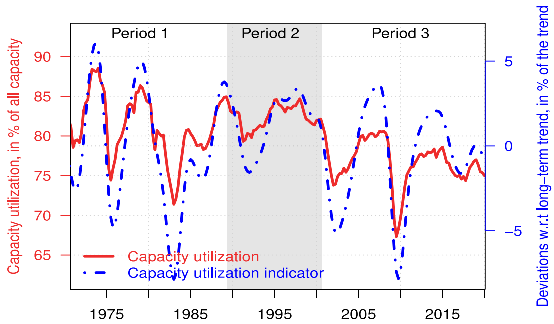

Fig. 6. Capacity utilization in the US.

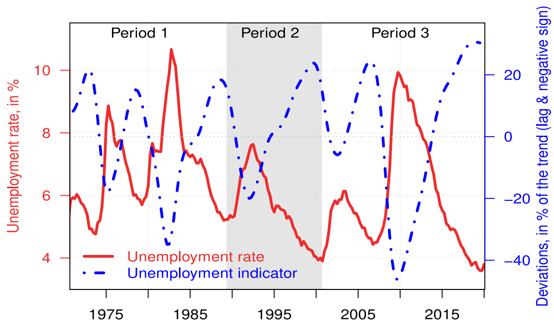

Fig. 7. Unemployment rate in the US.

respectively exhibit these variables in 2020 US dollars and the medium-term growth rates used to build the financial cycles for the US. These figures display some periods of important increases in residential prices and private credit, as well as some periods of large contractions. Medium-term fluctuations between these macroeconomic variables bear strong concordances. Industrial cycles are constructed similarly, using medium-term deviations of GCF, capacity utilization, and unemployment rate.[17] Figs. 5–7 show these variables for the US. Likewise, large concordances between these three macroeconomic indicators can be observed.[18]

The financial and industrial cycles for each country are the mean of their three respective subcomponents. They are exhibited in Figs. 8–12 for the US, Japan, Germany, the UK and France. High correlations between financial and industrial cycles indicate a sizeable concordance between the financial and industrial macroeconomic characterizations (particularly for the US). These high correlations confirm the relevance of jointly analyzing the two medium-term cycles as well as the need to differentiate their effects.[19]

To construct univariate indicators for all center leader countries, financial cycles (resp. industrial cycles) are estimated by computing the weighted average of financial (resp. industrial) cycles of the center leader countries. The weights are based on the

[17] Although the employment rate is more in line with the other two indicators and the development of productive capacity in the industrial sector than the unemployment rate, I use the latter because of its greater availability of data (notably for Japan and Germany).

[18] Industrial cycles exhibit distinct characteristics from conventional business cycles, which capture shorter-term fluctuations of real GDP around a longer-term growth trend. Statistical filters targeting business cycles focus on frequencies between one and eight years (e.g., Artis, Chouliarakis, & Harischandra, 2011; Jordà, Schularick, & Taylor, 2017). In contrast, industrial cycles operate at lower frequencies, spanning eight to 15 years, and capture fundamental changes in investment rates and factor utilization patterns across productive sectors in center economies.

[19] This joint analysis is crucial, as previous studies may have drawn incorrect conclusions by overlooking this relationship. The differentiation of effects relies primarily on data from Japan and the United Kingdom (UK), whose medium-term cycles are least synchronized among center countries.

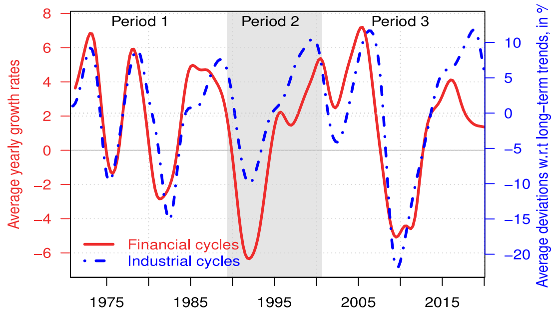

Fig. 8. Cycles in the US.

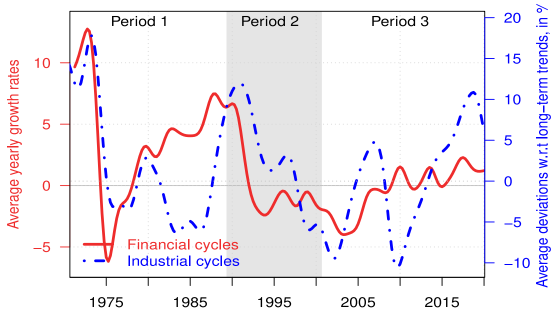

Fig. 9. Cycles in Japan.

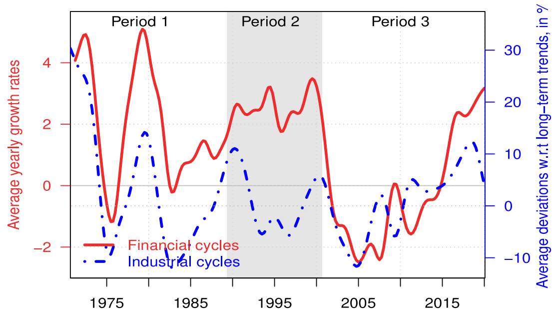

Fig. 10. Cycles in Germany.

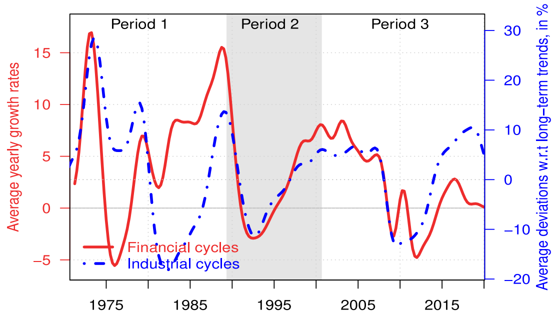

Fig. 11. Cycles in the UK.

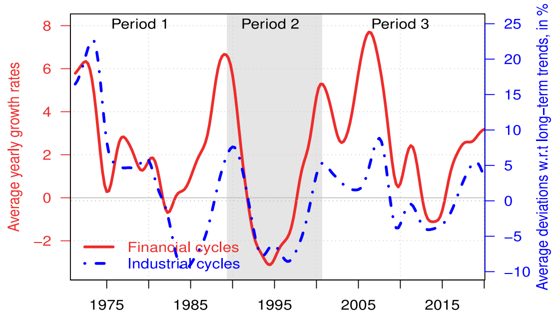

Fig. 12. Cycles in France.

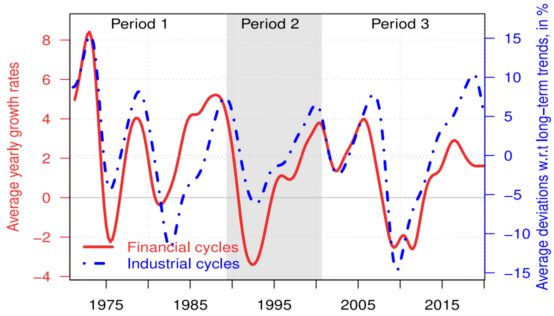

Fig. 13. Cycles in center leader countries.

average values of the current GDPs for 1971–2020. Fig. 13 displays the financial and industrial cycles. A high degree of concordance is noted; periods of industrial overcapacity match, to a significant extent, periods of medium-term financial distress. CLIF cycles are then constructed as the mean of the standardized values of these financial and industrial cycles of the center leader countries to avoid giving different weight to financial and industrial dynamics. The univariate indicator is represented in Fig. 1. The estimate signals five large drops in the activities of the center leader countries' financial and industrial sectors. The first two appear during the first period and reveal the impact of the 1973 first oil shock and the 1979 Volcker monetary shock. The third period of overcapacity and financial difficulties in center leader countries happened at the beginning of the 1990s, marked by the burst of the Japanese bubble and recessions in the US and Europe. The fourth drop is much smaller and partially caused by the burst of the dot-com bubble at the beginning of the 2000s. The 2007–09 Global Financial crisis is the cause of the last large plunge.

2.5.2. *Financial flows*

Financial inflows to semi-periphery countries are estimated using the IMF's Balance of Payments and International Investment Position dataset. Four key measures are utilized: (1) financial account flows, (2) net portfolio investments, (3) short-term investments (portfolio investments plus other investments), and (4) FDI flows. The short-term investments measure is most relevant for this study, aligning with the model in Section 2.2.[20]

[20] Other investments are particularly important for the first period (Peeters & Defraigne, 2023). Notably, they allow the inclusion of large bank loans. Net financial derivatives (other than reserves) and employee stock options are less important. Results are not significantly affected by the inclusion or exclusion of this category of financial products. The baseline results do not incorporate them in the category "short-term investments".

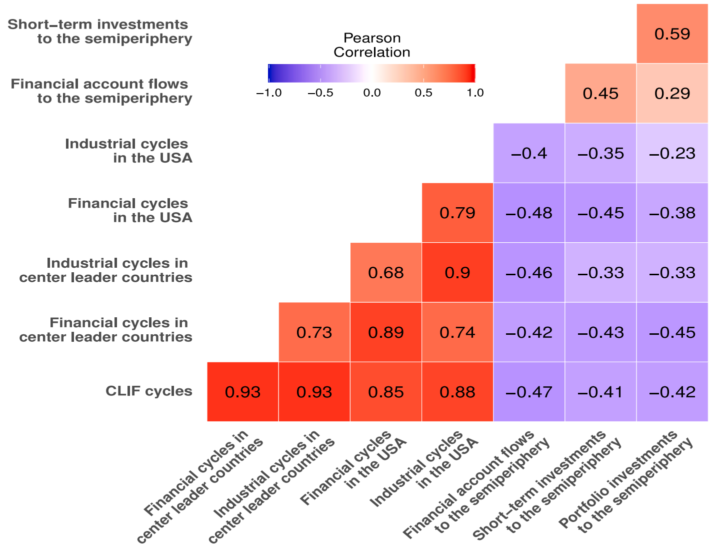

Fig. 14. Correlations and countercyclicity between financial flows and CLIF cycles.

2.5.3. *Independent variables*

The baseline estimations include country fixed effects and three groups of independent variables:

1. Demographic data from World Bank, United Nations (UN) Population Division, and Penn World Table databases.
2. Economic variables from World Bank, Penn World Table, Barro-Lee Dataset, Our World in Data, Historical National Accounts, OECD, EUKLEMS, 10 sector database, Economic Transformation Database, and World Input–Output Database. This second category (economic regressors) contains data that are available for a larger number of semi-periphery countries, of better overall quality, and less likely to be directly affected by the CLIF cycles. These data include estimates of a natural rent index, real GDP per capital, value added of agriculture, hunting, forestry and fishing in the GDP (in %), a human capital and education index.
3. This third category contains additional economic variables from the same sources. These extended economic regressors contains estimates of the gross capital formation, percentage of gross capital formation in GDP, value added of industry in GDP (in %), value added of the manufacturing sector in GDP (in %), electricity consumption per capita, real GDP, GDP in PPP. The difference with the second group of variables relies on the economic nature as well as the quality and availability of data.

To mitigate endogeneity bias, independent variables that could evolve pro- or counter-cyclically with CLIF cycles are smoothed using the Nadaraya–Watson estimator. For missing data, a multiple imputation technique is implemented.[21]

2.6. *Empirical results*

Hypothesis 1 posits that the CLIF cycles induce a pattern of countercyclical international financial inflows to semi-periphery countries. At the aggregate level, Fig. 14 displays the Pearson's correlations between indicators for financial flows and medium-term cycles. The major components of the CLIF cycles exhibit high correlations with each other. Importantly, substantial and significant negative correlations are observed between the estimates of financial flows and those of medium-term cycles. The highest p-value associated with all these correlations is below 0.2%. Financial cycles demonstrate a slightly more negative correlation with financial flows, particularly for portfolio investments.[22]

While aggregate results corroborate Hypothesis 1, more granular estimates based on the identification strategy introduced in Section 2.4 are necessary. Table 2 presents the estimates of DGP 1's parameters (Eq. (6)). Columns 2 and 4 provide estimates of β^A, while Columns 3 and 5 decompose the CLIF cycles into industrial and financial components. In Columns 4 and 5, the CLIF cycles are weighted by the GDPs of the semi-periphery countries (A_t is replaced by $GDP_{nt} \times A_t$ in Eq. (6)). As a visual illustration, Column 2 corresponds to a simulation schematized by the left-hand side of Fig. 15 when the CLIF cycles, A_t, influence similarly every semi-periphery country and act like a global factor. By contrast, Column 4 weights the influence of the global factor by the

[21] This method reduces the risk of bias compared to listwise deletion, as argued by Honaker, King, and Blackwell (2011).

[22] The aggregate-level analysis assumes that cross-country investments within the semi-periphery cancel each other out, allowing the aggregate indicators to estimate financial flows to the semi-periphery from the rest of the world. See Appendices C.3 and C.4 for details, including for other center leader countries.

Table 2
Estimates of DGP 1 for semi-periphery countries with short-term flows.

	CLIF cycles		GDP-weighted CLIF cycles	
A_t	-83.4** (0.024)		-72.4** (0.012)	
A_t^{fin}		-274** (0.013)		-212*** (2.2e-05)
A_t^{ind}		155** (0.016)		121*** (3.7e-05)
CFE	Yes	Yes	Yes	Yes
TFE	No	No	No	No
Regressors	DeEcEx	DeEcEx	DeEcEx	DeEcEx
R^2	0.068	0.085	0.085	0.14
Log-likelihood	-57019	-56957	-56958	-56730
N	6838	6838	6838	6838

A_t refers to the CLIF cycles and A^{fin} (respectively A_t^{ind}) represents an average of the medium-term financial (resp. industrial) cycles of the center leader countries. Financial flows considered here are portfolio investments and other investments in the balance of payments (to incorporate bank loans). GDP-weighted CLIF cycles indicates that the medium-term cycles on these columns are multiply by the real GDP of the economies that they are impacting, to capture of the size of these economies. CFE and TFE respectively stands for country and time fixed effects. DeEcEx indicates that demographic and extended economic regressors are used as control variables.
The main observation from this table is that the medium-term cycles, driven by the financial components, are negatively correlated to financial inflows in semi-periphery countries. The industrial cycles tend to produce procyclical inflows. Yet the magnitude of this effect is not as large as the countercyclicity from the financial cycles.

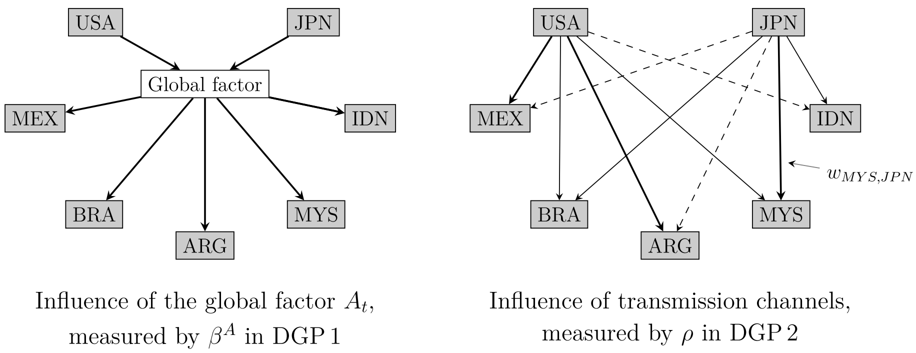

Fig. 15. Schematic of the difference between the estimations of DGPs 1 and 2.
The left-hand side of the figure represents the overall influence of the CLIF cycles such as modeled as a global factor in DGP 1. The estimate of the parameter β^A informs on this global influence. The right-hand side of the figure exhibits a similar schematic for DGP 2 where the global influence is captured by time fixed effects and the estimation aims to assess the influence through various transmission channels by estimating ρ. The thicknesses of the links indicate how large the effect is. Dashed links are even weaker.

GDP of the affected semi-periphery country (e.g., different thickness in the connections) to incorporate that, everything being equal, a large economy should receive more financial inflows.

The results in Columns 2 and 4 support Hypothesis 1. The coefficients are negative and significant (p-values around 2 %). The decomposition in Columns 3 and 5 reveals that financial and industrial cycles exert different influences. Financial cycles trigger countercyclical inflows to semi-periphery countries, with dynamics dominated by a substitution effect. As explained in Section 2.2, this can be interpreted as medium-term capital reallocations by investors who are relatively more attracted to investing in semi-periphery countries when expected returns in center leader countries are lower. Conversely, industrial cycles promote procyclical inflows to semi-periphery countries. This procyclical effect may be attributed to semi-periphery exports being more severely impacted by downturns in industrial cycles than financial cycles, deteriorating their balance-of-payment situation and overall attractiveness to investors. Another explanation is that investors in the center may be more inclined to finance efficiency-searching investments, new projects, and diversify their portfolios in the semi-periphery economies when unemployment in the center is lower, wages are higher, and facilities are operating at full capacity. Alternatively, industrial cycles might also correlate more strongly with the volume effect, leading to procyclicality. Given that the countercyclical effect of the financial cycles exceeds the procyclical effect of the industrial cycles, and due to their important synchronicity, the global factor measured by A_t induces countercyclical financial inflows to semi-periphery countries.[23]

Negative shocks to center countries are often viewed as leading to significant negative effects on net financial flows to semi-periphery countries, as international investors repatriate funds from the semi-periphery in response to these shocks. For instance, Shim and Shin (2021) assert that financial stress in lender countries (mostly center economies) is a "more important driver than the local financial conditions and macroeconomic fundamentals" of semi-periphery countries in explaining banking outflows. However, the findings of this study support that, on average, more funds are invested in the semi-periphery during the downward phases of the CLIF cycles. Two explanations merit consideration regarding this apparent paradox. First, local investors may play a stabilizing role, offsetting the retrenchment of foreign investors (Adler, Djigbenou, & Sosa, 2016). Second, the difference could stem from distinct temporal interpretations. Indicators of global factors, including medium-term cycles, are typically strongly correlated with one another (Tian, Jacobs, & de Haan, 2022). However, the definition of "shocks" tends to overweight short-term fluctuations (e.g., corporate bond spread) to enable identification when using shorter sample periods. This study focuses on medium-term components. Thus, these two effects could coexist and affect net financial flows in opposite directions over different time spans.

Beyond the effects of the CLIF cycles, our results reveal that financial flows to semi-periphery economies are influenced by structural characteristics as well. Human capital development (education and human capital indexes) strongly attracts financial inflows, while higher GDP levels are associated with lower marginal net inflows, consistent with the Lucas paradox. Countries with higher GCF consistently receive more foreign capital, suggesting complementarity between domestic and foreign investment. Demographic patterns and structural economic composition also influence flows, though with varying significance and sign across different financial flow types and model specifications.

3. Multipolar model and transmission channels

This section develops a N-country model and discusses the transmission channels through which the CLIF cycles impact financial flows to semi-periphery countries.

3.1. Multipolar model

Rather than considering the center and semi-periphery as homogeneous blocks, this model considers N_c center and N_s semi-periphery economies, with $N = N_c + N_s$. For simplicity, η_i is assumed to be zero. The model incorporates multiple components of the CLIF cycles, noted A_{mt} for the center country m. To capture network effects, two proximity weights, u_{nit} and v_{nit}, are associated with each investor-country pair. These weights model the economic ease and confidence of investor i regarding investments in country n. u_{nit} acts as a multiplicative factor of expected returns and v_{nit} divides the risk coefficient σ_{nit}. Both are modeled such that an increase in either weight raises the optimal investment share to the semi-periphery country n, noted θ^*_{nit}. These proximity weights are the products of several intertwined differences in the valuation of the investment location. Cognitive biases affect the attractiveness of a country for an investor regardless of the objective macroeconomic conditions (e.g., political risks). Linguistic and cultural proximity, differences of legal systems and business practices, are elements that affect these weights. Economic interconnection and integration (e.g., through exchanges, decrease in transaction cost, common technological standards, outsourcing and industrial integration, monetary cooperation, currency peg, trade and investment agreements, capital control policies) also alter these coefficients.

In this multipolar model, an investor i determines the investment share for each of the N countries to maximize return while minimizing risk. With $\theta^*_{it} = \{\theta^*_{nit}\}$ and S_c (resp. S_{sp}) the set of indexes for the N_c center (resp. N_{sp} semi-periphery) economies and $S_T = \{1, 2, \dots, N\}$, the optimization problem is expressed as:

$$\theta^*_{it} = \arg\max_{\theta_{it}} \underbrace{\sum_{n\in S_T} \theta_{nit} u_{nit} r_{nit}}_{\text{expected return}} - \underbrace{\frac{\lambda_i}{2} \sum_{n\in S_T} \frac{\sigma_{nit}\theta^2_{nit}}{v_{nit}}}_{\text{risk function}}, \tag{8}$$

with $r_{nit} = \kappa_{nit} + f(A_{nt})$ for center economies ($n \in S_c$) and $r_{nit} = \kappa_{nit} + \sum_{m\in S_{sp}} \epsilon_{nm} f(A_{mt})$ for semi-periphery economies ($n \in S_{sp}$) subject to $\sum_{n=1}^{N} \theta_{nit} = 1$. Assuming no binding constraint, the optimal allocation in the semi-periphery country n is given by[24]:

$$\theta^*_{nit} = \frac{v_{nit}}{\lambda_i \sigma_{nit}} \left\{ \lambda_i + u_{nit}\kappa_{nit} - \overline{\kappa}_{it} + \sum_{m\in S_c} \omega_{nimt} f(A_{mt}) \right\}, \tag{9}$$

where $\overline{\kappa}_{it} = \sum_{k\in S_T} \frac{v_{kit}u_{kit}}{\sigma_{kit}} \kappa_{kit}$ is the proximity-weighted mean of the independent-of-the-CLIF terms of the returns, and $\omega_{nimt} = u_{nit}\epsilon_{nm} - \overline{\epsilon}_{imt} - \frac{v_{mit}u_{mit}}{\sigma_{mit}}$ is the impact factor of the medium-term cycles in the center country m on the investment share in the semi-periphery country n.[25] In this relation, $\overline{\epsilon}_{imt} = \sum_{k\in S_{sp}} \frac{v_{kit}u_{kit}}{\sigma_{kit}} \epsilon_{km}$ is the proximity-weighted mean of the direct impact of the

[23] Although less significant, estimates for the influence of the industrial cycles alone indicate a countercyclical effect. The procyclical impact is observed only when estimated with financial cycles, i.e., when measuring the marginal influence of industrial cycles.

[24] See Appendix B.3 for the demonstration and discussion with and without binding constraints.

[25] For center economies, Eq. (9) holds with $\omega_{mimt} = u_{mit} - \overline{\epsilon}_{imt} - \frac{v_{mit}u_{mit}}{\sigma_{mit}}$ and $\omega_{nimt} = -\overline{\epsilon}_{imt} - \frac{v_{mit}u_{mit}}{\sigma_{mit}}$, $\forall\ n \neq m$.

medium-term cycles in the center country m on the semi-periphery. We can note that ω_{nimt} (respectively $u_{nit}\kappa_{nit} - \overline{\kappa}_{it}$) increases with ϵ_{nm} (resp. κ_{nit}). Using matrix notations, ω_{nimt} can be viewed as components of a transmission channel matrix (TCM) between the investment shares for each semi-periphery countries, $\theta^*_{it} = (\theta^*_{1it}, \theta^*_{2it}, \dots, \theta^*_{N_s it})'$, and the vector of the medium-term cycles in center economies, $(f(A_{1t}), f(A_{2t}), \dots, f(A_{N_c t}))'$.

This solution generalizes Eq. (3). As in the two-country model, everything else being kept equal, the optimal share of investment in a semi-periphery country θ^*_{nit} is likely countercyclical with CLIF cycles (i.e., $\omega_{ni..} < 0$ if $\epsilon_{n.}$ are not too large and positive), decreases with the estimated risk σ_{nit}, and increases with the average expected returns relative to the other countries ($u_{nit}\kappa_{nit} - \overline{\kappa}_{it}$). For a highly risk-averse investor i (i.e., $\lambda_i \gg f(A_{mt})$, $u_{nit}\kappa_{nit}$, and $\overline{\kappa}_{it}$), the share of investment approximates $\theta^*_{nit} \approx \frac{\upsilon_{nit}}{\sigma_{nit}}$, with the risk assessment between the different countries (weighted by υ_{nit}) as the main driver. An increase in either proximity weight, υ_{nit} or u_{nit}, raises the investment share θ^*_{nit}. These weights also influence the impact of changes in the CLIF cycles; for instance, a decrease in υ_{nit} reduces $\frac{\partial \theta^*_{nit}}{\partial A_{mt}}$, $\forall\, m$.

The solution reveals several heterogeneities that can lead to different sensitivities to the CLIF cycles, primarily resulting from heterogeneities in macroeconomic sensitivity of returns (ϵ_{nm}) and proximity weights (υ_{nit} and u_{nit}) within the semi-periphery. First, macroeconomic variables of some semi-periphery countries may be highly procyclically sensitive to medium-term cycles in one or several center economies (i.e., large ϵ_{nm} for some m), leading to a procyclical increase in θ^*_{nit}. Conversely, other semi-periphery economies with more independent domestic markets (small ϵ_{nm}) would receive a larger investment share during downward phases of the CLIF cycles, as ω_{nimt} would be negative ($\forall\, i,\ m$). Interestingly, even for a semi-periphery country n with returns independent of the CLIF cycles ($\epsilon_{nm} = 0,\ \forall\ m$), the investment share will still depend on these cycles. This occurs because such a country serves as a substitute for (i) other semi-periphery countries whose macroeconomic returns are impacted by the CLIF cycles and (ii) center countries whose returns are directly altered by these medium-term cycles. Second, substantial heterogeneities can arise due to differences in proximity weights between countries. For instance, if proximity weights for Mexico are zero for all non-American investors (i.e., $u_{n^{MEX},i,t} = 0$ and $\upsilon_{n^{MEX},i,t} = 0\ \forall\ i \notin I_{USA}$), only American investors would invest in Mexico. Conversely, if American investors ($i \in I_{USA}$) have much higher and similar preferences for investing in the US or Mexico than other countries, they will only invest in these two countries.[26] Interestingly, even in this specific context, the investment share by American investors to Mexico depends on the CLIF cycles of all center economies due to their impact on macroeconomic returns in Mexico through the terms ϵ_{nm}. If we assume that all American investors have similar expectations and preferences such that $u_{n^{MEX},i^{USA},t} = u_{n^{USA},i^{USA},t} = u_t$ and $\upsilon_{n^{MEX},i^{USA},t} = \upsilon_{n^{USA},i^{USA},t} = \upsilon_t$, the optimal investment share by American investors to Mexico becomes:

$$\theta^*_{n^{MEX},i^{USA},t} = \frac{\upsilon_t}{\lambda\sigma_{n^{MEX},t}} \left\{ \lambda + \frac{\upsilon_t}{\lambda\sigma_{n^{MEX},t}} u_t \left(\kappa_{n^{MEX},t} - \kappa_{n^{USA},t}\right) + \sum_{m \in S_c} u_t \epsilon_{n^{MEX},m} \left(1 - \frac{\upsilon_t}{\sigma_{n^{MEX},t}}\right) f(A_{mt}) \right\}.$$

This expression shows how investment decisions remain influenced by all center economies' cycles through the $\epsilon_{n^{MEX},m}$ terms, even under simplified preferences. Importantly, in practice, the proximity weights u_{nit} and υ_{nit} and the macroeconomic sensitivities ϵ_{nm} are not independent of each other. Rather, they likely depend on the level and nature of economic integration, which is why assessments in Section 3.4 rely on several economic networks.

A global and regional influence of the CLIF cycles on financial investments to semi-periphery countries emerges from Eq. (9). This can be highlighted by assuming three simplifications:

1. The function f is a linear operator.
2. The CLIF cycles can be decomposed into two components: $A_{mt} = A_t + \tilde{A}_{mt}$ with A_t a global factor common to all center economies and $\tilde{A}_{mt}$ a "purely domestic" component, where $\tilde{A}_{mt} \perp\!\!\!\perp \tilde{A}_{nt}$, $\forall\ n \neq m$.
3. The level of investment is constant for each investor, noted q_i.

The influence of the A_{mt} on the financial flows ($\phi_{nt} = \sum_i q_i \theta^*_{nit}$) is the sum of the influence of a global factor and a regional influence. The global factor, noted Ω^{GF}_{nt}, becomes the sum of the components of the transmission channel matrix (TCM) for all investors multiplied by their investments. We have $\sum_i q_i \sum_{m \in S_c} \omega_{nimt} f(A_{mt}) = \Omega^{GF}_{nt} f(A_t) + \sum_{m \in S_c} \Omega_{nmt} f(\tilde{A}_{mt})$ with $\Omega_{nmt} = \sum_i q_i \omega_{nimt}$. This suggests that the global factor has a different impact on different semi-periphery countries, depending on their overall macroeconomic sensitivity to the medium-term cycles ($\sum_m \epsilon_{nm}$) and the proximity weights of the largest investors.[27] The regional influence emerges from the observation that Ω^{GF}_{nt} no longer depends on ϵ_{nm}, making the domestic components $\tilde{A}_{mt}$ the only channels through which the CLIF cycles create differentiated macroeconomic impacts due to diverse macroeconomic links with the center and semi-periphery economies.

[26] That is $u_{n,i^{USA},t} \gg u_{p,i^{USA},t}$ and $\upsilon_{n,i^{USA},t} \gg \upsilon_{p,i^{US},t}$, $\forall\, n \in \{n^{MEX}, n^{USA}\}, p \notin \{n^{MEX}, n^{USA}\}$.

[27] For example, assuming that all major investors have similar proximity weights and expectations and that their total investment is unchanged ($q_{it} = \tilde{q}_{it}$), the differential between the impact of a change in the global factor A_t between two semi-periphery countries n_1 and n_2 is given by $\frac{\partial}{\partial A_t}\left(\theta^*_{n_1,t} - \theta^*_{n_2,t}\right) = \frac{\upsilon_{n_1,t}u_{n_1,t}}{\lambda\sigma_{n_1,t}} \sum_m \epsilon_{n_1,m} - \frac{\upsilon_{n_2,t}u_{n_2,t}}{\lambda\sigma_{n_2,t}} \sum_m \epsilon_{n_2,m}$. For similar proximity weights ($\upsilon_{n_1,t} = \upsilon_{n_2,t}$ and $u_{n_1,t} = u_{n_2,t}$) and risk valuation ($\sigma_{n_1,t} = \sigma_{n_2,t}$), if $\sum_m \epsilon_{n_1,m} > \sum_m \epsilon_{n_2,m}$, a drop in A_t would lead to a larger decrease (or lower increase) in funding to country n_1 than n_2 because of its macroeconomic sensitivity to the global factor. Likewise, for similar macroeconomic sensitivity ($\sum_m \epsilon_{n_1,m} = \sum_m \epsilon_{n_2,m}$) and risk valuation ($\sigma_{n_1,t} = \sigma_{n_2,t}$), if large investors prefer to invest in country n_1 (so that $\upsilon_{n_1,t}u_{n_1,t} > \upsilon_{n_2,t}u_{n_2,t}$), a drop in the global factor A_t would lead to a larger decrease (or lower increase) in funding to country n_1 than n_2 because of the preferences of major investors.

3.2. Methodology

A DGP enabling assessment of additional impacts of CLIF cycles on international investments can be derived from the N-country model. Based on Appendix B.2, the amount invested by investor i behaves procyclically with A_{mt} to reflect the dynamics of the volume effect: $q_{it} = \tilde{q}_{it} + \sum_{m \in S_c} g_{imt}(A_{mt})$.[28] After a linearization of components depending on the CLIF cycles, financial investments to semi-periphery country n in the N-country model can be expressed as:

$$\phi_{nt} \simeq \sum_{i} \tilde{q}_{it} \xi_{nit} + \sum_{m \in S_c} w^*_{nmt} A_{mt}, \tag{10}$$

with ξ_{nit} the share of investments in absence of the CLIF cycles and w^*_{nmt} the first-order weights characterizing the influence of the CLIF cycles.[29]

The exact shape of the transmission channel matrix (TCM) – noted W^*_t and composed of the weights w^*_{nmt} – is unknown. Thus, an approach is to estimate the transmission channels by modeling them as a linear combination of various potential known channels, noted W_t, which is unknown as well but composed of different known TCMs, noted W^k_t: $W_t = \sum_{k=1}^{K} a_k W^k_t$, with $\sum_{k=1}^{K} a_k = 1$, where a_k represents relative weights. Each matrix W^k_t is normalized so that $\sum_{nm} w^k_{nmt} = N_s$, $\forall\, t,\ k$ with N_s the number of semi-periphery countries.

Assuming various potential transmission channels linking semi-periphery to center countries are known, we can test the relative influence of each channel and whether they reflect an overall procyclical or countercyclical influence on financial investments. Specifically, we can assume the following DGP:

$$\text{DGP}\,2\,:\, \phi_{nt} = \alpha_n + \tau_t + \rho \sum_{m \in S_c} w_{nmt} A_{mt} + \beta X_{nt} + \varepsilon_{nt}, \tag{11}$$

where τ_t is the unknown time fixed effect for the period t, A_{mt} is an estimator of medium-term cycles in the center country m, w_{nmt} is a component of W_t weighting the influence of the medium-term cycles from the center country m on the semi-periphery country n, and coefficient ρ represents the overall influence of CLIF cycles through different TCMs.[30]

The difference between identification using DGPs 1 or 2 is schematized in Fig. 15. On the left-hand side, β^A estimates the overall intensity and direction (procyclical or countercyclical) of the impacts of CLIF cycles as modeled by a global factor, A_t. On the right-hand side, the pattern of interaction is more complex and is modeled by different weights, w_{nmt}. A small positive value of w_{nmt} relative to w_{lmt} indicates that the influence of the center country m (e.g., Japan on the figure) is smaller on the semi-periphery country n (e.g., Argentina) compared to the semi-periphery country l (e.g., Malaysia), represented by the weight $w_{MYS,JPN}$.

To test the influence of various transmission channels, this analysis relies on assumptions A1–A4 discussed in Section 2.4. An additional assumption is required to apply the empirical strategy. It refers to the TCMs which model the networks of influence of the CLIF cycles in Eq. (11):

Assumption 5 (*A*5)**.** W_t is (i) exogenous, and (ii) can be approximated based on macroeconomic bilateral data.

The exogeneity of W^k_t is crucial for correct estimation of a_k and ρ. This condition is likely to be respected as the study focuses on short-term financial flows while incorporate long-term connections between countries to model W^k_t. The impact of the second part is common for econometric tests and difficult to assess.

Conditional to A1–5, estimates for DGPs 1 and 2 help empirically confirm hypotheses regarding the impacts of CLIF cycles on financial inflows to semi-periphery countries. The most important of which are formulated in Hypotheses 1 and 2 and summarized in Table 3. This table highlights the conclusions that can be deduced from the estimates of DGPs 1 and 2. Hypothesis 1 implies that a countercyclical substitution effect dominates the influence of CLIF cycles on short-term financial flows to the semi-periphery. This hypothesis is confirmed if β^A and ρ are significantly negative for DGP 1 and DGP 2 respectively.

The next testable hypothesis concerns the influence of transmission channels modeled in DGP 2:

Hypothesis 2 (*H*2)**.** The influence of a center country on the financial flows of a semi-periphery country increases with their of economic integration.

If this hypothesis is confirmed, strongly connected semi-periphery countries are relatively more affected by CLIF cycles than less connected economies.

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[28] See Sections 2.2 and 2.4 for more details. Based on Appendix B.2, I consider $\frac{\partial \tilde{q}_{it}}{\partial A_{mt}} = 0, \forall\, m,\ g_{imt}(0) = 0, \forall\, m,\ \frac{\partial g_{ilt}}{\partial A_{mt}} > 0, \forall\, m = l$ and $\frac{\partial g_{ilt}}{\partial A_{mt}} = 0, \forall\, m \neq l$.

[29] For conciseness, details on the steps leading to this DGP are provided in Appendix B.4. Based on Eq. (9), $\xi_{nit} = \frac{v_{nit}}{\lambda_i \sigma_{nit}} \left(\lambda_i + u_{nit} \kappa_{nit} - \overline{\kappa}_{it}\right)$ and $w^*_{nmt} = f'_m \sum_i \frac{\tilde{q}_{it} v_{nit}}{\lambda_i \sigma_{nit}} \left(u_{nit} \epsilon_{nm} - \overline{\epsilon}_{imt} - \frac{v_{mit} u_{mit}}{\sigma_{mit}}\right) + g'_{imt} \sum_i \xi_{nit}$. The first term in right-hand side of the relation for w^*_{nmt} refers to the substitution effect highlighted in Section 2.2. It is likely negative if ϵ_{nm} are not too large. The second term is positive and reflects the volume effect. The balance between the two effects determine whether the CLIF cycles have a procyclical or countercyclical influence on the financial flows.

[30] The parameter ρ does not incorporate the influence of the global factor which is included in the time fixed effect. To estimate the influence of a global factor, I considered alternative DGP which consists in DGP 2 without time fixed effects but with the term $\beta^A A_t$. This model is therefore less accurate to estimate specific channels of transmission through the parameter ρ, yet it enables to have a simultaneous estimation of the effects of spatial components, ρ, as well as a global factor, β^A. The results obtained with this specification are consistent with the claims of this study. It is also worth noting that a_k can be negative. This indicates that the effect associated with the specific TCM W^k_t is of different direction that the overall effect (through W^k_t). For example, for $K = 2$, if we have $a_1 = 1.2$, $a_2 = -0.2$, and $\rho = -5$, this indicates that the overall influence is countercyclical ($\rho < 0$) and $|\rho||$ informs us of the intensity of the overall effect. The major part of the influence goes through W^1_t ($|a_1| > |a_2|$). The CLIF cycles have (on average) a procyclical influence on countries well-connected to center economies through W^2_t because $a_2 < 0$.

Table 3
Summary of the main hypotheses and the empirical identification.

ρ \ β^A	−	+	?
−	confirm H1 and H2	procyclical, yet countercyclical for highly connected economies, invalidate H2	confirm H1 only for specific channels, confirm H2
+	countercyclical, yet procyclical for highly connected economies, invalidate H2	invalidate H1, but confirm H2	
?	confirm H1 only for a global factor	invalidate H1	do not confirm or invalidate H1 nor H2, but support small effects

3.3. Transmission channel matrix

The identification strategy requires specifying *a priori* a network structure connecting semi-periphery and center leader countries to build a reasonable and exogenous TCM that likely respects A5. This network structure must approximate long-term peer relationships, evolve over time to capture long-term changes in the global economy, reflect economic interdependencies indicating investor preferences and interests, and include a large set of semi-periphery countries over an extended period. The baseline estimates for DGP 2 employ a linear combination of four matrices based on financial connections, trade flows, geographic proximity, and currency composition of external debts.

To build a TCM reflecting financial connections, noted W_t^{fin}, data from the World Bank International Debt Statistics (IDS) database on annual external debt stocks and flows data are used. As a benchmark, I used the annual public and publicly guaranteed (PPG) disbursements on aggregated long-term (original or extended maturity of more than one year) total external debt by semi-periphery countries in US dollars. The two major benefits of using the disbursements as well as PPG information are that data is available for almost all semi-periphery countries (all included in the IDS database) and is more reliable than other alternatives (non-PPG transfers, commitments, etc.). A trade-based TCM, noted W_t^{trade}, is computed using data on gross bilateral international trade positions at an annual frequency obtained from the International Trade Statistics UN Comtrade dataset. Several advantages arise from the use of international trade as a measure of economic proximity. International trade is a widely used proxy for capturing economic integration and building interaction networks (e.g., Dées & Galesi, 2021; Gygli, Haelg, Potrafke, & Sturm, 2019). Trade flows are stable and appropriately characterize structural interaction networks based on economic integration. The UN Comtrade dataset offer comprehensive coverage of semi-periphery countries over a long period of time, enabling us to build of a TCM to estimate a relevant spatial coefficient ρ_t. Interestingly, external debt disbursement and international trade data are dynamic and therefore enable us to incorporate long-term changes in the global economy, which is of particular relevance given that the time span of the empirical analysis is around 50 years.[31]

A static geographic or distance-based proximity matrix, noted W^{geo}, is constructed using the inverse distances between country capitals. The currency composition matrix, noted W_t^{cur}, reflects the percentage of external debt contracted in various currencies, based on IDS data. The more the external debt is contracted in a currency, the stronger the link is between the semi-periphery country and the issuer of the currency. Importantly, distances between countries and the percentage of external debt in a currency do not mirror the respective economic size of the semi-periphery economies involved in the estimation process. This contrasts with financial and trade transactions, which are larger for larger economies. Thus, each row of W_t^{geo} and W_t^{cur} are multiplied by the respective semi-periphery countries' real GDP (normalized so that the sum of the matrix is not altered).[32] The coefficients w_{nmt} introduced in Eq. (11) (DGP 2) are linear combinations of these matrices: $W_t = a_1 W^{fin} + a_2 W^{trade} + a_3 W^{geo} + a_4 W^{cur}$ where the magnitude of a_i indicates the intensity of the transmission channel i, and its sign whether this influence reinforces ($a_i > 0$) or decreases ($a_i < 0$) the overall influence (determined by ρ).

An appropriate normalization strategy of the TCMs is crucial to properly implement this identification strategy. Two common practices exist in the spatial econometric literature to determine appropriate normalization. The first considers a *row-normalized* TCM,

[31] These arguments reflect those introduced in Peeters and Girad (2025) where trade flows are contrasted with financial flows for the identification of international monetary policy interest spillovers. I do not use in this study any TCM based on aggregate financial flows because bilateral data for such transactions or connections are of relatively poorer quality in contrast to those introduced here. In addition, using financial flows to build the TCM would lead to endogenous issues in this specification. See the reference for comments.

[32] Based on a unique-scaling factor normalization (see below), the formal definitions of the two TCMs used in the baseline scenarios are:

$$w_{mnt}^{geo} = \frac{\mathrm{GDP}_{nt}}{\frac{1}{\bar{N}_s}\sum_{i=1}^{\bar{N}_s}\mathrm{GDP}_{it}}\left[\frac{1/\mathrm{dist}(n,m)}{\frac{1}{\bar{N}_s}\sum_{k=1}^{\bar{N}_s}\sum_{l=1}^{5} 1/\mathrm{dist}(k,l)}\right] \quad \& \quad w_{mnt}^{cur} = \frac{\mathrm{GDP}_{nt}}{\frac{1}{\bar{N}_s}\sum_{i=1}^{\bar{N}_s}\mathrm{GDP}_{it}}\left[\frac{\mathrm{share}(n,m)}{\frac{1}{\bar{N}_s}\sum_{k=1}^{\bar{N}_s}\sum_{l=1}^{5}\mathrm{share}(k,l)}\right], \tag{12}$$

where $\mathrm{dist}(n,m)$ is the distance between the semi-periphery country n and the center leader country m and $\mathrm{share}(n,m)$ corresponds to the percentage of external long-term PPG debt contracted by the semi-periphery country n in the national currency of the center leader country m.

W_t^r, such that $\sum_{l=1}^{N_c} w_{klt}^r = 1,\ \forall\ k \in \{1,\dots,N_s\}$. In other words, the sum of row connections is equal to one at each period of time for each country. The second approach is the *unique-scaling factor normalization* strategy, which consists of dividing the unnormalized spatial weighting matrix W_t^* (defined by international trade flows) by a scale scalar.[33] This study adopts a unique-scaling factor normalization rather than row normalization for three main reasons. The row normalization strategy (i) creates distortions in the "structure" (or shape) of the TCM, and (ii) these distortions are likely to be different for every time period for dynamic matrices (that is W_t^{fin}, W_t^{trade} and W_t^{cur}).[34] These distortions are particularly important as the aim of the study is to assess the global impact of the CLIF cycles on international pattern of financial flows. A row-normalization would overweight very small economies by "forcing" the impact to be equal for every semi-periphery country, while the unique-scaling factor normalization is deduced by relative economic relations which better reflect their economic importance. In addition, the normalization imposes $\sum_i \sum_j w_{ijt} = N_s$ to ensure comparability between the overall effect of A_t and the effect of the products with a TCM (e.g., $W_t^{trade} A_t$).

To mitigate potential endogeneity bias from time-varying TCMs, the matrices are smoothed to model only long-term relations, excluding medium-term fluctuations. Following arguments by Wang, van Lelyveld, and Schaumburg (2019) on how different temporal paces can reduce endogeneity risks in time-varying TCMs, this approach suggest that A5 is reasonable.

3.4. Empirical results

The results of the estimation of DGP 2 are provided in Table 4. These findings corroborate Hypothesis 1 as they confirm that the influence of the CLIF cycles through various transmission channels (estimated by W_t^{fin}, W_t^{trade}, W_t^{cur} and W_t^{geo}) lead to an overall countercyclical effect. The sum of all significant coefficients estimating the parameter ρ in Eq. (11) is negative. For a 10% significance threshold, the sum equals -76, -91, -63, and −92 for the four columns respectively. Therefore, the results confirm the dominance of a substitution effect, through a global influence and through a set of weighted interactions representing economic connections.

Tables 2 and 4 support that β^A and ρ are both significant and negative. Based on Table 3, these results not only confirm Hypothesis 1 but also corroborate Hypothesis 2. Table 2 indicates that the dominant effect is a countercyclical substitution effect. Table 4 shows that the more connected a semi-periphery country is, the larger is this countercyclical substitution effect. Moreover, the table highlights three effects worth detailing. First, financial connections tend to promote a countercyclical effect while trade relations might "compensate" this trend and lead to procyclical dynamics for semi-periphery countries with very high level of trade openness and integration with the center economies. Second, financial cycles tend to produce countercyclical inflows to the semi-periphery while industrial cycles tend to attenuate the effect or lead to a procyclical effect on financial inflows. Interestingly, the results suggest that the overall influence is primarily driven by financial cycles. The coefficients for industrial cycles are not very significant (nor as robust as those for financial cycles).[35] Third, the two most important channels through which CLIF cycles seem to interfere with the financial flows to semi-periphery countries are financial and trade connections. The currency composition of the external debts does not appear to be a major channel. Regarding geographical influence, the results are not conclusive.[36]

4. Heterogeneities across countries and financial flows

This section discusses differences in the effects of the CLIF cycles on patterns in international financial flows for various categories of countries and types of financial flows.

4.1. FDIs and portfolio investments

The first hypothesis concerns the presence of a heterogeneous influence of the CLIF cycles on various categories of financial flows:

Hypothesis 3 (*H*3). Hypothesis 1 hold for shorter-term financial investments (bank loans and portfolio investments) but not for FDIs.

At an aggregate level, in contrast with other categories of financial flows, robust negative correlations between the CLIF cycles and FDI investments to semi-periphery countries are not observed. Table 5 displays estimates of DGP 1 for portfolio investments and FDIs. The results indicate that the CLIF cycles have a countercyclical effect on portfolio investments – similarly to the combination of portfolio and other investments used above. This result does not hold for FDIs, which seem more modestly influenced by CLIF cycles. As for portfolio (including or not other investments), financial cycles seem to contribute to countercyclical FDI inflows and industrial cycles tend to lead to procyclical FDI inflows. However, in contrast to portfolio investments, the difference between the two cancels each other out so that the overall influence seems relatively tenuous on this category of investments. When considering all financial flows reported in the financial accounts, the findings suggest significant countercyclical effects, driven by the influence of the financial cycles.

[33] The spectral radius normalization is a specific case of unique-scaling factor normalization strategies which corresponds to the larger eigenvalue (in absolute terms) of matrix W_t^*.

[34] For more details on these arguments, refer to Peeters and Girad (2025) and Kelejian and Prucha (2010).

[35] The negative coefficients for $W_t^{trade} A_t^{ind}$ invalidate the assumption (in Section 2.6) that semi-periphery exports *as a whole* are severely impacted by drops in industrial cycles, deteriorating their balance-of-payment situation and therefore their financial attractiveness.

[36] Some specifications (see Appendix D) suggest that geographic proximity might induce a procyclical effect. This could be caused by a stronger demand effect from center economies on nearby semi-periphery countries.

Table 4
Estimates of DGP 2 for the semi-periphery with short-term financial flows.

	No Time Fixed Effects		With Time Fixed Effects	
$W_t^{fin} A_t$	−223***		−207***	
	(0.002)		(0.00082)	
$W_t^{trade} A_t$	147***		144***	
	(1e-08)		(3.9e−10)	
$W_t^{cur} A_t$	83.6		73.6	
	(0.17)		(0.21)	
$W_t^{geo} A_t$	−9.07		15.3	
	(0.93)		(0.87)	
$W_t^{fin} A_t^{fin}$		−340***		−337***
		(0.0031)		(0.0095)
$W_t^{fin} A_t^{ind}$		112		101
		(0.14)		(0.27)
$W_t^{trade} A_t^{fin}$		226***		245***
		(2.6e−05)		(0.00014)
$W_t^{trade} A_t^{ind}$		−50.2*		−40.7
		(0.075)		(0.22)
$W_t^{cur} A_t^{fin}$		−65		−94.1
		(0.5)		(0.26)
$W_t^{cur} A_t^{ind}$		35.5		45.6
		(0.41)		(0.26)
$W_t^{geo} A_t^{fin}$		−57.8		−42
		(0.72)		(0.79)
$W_t^{geo} A_t^{ind}$		73*		70.6
		(0.086)		(0.15)
CFE	Yes	Yes	Yes	Yes
TFE	No	No	Yes	Yes
Regressors	DeEcEx	DeEcEx	DeEcEx	DeEcEx
R^2	0.092	0.15	0.073	0.11
Log-likelihood	−39313	−39157	−39032	−38939
N	4670	4670	4670	4670

A_t refers to the CLIF cycles and A^{fin} (respectively A_t^{ind}) represents an average of the medium-term financial (resp. industrial) cycles of the center leader countries. Financial flows considered here are portfolio investments and other investments in the balance of payments (to incorporate bank loans). W_t^{fin} is a TCM based on external debt disbursements. Similarly, W_t^{trade}, W_t^{cur}, and W_t^{geo} represents TCMs respectively built based on international trade flows, currency composition of external debts, and geographic locations. CFE and TFE respectively stands for country and time fixed effects. DeEcEx indicates that demographic and extended economic regressors are used as control variables. The main observation from this table is that the medium-term cycles influence the financial inflows to semi-periphery countries through different channels. Estimates for the CLIF cycles are negatively correlated to financial inflows (particularly notably due to the effects on rows 1 and 5) supporting Hypotheses 1 and 2.

Table 5
Estimates of DGP 1 for the semi-periphery for portfolio investments and FDIs.

	Portfolio investments				FDIs			
	CLIF cycles		GDP-weighted cycles		CLIF cycles		GDP-weighted cycles	
A_t	−57.2**		−60.9***		0.0625		0.806	
	(0.043)		(0.00015)		(0.99)		(0.88)	
A_t^{fin}		−117**		−93***		−27.2***		−8.92
		(0.032)		(6.6e−06)		(0.0077)		(0.16)
A_t^{ind}		42.2		21		23.9***		9.09*
		(0.11)		(0.23)		(0.00027)		(0.064)
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TFE	No	No	No	No	No	No	No	No
Reg.	DeEcEx	DeEcEx	DeEcEx	DeEcEx	DeEcEx	DeEcEx	DeEcEx	DeEcEx
R^2	0.035	0.04	0.067	0.082	0.068	0.071	0.068	0.07
Log-lik.	−48170	−48155	−48069	−48018	−47752	−47741	−47752	−47744
N	6069	6069	6069	6069	6757	6757	6757	6757

The analysis using transmission channels supports the overall conclusions developed above for portfolio investments and total financial investments, and corroborates Hypotheses 1 and 2. For FDIs, it seems that trade connections do not lead to procyclical but countercyclical investments – driven by industrial cycles –, in contrast to other categories of financial flows (for example, see second row in Table 4). Overall, the analysis for different categories of financial flows supports two general conclusions:

1. FDIs are less impacted by CLIF cycles than shorter-term flows, corroborating Hypothesis 3. The most consistent effect is the countercyclical influence of industrial cycles on highly trade connected semi-periphery countries. These economies are likely to act as export platform for center economies. During the downward phases of the industrial cycles, the demand from the center for products manufactured in these export platforms decreases, and less FDIs are needed to build new facilities.

2. The impact of CLIF cycles on financial accounts of semi-periphery countries is driven by its countercyclical impacts on portfolio investments.

4.2. *Impacts on center, semi-periphery, and periphery countries*

The second heterogeneity relates to categories of countries. So far, only the effect of CLIF cycles on semi-periphery economies was considered. What about the periphery and non leader center countries? The following hypothesis can be formulated:

Hypothesis 4 (*H*4). Financial flows to periphery economies behave procyclically.

Using aggregate data, positive correlations between the CLIF cycles and financial investments to periphery countries are obtained. Estimations of the parameters of DGP 1 for periphery economies support this hypothesis. The influence of CLIF cycles on periphery economies is drastically different from that on semi-periphery economies. Financial cycles do not seem to substantially impact financial inflows and the overall effect is dominated by a procyclical influence of the industrial cycles. These results confirm Hypothesis 4. Section 2.2 highlighted that a potential reason could be a large procyclical macroeconomic dependence to the center (i.e., $\epsilon > 1$ for the periphery) and/or a large volume effect that dominates the substitution effect for these economies. These effects may emerge because periphery economies rely more on exports (e.g., energy, grains, and minerals) whose prices are more volatile and sensitive to the demand of center leader economies (Jacks, O'rourke, & Williamson, 2011; Poelhekke & van der Ploeg, 2007). Consequently, downward phases of CLIF cycles are associated to financial difficulties and lower expected returns. Thus, investors tend to leave rather than enter these economies during such periods.

Financial flows to non leader center economies seem to exhibit a countercyclical pattern. Yet, four distinctions with semi-periphery countries should be highlighted. The countercyclicity appears less robust for center economies. FDIs seem procyclical for center economies, while no strong pattern emerges for semi-periphery economies. This might be due to a volume effect affecting these highly more integrated and developed economies. Industrial cycles tend to have a countercyclical impact on portfolio investments but procyclical for bank loans for center economies. Geographic proximity seems to play a more important role.

Two final observations can be made:

(1) FDI flows appear less affected by the CLIF cycles for all groups of countries. The coefficients are not significant nor robust in most simulations.
(2) The use of portfolio and short-term investments (i.e., the combination of portfolio and other investments) provide very close estimates for all categories of countries.

5. Robustness analysis

Several robustness checks were performed. Different normalizations were tested for each subcomponent of industrial and financial cycles. The impact of standardizing each subcomponent, dividing the indicator by their respective long-term trends, or keeping the growth rate was assessed. Each configuration provides comparable results. Various smoothing techniques were tested: simple moving average, bandpass filters, Nadarya–Watson estimates, cubic spline estimation, Hodrick–Prescott filter, and Kalman filter. The results are robust to these changes (different techniques and metaparameters). As discussed in Appendix A, the choice between different smoothing techniques yields virtually identical results. Similar patterns and correlations are observed using only subsets of the indicators used to build financial and industrial cycles (e.g., by only using GCF and capital utilization, without unemployment rate, for the industrial cycles). The substitution of several variables by close but different estimates were also evaluated. The statistical results are marginally affected by these specification changes. Different weights between industrial and financial cycles as well as between countries to build the indicator of the CLIF cycles were tested. The results are robust to these changes. Similar variations (smoothing techniques, composition, etc.) for control variables were also tested with the results are robust to all these changes. Various changes in the classification of countries (center leader and semi-periphery countries) do not alter the main conclusions (e.g., using different thresholds to differentiate semi-periphery from periphery countries, using a time-varying sample to reflect the industrialization of some countries or using a fixed sample). Hypothesis 1 was tested for enlarged or restricted samples for the semi-periphery and periphery, with similar conclusions. The impact of a potential sample bias was assessed, and the results are resilient. In all cases, we observed a high level of procyclicity between medium-term cycles of center leader countries and a high level of countercyclicity between these medium-term cycles and financial flows to the semi-periphery.

Diverse specifications were examined. The model was tested with and without country fixed effects, different compositions, interactions and normalization for the dependent variables. Due to small serial correlation, I tested the model with various lags. To verify the influence of Assumption 4, several specifications with higher order terms were tested. In all cases, the reported conclusions are robust and consistent. The impact of changes in the modeling of the TCMs were also assessed. Different smoothing techniques, normalizations, and compositions were tested for W_t^{fin}, W_t^{trade}, W_t^{cur}, and W^{geo}. Variations caused by using another definition for W_t^{fin} using other data from the World Bank IDS dataset were checked. Although fewer data was available for the alternatives, the estimations suggest similar conclusions.[37]

[37] A few additional tables of results are provided in Appendix D. Estimations for different configurations and details on the tests are available upon specific request.

6. Conclusion

This study reveals that international financial flows between center and semi-periphery countries exhibit patterns beyond established frameworks. Our portfolio optimization model explains how financial and industrial cycles in center economies – termed CLIF cycles – drive countercyclical inflows to semi-periphery countries through substitution effects. When center country returns decline during cyclical downturns, international investors systematically shift capital toward semi-periphery markets as attractive substitutes – a portfolio rebalancing effect that generates substantial cyclical inflows over medium-term horizons. This leads to periods of large financial inflows and outflows to the semi-periphery countries.

Our empirical findings confirm this substitution mechanism in international financial flows. CLIF cycles drive countercyclical inflows to semi-periphery countries, particularly portfolio investments and bank loans. Financial integration amplifies this effect — semi-periphery countries with stronger financial connections to center economies experience larger countercyclical inflows as investors seek substitutes for declining center country returns. Trade integration tend to produce the opposite pattern – at a given level of financial integration – generating procyclical flows in highly trade-connected semi-periphery countries. FDIs remain largely unaffected by these medium-term cycles. This countercyclical substitution pattern distinguishes semi-periphery from periphery economies, which exhibit more conventional procyclical behavior.

Our findings have several policy implications are substantial for semi-periphery economies. Understanding that countercyclical inflows occur during center country downturns enables more strategic timing of debt issuance and reserve management policies. Semi-periphery countries could anticipate periods of increased capital availability and plan their financing strategies accordingly. The findings that these flows operate through portfolio optimization channels rather than traditional risk-on/risk-off dynamics suggests that conventional macroprudential policies may need recalibration. Measures should account for medium-term dynamics rather than focusing solely on business cycle considerations, as the countercyclical pattern operates over longer horizons than typical short-term volatility management tools. Finally, the heterogeneous effects across flow types (portfolio investments vs. FDI), development stages (semi-periphery vs. periphery), and integration patterns (financial vs. trade) suggest that policy interventions should be tailored to incorporate these country and flow characteristics. Semi-periphery countries with extensive financial ties to center economies may need more robust macroprudential frameworks to manage the larger cyclical inflows our analysis predicts.

Several avenues for future research emerge from this study's findings and limitations. Incorporating market risk indicators (e.g., VIX) into medium-term cyclical analysis would provide a better understanding of how risk perceptions interact with the substitution effect. Country-specific analysis of heterogeneous responses to CLIF cycle shocks would offer important insights into the mechanisms driving differential sensitivities across semi-periphery economies. Such research would be particularly useful for designing tailored macroprudential policies that account for each country's profile. Extending the CLIF cycle cycle estimation beyond the current five major center countries would provide broader geographic coverage as data availability improves for more recent periods. Investigating temporal evolution of these relationships and the impact of China's economic rise on patterns would enhance our understanding of how structural changes in the global economy affect these transmission mechanisms.

Declaration of competing interest

The author declares no conflict of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.iref.2025.104456.

Data availability

Data will be made available on request.

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List of acronyms

BIS: Bank for International Settlements
CLIF cycle: CenterCLIF cycle Leader economies' Industrial-Financial cycle
CPI: consumer price index
DGP: data generating process
FDI: Foreign Direct Investment
FRED: Federal Reserve Economic Data
GCF: Gross Capital Formation
IDS: International Debt Statistics
IMF: International Monetary Fund
IPN: International Production Network
METI: Ministry of Economy Trade & Industry
MNE: Multinational Enterprise
OECD: Organization for Economic Co-operation and Development
PPG: public and publicly guaranteed.
PPP: purchasing power parity
TCM: Transmission channel matrix (also known as spatial weighting matrix)
UK: United Kingdom of Great Britain and Northern Ireland.
UN: United Nations
US: United States of the America.

Benjamin Peeters is a postdoctoral researcher at the Potsdam Institute for Climate Impact Research (PIK). His research in the GeoClimRisk project examines the links between physical and transition risks of climate change through the REMIND model (REgional Model of Investment and Development). His work focuses on climate damages, adaptation costs, and the effects of climate risks on the cost of capital.

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